Cardiac incidents cause over 50% of LODD in firefighters (FF) and may be related to their BP responses. Also, years of service may affect FF stress and depression levels and impact overall health. Using ambulatory BP (ABP) monitoring to quantify the BP surge with alarm is a novel way to assess risk, and preliminary data showed that newer FF have higher BP surge. PURPOSE: To compare changes in health between FF with <1yr service (FF-10) and FF with >1yr service (FF+10) after a 6-wk Mediterranean diet & circuit training program. METHODS: We included 21 FF who completed a 6-wk intervention. Pre- and post-intervention testing included ABP monitoring with pager activation, a fasted clinical appt, and fitness testing. Participants wore the ABP cuff for 12-hrs, during which they were paged by a pager app (OnPage) or by emergency service dispatch. When the pager sounded, they were instructed to force an ABP reading to assess the BP surge. Average BP levels and surges were determined. Fasted visit included BP, body fat, lipid panel, and vascular health measures. Fitness test included a treadmill VO2peak and a battery of other fitness tests. Participants also completed a health history form and the DASS-21 questionnaire assessing stress, anxiety, and depression.

RESULTS: FF+10 (N=12, 45.7 ± 3yrs) had worse blood pressure levels and lower BP surges, but larger improvements with intervention compared to FF-10 (N=9, 36.8 ± 6.2yrs), P<0.05 for differences. FF+10 had lower HDL levels and a 3.8 vs 2.2 vs 57.9 ± 9.7 mg/dl, was heavier (213 ± 8.6 vs 205.1 ± 8.6 lbs), had higher average SBP (136.6 ± 4.8 vs 126.9 ± 3.6 mmHg) and DBP (83.2 ± 2.8 vs 75.7 ± 2.8 mmHg) levels, higher pre-alarm and post-alarm BP, but had a smaller surge in SBP (11.6 ± 3.2 vs 15.0 ± 3.3 mmHg) and DBP (4.1 ± 2.7 vs 7.3 ± 1.7 mmHg) when the pager sounded. FF+10 also had worse overall psychometric scores: higher DASS-21 11.2 ± 5.3 vs 7.6 ± 1.3; depression 3.4 ± 1.3 vs 1.4 ± 0.3; and stress 5.4 ± 1.7 vs 3.3 ± 0.5; but similar anxiety scores 2.4 ± 1.0 vs 3.0 ± 0.9. With intervention, in FF+10 we found that BF lowered, fitness improved, and psychosocial constructs improved.

CONCLUSION: With this subset of baseline data, we show that FF+10 have smaller BP surge, worse CV health, stress, and depression levels, but larger improvements with intervention compared to FF-10. Data confirms the importance of wellness programs for FF.

Table 1. Data are expressed as Average (SD)

<table>
<thead>
<tr>
<th></th>
<th>Outside Command/Pump</th>
<th>Outside Vent</th>
<th>Inside</th>
<th>Overhaul</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>47.0 (3.9)</td>
<td>33.1 (6.8)</td>
<td>34.0 (6.8)</td>
<td>37.9 (8.6)</td>
</tr>
<tr>
<td>BMI (kg/m2)</td>
<td>28.5 (3.2)</td>
<td>27.3 (3.4)</td>
<td>26.9 (3.7)</td>
<td>27.1 (2.9)</td>
</tr>
<tr>
<td>MAP (mmHg) Pre</td>
<td>107.6 (10.7)</td>
<td>103.6 (5.7)</td>
<td>103.8 (9.3)</td>
<td>103.1 (8.5)</td>
</tr>
<tr>
<td>MAP (mmHg) Post</td>
<td>105.3 (10.6)</td>
<td>102.0 (7.9)</td>
<td>105.9 (8.9)</td>
<td>98.6 (9.5)</td>
</tr>
<tr>
<td>MAP (mmHg) 30min Post</td>
<td>105.1 (8.2)</td>
<td>99.3 (3.9)</td>
<td>102.3 (9.2)</td>
<td>97.4 (7.8)</td>
</tr>
</tbody>
</table>

Firefighters (FFs) can increase their risk of cardiovascular (CV) events >100-fold during emergency response. FF research has tended to analyze career FFs or a career-volunteer blend, while neglecting to provide specific results for the volunteer population. This leaves a gap in literature that seeks to understand the magnitude and duration of call-related perturbations. Autonomic tone (AT), measured by heart rate variability (HRV) is a non-invasive measure providing insight into CV risk and resiliency, and stress response. PURPOSE: To identify the magnitude and duration of changes in volunteer FFs’ autonomic CV control during night time emergency response. METHODS: Eight male FFs (36.9 ± 12.1 years) wore monitors to track heart rate (HR) and R-R intervals from 19:00-07:00 on nights with, and without call response for a total of 12 calls. Data filtering preceded HRV analysis in both time and frequency domain. Data was organized into 15-minute epochs, focusing on: 15-0 (PRE) pre-dispatch, 0-15 (PC1) and 75-90 (PC2) post-dispatch, and 0-15 (WAKE) when waking without a call. RESULTS: Compared to PRE, increases in the LF/ HF ratio were observed at both PC1 (1.784 ± 1.345, p<.014), and PC2 (1.265 ± 1.238, p<.046) in the call condition. PRE-PC1 comparison showed 10.2% increases in HRMEAN (43 ± 13 bpm, p<.0005, n²=0.837) and HRMAX (60 ± 22 bpm, p<.0005, n²=0.923) at PC1, though only HRMEAN remained elevated from PRE values at PC2 (12 ± 8 bpm, p=.005). RMSDD and HF Power (HFp) decreased at PC1 (RMSDD:16.868 ± 8.100 ms, p<.001, n²=.781; HFp: 552.057 ± 311.930 ms, p=.002, n²=.575), returning within PRE ranges by PC2. Comparison of the two sleep periods at normal WAKE revealed decreased HFp (234.726 ± 163.721 ms, p=.002, n²=.577) and increases in both LF/HF (6.920 ± 5.044, p<.013, n²=.556) and HRMEAN (18 ± 13 bpm, p=.012, n²=.564). CONCLUSION: Results from the current study show sympathetic activation and parasympathetic withdrawal at PC1 and PC2 compared to...
FRIDAY, MAY 29, 2020

2944 Board #4 May 29 1:00 PM - 3:00 PM
Prevalence Of Coronary Heart Disease Risk Factors In A Large Sample Of Southern Californian Firefighters
Terri Wann, Kris Ross, Jennifer Meloni, Ralph Rozennek. Santa Ana College, Santa Ana, CA.

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(Note relevant relationships reported)

Firefighters (FF) are exposed to a variety of work-related stresses that can lead to increased risk of disability and premature death. Heart attack is the primary “on-duty” cause of death in these individuals. Few studies have investigated the prevalence of the various coronary heart disease (CHD) risk factors (RF) in FF and how they are affected by age in this specific group.

PURPOSE: 1) To determine the prevalence of CHD RF and; 2) to examine the relationship between the CHD RF and age in a large group of FF.

METHODS: Data from 1949 male (n = 1924) and female (n = 25) FF (mean age ± s.d. = 39.8 ± 8.8 yr.) representing 27 departments in Southern California were used for analyses in this cross-sectional study. Apart from age, the RF selected represented those that were independent of gender. Standard statistical techniques were applied to determine HDL RF frequencies and percentages. Chi-Square Analyses with Cramer’s V were used to assess the relationship between age-group and RF prevalence and to estimate effect size. RESULTS: Overall 70.0% of FF had exceeded at least one CHD RF threshold. High blood pressure (HBP) was the most prevalent RF (26.9%) in the 20-29 yr. age-group followed by elevated body mass index (BMI) (11.2%) and low-density lipoprotein cholesterol concentrations (LDL-C) (11.2%). By contrast, 64.4% of FF in the 50+ yr. age-group had HBP with 31.9% having elevated BMI and 30.7% blood lipid panels (TC, TG, LDL, blood glucose, SBP, or DBP) (p<0.05). A significant reduction occurred in HDL (Pre: 53 mg/dL ± 14, Post: 45 mg/dL ± 18, p=0.043) and HbA1c increased (Pre: 5.2% ± 0.2 ; Post: 5.3% ± 0.2, p=0.034) from pre- to post-season. CONCLUSION: These data suggest a WLFF season did not impact resting markers of heart rate variability, pulse wave velocity, and oxidative stress. Alterations in metabolic biomarkers of cardiovascular risk factors (HDL and HbA1c) demonstrate unfavorable seasonal changes, suggesting that the WLFF season may increase cardiovascular risk.

2946 Board #6 May 29 1:00 PM - 3:00 PM
Metabolic And Cardiovascular Alterations During Critical Training In Wildland Firefighters

(Note relevant relationships reported)

Introduction: Wildland firefighters (WLFF) are confronted with numerous physical and mental stressors. Pre-fire season includes an intense two-week critical training period; a preparatory phase that sometimes results in injuries, illness, and rhabdomyolysis. Purpose: To identify physiologic changes to oxidative stress and other metabolic biomarkers that occur during 2 weeks of critical training in WLFF.

METHODS: Eighteen male (29.4±1.1 yr, 182.1±1.6 cm) and three female (26.7±2.6 yr, 169.5±4.2 cm) participants were recruited from a Type I interagency hotshot fire crew and monitored for the duration of their two-week critical training. Subjects were asked to arrive fasted and uncaffeinated for blood draws on days 1, 4, 8, and 11. Plasma was analyzed for changes in the metabolic profile and oxidative stress markers 3-Nitrotyrosine (3-NIT) and 8-isoprostane (8-ISO). A one-way repeated measures ANOVA was used to analyze 8-ISO and 3-NIT. Paired samples t-tests were used to compare metabolic biomarkers. Data presented as mean±SEM.

RESULTS: Critical training elicited a decrease in total cholesterol (173.6±12.1 to 153.4±8.6 mg/dL, p<0.001), triglycerides (TG) (45 mg/dL ± 14, Post: 45 mg/dL ± 18, p=0.043) and HbA1c increased (Pre: 5.2% ± 0.2 , Post: 5.3% ± 0.2, p=0.034) from pre- to post-season. CONCLUSION: These data suggest a WLFF season did not impact resting markers of heart rate variability, pulse wave velocity, and oxidative stress. Alterations in metabolic biomarkers of cardiovascular risk factors (HDL and HbA1c) demonstrate unfavorable seasonal changes, suggesting that the WLFF season may increase cardiovascular risk.

2945 Board #5 May 29 1:00 PM - 3:00 PM
Seasonal Changes In Cardiovascular Function, Risk Factors, And Oxidative Stress Of Wildland Firefighters
Cassie Williamson-Reisedorf, Katie S. Christison, Shae C. Gurney, Kathryn G.S. Tiemessen, Joseph A. Sol, Tiffany S. Quindry, Charles G. Palmer, Matthew W. Bundle, Charles L. Dumke, FACSM, John C. Quindry, FACSM. University of Montana, Missoula, MT. (Sponsor: John C. Quindry, FACSM)

(Note relevant relationships reported)

Wildland firefighters (WLFF) experience extreme physiological stress throughout a typical season due to intense occupational demands and consistent woodsmoke exposure. There is a rationale to indicate that accumulated physiological stress, and oxidative stress, throughout a WLFF season has the potential to negatively alter cardiovascular function and risk factors, and markers of oxidative stress in WLFF.

METHODS: Fourteen members of a Type I interagency hotshot crew participated in the study (males: n=13, females: n=1, age: 30.1 years ± 4.8). Pre- and post-seasonal resting measurements (May, October) were obtained for heart rate variability (InMMSSD, IHRf, IHRf-LF:HF), pulse wave velocity (PWV), blood lipid panels (TC, TG, LDL, HDL), metabolic biomarkers (blood glucose, HbA1c), blood pressure (SBP, DBP) and blood oxidative stress (3-nitrotyrosine, 8-isoprostane). Paired samples t-tests were used to identify differences among pre- and post-seasonal values. RESULTS: There were no seasonal effects observed on resting heart rate variability, PWV, 3-nitrotyrosine, 8-isoprostane, TC, TG, LDL, blood glucose, SBP, or DBP (p>0.05). A significant reduction occurred in HDL (Pre: 53 mg/dL ± 14, Post: 45 mg/dL ± 18, p=0.043) and HbA1c increased (Pre: 5.2% ± 0.2 ; Post: 5.3% ± 0.2, p=0.034) from pre- to post-season. CONCLUSION: These data suggest a WLFF season did not impact resting markers of heart rate variability, pulse wave velocity, and oxidative stress. Alterations in metabolic biomarkers of cardiovascular risk factors (HDL and HbA1c) demonstrate unfavorable seasonal changes, suggesting that the WLFF season may increase cardiovascular risk.

2947 Board #7 May 29 1:00 PM - 3:00 PM
Nutrition, Physical Activity And Cardiovascular Disease Risk Of Career Firefighters In A Low-Income Area
Brandi Ellen Phipps, Kathy Carter, FACSM. Central State University, Wilberforce, OH. (Sponsor: Kathy Carter, FACSM)

Email: bhipps@centralstate.edu

(Note relevant relationships reported)

The majority of on-duty firefighter (FF) deaths result from cardiovascular incidents, and FF wellness is related to job effectiveness and safety. Departments in low-income communities are often unable to provide wellness programming, allowing opportunities for local universities to fill the need.

PURPOSE: To determine health and cardiovascular disease (CVD) risk of local career FF in a low-income community for use in developing ongoing wellness interventions.

METHODS: Nutrition behavior, physical activity information, anthropometric measurements [body fat percentage (%BF), mass of body fat (MBF); waist circumference (WC); height; weight], and blood lipid levels [total cholesterol (TC), low-density lipoprotein (LDL); high-density lipoprotein (HDL); and triglycerides (TCG)] were collected from a cohort of FF and analyzed. RESULTS: Thirty-three percent (42/127) of department members participated in the study, with even representation across unit, age, and years worked. Eighty-three percent of FF were overweight/obese, as determined by bioelectrical impedance. Similarly, 83% were at-risk or at-significant-risk for CVD by waist-to-height ratio (WTHR, 0.5-0.6 and BMI > 30 kg x m-2)

Publication of this manuscript is funded by the US Forest Service 16-CR-11138200-005.
Over 80% of the US fire service is overweight (BMI: 25-29.9 kg/m$^2$) or obese (BMI$\geq$30 kg/m$^2$), increasing the risk for cardiovascular disease (CVD). Although age is an important CVD risk factor, it is not often examined among firefighters (FFs). Risk scores are a common tool used by medical professionals. However, no investigations have examined calculated risk scores and changes over time among FFs. **PURPOSE:** To describe changes in weight, BMI and CVD risk scores among a large cohort of younger (<45 years) and older (≥45 years) FFs over a 5-year period. **METHODS:** Age, body weight, body mass index (BMI), and calculated CVD risk scores of 672 FFs (45: n=522; 35±6 yr; ≥45: n=150; 48±3 yr) in a large northeastern fire department were assessed during an occupational medical exam in 2009-2011 and 5 years later. CVD risk scores were calculated using the Framingham Risk Score (FRS) calculation. Descriptive statistics summarized data, logistic or linear regression models compared proportions or means, and paired t-tests were used for within subject comparisons to test for significance. **RESULTS:** At baseline, younger FFs weighed 88.5 kg with a BMI 27.9 kg/m$^2$ and FRS of 3.4. Older FFs weighed 89.9 kg with a BMI of 28.5 kg/m$^2$ and FRS of 12.1. Over the 5 years, FFs <45 yr gained (+3.0 kg) significantly more weight than those ≥45 yr (+0.8 kg; p<0.001). BMI for both groups increased significantly (+0.9±0.1 and +0.4±0.2 respectively for <45 and ≥45 yr. Significantly more (55%) FFs <45 yr gained weight compared to 38% of FFs ≥45 yr (p<0.01). However, older FFs had significantly higher (p<0.001) CVD risk scores at baseline and follow up (9.3; 12.1) than younger FFs (3.4; 4.9). Although the majority of FFs ≥45 lost/maintained body weight (62%), overall their CVD risk increased (+2.8±0.4; p<0.001). **CONCLUSION:** Although FFs cannot avoid aging, they can aggressively manage other risk factors that affect their CVD risk score including preventing weight gain. Research indicates health care providers are more likely to counsel older FFs regarding weight loss. Our findings suggest younger FFs are more at risk of gaining weight than those ≥45 yr (+0.8 kg; p<0.001). BMI for both groups increased significantly (+0.9±0.1 and +0.4±0.2 respectively for <45 and ≥45 yr. Significantly more (55%) FFs <45 yr gained weight compared to 38% of FFs ≥45 yr (p<0.01). However, older FFs had significantly higher (p<0.001) CVD risk scores at baseline and follow up (9.3; 12.1) than younger FFs (3.4; 4.9). Although the majority of FFs ≥45 lost/maintained body weight (62%), overall their CVD risk increased (+2.8±0.4; p<0.001). **CONCLUSION:** Although FFs cannot avoid aging, they can aggressively manage other risk factors that affect their CVD risk score including preventing weight gain. Research indicates health care providers are more likely to counsel older FFs regarding weight loss. Our findings suggest younger FFs are more at risk of gaining weight and could benefit from guidance on this important risk factor. Further efforts are needed to encourage physicians and fire departments to direct FFs to establish healthy weight and could benefit from guidance on this important risk factor. Further efforts are needed to encourage physicians and fire departments to direct FFs to establish healthy habits early in their career. Supported by FEMA Grant EMW-2017-FP-PP-00445

### F-07 Peak accelerations and shock attenuation over the course of a marathon

**Board #8 May 29 1:00 PM - 3:00 PM**

**Changes In Obesity And Cardiovascular Disease Risk Among Older And Younger Firefighters**

Brittany S. Hollerbach1, Kevin C. Mathias1, Yuchen Wu1, Donald F. Stewart2, Denise L. Smith, FACSM1. 1Skidmore College, Saratoga Springs, NY. 2Public Safety Occupational Health Center, Fairfax, VA.

Email: bhollerb@gmail.com

(No relevant relationships reported)

Peak tibial and peak sacral accelerations have been shown to increase during a fatiguing run. Peak accelerations are often used as a surrogate for impacts on the body during running. High tibial impacts have been linked to development of tibial stress fractures. To understand how impacts are related to injury development, we need more insight in how shocks propagate through the body, especially under the influence of fatigue.

**Purpose**

To investigate bilateral peak accelerations and shock attenuation over the course of a marathon.

**Methods**

5 trained athletes (2M 3F, 33.8±11.8 years, 182.3±5.8 cm, 73.9±9.1 kg years) ran a marathon during competition. Inertial measurement units (240Hz) were placed on the sternum, pelvis, and bilaterally on the tibia and foot. Mean peak accelerations around initial contact and shock attenuation (% decrease of peak acceleration) were calculated over 25 strides during the 2nd and 42nd km of the marathon. Paired sample t-tests were used to test for statistical differences between the 2nd and 42nd km and between the dominant and non-dominant side.

**Results**

See Table 1. Mean finish time was 4:07:40/10:19:07.

**Conclusion**

Impacts and shock attenuation changed asymmetrically during a marathon. Both side dominance and fatigue significantly influenced shock attenuation. However, on sternum level, only fatigue influenced impacts and shock attenuation, implying some sort of protective mechanism to keep proximal impacts low. The non-dominant side showed larger impacts during the whole marathon, possibly because this side is less strong and therefore less able to actively (i.e. muscle contractions) absorb shocks. Overall, impacts increased and shock attenuation decreased towards the end of the marathon, possibly increasing the risk of overuse injuries.

#### Table 1. Bilateral peak accelerations and shock attenuations for the 2nd and 42nd km of a marathon

<table>
<thead>
<tr>
<th>Side</th>
<th>Foot</th>
<th>Lower leg</th>
<th>Pelvis</th>
<th>Sternal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd km</td>
<td>99.4±24.0**</td>
<td>92.2±21.6**</td>
<td>82.8±55.9</td>
<td>25.1±11.3</td>
</tr>
<tr>
<td>42nd km</td>
<td>116.2±35.4**</td>
<td>124.2±68.0**</td>
<td>87.5±59.1</td>
<td>35.9±16.8</td>
</tr>
<tr>
<td>2km</td>
<td>92.7±24.5**</td>
<td>84.8±18.4</td>
<td>64.2±31.1</td>
<td>25.9±10.0</td>
</tr>
<tr>
<td>42km</td>
<td>94.4±21.2**</td>
<td>87.2±26.6**</td>
<td>77.3±36.2*</td>
<td>36.7±12.6*</td>
</tr>
</tbody>
</table>

**Note:** All values are in m/s$^2$. Values marked with an asterisk (*) indicate a significant difference (p<0.05) between the 2nd and 42nd km. A superscript (*) indicates a significant difference (p<0.05) between the non-dominant and dominant side at either the 2nd or 42nd km.

<table>
<thead>
<tr>
<th>Side</th>
<th>% reduction in shock attenuation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd km</td>
<td>Foot-Lower leg 7.3±18.4*</td>
</tr>
<tr>
<td></td>
<td>Lower leg-Pelvis 10.2±22.3*</td>
</tr>
<tr>
<td>42nd km</td>
<td>Pelvis-Sternal 69.6±19.5*</td>
</tr>
<tr>
<td>2km</td>
<td>Foot-Lower leg -6.9±49.1*</td>
</tr>
<tr>
<td></td>
<td>Lower leg-Pelvis 29.5±35.5*</td>
</tr>
<tr>
<td>42km</td>
<td>Pelvis-Sternal 59.0±43.0*</td>
</tr>
</tbody>
</table>

**Note:** All values are in %. Values marked with an asterisk (*) indicate a significant difference (p<0.05) between the 2nd and 42nd km. A superscript (*) indicates a significant difference (p<0.05) between the non-dominant and dominant side at either the 2nd or 42nd km.

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**Abstracts were prepared by the authors and printed as submitted.**
High tibial acceleration peaks have been associated with tibial stress fracture in runners. Field-testing with wearable wireless accelerometers in now commonplace, but some devices have a lower sampling frequency than in laboratory testing. PURPOSE To determine the influence of sampling rate on peak axial tibial acceleration and peak resultant tibial acceleration magnitude during running. METHODS As part of a larger study, 19 healthy adults were recruited (10 women; 31±6 years; 1.70±0.08 m; 68.6±11.6 kg) and provided informed consent to participate. A precision accelerometer sampling at 1000Hz was attached to the distal anteriomedial aspect of the right tibia. Participants ran at 3.0 m/s in the laboratory for five good trials making contact with a force plate sampling at 1000Hz. Raw data were down-sampled to 500Hz and 100Hz, common sampling rates for wearable wireless accelerometers. All data were low-pass filtered at 70Hz. Stance phase was identified by foot contact on the force plate. Accelerometer data and sensor orientation for each trial and averaged. One factor repeated measures analysis of variance with least significant difference post-hoc tests determined whether peaks differed among sampling rates. Effect sizes were calculated to aid interpretation of the data. RESULTS Both peak axial and peak resultant acceleration were significantly reduced when tibial acceleration was sampled at 1000Hz compared to 500Hz or 100Hz (p = 0.041). Reductions were 0.7g or about 10% of the peak magnitude at 1000Hz, a small effect. Values were stable between the 500Hz and 1000Hz sampling rates. CONCLUSION We recommend that tibial acceleration data are sampled at rates of 500Hz or greater to avoid attenuation of peaks producing erroneously low values for both peak axial and peak resultant acceleration.

Table: Mean and standard deviation of peak axial and peak resultant tibial acceleration.

<table>
<thead>
<tr>
<th>Accelerometer Sampling Rate (Hz)</th>
<th>Mean (SD) g</th>
<th>p value</th>
<th>Effect Size</th>
<th>Mean (SD) g</th>
<th>p value</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>5.4 (1.8)</td>
<td>&lt;0.01</td>
<td>0.36</td>
<td>7.4 (2.9)</td>
<td>0.025</td>
<td>0.22</td>
</tr>
<tr>
<td>500</td>
<td>6.0 (2.1)</td>
<td>0.09</td>
<td>0.05</td>
<td>8.1 (3.4)</td>
<td>0.93</td>
<td>0.08</td>
</tr>
<tr>
<td>1000</td>
<td>6.1 (2.1)</td>
<td></td>
<td></td>
<td>8.1 (3.4)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RESULTS:** Table 1

An 8 x 400 meter interval training is often performed with the aim of improving aerobic fitness. Besides being physiologically and physically challenging this type of training is also mechanically demanding. As such it could have potential negative effects on running mechanics. Inertial measurement units (IMUs) allow for continuous measurement of running mechanics during this type of training.

**PURPOSE:** To investigate changes in running mechanics during an 8 x 400 meter interval training on the athletic track Measured With IMUs

Jasper Reenalda1, Emily J.C. Zoetbrood1, Marit A. Zandenberg1, Jaap H. Buurke2, Brian W. Noehren, FACSM2. Roessingh Research and Development, University of Twente, Enschede, Netherlands. 1University of Kentucky, Lexington, KY. (Sponsor: Brian W. Noehren, FACSM)

Email: j.reenalda@rrd.nl

(No relevant relationships reported)

**METHODS:** 19 trained athletes (4M 1F, 25.4±7.9 years, 185.6±8.3 cm, 69.2±12.7 kg) ran 8 x 400 meters on the athletic track. They were paced to run each 400 meter at 5 km race pace with half of the time run as rest. Eight IMUs (240 Hz) were placed at the feet, tibia, upper legs, sacrum and sternum. Accelerometer data and sensor orientation were used to calculate the following parameters using custom code after calibration trials: Hip, knee and ankle angle at Initial Contact (IC), knee angle at Midstance (MST) and Midswing (MSW), peak tibial and sacral acceleration (PTA, PSA), and centre of mass (COM) displacement. Parameters were calculated for both straights of the 2nd, 4th, 6th and 8th 400 meters. Borg scale (0-20) was asked after each bout for perceived exertion. Paired sample t-tests were used to test for statistical differences between the 2nd and 8th bout.

**RESULTS:** Table 1

**CONCLUSIONS:** Running mechanics (mainly ankle and knee mechanics and tibial impact) changed over the course of a typical interval training, putting runners at higher risk with increasing bouts. This indicates that this type of training is not only physiologically and physically demanding but puts increasing mechanical stress on the body. These results suggest caution should be used among athletes returning from an injury.

**Table 1:** Results of the 8 x 400 meters interval training on the athletic track. Mean values (± SD) are presented for the selected parameters during the 2nd, 4th, 6th and 8th run. P value is given for the significance between the 2nd and 8th bout.

<table>
<thead>
<tr>
<th>Bout</th>
<th>R2</th>
<th>R4</th>
<th>R6</th>
<th>R8</th>
<th>R2 vs R8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>P value</td>
</tr>
<tr>
<td>Hip angle IC</td>
<td>25.7±7.4</td>
<td>40.0±8.2</td>
<td>29.9±8.0</td>
<td>31.2±8.4</td>
<td>0.023</td>
</tr>
<tr>
<td>Knee angle IC</td>
<td>24.1±7.5</td>
<td>26.8±15.5</td>
<td>27.3±6.9</td>
<td>27.2±7.7</td>
<td>0.00</td>
</tr>
<tr>
<td>Kne angle at MST</td>
<td>42.0±7.8</td>
<td>43.7±8.1</td>
<td>43.3±8.4</td>
<td>43.8±7.4</td>
<td>0.00</td>
</tr>
<tr>
<td>Kne angle MSW</td>
<td>112.4±11.7</td>
<td>113.4±11.5</td>
<td>113.4±11.5</td>
<td>116.2±7.7</td>
<td>0.00</td>
</tr>
<tr>
<td>Ankle angle IC</td>
<td>-6.2±5.6</td>
<td>-3.1±8.1</td>
<td>-1.5±9.1</td>
<td>-1.9±8.6</td>
<td>0.02</td>
</tr>
<tr>
<td>PTA (m/s²)</td>
<td>91.9±13.5</td>
<td>97.8±14.2</td>
<td>94.0±11.0</td>
<td>99.3±13.0</td>
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</tr>
<tr>
<td>PSA (m/s²)</td>
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<td>COM (mm)</td>
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<td>87.7±48.9</td>
<td>101.3±57.1</td>
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<tr>
<td>Borg scale*</td>
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</table>

**2952 Board #3 May 29 1:00 PM - 3:00 PM Changes In Running Mechanics During A Typical Interval Training On The Track Measured With IMUs**

**Adriana Miltko1, Taylor M. Vickery1, Richard T. Beltran1, Clare E. Milner, FACSM2, Max R. Paquette1, University of Memphis, Memphis, TN. (Sponsor: Clare E. Milner, FACSM)

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(No relevant relationships reported)

Using wearable sensors to assess running gait variability may be a valuable tool to identify deterioration in performance or health in competitive and recreational runners. PURPOSE: To measure associations between gait variability and training intensity, mood state, and perceived fatigue in collegiate runners (CR) and novice/recreational runners (NR). METHODS: 30 CR wore a waist-mounted ActiGraph GT3X+ accelerometer for all non-interval and non-competition training sessions for a full season. 16 NR wore a waist-mounted GT3X+ and an on-shoe activity monitor (MilestonePedometer) during 13 weeks of progressive training. Subjects completed written (CR) or email (NR) daily surveys. Recently developed running and step recognition algorithms were applied to isolate running gait cycles from raw sub-second level accelerometer data. Gait variability was assessed using amplitude deviation of resultant acceleration. Associations between variability and training intensity, mood state, and fatigue were assessed with generalized additive mixed models. RESULTS: 1069 runs and 7.64 million steps were analyzed. Variability was greater in CR than NR (0.301 vs 0.262 g; p=0.019). Within individual runs, variability was stable from 10-60 minutes in both CR and NR (Fig. 1). In CR, mood state was not significantly associated with variability (p>0.70). In NR, variability increased nonlinearly with average running speed (p=0.001), and a 1-point increase in fatigue on a 0-10 scale was associated with a 0.003g decrease in variability (p=0.051). CONCLUSION: A runner’s gait variability may be more strongly influenced by skill level and running speed than by acute changes in perceived fatigue or mood state. Unmeasured variables, such as training surface, may also affect gait variability.

Figure 1. Gait variability in CR and NR across different individual runs (top left, black dots), across different levels of fatigue (top right), and within any given run (bottom left and right, thin lines).

**2954 Board #5 May 29 1:00 PM - 3:00 PM Validity Of Peak Tibial Acceleration Using Wearable Accelerometers During Running**

**Adriana Miltko1, Taylor M. Vickery1, Richard T. Beltran1, Clare E. Milner, FACSM2, Max R. Paquette1, University of Memphis, Memphis, TN. (Sponsor: Clare E. Milner, FACSM)

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(No relevant relationships reported)

With wearable technology becoming more popular, more companies are creating sensors to assess biomechanical parameters including peak tibial acceleration (PTA) during running. However, validity of data from wearable technology relative to “gold-standard” research-grade instruments is highly important. PURPOSE: Assess the difference in PTA obtained from wearable inertial measurement units (IMU) and a research-grade accelerometer at different running speeds. METHODS: Six participants completed 1-2min treadmill running bouts at 3.0 m/s and 4.0 m/s white
wearing standardized footwear (1080, New Balance). A research-grade tri-axial accelerometer (ACC; 1200Hz, model 356A26, PCB Piezotronics) and a 9-axis IMU (1000Hz, Blue Trident, IMeasureU) were secured to the distal tibia to capture PTA during running. The testing at both speeds was completed with the ACC below and above the IMU to account for possible position effects. Data were collected for the final 15 seconds of each running bout and the average of both positions for 10-15 peaks of axial tibial acceleration were used for analyses. Paired t-tests and Cohen’s d effect sizes were calculated to compare instrument PTA means at different speeds.

**RESULTS:** At 3.0 m/s, mean PTA was not different between ACC (5.2±1.9 G) and IMU (5.9±2.2 G; p = 0.33; d = 0.34). At 4.0 m/s, mean PTA was not different between ACC (8.5±3.7 G) and IMU (9.8±4.2 G; p = 0.33; d = 0.33). Figure 1 demonstrates the individual variability in the difference in PTA obtained from the ACC and IMU at different speeds (A) and different positions (B). **CONCLUSION:** Despite the statistically similar PTA means obtained from both instruments, the difference in PTA between ACC and IMU appears to be highly variable among individuals. This variability in PTA may be due to differences between devices, device placement, attachment method, or individual running style. This highlights the difficulty in controlling sources of variability during testing.

**METHODS:** 30 collegiate runners wore an ActiGraph GTX3+ during ‘easy’ training (COM) resultant acceleration during running is associated with RROI development. If changes in complexity, quantified by mean control entropy, of center of mass (COM) signals may be more sensitive in differentiating between groups of varying health status, including predicting who may develop a running-related overuse injury (RROI). This theory has yet to be tested in prospective running studies.

**PURPOSE:** To evaluate if changes in complexity, mean control entropy, of center of mass (COM) resultant acceleration during running is associated with RROI development.

**METHODS:** 20 collegiate cross-country athletes (12 females) ran on an instrumented treadmill with 3-D motion capture at standard (2.68 m/s) and fast (3.60 m/s) speeds. Foot strike outcomes were obtained bilaterally using running wearable sensors, and sagittal plane ankle kinematics were simultaneously recorded. Pearson’s r correlation coefficients were used to determine the relationship between sensor-derived metrics of foot strike type and ankle sagittal motion during running. Therefore, the purpose of this study was to validate the sensor-derived foot strike type outcome by determining the relationship between foot strike type and ankle sagittal plane kinematics during a treadmill running analysis. We hypothesized that a rearfoot strike (RFS) would highly correlate to increased ankle dorsiflexion, while a forefoot strike (FFS) would highly correlate to increased ankle plantarflexion.

**RESULTS:** Eight hundred total steps were included for analysis. Foot strike type and ankle angles at initial contact had a strong, inverse correlation, such that a higher foot strike value was strongly related to increased ankle dorsiflexion, while a forefoot strike (FFS) would highly correlate to increased ankle plantarflexion.

**CONCLUSIONS:** Sensor-derived foot strike metrics were highly correlated to sagittal plane ankle measures, thus confirming our initial hypotheses. These outcomes support that the running wearable sensors are a valid means to assess foot strike patterns during treadmill running analysis. We hypothesized that a rearfoot strike (RFS) would highly correlate to increased ankle dorsiflexion, while a forefoot strike (FFS) would highly correlate to increased ankle plantarflexion.
that intensity mattered after controlling for volume (count-min or MET-min). The relationship between BMI and intensity was complicated, while PA accumulated at higher intensity was found to be associated with lower fasting glucose levels after controlling for volume. **CONCLUSION:** We provided a cutpoint-free analytic framework to model PA intensity continuously. The effect of PA on BMI and fasting glucose varied across intensity levels, even when fixing PA volume. The proposed methods are applicable not only to counts data, but also to other acceleration-based metrics calculated using raw data. **Figure 1.** Association of PA intensity (counts/15-sec or equivalent METs) with BMI and fasting glucose. The adjusted analysis included age, race-ethnicity and education for BMI, and for glucose additionally adjusted for BMI. Corresponding METs were calculated based on an internal calibration study.
In adjusted models, those in the high
Results of falls per unit time (year) and falls per unit of activity (active minute).
and ii) risk of falls by demographic and functional characteristics, comparing measures
as key indicators for the decline in gait speed over time. Whereas only functional
prediction accuracy is 79%.
sit-to-stand and gait speed, as well as accelerated decline in gait speed. The overall
poor WOMAC status prediction (Fig.1B), the top predictors are impaired baseline
light activity range (CPM 800-2499). The overall prediction accuracy is 82%. For
contributing factors include high WOMAC score, low minutes in the performance
study was extracted from 1229 participants tested at baseline and 2 years, including
METHODS
were reported using a monthly calendar. Minute level activity counts were examined
to derive diurnal patterns of PA and number of active minutes/day in 319 participants
(mean age 77 (SD=5.4) years, 43% female). Multiple logistic regression models
adjusted for age, sex, and gait speed examined the: i) risk of falls by tertiles of daily PA and
ii) risk of falls by demographic and functional characteristics, comparing measures of
falls per unit time (year) and falls per unit of activity (active minute).
Results: In adjusted models, those in the high and low PA tertiles had 78% and 7%
greater odds of falling over the next 12 months compared to those in the moderate PA
tertile, respectively (p<0.05). Moreover, peak daily PA declined 12% between baseline
and 24-month follow-up among fallers vs. 8% among non-fallers (p<0.05). Differences in
daily PA between fallers and non-fallers tended to be greatest between 8am-12pm.
Models comparing risk of falls over 24 months of follow-up demonstrated stronger
trends in falls risk at higher ages (80 vs >80), among men, and for those with slower
gait speeds (<0.8 m/s vs 0.8m/s) when analyzed per unit of activity (falls/active
minute) vs. unit of time (falls/year).
Conclusion: These results demonstrate a J-shaped association between PA and falls,
with stronger differences in PA between fallers and non-fallers during the morning
hours. Furthermore, the trend towards more robust results for falls/active minute vs.
falls/year highlight the complex nature of the association between PA and falls and
suggest that novel PA metrics may serve as more sensitive indicators for discerning
falls risk.

CONCLUSIONS
capacity measures (gait speed and sit-to-stand performance) were identified as key
indicators for the longitudinal decline in the WOMAC score. These findings may
enable early detection and intervention for functional decline prevention in knee OA
patients.

Purpose: The association between physical activity (PA) and falls is complex and bi-
directional, with more active persons often demonstrating greater falls risk. The role
of PA in preventing or aggravating falls risk may be illuminated by novel, more sensitive
measures of PA. We examined the longitudinal association between accelerometer
derived PA metrics and falls in control group participants of STURDY (Study to
Understand Fall Reduction and Vitamin D in You), a randomized trial of vitamin D
supplementation to prevent falls in older adults.
Methods: PA was assessed at baseline, 12-, and 24-months using the Actigraph Link
accelerometer, worn 24-hours per day for 7 days on the non-dominant wrist. Falls
were reported using a monthly calendar. Minute level activity counts were examined
to derive diurnal patterns of PA and number of active minutes/day in 319 participants
(mean age 77 (SD=5.4) years, 43% female). Multiple logistic regression models
adjusted for age, sex, and gait speed examined the: i) risk of falls by tertiles of daily PA and
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CONCLUSIONS
capacity measures (gait speed and sit-to-stand performance) were identified as key
indicators for the longitudinal decline in the WOMAC score. These findings may
enable early detection and intervention for functional decline prevention in knee OA
patients.
Dynamic segmentation algorithms are used to find activity transitions in accelerometer data. Youth Sojourn models use a crude algorithm, which may be improved by instead using a change point detection (CPD) algorithm. Pruned exact linear time (PELT) is a CPD algorithm that finds transitions by minimizing a cost function while iterating over the data and pruning out inviable transition points. PURPOSE: To compare the performance of youth Sojourn and PELT. METHODS: Raw acceleration data (hip-worn ActiGraph GT3X) from 86 youth (age 6-18 yrs; 48% male; 16% overweight/obese) were processed using Sojourn and PELT. Participants performed two semi-structured activity routines on separate days, with each visit lasting approximately 2-2.5 h. A total of 16 activities (eight each day) were performed, twice each, and the study protocol was designed to promote variability in the ordering and duration of activities. Throughout each trial, direct observation was performed using focal sampling, which served as a criterion measure of when activity transitions occurred. Sojourn and PELT were compared to the criterion using the transition pairing method, with a maximum of 5-s lag time allowed for a prediction to be considered a true positive. Performance metrics were recall, precision, and root mean squared error (RMSE). The metrics were calculated for each participant (both visits combined), after which paired t-tests were used to compare Sojourn-vs-PELT means for each metric. RESULTS: Values are mean ± SD. Recall was similar for Sojourn (49.6% ± 9.0%) and PELT (51.5% ± 9.2%, p = 0.15), and the same was true for RMSE (2.9 ± 0.3 s for Sojourn, versus 3.1 ± 0.4 s for PELT, p < 0.001). However, precision for Sojourn (21.7% ± 4.9%) was substantially lower than for PELT (38.7% ± 11.0%, p < 0.001). CONCLUSION: Youth Sojourn models may benefit from replacing their current segmentation algorithms with CPD algorithms like PELT. Thus, CPD warrants further investigation. Supported by NIH R01HD083431

PURPOSE: To compare the energy expenditure of driving measured by a CPD algorithm with the Compendium of Physical Activities (Compendium). Participants performed two semi-structured activity routines on separate days, with each visit lasting approximately 2-2.5 h. A total of 16 activities (eight each day) were performed, twice each, and the study protocol was designed to promote variability in the ordering and duration of activities. Throughout each trial, direct observation was performed using focal sampling, which served as a criterion measure of when activity transitions occurred. Sojourn and PELT were compared to the criterion using the transition pairing method, with a maximum of 5-s lag time allowed for a prediction to be considered a true positive. Performance metrics were recall, precision, and root mean squared error (RMSE). The metrics were calculated for each participant (both visits combined), after which paired t-tests were used to compare Sojourn-vs-PELT means for each metric. RESULTS: Values are mean ± SD. Recall was similar for Sojourn (49.6% ± 9.0%) and PELT (51.5% ± 9.2%, p = 0.15), and the same was true for RMSE (2.9 ± 0.3 s for Sojourn, versus 3.1 ± 0.4 s for PELT, p < 0.001). However, precision for Sojourn (21.7% ± 4.9%) was substantially lower than for PELT (38.7% ± 11.0%, p < 0.001). CONCLUSION: Youth Sojourn models may benefit from replacing their current segmentation algorithms with CPD algorithms like PELT. Thus, CPD warrants further investigation. Supported by NIH R01HD083431

PURPOSE: To determine if adapting a sedentary video game’s controls to involve total body movements can elicit an exercise intensity consistent with moderate-to-vigorous physical activity. METHODS: Thirty adults, 19 to 55 years of age, visited our exercise lab twice. During each visit, the participants played a sedentary video game in three randomized conditions: 1) sitting, using a hand-held controller (Controller), 2) standing, reaching and jumping in front of a motion sensor (Sensor), and 3) standing, moving and reaching for buttons with their hands and feet (Button). Oxygen consumption (VO2), heart rate, and ratings of perceived exertion (RPE) using the Borg 6 to 20 scale were assessed throughout each condition. We hypothesized that mean relative VO2 would be 3 to 6 metabolic equivalents (METs), mean heart rate would be 50% to 80% of age-predicted maximum heart rate (%HRmax), and RPE would be 12 (somewhat hard) to 15 (very hard) in the Sensor and Button conditions. Further, METs, %HRmax, and RPE would be lower in the Controller condition than in Sensor and Button conditions. A two-way repeated-measures analysis of variance with Bonferroni post-hoc analysis was used to compare within-participant differences in METs, %HRmax, and RPE across the two visits and three conditions. Chi-square analysis was used to determine if a significant proportion of participants achieved moderate-to-vigorous physical activity during the Sensor and Button conditions. RESULTS: All measures were less during the Controller condition (0.99±0.09 METs, 59±10%HRmax, 13±2 RPE, p<0.001) and Button (4.02±0.61 METs, 62±12%HRmax, 14±2 RPE, p<0.001) conditions. There was no difference between visits (p=0.32). For the 30 participants, 83% and 100%, respectively, sustained MET levels of 3 to 6 during the Sensor and Button conditions (p=0.01). Similar results were found for %HRmax and RPE (p<0.01). CONCLUSION: Sustained moderate-to-vigorous physical activity was achieved by adapting sedentary video game controls to require total body movements. Future studies should consider adapting video game controls to increase exercise enjoyment, adherence and intensity.
RESULTS: The sample included 1254 patients (80.1% women), who were 48.9 ± 15.46 years of age, with a BMI of 37.4 ± 10.46 and reported fair/good (74.9%), poor (16%) or very good/excellent (9.1%) health. Eighty-three patients (6.7%) completed multiple fitness tests and 654 (52.2%) completed one test. Only females completed multiple fitness tests. Chi-square test found those who completed one test had higher perceived health ratings (χ² = 15.6, p = .048). Bivariate correlations found BMI was associated positively with waist measures (r = .38, p < .001), and negatively with chair stand score (r = -.21, p = .015), march score (r = -.32, p = .029), general health rating (r = -.53, p < .001), general physical (r = -.11, p = .054), and mental (r = - .33, p = .043) health.

CONCLUSIONS: Results revealed differential characteristics between patients who only visited HealthyMe and those who completed the health/fitness tests. Future directions include using tailored approaches to encourage fitness test completion. Multiple correlations with BMI and health/fitness parameters align with previous work and emphasize the importance of promoting healthy behaviors in HLMPs, such as exercise.

Emerging research shows retired college athletes experience detrimental physical and mental health declines following retirement from sport. Such effects include worsening body composition, health-related quality of life, and physical function, as well as increased prevalence of depression, alcohol dependence, and eating disorders. Despite sports training, former college athletes exhibit substantial decreases in physical activity (PA) levels following retirement, which may contribute to these health declines.

PURPOSE: Explore what intervention components would be attractive, effective, and feasible for a PA program designed for former NCAA Division I (DI) college athletes.

METHODS: Semi-structured, bracketed interviews were conducted with former NCAA DI athletes retired ≤10 years from college sport and inactive based on the PA Guidelines for Americans (PAGA; assessed via the Paffenbarger PA Questionnaire). Qualitative analysis was conducted using the Consensual Qualitative Research Method to determine domains, categories, and core ideas from participant responses.

RESULTS: Participants (N=17, 7 men, 26±3 y, 91% Caucasian) retired 3 months to 10 years (4±3 y) and representing 9 sports across 13 athletic conferences underwent individual interviews. Based on the PAGA, 18% did not meet the muscle strengthening guidelines, 29% did not meet the aerobic guidelines, and 53% did not meet both thresholds. Emergent domains include: 1) The Recreated Team; 2) Program Needs; 3) Preventive Factors; 4) Participation Benefits. 5) Core ideas include: 1) the 'ritual' of training, 2) the social support, 3) the team identity, and 4) the sense of belonging. CONCLUSIONS: Board #3: May 29 1:00 PM - 3:00 PM

Commercial App Use Linked With Sustained Physical Activity In Two Canadian Provinces: A 12-month Quasi-experimental Study

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BACKGROUND: Top tier commercial physical activity apps rarely undergo peer-reviewed evaluation. Even fewer are assessed beyond six months, the theoretical threshold for behaviour maintenance.

PURPOSE: The purpose of this study was to examine whether a commercial app rewarding users with digital incentives for walking was associated with an increased in physical activity over one year.

METHODS: This 12-month quasi-experimental study was conducted in two Canadian provinces (n=39113 participants). Following a two-week baseline period, participants earned digital incentives ($0.04 CAD/day) every day they reached a personalized daily step goal. Mixed-effects models estimated changes in weekly mean daily step count between baseline and the last two recorded weeks. Models were fit for several engagement groups and separately by baseline physical activity status within engagement groups.

RESULTS: Nearly half of participants (43%) were categorized as physically inactive at baseline (fewer than 5000 daily steps), and 60% engaged with the app for at least six months [‘Regular’ (24-51 weeks of data) or ‘Committed’ sub-groups (52 weeks)]. Weekly mean daily step count increased for physically inactive users regardless of engagement status (P<.0001). The increase was largest for ‘Regular’ and ‘Committed’ participants—1215 and 1821 steps/day, respectively. For physically active participants, step count increases were only observed in the ‘Committed’ sub-group (P<.0001).

CONCLUSIONS: A commercial app providing small but immediate digital incentives for individualized goals was associated with an increased weekly mean daily step count on a population-scale over one year. This effect was more evident for physically inactive and more engaged participants.

PURPOSE: While physical activity participation is recognized as an effective modifiable risk factor for osteoporosis, adherence and compliance present significant challenges. We aimed to explore the experiences related to a bone-targeted exercise intervention, determine enjoyment and acceptability of each exercise mode, and identify barriers and facilitators to osteogenic exercise for young adult women with low bone mass.

METHODS: A mixed-methods study was conducted within the OPTIMA-Ex trial, a three-arm RCT comparing musculoskeletal outcomes from high-intensity impact training (IT), high-intensity resistance training (RT), and a home-based low-intensity exercise control (CON). All 32 participants (IT=10, RT=12, CON=10) who finished the trial completed questionnaires on physical activity enjoyment (PACES-8, Kruksal-Wallis and Friedman’s test), quality of life (AQoL-6D, repeated measures ANOVA), and semi-structured interviews to facilitate qualitative analysis (Leximancer v4.50) of participant experiences. RESULTS: At follow-up, RT had the highest total score for PACES-8 (48.6±4.7), while only the IT group experienced an increase in total score over the 10 months (34.8±4.1 to 41.4±4.9, p<0.05). Only CON experienced an improvement in total AQoL-6D score. For the sub-domains, all groups experienced clinically significant improvements (>0.06 points) for ‘mental health’, while IT improved for ‘sensory’ and CON improved for ‘coping’ (p<0.05). The qualitative analysis revealed that overall trial exercises were viewed positively by all groups, yet the two high-intensity groups had the ‘richest’ exercise experiences, developing a more positive attitude to exercise. Barriers to exercise related to time, convenience, accessibility, and cost. Both IT and CON groups experienced a 41% drop-out compared to 29% in the RT group. Compliance did not differ between CON (78.8±4.1%), IT (61.4±15.1%), or RT (66.4±11.2%) (p=0.085).

CONCLUSIONS: While IT and RT provide enjoyable bone-targeted exercise experiences for young adult women, on balance RT appears most favorable. It seems prudent, that bone-targeted exercise interventions for this demographic address perceptions of time demands and environmental barriers to participation in order to maximize compliance and adherence.

Weekly, physical activity should be a primary component in long term, healthy lifestyles to enhance aerobic capacity and potentially decrease risk of cardiovascular disease (CVD). Start The Cycle (STC) is a non-profit, community-based program dedicated to building confidence and self-esteem in at-risk youth (e.g., helping them achieve healthy, life goals) through weekly mountain bike rides and adult mentorship.

PURPOSE: To quantify physiological change and probability of CVD in at-risk youth during a 16-wk, mentored mountain biking program.

METHODS: Participants included (mean ± SD) new members (NM, n = 15, age = 13.6 ± 1.8 years), returning members (RM, n = 15, age = 15.9 ± 2.3 years), and combined (NM + RM) members (CM, n = 30, age = 14.7 ± 2.4 yrs). Free mountain bikes were provided to participants

#### Abstracts were prepared by the authors and printed as submitted.
by STC with a promise of ownership if the full program was completed. The program met 16-wks, 1 x week, and 2-3 hrs day\(^{-1}\) starting late spring and into late summer. Indoor physical conditioning and bike maintenance + skills classes were implemented the initial 4-wks with mentored, group rides occurring the last 12-wks. Maximal oxygen uptake (i.e., via the progressive aerobic cardiovascular endurance run or PACER test) and CVD risk (via a prediction equation from prior, unpublished research) were assessed pre- and post-intervention following the indoor training sessions (i.e., after 4-wks) and immediately prior to a final, 28-mi organized bike race. Data were analyzed using paired t-tests between pre- and post-intervention within NM, RM and CM groups with significance set at \(p < 0.05\). Effect size is reported as Cohn’s \(d\) with \(d = 2.5, 5, \) and \(8 = \) small, medium, and large effect sizes, respectively. **RESULTS:** Significance from pre- to post-test (mean \(\pm SD\), respectively, is as follows for \(VO_{2max}\) in ml kg\(^{-1}\) min\(^{-1}\): (NM, 37.1 \(\pm 5.4, p = 0.004, d = 0.93\); RM, 40.7 \(\pm 6.8 vs 46.2\), \(p = 0.037, d = 0.19\); and CM, 38.7 \(\pm 5.1 vs 43.8 \pm 8.3, p = 0.000, d = -0.04\) and CVD risk with lower score = decreased risk (NM, 5.2 \(\pm 2.8 vs 3.8 \pm 2.8, p = 0.018, d = -0.38\); RM, 6.2 \(\pm 6.2 vs 3.9 \pm 8.0, p = 0.027, d = 0.19\); and CM, 5.7 \(\pm 4.7 vs 3.8 \pm 5.8, p = 0.001, d = -0.07\). Body mass index (BMI) did not change across any group. **CONCLUSION:** A community-based, adult-mentored, youth mountain bike program is a practical means to improve aerobic capacity and reduce CVD risk in at-risk minors.

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**F-10** Thematic Poster - Resistance Training

**F-10** Thematic Poster - Resistance Training

**Board #1** May 29 1:00 PM - 3:00 PM

**Is There A Cross Over Effect In Post Activation Potentiation?**

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(No relevant relationships reported)

Post activation potentiation (PAP) is a phenomenon whereby strength is acutely increased following a conditioning contraction. This effect is purported to be small and specific to the contraction history of the muscle (local), however, a potential cross-over effect in PAP has not been ruled out. **PURPOSE:** To determine if PAP is specific to the muscle being conditioned or if it is also observed within the homologous muscles of the contralateral limb. **METHODS:** 56 men and women participated in a four-visit study. Visit 1 included baseline measurements and familiarization of the unilater bilecic contractions (isometric and isokinetic for each arm). Visits 2-4 included the completion of one of the three experimental conditions: 1) control, 2) same side PAP, and 3) cross over PAP in a randomized order. Each visit included a warm up followed by three maximal isokinetic contractions at 210°/second (baseline). The control condition then rested eight minutes prior to completing three more maximal isokinetic contractions (post). The other two conditions completed the preset follow five minutes later by a six-second maximal isometric contraction on the same side as the baseline isokinetic test (same side PAP) or on the opposite side (cross over PAP) followed by three additional maximal isokinetic contractions (post) three minutes after conditioning stimulus. The variable of interest was the change from baseline in isokinetic strength. Three hypotheses were compared using Bayesian Informative Hypothesis Evaluation (BAIN). The hypotheses were as follows: H1) same > cross - control; H2) same > cross - control; H3) same > cross - control. **RESULTS:** Torque produced during the potentiating stimulus was similar between PAP conditions (same: 47 Nm vs. cross: 45 Nm). The change (mean [95% credible interval]) in isokinetic strength for each condition was: control = -0.41 [-0.91, 0.07] Nm; same side PAP = 0.48 [-0.20, 1.16] Nm, and cross PAP = -0.03 [-0.67, 0.60] Nm. The posterior probabilities were 0.45, 0.28, 0.19, and 0.06 for H1, H2, H3, and the unconstrained model, respectively. H1 was 1.5 and 2.2 times more likely than H2 and H3, respectively. **CONCLUSIONS:** The current evidence indicates that if a PAP effect exists, it is small and may be specific to the muscle being conditioned. There does not seem to be a substantial cross over effect in PAP.

**Board #2** May 29 1:00 PM - 3:00 PM

**Muscle Thickness Changes Do Not Mediate Changes In Muscle Strength**

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(No relevant relationships reported)

The position that hypertrophy mechanistically increases muscle strength is currently debated among scientists. **Purpose:** To determine indirect (via hypertrophy) and direct (not hypertrophy) effects of training on muscle strength. **Methods:** 151 participants were randomized into control, one-repetition maximum training, or traditional training. For 6 weeks control avoided resistance exercise; training groups performed elbow flexion 3xweek (dominant arm). One-repetition maximum participants had 5 attempts to lift the greatest load possible. Traditional participants performed 4 sets to task failure (load adjusted for ~8-12 repetitions). Attempts/sets were separated by 90 s. Anterior muscle thickness (B-mode ultrasound) at 50, 60, and 70% upper arm length, and strength (one-repetition maximum) were assessed pre- and post-training. Change-score mediation models (adjusted for sex, pre-muscle thickness, and pre-strength) were constructed for each muscle thickness site. Effects of each training were evaluated relative to control. Data presented as coefficient (95% CI). **Results:** Relative direct effects on strength were greater on one-repetition maximum [-0.06 = 1.89 (1.20, 2.58); 60% = -1.18 (1.19, 2.58); 70% = -1.81 (1.12, 2.50) kg] and...
Effects Of High-Volume Versus High-Intensity Resistance Training On Vastus Lateralis Muscle Morphology In Previously Trained, College-aged Males.

Carlton D. Fox¹, Christopher G. Vanni¹, Shelby C. Osburn¹, Casey L. Sexton², Morgan A. Smith¹, Johnathon H. Moore¹, Stuart M. Phillips, FACSM¹, Kaelin C. Young², Michael D. Roberts³, Auburn University, Auburn, AL. ²McMaster University, Hamilton, ON, Canada. ³Edward Via College of Osteopathic Medicine - Auburn, Auburn, AL. Email: cdfox007@tigermail.auburn.edu

Purpose: To compare the effects of high-volume (HV) versus high-intensity (HI) resistance training on vastus lateralis muscle morphology. Methods: Resistance trained, college-aged males (n=15) participated in 6 weeks of resistance training in which their legs were randomized to undertake HV and in the contralateral leg HI. Resistance training was undertaken 3 days per week. All participants went through 10 days of deload following the 6 weeks of training. Muscle ultrasound of both vastus lateralis muscles was conducted prior to week 1 of training (T1), 72 hours following the last training bout of week 6 (T2), and 10 days following the last training bout (T3) for muscle thickness, pennation angle, and fascicle length assessments. Results: There was a significant condition by time effect (p<0.039) for muscle thickness. Post hoc analysis revealed that muscle thickness significantly increased from T1 to T2 (2.7±0.4 cm to 2.9±0.4 cm, p=0.023) in the HV leg, but not in the HI leg. However, there was no difference between conditions at any time point. Furthermore, there were no significant interactions or main effects for pennation angle or fascicle length. Conclusion: HI versus HV training elicits differential effects in vastus lateralis muscle thickness over a 6-week period, albeit neither training modality altered fascicle length.

CONCLUSION: One-repetition maximum and traditional training increase strength, whereas HV training induces muscle hypertrophy without affecting strength. Future studies should determine the effects of HI and HV training on muscle thickness.

EFFECTS OF SIX WEEKS OF UNILATERAL HIGH-VOLUME Versus HIGH-INTENSITY RESISTANCE TRAINING ON VASTUS LATERALIS MUSCLE MORPHOLOGY IN PREVIOUSLY TRAINED, COLLEGE-AGED MALES.

LaGrange, GA. 3Edward Via College of Osteopathic Medicine - Auburn Campus, Auburn, AL. 4LaGrange College, LaGrange, GA. 5Edward Via College of Osteopathic Medicine - Auburn, Auburn, AL. 6LaGrange College, LaGrange, GA. 7Auburn University, Auburn, AL. 8McMaster University, Hamilton, ON, Canada. 9LaGrange College, LaGrange, GA. 10McMaster University, Hamilton, ON, Canada. 11Auburn University, Auburn, AL. 12Auburn University, Auburn, AL. 13McMaster University, Hamilton, ON, Canada. 14Auburn University, Auburn, AL. 15Auburn University, Auburn, AL. 16Auburn University, Auburn, AL. 17Auburn University, Auburn, AL. 18Auburn University, Auburn, AL. 19Auburn University, Auburn, AL. 20Auburn University, Auburn, AL. 21Auburn University, Auburn, AL. 22Auburn University, Auburn, AL. 23Auburn University, Auburn, AL. 24Auburn University, Auburn, AL. 25Auburn University, Auburn, AL. 26Auburn University, Auburn, AL. 27Auburn University, Auburn, AL. 28Auburn University, Auburn, AL. 29Auburn University, 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at 30% in the high contraction frequency group and 50% in the low contraction frequency group. Phosphorylated rpS6 (Ser240/244) significantly increased 70% in both groups (p<0.05). After the chronic training sessions, muscle wet weight increased significantly on the exercise side by 10.7% in the high contraction group and 6.5% in the low contraction group (p<0.05) without significant difference between the two groups.

CONCLUSIONS: Even though exercise volume was different (5 repetitions x 5 sets vs 10 repetitions x 5 sets), analobic responses and muscle hypertrophy rate were equivalent. We speculate that repetitions with high power output are enough for inducing muscle protein synthesis and muscle hypertrophy.

2981 Board #7
May 29 1:00 PM - 3:00 PM

Does Muscle Glycogen Content Account For The Contralateral Force Deficit During Unilateral Fatigue?
JoCarol E. Shields, Jesus A. Hernandez-Sarabia, Alejandra Barrera-Curiel, Micheal J. Luera, Jason M. DeFreitas. Oklahoma State University, Stillwater, OK.

(No relevant relationships reported)

Performing unilateral contractions to exhaustion has been shown to lead to force deficits of both the exercised and unexercised limbs. It has been proposed that the contralateral force deficits are of neural origin, and not due to peripheral mechanisms of fatigue (e.g. glycogen depletion). While this proposed model appears likely, it remains speculative as the absence of peripheral factors to contralateral force deficits have not been verified. PURPOSE: Therefore, the purpose of the study was to quantify the changes in muscle glycogen content and maximal force of both limbs in response to unilateral fatigue. METHODS: Nineteen healthy subjects performed two maximal voluntary isometric (MVC) knee extensions of each leg before (PRE) and after (POST) a fatiguing protocol of the right leg. The fatiguing protocol consisted of repeated 56 second long ramp contractions of the right leg at 30% MVC until failure. During the plateau phase of each contraction, ultrasound images were taken at the midpoint of the rectus femoris (RF). The echo intensity, which has been shown to be sensitive to acute changes in muscle glycogen content, was analyzed from each image of the RF muscle. RESULTS: A two way repeated measures ANOVA showed a significant time x limb interaction (p = 0.001) for MVCs. Follow-up paired sample t-tests indicated that both limbs showed significant force loss. However, the right leg (−33%, from 773.36±191.79 to 517.13±136.72, p = 0.001) demonstrated a much larger force deficit than the left leg (−9.7%, from 803.07±215.32 to 725.04±198.44, p = 0.002). For echo intensity, the right leg demonstrated a significant change (8.8%, from 48.68±7.70 to 52.85±6.68, p = 0.009) from PRE to POST. However, the left leg did not change (3.4%, from 55.93±7.63 to 54.65±7.25, p = 0.62). It is worth noting the increase in echo intensity, as shown with the right leg, represents a decrease in tissue density (e.g. decreased muscle glycogen content). CONCLUSION: Our findings suggest peripheral fatigue mechanisms, such as muscle glycogen content, were not responsible for the decreased force in the contralateral limb. This absence of peripheral, intracellular changes supports the original proposal that the contralateral force deficit is of a central, neural origin.

2982 Board #8
May 29 1:00 PM - 3:00 PM

Does Skeletal Muscle Growth Contribute To Strength Adaptation In Resistance Trained Individuals?

(No relevant relationships reported)

Performing a one-repetition maximum (1RM) strength test twice a week has been shown to produce similar strength adaptations as traditional resistance exercise. Of note, the increase in muscle size with traditional training has no additive effect on strength adaptation in non-resistance trained individuals. The training status is often pointed out as a limitation to understanding the “potential” of muscle growth to contribute to strength. Specifically, it is thought that growth would be of increased importance for resistance-trained individuals. PURPOSE: To examine the changes in biceps muscle thickness (MT), and 1RM strength following 8 weeks of 1RM practice or traditional training. METHODS: 19 individuals completed the study. Participants visited the lab for 18 visits. During visit 1, MT and strength were measured. MT was measured at 50, 60 and 70% the distance between the acromion process and lateral epicondyle. Participants then performed biceps curls twice a week for 8 weeks. One arm performed 4 sets of as many repetitions as possible with approximately 70% of their 1RM, and the other arm performed a single maximal repetition. Post measurements of MT and strength were taken. Results are displayed as means (SD).

RESULTS: For MT at the 50% site there was an interaction (p = 0.004). MT increased from pre [2.60 (6.6) cm] to post [2.71 (5.5) cm, p < 0.02] intervention in the hypothyroid condition, with no change in the strength condition (p = 0.57). For MT at the 50% site there was an interaction (p = 0.03). MT increased from pre [2.86 (6.6) cm] to post [3.02 (5.5) cm, p < 0.004] intervention in the hypothyroid condition, with no change in the strength condition (p = 0.52). For MT at the 70% site there was an interaction (p < 0.001). MT increased from pre [3.26 (5.5) cm] to post [3.48 (5.5) cm, p < 0.001]

intervention in the hypothyroid condition, with no change in the strength condition (p = 0.26). For 1RM strength there was no condition x time interaction (p = 0.29).

However, there was a main effect for time (p < 0.001). 1RM strength increased from pre [16.7 (4.2) kg] to post [18.9 (4.2) kg] intervention, with no difference observed between conditions. CONCLUSIONS: In resistance trained individuals, bi-weekly 1RM training produces similar increases in 1RM strength as a more traditional resistance training approach without inducing muscle growth.
Purpose: The PFO is a source of intracardiac right-to-left shunt and is present in ~1/3 of the adult population. Deficits in pulmonary gas exchange efficiency associated with PFO have been well-documented (Lovering et al, J Appl Physiol 2016). However, changes in pulmonary artery pressure and total pulmonary resistance (TPR) following closure have not previously been reported.

Methods: Four candidates (3F, 1M) for closure of PFO were identified by local methods.

Results: Exercise time was longer for heavy vs. severe exercise (36 ± 6 vs. 10 ± 3 min, P < 0.05). Final min VO2 was lower during heavy (3.12 ± 0.74 L/min; 82 ± 5% of VO2peak) vs. severe exercise (3.60 ± 0.83 L/min; 95 ± 4% of VO2peak) (P < 0.05). Both heavy and severe exercise elicited a significant reduction in PDtw (~3 ± 1% and -19 ± 13%) and Pgap (-23 ± 20% vs. -24 ± 17%) (both P < 0.05); however, the magnitude of exercise-induced respiratory muscle fatigue was not different between trials (P > 0.05). The cumulative diaphragm and gastric pressure-time products were greater for heavy vs. severe exercise (TPPa: 16790 ± 6727 vs. 5945 ± 1956 cmH2O; TPGa: 7818 ± 3368 vs. 2595 ± 1233 cmH2O; both P < 0.05). CONCLUSION: The diaphragm and expiratory muscles fatigue in response to exhaustive heavy- and severe-intensity exercise in healthy humans. The magnitude of exercise-induced respiratory muscle fatigue between trials was not different despite a substantially greater cumulative TTPa and TPGa for heavy- vs. severe-intensity exercise.

2986 May 29 1:30 PM - 1:45 PM
Reduction In Pulmonary Arterial Pressure At Rest And During Exercise Following Percutaneous Closure Of Patent Foramen Ovale

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(No relevant relationships reported)

Purpose: To investigate the effect of exercise intensity on the presence and severity of exercise-induced diaphragm and expiratory muscle fatigue in healthy humans.

Methods: Ten healthy adults (25 ± 3 y, 3 females) performed a ‘ramp sprint’ test to determine critical power (CP), peak ramp power (Ppeak) and VO2peak (54 ± 9 ml/kg/min). The subjects then performed two constant-power cycling tests to exhaustion: 1) 5% < CP (173 ± 50 W, heavy intensity); 2) ~25% of the difference between CP and Ppeak (215 ± 53 W, severe intensity). Diaphragm and expiratory muscle fatigue were quantified as the pre- to post-exercise reduction in the transdiaphragmatic (PDtw) and gastric (Pgap) twitch pressure response to magnetic stimulation of the cervical and thoracic nerves, respectively.

Results: Exercise time was longer for heavy vs. severe exercise (36 ± 6 vs. 10 ± 3 min, P < 0.05). Final min VO2 was lower during heavy (3.12 ± 0.74 L/min; 82 ± 5% of VO2peak) vs. severe exercise (3.60 ± 0.83 L/min; 95 ± 4% of VO2peak) (P < 0.05). Both heavy and severe exercise elicited a significant reduction in PDtw (~3 ± 1% and -19 ± 13%) and Pgap (-23 ± 20% vs. -24 ± 17%) (both P < 0.05); however, the magnitude of exercise-induced respiratory muscle fatigue was not different between trials (P > 0.05). The cumulative diaphragm and gastric pressure-time products were greater for heavy vs. severe exercise (TPPa: 16790 ± 6727 vs. 5945 ± 1956 cmH2O; TPGa: 7818 ± 3368 vs. 2595 ± 1233 cmH2O; both P < 0.05). CONCLUSION: Improvements in pulmonary gas exchange efficiency are expected with removal of the intracardiac right-to-left shunt. However, our results demonstrating a significantly reduced pulmonary artery pressure, due to a significantly reduced TPR, are intriguing and deserve more attention to better understand the contributing factors of a PFO to exercise-induced pulmonary hypertension.

2987 May 29 1:45 PM - 2:00 PM
Effect Of Active Muscle Mass On Work Of Breathing And Oxygen Cost Of Ventilation

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(No relevant relationships reported)

Purpose: To compare estimates of work of breathing (Wb) and O2 cost of ventilation in the respiratory muscles (VRMO2) among three types of exercise, representing smaller and large active muscle masses.

Methods: Twenty healthy adults (25±4.9 yrs, BMI: 23.9 ±2.6 kg/m2) completed three randomized peak cardiopulmonary exercise tests (CPET) on separate days: 2-leg (large muscle mass) and 1-leg (medium mass) tests and 1-arm (small mass). Estimates of Wb and VRMO2 were compared at power outputs corresponding to 25%, 50%, 75%, and 100% of the peak power output on the tests and at Isomax, defined as the power output identical to peak exercise on the 1-arm CPET. Wb was estimated using an established algorithm: [(] and VRMO2 = [(]

Results: Peak power output was 32 ±11.96 watts for the 1-arm, 97.8 ±30.48 watts for the 1-leg, and 186.25 ±44.03 watts for the 2-leg CPETs. At 50% of peak WR, significant differences in Wb and VRMO2 between 1-arm and 2-leg (Wb p=0.001; VRMO2 p=0.001). At 100%, there were differences in Wb and VRMO2 between 1-arm and 2-leg (Wb p=0.01; VRMO2 p=0.01) and between 1-leg and 2-leg CPETs (Wb p<0.02; VRMO2 p=0.02)

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<th>1-arm</th>
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<td>Wb kg.m.min [-1]</td>
<td>1.2 ± 0.9</td>
<td>5.91 ± 4.7</td>
<td>2.2 ± 1.2</td>
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<tr>
<td>VRMO2 mL.min [-1]</td>
<td>7.4</td>
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At Isomax, significant increases were found in Wb and VRMO2 between the 1-arm and 1-leg (p<0.001) CPETs and between the 1-arm and 2-leg (p<0.001) CPETs.

Conclusion: The findings suggest that breathing economy is diminished with respect to exercising that requires progressively smaller active muscle masses. This study suggests that CPETs requiring smaller active muscle masses may not be sufficient for examining maximal Wb or VRMO2 capacity.
**Conclusions:** Bronchodilator administration prior to maximal exercise testing may be necessary to increase estimated ventilatory capacity and reduce ventilatory limitations even in children with mild asthma.

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**Methods:** Nine children with mild asthma (7 boys, 10±1 y; BMI percentile: 66±30), forced expiratory volume in 1 s (FEV1) 106±124% predicted, Range 78-144) completed spirometry before and after 360µg of albuterol. On a separate visit, they completed an incremental exercise test while receiving 180µg albuterol before the incremental test. Five would benefit from bronchodilator therapy in their normal exercise setting.

**Results:** Maximum exercise capacity increased by 16% after bronchodilator (602±23 vs. 692±27 L/min; p=0.013). Measured maximal tidal volume was lower than estimated (1.12±0.32 vs. 1.33±0.25 L; p=0.002) but measured maximal total respiratory cycle time (TRES) did not differ from estimated (1.14±0.36 vs. 1.47±0.46 L; p=0.792). In a subset of seven children who received 180µg albuterol before the incremental test, five would have been ventilatory limited (i.e., <10% breathing reserve) at maximal exercise using “before bronchodilator” estimated ventilatory capacity (breathing reserve range: ±6 to +9%). However, only one child was ventilatory limited at maximal exercise using “after bronchodilator” estimated ventilatory capacity.

**Purpose:** To test the hypothesis that exercise training improvements in muscle convective and diffusive O2 transport, and therefore VO2peak, would not be attenuated in patients with COPD compared to matched controls.

**METHODS:** Metabolic and vascular adaptations to single leg knee extensor exercise (KExE) training (1 h, 3 times a week for 8 weeks) were compared between 8 patients with severe COPD (FEV1 <60.1 L, 30% of predicted) and 8 controls matched for age and physical activity. Femoral arterial and venous blood samples, in conjunction with thermodilution, were used to determine muscle O2 transport and utilization at peak KExE.

**RESULTS:** Training increased muscle convective O2 transport in the controls (0.69±0.07 vs. 0.80±0.10 L/min, p<0.05), but not in the patients with COPD (0.44±0.06 vs. 0.49±0.08 L/min, p>0.05). Muscle diffusive O2 transport was increased with training in both the patients (6.6±0.8 vs. 9.1±0.12 ml/min/mmHg) and controls (10.4±0.9 vs. 13.3±0.9 ml/min/mmHg) (each p<0.05), which equated to an 86% training response in the patients relative to the controls. Training increased VO2peak in the patients with COPD (0.27±0.04 vs. 0.34±0.05 L/min) and controls (0.42±0.05 vs. 0.58±0.07 L/min) and peak work rate in the patients (12.2±2 vs. 16.2±2 W) and controls (24.4±3 vs. 36.4±4 W) (each p<0.05), which equated to a 44% (VO2peak) and 33% (peak work rate) training response in the patients relative to the controls. **CONCLUSIONS:** These findings document limited plasticity in convective O2 transport to the muscle, but relatively conserved plasticity in muscle diffusive O2 transport with exercise training in COPD.**

**Results:** Bronchodilator increases estimated ventilatory capacity in children with mild asthma.

**Methods:** Bronchodilator administration prior to maximal exercise testing may be necessary to increase estimated ventilatory capacity and reduce ventilatory limitations even in children with mild asthma.

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training at altitude. **Purpose**: To determine how markers of iron homeostasis, including ferritin (fer), hemoglobin concentration (Hb), reticulocytes, HEP, ERY, interleukin 6 (IL-6), and tumor necrosis factor alpha (TNFa), lactate dehydrogenase (LDH) and creatine phosphokinas (CPK) change during training in female endurance and team sport athletes residing at moderate altitude. **Methods**: We recruited 94 female athletes from the University of Colorado DI cross country (XC); n = 28, nordic (n = 6) and alpine (n = 8) skiing, lacrosse (LAX; n = 35) and soccer teams (n = 17). In addition, 12 full time female college students were recruited as controls. Between 2 to 7 fasted blood samples were collected over a minimum of 3 months. All athletes were provided with oral iron supplements from a certified nutritionist during this period. **Results**: Average fer and Hb were higher in endurance athletes (fer: 53 ± 30 ± 43; Hg: 14.6 ± 0.8) compared to team sport athletes (31 ± 19; 13.8 ± 0.8) and controls (18 ± 9; 13.9 ± 1.1). fer remained stable over time for all groups except LAX, who decreased by 20 ng/dl; post season. HEP was higher in endurance (36.6 ± 60.3 ng/dl) compared to team sport athletes (18.0 ± 12.0), but there were no differences between groups for ERY (overall average: 10.1 ± 50.8 ng/dL); neither HEP or ERY changed significantly over time. In LAX, soccer, and nordic, IL6 and TNFa were lower than XC and remained stable over time; however, IL6 and TNFa started higher in XC and decreased over time. All teams except nordic showed fluctuations in LDH and CPK over the training cycle, but there were no differences between groups for these parameters or percent reticulocytes for any groups. **Conclusion**: Endurance athletes had higher Hb, fer, and HEP. While IL6 and TNFa were higher in XC athletes, other biomarkers of iron homeostasis tended to not be different between groups, although some parameters fluctuated over time.

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**2993 May 29 1:15 PM - 1:30 PM Markers Of Training Stress Associated With Functional Overreaching In Middle Distance Runners**

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**PURPOSE**: The present study aimed to identify markers of training stress that were related to the incidence of overreaching in response to overload training in middle distance runners. **METHODS**: Twenty-four middle distance runners (n=16 M, VO2peak: 37.3±4.3 ml·kg·min⁻¹; n=8 F, VO2peak: 62.3±4.3 ml·kg·min⁻¹) completed 3 wk of normal training, followed by 3 wk of high-volume training (HVTr; 10% increase in volume each successive week), and a 1-wk taper (TapTr; 55% exponential reduction in training volume from HVTr wk 3). Before, and immediately after each training phase, an incremental treadmill test was performed to measure time to exhaustion (TTE), peak heart rate (HRpeak), HR recovery, peak blood lactate concentration ([La]peak) and VO2peak. In addition, resting metabolic rate (RMR), body composition, energy intake and resting blood biomarkers of training stress were measured. Runners who had a decreased TTE (>CV) after HVTr were classified as being functionally overreached (FOR), others as acutely fatigued (AF; <0.05); 21%) or hypoxic (FiO2 < 0.05; 4.5 (1.3) and 4.8 (1.2) mg·kg FFM⁻¹·min⁻¹ in the adipose tissue and skeletal muscle-sub-groups, respectively, p < 0.05). No statistically significant sex differences were found in the content of any of the measured proteins involved in lipid metabolism in adipose tissue or skeletal muscle. **CONCLUSIONS**: The molecular regulation of PFO during exercise remains poorly characterized. The aim of this study was to examine the relationship between the content of key proteins involved in adipose tissue and skeletal muscle fat metabolism with PFO.

**METHODS**: Thirty-six healthy men and women adults [15 females; mean (SD) age 40 (11) years; VO2peak 42.5 (9.5) ml·kg·min⁻¹; body fat % 21.8 (2.8 %)] completed two incremental exercise tests (separated by 7-28 days) to determine PFO via indirect calorimetry. A DEXA scan and adipose tissue and/or skeletal muscle biopsies were obtained 2-7 days after the second exercise test to determine the protein content of PLIN1, CGI-58, ATGL, HSL, ACSL1, and oestrogen receptor α (ERα) in adipose tissue, and FABPpm, ATGL, ACSL1, CP1b and ERα in skeletal muscle. Sex comparisons were performed on sub-groups of males and females matched for aerobic capacity relative to fat free mass and classifications of the physical activity level index and fat mass index (r = 14 and 12 for adipose tissue and skeletal muscle mass comparison sub-groups, respectively).

**RESULTS**: Moderate strength correlations were found between PFO (mg·kg FFM⁻¹·min⁻¹) and the protein content of ATGL [r = 0.41 (0.05 - 0.68), p < 0.05] and CPT1b [r = 0.41 (0.05 - 0.68), p < 0.05] in skeletal muscle. No other statistically significant significant biomarker correlations were found between PFO and the content of proteins in adipose tissue or skeletal muscle. Females had a greater PFO compared to males when expressed relative to fat-free mass [mean (SD): 7.1 (1.9) and 7.3 (1.7) vs 4.5 (1.3) and 4.8 (1.2) mg·kg FFM⁻¹·min⁻¹ in the adipose tissue and skeletal muscle-sub-groups, respectively, p < 0.05].

**CONCLUSIONS**: The molecular regulation of PFO may primarily lie within skeletal muscle rather than adipose tissue, involving processes relating to intramyocellular triglyceride hydrolisis (ATGL) and mitochondrial fatty acid transport (CPT1b). Future studies should explore alternative molecular mechanisms that may account for sexual dimorphism in exercise fuel metabolism.

**2995 May 29 1:45 PM - 2:00 PM The Effect Of Ischemic Preconditioning And Hypoxia On Neuromuscular Function During Intense Exercise**

Samuel Halley, Paul Marshall, Jason Siegler, FACSM. Western Sydney University, Sydney, Australia. (Sponsor: Dr Jason Siegler, FACSM)

**PURPOSE**: To determine whether IPC mediated effects on neuromuscular function are dependent on tissue oxygenation. **METHODS**: Eleven resistance-trained males completed four exercise trials (6 sets of 11 repetitions of maximal effort dynamic single-leg extensions) in either normoxic (fraction of inspired oxygen (FiO2): 21%) or hypoxic (FiO2: 14%) conditions, preceded by treatments of either IPC (3 x 5 min bilateral leg occlusions at 220 mmHg) or sham (3 x 5 min at 20 mmHg). Femoral nerve stimulation was utilized to assess voluntary activation and potentiated twitch characteristics during maximal voluntary contractions (MVCs) performed at baseline, prior to the exercise task and after each set of the exercise task. Tissue oxygenation (via near-infrared spectroscopy), blood oxygenation (via pulse oximetry) and surface electromyography activity was measured throughout the exercise task. **RESULTS**: MVC and twitch torque declined 62% and 54%, respectively (MVC: 96 ± 24 Nm, 95% CI = 73 to 119 Nm, Cohen’s d = 2.9, p < 0.001; twitch torque: 37 ± 11 Nm, 95% CI = 26 to 48 Nm, d = 1.6, p = 0.001), between pre- and post-exercise measurements without reductions in voluntary activation (mean decrease 0.2 ± 0.6%, 95% CI = -5.7 to 6.1%, d = 0.05, p = 0.21); there were no differences between conditions. Hypoxia reduced both blood and tissue oxygenation by 5% and 6%, respectively, compared to normoxic conditions (blood oxygenation: 4.8 ± 0.3%, 95% CI = 4.7 to 5.0%, d = 1.9, p = 0.001; tissue oxygenation: 3.5 ± 1.5%, 95% CI = 2.6 to 4.4% d = 2.4, p = 0.001), with a further 3% reduction in tissue saturation evident in the hypoxic IPC compared to hypoxic sham trial (mean decrease 1.8 ± 0.7%, 95% CI = 0.5 to 3.5%, d = 1.0, p = 0.05).
Initial THM values for controls (894 ± 38.1) was not different and did not change with training. Initial PV values for controls, alpine, FB and NSKI were 3763 ± 158, 3901 ± 268, 4855 ± 121 and 4597 ± 260 mL, respectively. Initial PV for controls were lower than FB and NSKI, while alpine was lower than FB. NSKI had a decrease in PV (~477 ± 157 mL), which then returned to initial values. Conclusion: THM remained constant during training, regardless of sport or sex, indicating that the training stimuli experienced by the athletes may not alter THM. During the course of training some teams exhibited a decrease in PV, which could be a result of the nature of training stimuli and/or hydration status.

Interval training (IT) is a method commonly used by coaches. The rest between stimuli is a variable that can be manipulated in IT. Rest time influences the specificity of workload. Considering that Blood Lactate (BLA) represents the balance of metabolic intracellular production-removal-oxidation, it is very important to determine different levels of Lactate Steady-State (La SS) with variation in rest time, which are able to sustain La SS for longer periods, using IT workouts. PURPOSE: To analyze BLA during 90s of passive rest (pr) in steady-state moderate intensity IT (mIT). In previous work, we have shown that La SS was maintained for 60s of pr (Mazza et al., 2018), without significant differences (SD). METHODS: Eleven trained swimmers (19.4±3.8 y) performed a mIT (BLA 4 to 6 mMol/L). The bout was 10x100m freestyle with 90s pr. BLA and heart rate (HR) were measured at 10s, 50s and 80s at same time, during pr, every 2 reps. We applied Shapiro-Wilk test to analyze distribution's data. We compared BLA-10s vs. BLA-50s vs. BLA-80s applying One-way ANOVA (p<0.05) in reps 2-4-6 and 10; also, we determine Pearson correlation coefficient (r) between BLA-10s, BLA-50s, BLA-80s vs. HR-10s, HR-50s, HR-80s, respectively. RESULTS: BLA data show normal distribution (p>0.05). The mean BLA max/min. values were 6.25±0.58 mMol/L, respectively, at 1.49±0.07 m/s. Statistical analyses are shown in the following table: 

<table>
<thead>
<tr>
<th>Rep</th>
<th>BLA-10s vs. BLA-50s</th>
<th>BLA-50s vs. BLA-80s</th>
<th>BLA-10s vs. BLA-80s</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>*</td>
<td>#</td>
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<td>4</td>
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<td>6</td>
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<tr>
<td>8</td>
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</tbody>
</table>

We found a low r between BLA and HR (r=-0.25-0.30). CONCLUSION: This work shows that La SS in mIT depends of pr duration to generate sustained metabolic stress during whole exercise - rest workout. BLA-10s vs. BLA-50s does not register SD (except rep. 6). However, BLA-50s vs. BLA-80s are SD, showing a tendency to lower BLA level. La SS is maintained within BLA 4 to 6 mMol/L range with only 1.17 mMol/L differences between max/min. mean values. Also, we found that HR is not valid variable to control metabolic stress in mIT.

**CONCLUSION:** IPC did not affect any measure of neuromuscular function regardless of tissue oxygenation. A reduction in FIO₂ did invoke a humoral response and improved muscle O₂ extraction during exercise, however it did not manifest into any performance benefit.

**F13**

**Free Communication/Slide - Neuroscience**

**3000**

**May 29 1:00 PM - 1:15 PM**

**Brain-Heart Dynamics Are Associated With Cardiorespiratory Fitness & Cognitive Control**

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An association between cardiovascular activity and cognitive control may represent overlapping roles of the prefrontal cortex for autonomic and cognitive functions. Greater vagal tone is associated with greater cardiorespiratory fitness and may partially explain the well-established benefits of exercise for cognitive control. PURPOSE: The aim of this study was to relate cardiorespiratory fitness (VO₂max) and cognitive control to dynamic brain-heart connectivity. METHODS: Twenty-three, recreationally active young adults (14 women; 18-35 years old) completed a treadmill VO₂max test, assessment of cognitive control, and resting measures of electroencephalography (EEG) and electrocardiography (ECG). Cognitive control was defined by performance on the Flanker Test (‘inhibitory control’) and Dimensional Change Card Sort Test (‘cognitive flexibility’). A multi-taper method (1-50 Hz; 1 Hz steps) was used to compute dynamic power from four different electrodes and six posterior electrodes as controls. A point-process model, based on an inverse Gaussian distribution fit between R-peaks, was used to produce an instantaneous estimate of heart rate. The maximal information coefficient (MIC), a non-parametric statistic capable of identifying linear and non-linear associations, was computed between the heart rate model and time-varying power at each electrode and frequency to represent dynamic brain-heart connectivity. A partial least squares analysis characterized the brain-heart connections that significantly and reliably contributed to a relationship between MIC and VO₂max and cognitive control. RESULTS: One latent variable (p=0.036) represented independent, negative correlations between MIC and VO₂max, inhibitory control, and cognitive flexibility. High VO₂max and cognitive control were positively associated with right-lateralized MICs (boot-strap ratios ≥ 1.96) in the delta band (1-3 Hz) and negatively associated with left-lateralized MICs (boot-strap ratios ≤ 1.96) in the delta and theta bands (1-7 Hz). There was no relationship between MIC measured with control (posterior) electrodes and the dependent variables (p=0.236). CONCLUSION: The benefits of exercise for cognitive control may be associated with right-lateralized communication between the prefrontal cortex and heart.

**3001**

**May 29 1:15 PM - 1:30 PM**

**Aerobic Exercise Regulates Synaptic Homeostasis In The Hippocampal CA1 Region Of APP/PS1/tau Mice**

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PURPOSE: Physical exercise is an important lifestyle behavior that may reduce the risk of Alzheimer’s disease (AD) and delay the onset and progression of AD. Most of the mechanisms underlying these effects are based on molecular biology and little reports are involved in cellular function. In this study, we were to explore the changes
3002 May 29 1:30 PM - 1:45 PM
Is Aerobic Fitness Associated With The Dopaminergic System? Evidence From Spontaneous Eye Blink Rate
Ryuta Kuwarnizuma, Kazuya Suwabe, Takemune Fukuie, Genta Ochi, Taichi Hiraga, Hideaki Soya, Faculty of Health and Sport Sciences, University of Tsukuba, Tsukuba, Ibaraki, Japan.
(No relevant relationships reported)

Many studies, including ours, have revealed that aerobic fitness, as a physiological indicator of physical activity, is associated with cognitive performance based on the prefrontal cortex and the hippocampus (Hyodo, Soya et al., NeuroImage, 2016; Suwabe, Soya et al., Sci Rep, 2017). As a potential neurobiological basis for this, the brain dopaminergic system is postulated by animal and a few human studies. Current studies hypothesize that higher physical activity levels may prevent elderly peoples from declining cognitive function probably via a protective effect against reduced dopamine D2-receptor availability (Könnecke et al., NeuroImage, 2018; Jonasson et al., Neuronadme, 2019). Forced exercise, but studies using the 3xTg-AD mouse did not after a voluntary exercise. Discrepancies in the data may be due to the wide range of transgenic animal strains, starting age, intervention type, and length of intervention used in these studies. Here, we used 12-week protocol starting with different age of 3xTg mouse to investigate forced running effect on Aβ levels.

METHODS: 6, 9 and 12 months 3xTg mice were randomly divided into exercise group, sedentary group, 3xTg mouse as the control group. The exercise groups would run on the treadmill for 12 wks. Immunofluorescence and Dot blot were used to detect Aβ plaque and soluble Aβ respectively. Western blots were used to detect B-site APP cleaving enzyme (BACE1) and Aβ degradation or clearance enzyme Neprilysin (NEP) in the cerebral cortex and hippocampus and Insulin-degrading enzyme (IDC) in liver.

RESULTS: The hippocampal and cortical tissue showed soluble Aβ increased with age. Obvious Aβ plaque accumulation was showed at 9 and 12-month-old. With AD-pathology the BACE1 levels were increased (p<0.05) while NEP expression decreased (p<0.05) in hippocampus and cortex, and IDC content decreased (p<0.05) in liver. Disturbances went more severe with aging. Exercise treatment ameliorated soluble Aβ aggregation and Aβ plaque, BACE1 (0.70±0.13, 0.78±0.13, 0.81±0.18/0.106±0.12, p<0.05) of pyramidal neurons. Aerobic exercise also reversed the changes above of AS in I–O curve (0.74±0.03, LTD (170.97±5.42%), the frequency of mEPSCs (0.51±0.48 Hz), the amplitude of mIPSCs (41.20±1.13 pA) and E/I ratio (0.71±0.03), and decreased PPF(1.42±0.07). LTD (79.01±4.99%), the amplitude of mEPSCs (11.52±0.29 pA) and the frequency of mIPSCs (1.72±0.12 Hz). Meanwhile, those electrophysiology signals were also increased in the CE group.

CONCLUSIONS: In the 3xTg-AD mice at different age of 6, 9 and 12 months, 12 wks forcing treadmill exercise can obviously reduce the levels of Aβ with lower BACE1, higher NEP expression in the brain and IDE of the liver. Although it is not definite that forced could interventions are better for reducing Aβ levels, the benefits of exercise interventions still support the value of this healthy life-style against neurodegeneration.

P3004 May 29 2:00 PM - 2:15 PM
Effects Of Aerobic Exercise On The Nicotine Addiction Induced Inhibitory Synaptic Plasticity In The Vta
Yan Li, Jie Zhang, Li Zhao. Beijing Sport University, Beijing, China.
(No relevant relationships reported)

PURPOSE: Disinhibition of the ventral tegmental area (VTA) dopamine neurons has been implicated in nicotine addiction. This study aimed to investigate the effect of aerobic exercise on the nicotine addiction behavior in mice, and the effect on GABAergic transmission and dopaminergic activity in the VTA.

METHODS: 2 months old male C57BL/6J mice were randomly divided into sedentary group (SS), sedentary + nicotine group (SN), exercise + nicotine group (EN) respectively. The ES and EN groups were made to run on the treadmill for 1 hour per one day, five times a week, for 12 weeks. The exercise workload consisted of running at a speed of 12 m/min for the first 10 min, 15 m/min for the last 50 min, with 0% grade of inclination. The conditioned place preference (CPP) assay was used to evaluate nicotine addiction related behavior. In the CPP assay, SN and EN mice were given an intraperitoneal (i.p.) injection of nicotine (0.5 mg/kg) while SS and ES mice were given an injection of saline. Patch clamp was used to investigate the dopamine neuron excitability and GABAergic transmission in the VTA. Immunofluorescence was used to detect the expression of tyrosine hydroxylase (TH) in the VTA.

RESULTS: 8 weeks of treadmill exercise decreased nicotine exposure induced CPP expression (CPP score, SS, -33.69±16.57; SN, 121.51±14.53; ES, -21.72±15.12; EN, 66.34±15.12; SS vs. SN, p<0.001; EN vs. SN, p<0.05, two-way ANOVA). Exercise decreased nicotine CPP induced dopamine neuron hyperexcitability (SS, 3.36±0.45; SN, 6.63±0.56; ES, 3.22±0.05; EN, 4.60±0.18; SS vs. SN, p<0.001; EN vs. SN, p<0.01, two-way ANOVA). Exercise decreased nicotine CPP induced increase of TH expression in the VTA (relative fluorescence intensity, SS 1.00, SN 2.03±0.15; ES, 1.38±0.06; EN, 1.40±0.07; SS vs. SN, p<0.001; EN vs. SN, p<0.001, two-way ANOVA). Exercise restored nicotine CPP induced impairment of GABA transmission in the VTA (IPSCs frequency, % as baseline, SS, 154.62±6.86%; SN, 102.19±6.20; ES, 141.36±8.4; EN, 121.82±4.41; SS vs. SN, p<0.001; EN vs. SN, p<0.05, two-way ANOVA).

CONCLUSIONS: Aerobic exercise restores nicotine addiction induced VTA dopamine neuron hyperexcitability by enhancing the inhibitory transmission. Supported by the China Postdoctoral Science Foundation (2018M641250, 2019T120067).
Pupillary Responses Indicate Working Memory Processing Differences: Implications For Healthy And Clinical Populations

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(NO relevant relationships reported)

Purpose: To examine the effects of concussion history, sex, and performance accuracy on PRs in healthy individuals during a digit-span task. Methods: Participants self-reported sex (female vs. male) and concussion history (yes vs. no), and completed a backwards digit-span task in a single testing session. A virtual reality headset with 60Hz infrared eye tracking displayed the task and recorded pupil size fluctuations. Pupil size (diameter in mm) was recorded before each trial (baseline=3sec) and fixation randomly presented digit sequences between 4 and 14 digits long (retention=2sec). PR was calculated as the mean size during retention eye normalized to mean baseline. Accuracy was calculated as the proportion of correctly recalled digits by serial position. A mixed effects model examined concussion history, sex, and accuracy effects on PR across sequence-lengths (a priori α=0.05). Results: 40 participants were included (21 females, 19 males; mean age=17.43 years; concussion history). There were significant effects of sex (F1,38=15.66, p<0.001) and accuracy (F1,38=4.70, p=0.035) on overall relative PR controlling for all other model predictors and interactions. Specifically, females exhibited smaller mean PRs compared to males. Smaller mean PRs were also associated with higher average task accuracy. Conclusion: In our study, females exhibited smaller overall pupillary responses during a digit-span working memory task compared to males, indicating potential sex-dependent processing differences. The association between better task accuracy and smaller PRs may further support PR measures to better inform neurocognitive processing differences in healthy and clinical populations, where demands exceed cognitive resource availability.

Medicine & Science in Sports & Exercise

F-14 Free Communication/Slice - Older Adults: Methods, Interventions, and Outcomes

Friday, May 29, 2020, 1:00 PM - 3:00 PM
Room: CC-2022

3007 May 29 2:45 PM - 3:00 PM
Relationships Between Muscular Strength, Cognitive Control, And Hippocampal Dependent Relational Memory Function
Jeongwoon Kim1, Colleen F. McKenna1, Amadeo F. Salvador1, Susannah E. Scarl1, Jonathan Cerna1, Corinne N. Cannavale1, Scott A. Paluska, FACSM2, Michael De Lisio3, Nicholas A. Buri1, Naiman A. Khoury1, University of Illinois, Urbana-Champaign, IL. 2University of Ottawa, Ottawa, ON, Canada.

(Sponsor: Scott A. Paluska, FACSM)

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(NO relevant relationships reported)

Purpose: An increasing number of studies have shown a positive correlation between aerobic fitness and cognitive control, and hippocampal memory performance. However, the relationship between muscular strength and specific domains of cognitive function has not yet been well elucidated. The aim of this study was to examine cross-sectional relationships between muscular strength and cognitive control (i.e., attention and inhibitory control), as well as hippocampal-dependent relational memory. Methods: Adults (N=35) between 45 and 64 years underwent strength assessments measured by leg extension one-repetition maximum (IRM), maximal voluntary isometric contraction (MVC), and isokinetic knee extension. Selective attention, inhibitory control, and hippocampal-dependent relational memory was assessed using the Flanker, Go/NoGo, and a Spatial Reconstruction task, respectively. Lean mass was measured via dual X-ray absorptiometry (DXA). Results: Following adjustment for covariates (i.e., age, sex, and lean mass), greater MVC (r=0.37, P=0.04) and isokinetic peak knee extension torques measured at 60°·s−1 (r=−0.47, P=0.008), 120°·s−1 (r=−0.37, P=0.04), and 180°·s−1 (r=−0.39, P=0.03) were related to faster incongruent reaction time during the Flanker task. Misplacement error during spatial reconstruction task was inversely related to peak knee extension torques measured at 120°·s−1 at the trend level (r=−0.36, P=0.05). No significant associations were observed for Go/NoGo accuracy (all P≤0.34, all P>0.06). Conclusion: Individuals with greater muscular strength exhibit greater cognitive function. These findings provide insights into the potential for domain-specific interrelationships between muscular strength and attention abilities over memory performance and inhibitory control. This work was funded by The Beef Checkoff.

F-13 Effect Of Type And Intensity Of Community-based Exercise Interventions In Older Women

Emmanuel Gomes Ciola1, Gabriel Souza Zanini1,2, Vanessa Teixeira Amara1, Gabriel Falcao1, Bianca Mendes1,3,4, Isabela Roque Marcal1, Awassi Ophira Ngomane1,5, Guilherme Veiga Guimarães1,2, São Paulo State University - UNESP, Bauru, Brazil. 3University of São Paulo - USP, São Paulo, Brazil.

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(NO relevant relationships reported)

Purpose: To assess the effect of different community-based exercise interventions on hemodynamic and functional variables in older women. Methods: 33 sedentary or insufficiently active older women (69 ± 5 ys) were randomly assigned to perform a twice-weekly community-based moderate-intensity continuous aerobic training plus resistance training (MICT+RT), high-intensity interval training plus resistance training (HIIT+RT) or resistance training (RT) programs. Anthropometric (weight, height and BMI), hemodynamic (resting blood pressure and carotid-femoral pulse wave velocity) and functional variables (seat-and-stand, handgrip, five times sit-to-stand (FTSS), timed up-and-go (TUG), and 6-minute walking (6MW) tests) were assessed before and after 9 months of follow-up.
RESULTS: There were no significant difference between groups in any variable at baseline. Anthropometric and hemodynamic variables, as well as seat-and-reach and handgrip did not change during follow-up in any group. However, FTSS, TUG and 6 MW improved (p<0.05) similarly between groups during follow-up (Table 1).

CONCLUSION: The present preliminary results suggest that twice-weekly community-based exercise programs of different types and intensity are effective to improve functional capacity, but not anthropometric and hemodynamic variables, in older women.

Table 1. Anthropometric, hemodynamic and functional variables before and after 9 month follow-up

<table>
<thead>
<tr>
<th>Variable</th>
<th>MICT_RT</th>
<th>RT</th>
<th>HIIT+RT</th>
<th>RT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>70 ± 12</td>
<td>74 ± 11</td>
<td>66 ± 9</td>
<td>63 ± 10</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>28.2 ± 4.2</td>
<td>28.5 ± 5.1</td>
<td>27.0 ± 4.4</td>
<td>26.2 ± 4.4</td>
</tr>
<tr>
<td>Systolic BP (mmHg)</td>
<td>118 ± 11</td>
<td>122 ± 8</td>
<td>124 ± 19</td>
<td>128 ± 15</td>
</tr>
<tr>
<td>Diastolic BP (mmHg)</td>
<td>64 ± 6</td>
<td>66 ± 7</td>
<td>63 ± 7</td>
<td>69 ± 9</td>
</tr>
<tr>
<td>PWV (cmHg)</td>
<td>9.4 ± 2.3</td>
<td>9.0 ± 3.0</td>
<td>10.5 ± 10.1</td>
<td>10.1 ± 1.9</td>
</tr>
<tr>
<td>Seat and reach (cm)</td>
<td>22.5 ± 7.7</td>
<td>28.0 ± 8.2</td>
<td>23.0 ± 21.5</td>
<td>21.5 ± 8.0</td>
</tr>
<tr>
<td>Handgrip (kg)</td>
<td>25.0 ± 5.3</td>
<td>24.0 ± 4.3</td>
<td>22.5 ± 5.9</td>
<td>25.5 ± 4.9</td>
</tr>
<tr>
<td>FTSS (s)</td>
<td>11.6 ± 2.1</td>
<td>7.8 ± 1.6**</td>
<td>11.1 ± 2.9</td>
<td>8.9 ± 1.7***</td>
</tr>
<tr>
<td>TUG (s)</td>
<td>8.3 ± 1.1</td>
<td>6.2 ± 1.3**</td>
<td>7.6 ± 2.5</td>
<td>5.9 ± 1.1***</td>
</tr>
<tr>
<td>6MW (m)</td>
<td>482 ± 33</td>
<td>512 ± 43**</td>
<td>464 ± 88</td>
<td>536 ± 53***</td>
</tr>
</tbody>
</table>

FTSS: five sit-to-stand test; HIIT-RT: high-intensity interval training plus resistance training group; MICT: moderate-intensity continuous training plus resistance training group; PWV: carotid-femoral pulse wave velocity; RT: resistance training group; TUG: timed up-and-go test; 6MW: six minute walking test; Asterisk: significant difference from before follow-up at the same group (* = P < 0.05; ** = P < 0.01; *** = P < 0.001)

Abstract Withdrawn

Regular exercise is associated with a reduced risk of developing chronic diseases and improved physical capacity. However, to our knowledge, the effects of modality, intensity and consequences of detraining have not yet been investigated in the elderly population. We sought to evaluate and compare the effect of modality and intensity (moderate intensity continuous aerobic training - MICT, high intensity interval aerobic training - HIIT, resistance training - RT, or combined - MICT + RT and HIIT + RT) of a training program, on the hemodynamic and functional variables of elderly women after 12 weeks of training and 16 weeks after their interruption.

PURPOSE: To verify the effect of exercise modality and intensity on the hemodynamic variables of the elderly.

METHODS: 69 elderly women (69.19 ± 7.89 years) were randomized into MICT (n = 29), RT (n = 15), MICT + RT (n = 12), and HIIT + RT (n = 13). Participants performed physical exercises twice a week during 60 minutes. The variables investigated were blood pressure (BP), heart rate (HR), abdominal circumference (AC) at pre, after 12 weeks of intervention, and after 16 weeks of training interruption (detraining).

RESULTS: Diastolic blood pressure decreased in HIIT + RT between pre and detraining (p < 0.01) and in RT between post and detraining (p < 0.02). There was a significant increase in HR between post and detraining MICT (p < 0.02) and a decrease in MICT + RT between post and detraining (p < 0.00), with no significant difference in detraining. AC decreased in HIIT + RT between pre and post (p < 0.01), in RT between post and detraining (p < 0.009) and post and detraining (p < 0.01). There was an increase in post and detraining WC for MICT (p < 0.05) and MICT + RT (p < 0.03).

CONCLUSION: Isolated or combined aerobic training can be effective in reducing blood pressure levels. Resistance training was also effective for reducing abdominal fat levels.

Abstract Withdrawn

3011 May 29 1:30 PM - 1:45 PM

Abstracts Withdrawn

3012 May 29 1:45 PM - 2:00 PM

Effects Of Community-based Exercise Training And Detraining On Hemodynamic Variables In Older Women: Role Of Intensity And Modality

Vanessa Teixeira Amaral, Gabriel Souza Zaninni, Guilherme Falcão, Isabela Roque Marçal, Bianca Fernandes, Awassi Yophiwa Ngomane, Emmanuel Gomes Ciolac. São Paulo State University - UNESP, Bauru, Brazil.

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(No relevant relationships reported)
Falling and fear of falls among older adults can have significant impacts on daily life such as restricted activity, functional decline, and social isolation. Exercise interventions need to target modifiable risk factors to have the greatest impact.

PURPOSE: The first aim was to determine the effectiveness of an eight-week Stay Strong, Stay Healthy (SSSH) exercise intervention on older adults’ fear of falling and risk of falls. The second aim was to determine the strongest predictors of reported number of falls among older adults.

METHODS: 60 adults over the age of 60 yrs, were randomized into SSSH, active control (WALK), or sedentary control (CON) groups. 46 participants (SSSH n=15, WALK n=17, CON n=14) completed pre-post intervention questionnaires on physical activity (PA), fear of falling, and sleep quality using the Pittsburgh Sleep Quality Index Survey (PSQI). Participants also completed the 8 ft timed up and go (TUG) and 30 s sit to stand (30STS), dynamic balance tasks and grip strength testing. Repeated measures ANOVAs were used to determine group (SSSH, WALK, CON) x time (pre, post) interaction effects for TUG, 30STS, and grip strength; one-way ANOVAs were used to analyze percent changes (%Δ); and simple linear regression was used to predict the number of falls in the last 12 months; alpha was set at 0.05. RESULTS: SSSH and WALK significantly improved 3.4 repetitions and 1.1 repetitions, respectively, while CON did not improve. PSQI scores significantly increased (worsened) in CON (p=0.040), did not change in WALK, and decreased (improved) by 1.3 points in SSSH (p=0.009). Reported PA did not change for WALK or CON; however, SSSH increased PA by >60 min/wk (p=0.049). A significant time effect was observed as TUG times decreased and grip strength did not change for all groups. CON and WALK increased their overall fear of falling scores by 7.7% and 3.9%, respectively, while SSSH decreased by 2.3%. The strongest predictive model for the number of falls reported in the past 12 months included PSQI scores, PA, and grip strength (R=0.282; p=0.003). CONCLUSIONS: These data suggest participation in eight weeks of the SSSH significantly improves important modifiable risk factors (e.g., sleep and PA), and reduced fear of falling scores which is consistent with our prediction model for the number of falls sustained.

The aging process, even in the absence of chronic disease, is marked by a decline in the mass, quality, and function of skeletal muscle, increasing the risk of falls.

PURPOSE: The purpose was to determine effectiveness of an 8-week Stay Strong, Stay Healthy (SSSH) exercise intervention on improving older adults’ muscle strength, dynamic balance, and fall risk compared to controls. METHODS: 60 adults aged ≥60 yrs, were randomized into SSSH, active control (WALK), or sedentary control (CON) groups. 46 participants (SSSH n=15, WALK n=17, CON n=14) completed pre-post intervention general health and physical activity (PA) questionnaires, the Pittsburgh Sleep Quality Index Survey (PSQI), and total body DXA. Participants also completed the 10 m walk test (10MWT), 8 ft timed up and go (TUG), 30 s sit to stand (30STS), the 8 ft timed up and go (TUG), 30 s sit to stand (30STS), back scratch (BS), sit and reach flexibility tests, and the CDC four phase balance task. Repeated measures ANOVAs were used to determine group (SSSH, WALK, CON) x time (pre, post) interaction effects and percent changes (%Δ) were analyzed using one-way ANOVAs; alpha was set at 0.05. RESULTS: SSSH and WALK participants significantly improved 30STS performance by 2.4 repetitions (p < 0.001) and 1.1 repetitions (p = 0.008), respectively, while CON did not improve. PSQI scores significantly increased (worsened) in CON (p = 0.040), did not change in WALK, and decreased (improved) by 1.3 points in SSSH (p = 0.009). Average BS distance increased by more than 60 min/wk (p = 0.049). Reported PA did not change for WALK or CON; however, SSSH increased PA by >60 min/wk (p = 0.049). CONCLUSIONS: Participation in the 8-week SSSH resistance training program significantly improves lower body strength/ coordination, dynamic balance, sleep quality, and engagement in auxiliary PA over sedentary and exercise volume matched walking groups,

Table 1. Blood pressure, heart rate and abdominal circumference during follow-up

<table>
<thead>
<tr>
<th>Intensity</th>
<th>Pre</th>
<th>Post</th>
<th>Detraining</th>
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<tr>
<td><strong>Systolic blood pressure (mmHg)</strong></td>
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<tr>
<td>Pre</td>
<td>136 ± 17</td>
<td>132 ± 19</td>
<td>129 ± 14</td>
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<tr>
<td>Post</td>
<td>132 ± 27</td>
<td>126 ± 17</td>
<td>119 ± 15</td>
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<tr>
<td><strong>Diastolic blood pressure (mmHg)</strong></td>
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<tr>
<td>Pre</td>
<td>78 ± 9</td>
<td>68 ± 10</td>
<td>68 ± 11</td>
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<tr>
<td>Post</td>
<td>73 ± 13</td>
<td>70 ± 7</td>
<td>71 ± 8</td>
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<tr>
<td><strong>Heart rate (bpm)</strong></td>
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<tr>
<td>Pre</td>
<td>74 ± 8</td>
<td>73 ± 8</td>
<td>70 ± 8</td>
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<tr>
<td>Post</td>
<td>70 ± 7</td>
<td>70 ± 7*</td>
<td>71 ± 8</td>
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<tr>
<td><strong>Abdominal circumference (cm)</strong></td>
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<tr>
<td>Pre</td>
<td>91 ± 14*</td>
<td>97 ± 15</td>
<td>97 ± 10</td>
</tr>
<tr>
<td>Post</td>
<td>96 ± 13</td>
<td>102 ± 17</td>
<td>98 ± 9</td>
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HIIT+RT: high-intensity interval training plus resistance training; MICT: moderate-intensity continuous training; MICT+RT: moderate-intensity continuous training plus resistance training; RT: resistance training; * different from pre (P < 0.05); † different from pos (P = 0.05)

**Figure 1.** Changes in lower body strength and dynamic balance with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 2.** Changes in sleep quality and fear of falling with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 3.** Changes in physical activity volume and quality with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 4.** Changes in social isolation and risk of falls with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 5.** Changes in physical activity and quality of life with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 6.** Changes in cardiovascular health and fitness with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 7.** Changes in mental health and well-being with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 8.** Changes in cognitive function and physical activity with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 9.** Changes in functional independence and physical activity with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 10.** Changes in grip strength and physical activity with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 11.** Changes in fear of falling and physical activity with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 12.** Changes in sleep quality and physical activity with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 13.** Changes in physical activity and coordination with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 14.** Changes in dynamic balance and physical activity with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 15.** Changes in physical activity and fear of falling with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 16.** Changes in physical activity and cognitive function with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 17.** Changes in physical activity and physical activity volume with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 18.** Changes in physical activity and quality of life with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 19.** Changes in physical activity and social isolation with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 20.** Changes in physical activity and cardiovascular health with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 21.** Changes in physical activity and functional independence with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 22.** Changes in physical activity and coordination with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.

**Figure 23.** Changes in physical activity and physical activity volume with an 8-week Stay Strong, Stay Healthy intervention in older adults with prediabetes.
3016 May 29 2:45 PM - 3:00 PM
Influence Of Exercise And Gardening Activity On Successful Aging: A Six-year Cohort Study
Yuxin Yang, Xu Wen. Zhejiang University, Hangzhou, China. Email: yangyx20@163.com
(No relevant relationships reported)

Purpose: Population aging has become a prominent social problem in China. This study aimed to examine the influence of exercise and gardening activity on successful aging (SA).

Methods: This study was based on the 2008-2014 data set of Chinese Longitudinal Healthy Longevity Survey (CLHLS). A total of 5245 elderly people aged 65 and older were included in this study. SA was defined as no major illness, being free of disability, normal cognitive function, engaging in social or productive activity, and satisfaction on life. Correlates of SA included demographics (gender and age) and socio-economic feature (education). With activities being measured in 2008 and 2011, SA being assessed both in 2008, 2011 and 2014. Binary logistic regression analysis was used to determine whether these two activities have positive effects on SA.

Results: According to the activity data of 2008 and SA situation in 2014, the regression analyses indicated that regular exercise (OR=1.223, 95%CI: 1.001-1.495) and gardening (OR=1.640, 95%CI: 1.272-2.115) were significant predictors to better SA (P<0.05). From the combination activity data of 2008 and 2011, compared with the sedentary elderly, the elderly participated exercise (OR=1.661, 95%CI: 1.286-2.145, P<0.05) or gardening (OR=1.807, 95%CI: 1.331-2.453, P<0.05) continuously were found to have higher odds to be successful agers in 2014. Moreover, the results showed that the elderly just participated from 2011 have higher probability to be successful than the sedentary elderly, the odds ratios of exercise and gardening were (OR=1.640, 95%CI: 1.272-2.115) were significant predictors to better SA.

Conclusion: These findings suggest that exercise and gardening activity may have positive effects on SA, and continuous participation has better effects.

3070 Chair: Truls Raastad. Norwegian School of Sport Sciences, Oslo, Norway.
(No relevant relationships reported)

F-32 Thematic Poster - Blood Flow Restriction
Friday, May 29, 2020, 3:15 PM - 5:15 PM
Room: CC-2010

3071 Board #1 May 29 3:15 PM - 5:15 PM
Exercise With Blood Flow Restriction To Improve Muscular And Physical Function After Total Knee Arthroplasty
Alexander Kuck1, Benjamin Cockfield2, Alicia DenHerder1, Lydia Lyttle1, Isaac Wedig3, Steven Elmer1. 1Central Michigan University, Mt Pleasant, MI. 2Michigan Technological University, HOUGHTON, MI. 3Aspirus Keweenaw Outpatient Therapies, Laurium, MI. 4Michigan Technological University, Houghton, MI. Email: bacockfi@mtu.edu
(No relevant relationships reported)

Purpose: To evaluate the effectiveness of a 10wk home-based BFR exercise program to improve muscular and physical function after TKA. METHODS: Six adults (age: 59±9yrs, BMI: 33±5) with a unilateral TKA (2.7±1.7 yrs post-surgery) performed body weight half squats, isolated knee extension using a resistance band, and walking exercises with BFR 3x/wk for 10wk. During exercise, blood flow in the affected limb was restricted using a 15cm wide thigh cuff inflated to 50% of limb occlusion pressure which was identified using Doppler ultrasound. Outcome measures of vastus lateralis thickness, maximal knee extensor isometric torque, and physical function (repetitions performed during 30s chair stand test, distance covered during 6min walk test) were assessed at baseline and post-training. RESULTS: Participants completed 98% of the home-based BFR training sessions and tolerated the exercise program well as joint pain (0.6±0.1cm) and muscle soreness (0.5±0.1cm) were very low (0-10cm visual analogue scale). Vastus lateralis thickness and knee extensor strength in the affected leg increased by 18±11% and 17±13%, respectively (both P<0.05). After training, number of repetitions during the 30s chair stand test increased (11±2 vs. 18±4 repetitions, p=0.01) and this change (6 repetitions) exceeded the minimally important clinical difference. There was a significant increase in distance covered during the 6min walk test (511±36 vs. 556±36m, 9±7%, p=0.03) but this improvement (46m) did not exceed the clinical threshold. CONCLUSION: Results from this pilot study are promising and suggest that home-based BFR exercise can be feasible, safe, and effective for improving muscular and physical function after TKA. Further research is needed to confirm these initial findings in a larger randomized TKA control trial.

3072 Board #2 May 29 3:15 PM - 5:15 PM
Acute Physiological Responses To Low-intensity Exercise With Different Levels Of Blood Flow Restriction
Jia Wei1, Yongdi Zou1, Xiaolu Wang1, George Nassis2, Yongming Li1. 1Shanghai University of Sport, Shanghai, China. 2City Unity College, Athens, Greece. Email: weijia_gavin0807@gmail.com
(No relevant relationships reported)

Purpose: External pressure is a key factor in blood flow restriction (BFR) training. Previous studies have used a limited range of occlusion pressures to compare the acute physiological and perceptual responses during leg exercise. The aim of this study was twofold: i) to compare the physiological and perceptual responses of low-intensity exercise (LI) with different levels of BFR, and ii) to compare LI with BFR on the bike with high-intensity (HI) exercise without BFR.

Methods: Twenty-one healthy, moderately-trained male (age: 24.6±2.4yrs; VO2peak 47.2±7.0 ml/kg/min, mean±sd) volunteered to perform one maximal graded exercise test on the bike and seven 5-min constant intensity exercise bouts on separate days and in a counterbalanced order. Six bouts were at 40% peak power (Ppeak: Ul), one without BFR and five with different levels of BFR (40%, 50%, 60%, 70%, 80% of arterial occlusion pressure, LI-BFR). Finally, they performed one HI bout (70%
Resistance training (RT) with blood flow restriction (BFR) induces similar adaptations to traditional RT but uses markedly lower training loads. However, information about the acute exercise pressor, hemodynamic, and local metabolic cost of this training approach is sparse. These data are needed to understand the acute safety implications of this training approach and help identify an optimal BFR protocol. PURPOSE: To compare the acute central and systemic haematological, and local metabolic responses to resistance exercise performed with continuous (BFR-C) and intermittent (BFR-I) BFR.

METHODS: 12 resistance-trained males (mean ± SD) aged 22.3 ± 3.2yrs, 1.82 ± 0.06m, and 84.1 ± 9.0kg performed 4 separate acute resistance training sessions in a random order, each separated by 7 days. Training sessions involved four sets of squats-based RT at 30% of individuals’ 1 repetition maximum with 1) no BFR (CON), 2) BFR-C, 3) BFR-I, and 4) traditional high load training at 70% of 1 repetition maximum with no BFR (HL). Systemic blood pressure and derivatives of cardiac output, central aortic blood pressure pulse wave characteristics, and local blood volume and metabolism were assessed periodically during, and after each training session. Data were assessed by two-way ANOVA with Bonferroni-corrected post-hoc comparisons.

RESULTS: All sessions similarly increase average metabolic demand, seen by a decreased tissue saturation index (-1.5%, 95% CI 13.3 to 17.4, p=0.001) with no difference between conditions (p>0.05). While changes in haemoglobin-derived Vastus Lateralis blood volumes were similar between conditions, they were higher with BFR-C than CON (6.97μL/mL, 95% CI 12.0 to 13.6, p=0.04) and HL (7.9μL/mL, 95% CI 1.2 to 14.8, p=0.01). Training equally increased mean systemic mean arterial pressure (MAP) (+7.05 to 76.6 mmHg, p<0.001) and cardiac output (+0.94 to 0.6 L, p=0.001) above baseline, with no difference between conditions. Training also equally increased mean aortic MAP (+14.8 to 24.2 mmHg, p=0.001) above baseline across conditions.

CONCLUSIONS: BFR-C and BFR-I cause similar exercise pressor responses comparable with both traditional resistance training, and training without BFR. Adding BFR to resistance training didn’t exacerbate the magnitude of duration of the associated cardiovascular stress.

Board #3  May 29 3:15 PM - 5:15 PM Central And Systemic Haematological Responses Are Similar Between Continuous And Intermittent Blood Flow Restricted Resistance Exercise
Llion A. Roberts1, Charlie Davids2, Jeff Coombes, FACSM2, Jonathan Peake1, Treis Raastad1. 1Griffith University, Southport, Australia. 2University of Queensland, Brisbane, Australia. 3Queensland University of Technology, Brisbane, Australia. 4Norwegian School of Sport Science, Oslo, Norway. (Sponsor: Jeff Coombes, FACSM)
Email: llion.roberts@griffith.edu.au

No relevant relationships reported

Purpose: The study compared the effect of low intensity resistance exercise with blood flow restriction (BFR) in the proximal thigh under different occlusion pressure on muscle morphology and function.

Methods: Twenty-seven healthy college students who had no training experience were randomly divided into three groups by different occlusion pressure: 0 mmHg (CON), 120 mmHg (LBFR) and 180 mmHg (HBFR). Before and after 12 weeks training with an inflatable cuff (20% IRM, half squats, 4 sets, 75 repetitions in total, 3 days a week) in three groups, the muscle thickness (MT) of rectus femoris and medius femoris were assessed by ultrasound for all subjects. The maximal isokinetic torque (ITmax), relative maximal isokinetic torque (R-ITmax) and maximal power (Pmax) were measured at angular velocities of 60°/sec by ISOMED 2000 System in dominant limb of all subjects.

Results: The MT of rectus femoris and medius femoris in LBFR increased after training compared with pre-training (212.6±18.9 vs. 199.1±20.6 cm, p<0.05), whereas in HLRE (212.6±18.9 vs. 199.1±20.6 cm, p>0.05) and CON (212.6±18.9 vs. 199.1±20.6 cm, p>0.05). ITmax, R-ITmax and Pmax in LBFR had a significant change compared with CON respectively after training (p<0.05). There was no significant difference in the MT, ITmax, R-ITmax, Pmax between LBFR and HLRE after training (p>0.05).

Conclusions: BFR training protocols under 120mmHg or 180mmHg pressure are effective in improving muscular morphology and function. But the higher occlusion pressure may not have more benefit in improving muscular performance than the lower occlusion pressure.

Board #5  May 29 3:15 PM - 5:15 PM Resistance Exercise With Blood Flow Restriction Under Different Occlusion Pressure On Muscular Performance
Jieming Lu, Zhiqiang Lian, Peng Sun, Wulan Li, Shanyun Liu, Dongqing Xu. Tianjin University of Sport, Tianjin, China. (No relevant relationships reported)

Purpose: To examine the effects of blood flow restriction (BFR) during a dynamic warm-up on various sprint times.

Methods: Fourteen participants (22±3.1 years) volunteered to participate in this cross-over study. Participants were randomly assigned to either the BFR or control group during their first trial, then completed the other trial seven days (±1 day) later. During the BFR training intervention, the cuffs were inflated to 40, 50, 60, 70, 80, 90 or 100% of the maximum arterial occlusion pressure for 2 min, 5 min, 10 min and 24 h post-exercise. RESULTS: There was a two-way interaction effect for the dominant quadriceps site. Post-hoc analysis showed that, compared to CON, PPT was lower following BFR40, BFR80 and HLRE. PPT was lower following BFR compared to BFR40 and HLRE. At 24 h post-exercise, PPTs were 14.5 ± 6.7% and 23.9 ± 8.2% higher than pre-exercise values in the BFR40 and BFR80 trials, respectively, whereas PPTs had returned to baseline in the LLRE and HLRE trials. Compared to LLRE, the increase in PPT was greater following BFR40 (0.28 ± 0.13 AU), BFR80 (0.64 ± 0.42 AU) and HLRE (0.34 ± 0.20 AU) in the non-dominant quadriceps. At 24 h PPTs had returned to baseline. Compared to LLRE, the increase in PPT was greater following BFR40 (0.31 ± 0.27 AU), BFR80 (0.30 ± 0.17 AU) and HLRE (0.26 ± 0.13 AU) for the triceps. At 24 h PPTs had returned to baseline. CONCLUSIONS: In conclusion BFR with higher pressure leads to EIH in both dominant and non-dominant limbs suggesting both central and peripheral mechanisms of action.

Board #6  May 29 3:15 PM - 5:15 PM Blood Flow Restriction Training During A Dynamic Warm-Up And Its Effects On Various Sprints Times
Alexandra Howard1, Justin Goin1, Matthew Steurveys2, Amy Frailey Hand1, Jay Patel1. 1University of South Carolina, Columbia, SC. 2Prinsa Health, Columbia, SC. Email: ah256@email.sc.edu

No relevant relationships reported

Purpose: To examine the effects of blood flow restriction (BFR) during a dynamic warm-up on 25, 50, and 100-meter run time, rating of perceived exertion (RPE), and heart rate (HR) in recreational athletes. METHODS: Fourteen participants (22.3 ± 1.8 years) volunteered to participate in this cross-over study. Participants were randomly assigned to either the BFR or control group during their first trial, then completed the other trial seven days (± 1 day) later. During the BFR training intervention, the cuffs were inflated to 40, 50, 60, 70, 80, 90 or 100% of the maximum arterial occlusion pressure for 2 min, 5 min, 10 min and 24 h post-exercise. RESULTS: There was a two-way interaction effect for the dominant quadriceps site. Post-hoc analysis showed that, compared to CON, PPT was lower following BFR40, BFR80 and HLRE. PPT was lower following BFR compared to BFR40 and HLRE. At 24 h post-exercise, PPTs were 14.5 ± 6.7% and 23.9 ± 8.2% higher than pre-exercise values in the BFR40 and BFR80 trials, respectively, whereas PPTs had returned to baseline in the LLRE and HLRE trials. Compared to LLRE, the increase in PPT was greater following BFR40 (0.28 ± 0.13 AU), BFR80 (0.64 ± 0.42 AU) and HLRE (0.34 ± 0.20 AU) in the non-dominant quadriceps. At 24 h PPTs had returned to baseline. Compared to LLRE, the increase in PPT was greater following BFR40 (0.31 ± 0.27 AU), BFR80 (0.30 ± 0.17 AU) and HLRE (0.26 ± 0.13 AU) for the triceps. At 24 h PPTs had returned to baseline. CONCLUSIONS: In conclusion BFR with higher pressure leads to EIH in both dominant and non-dominant limbs suggesting both central and peripheral mechanisms of action.
were placed on the proximal thigh at the level of the gluteal fold and were inflated to 80% of the participants’ limb occlusion pressure (LOP), which was assessed prior to participation. Participants completed a five-minute dynamic warm-up wearing the blood flow restriction cuffs, and the same dynamic warm-up was completed during the control intervention without the use of the cuffs. After each warm-up, a three-minute revascurarization period was provided before participants ran a 100-meter sprint at maximal effort, in which 25, 50, and 100-meter times were recorded. Heart rate was measured throughout the entirety of the study, and RPE was measured immediately after the sprint for both trials. Time measures, RPE scores, and heart rate were compared using a paired samples t-test (α < .05). RESULTS: There were no significant differences between control and BFR sprint times, post warm-up HR, or post run HR. There was a significant difference between the control and BFR RPE scores (3.14 ± 0.66 vs. 4.79 ± 1.42, p < .001). CONCLUSION: There is currently minimal evidence investigating the acute effects of BFR. Based on our results, there were no significant differences in sprint times between the control and BFR trials. RPE scores during the BFR trial were significantly higher than the control, indicating that participants felt the intensity of the BFR trial was more difficult although the times did not vary. Although not statistically different, average heart rates in the BFR trial were lowered by up to nine beats per minute compared with the control trial. This may be related to the perceived difficulty of the BFR trial as participants possibly could not exert themselves as much as when completing the control trial. These results do not support acute use of BFR to increase short-term performance, but more research should be performed.

Aerobic exercise with blood flow restriction (BFR) is emerging as an effective method to improve both aerobic capacity and muscular function. Using an inflatable cuff, blood flow is usually restricted during walking and cycling. The extent to which BFR can be applied during upper-body aerobic exercise such as arm cranking is not well documented. Arm cranking with BFR might offer an exercise option for clinical populations that need to exercise upper-body muscles (e.g., wheelchair users, individuals with shoulder injuries).

PURPOSE: To evaluate physiological and perceptual responses to acute submaximal arm cranking with BFR.

METHODS: Fourteen male adults (age: 23 ± 4 yrs, arm cranking VO2peak: 33 ± 8 ml/kg/min) performed 4 intermittent arm cranking protocols (6x2 min, 3x4 recovery): 1) low-load arm cranking (LL, 40% VO2peak), 2) low-load arm cranking with BFR (BFR, 40% VO2peak), and 3) high-load arm cranking (HL, 80% VO2peak). For BFR, blood flow was restricted using 5cm cuffs inflated to 70% of limb occlusion pressure as identified using Doppler ultrasound. Cardiorespiratory and perceptual responses (VO2, HR, perceived effort) and tissue perfusion (tissue saturation, deoxyhemoglobin concentrations) were measured using a metabolic cart and near-infrared spectroscopy, respectively.

RESULTS: Oxygen consumption during BFR (1.51±0.32ml/kg/min) did not differ from LL (1.04±0.26ml/kg/min, p=0.31) and was less than HL (2.28±0.60ml/kg/min, p=0.01). Compared to LL (104±6b/min), heart rate during BFR was increased (115±13b/min, p<0.04) but was less than HL (166±19b/min, p=0.01). BFR required greater perceived effort in the arms (123±3) compared to LL (9.2±0.03) but less effort than HL (161±2, p<0.01). In general, BFR decreased tissue saturation and increased deoxyhemoglobin concentrations compared to arm cranking without BFR (all p<0.05).

CONCLUSION: These results suggest that arm cranking with BFR has potential to increase metabolic stress without excessive respiratory strain. This exercise mode may provide a useful alternative to HL for populations that need to exercise upper-body muscles for rehabilitation. These findings provide guidance for future acute and chronic studies examining the feasibility and efficacy of arm cranking with BFR.

The effects a particular kind of short term fasting called time restricted feeding (TRF) have been recently investigated on resistance training athletes; no data are available, instead, on endurance athletes. PURPOSE: We sought to investigate the effects of 4 weeks of 16/8 TRF (with windows of 16 hours of fasting and 8 hours of feeding) on endurance athletes.

METHODS: 16 elite under-23 cyclists were randomly assigned to a TRF group or a control group (CTRL) with a traditional meal pattern. The TRF group consumed 100% of its estimated daily energy needs in an 8-hour time window: from 10:00 AM to 6:00 PM whilst the CTRL group consumed 100% of its estimated daily energy needs in 3 meals between 7:00 AM and 9:00 PM. During the experimental period, training loads were similar in the two groups. Athletes were tested before and after 4 weeks of the intervention. Fat and lean body mass were measured by bioelectrical impedance analysis, VO2max and basal metabolism were measured by indirect gas analyzer. In addition, blood counts, free testosterone, SHBG, IGF-1, IL-6, TNF alpha, VES, PCR, total cholesterol, triglycerides, TSH, free T3, insulin, adiponectin, and cortisol were measured.

RESULTS: After 4 weeks, there was a significant decrease of body weight (TRF: -1.26 kg ± 1.57 vs. CTRL: +0.22 ± 0.96 kg, p=0.038) and fat mass in the TRF group (p=0.003) compared to CTRL group with no differences in lean body mass. Performance tests showed no significant differences between groups even though there was a significant increase in the peak power output/body weight ratio (p=0.024) in the TRF group due to weight loss. Free testosterone and IGF-1 decreased significantly (p=0.004 and p=0.048 respectively) in the TRF group; leukocyte count decreased more in the CTRL group (p = 0.039). Lymphocyte count increased in TRF group (p<0.001) whilst neutrophils decreased in both groups (p<0.001), thus the neutrophil to lymphocytes ratio (NLR) decreased significantly (p=0.003) in TRF group. No significant changes in other blood chemistry values were observed.

CONCLUSIONS: Our results suggest that a TRF program with an 8-hour feeding window causes fat loss, maintains lean mass and performance indexes and improves peak power output/body weight ratio. The changes of white blood cells parameters worth further investigation.

No relevant relationships reported.

Chair: Javier Gonzalez, University of Bath, Bath, United Kingdom.
The Effects Of The 16/8 Diet On Cardio-metabolic Outcomes In Competitive Male Runners

Christine E. Richardson1, Ashley P. Tovar1, Gretchen A. Casazza2, Brian Davis, FACSM3, Nancy Keim1,2,3,4. University of California, Davis, Davis, CA. 1Sacramento State, Sacramento, CA. 2University of California at Davis Medical Center, Sacramento, CA. (Sponsor: Dr. Brian Davis, FACSM)

Purpose: The objective of the present study was to investigate the effects of the 16/8 diet on cardio-metabolic risk factors in competitive male runners. Methods: This ongoing study is a randomized cross-over intervention that consists of two 4-week accrual protocols with an 8-week “normal” arm (12 months, 12 hours fasted and 12 hours fed) and a 2-week washout. Sixteen subjects will complete the study and will participate in 4 test days (12 hours fasted), one at the beginning and end of each arm, where they will undergo a DXA scan, resting energy expenditure measurement and a fasting blood draw for biomarker quantification. Overall calories, macronutrient intake and exercise training will be held constant over the 2 interventions. Preliminary Results: Data on 9 subjects shows no significant differences between groups in changes in body mass (±0.41 ND vs. -0.72 kg TRF, p=0.25), fat mass (-0.29 ND vs. -0.63 kg TRF, p=0.65), free fat mass (+0.56 ND vs. -0.25 kg TRF, p=0.18) and body fat (-0.42 ND vs. -0.61 % TRF, p=0.72) with the 4 week intervention. Changes in resting energy expenditure (-152.1 ND vs. -113.3 kcal TRF, p=0.18), resting respiratory exchange ratio (-0.003 ND vs. -0.04 TRF, p=0.36), blood glucose (-3.9 ND vs. -1.9 mg/dl TRF, p=0.61), total cholesterol (+1.0 ND vs. -3.0 mg/dl TRF, p=0.68), HDL cholesterol (-1.7 ND vs. 0.0 mg/dl TRF, p=0.71), LDL cholesterol (0.0 ND vs. -3.8 mg/dl TRF, p=0.41), and triglycerides (+17.9 ND vs. 74.3 mg/dl TRF, p=0.46) also did not differ between interventions. Conclusion: While no interaction effect, there were significant improvements for both groups for push-ups completed (41.7 and 37.1 reps; p = 0.007) and ventilatory threshold in absolute (2.47L/min to 2.58L/min; p < 0.001) and relative (65.8%VO2max to 69.7%VO2max; p = 0.001) terms. The control group had significantly lower mean body fat percentage compared to the TRF group (14.27 and 20.5%, respectively; p <.0001). The control group had significantly higher VO2max values compared to the control group (3.80 L/min and 3.65 L/min, respectively; p = 0.016).

CONCLUSIONS: While TRF did not directly improve health or performance variables, the diet did not hinder health or performance outcomes. The standardized resistance training program resulted in improvements for muscular endurance and ventilatory threshold. The improved performance variables may reduce risk for heart disease and SCD while optimizing markers of performance.

The Effect Of Fasted Cycling Exercise At Different Times Of The Day In Overweight Individuals

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Purpose: To investigate the effect of fasted exercise at different times of the day on metabolic responses and appetite regulation in overweight males. METHODS: Twelve healthy males (Mean ± SD; age 26 ± 4 y; body fat 23 ± 2%) completed four, 60 min cycle ergometry trials at 60% VO2peak in a randomised order; in the morning fasted (AMFAST), evening fasted (PMFAST) and after consuming a breakfast meal in the morning (AMFED) and evening (PMFED). Circulating levels of ghrelin, glucagon-like peptide-1 (GLP-1), pancreatic polypeptide (PP), peptide tyrosine tyrosine (PYY), insulin, triglycerides, non-esterified fatty acid (NEFA), glucose, and cholesterol were measured at baseline, post-breakfast, pre-exercise, post-breakfast and at each 30 min and continuously throughout exercise. RESULTS: Area under the curve (AUC) values for NEFA were greater in PMFAST compared to all trials (186.5 ± 46.3 vs. AMFAST 120.5 ± 42.6, AMFAST 80.8 ± 23.8, PMFAST 91.1 ± 36.4 mmol/L. 4.75 h; P<0.05). AUC for NEFA was also greater than AMFAST (P=0.029). AUC values were greater for GLP-1 in AMFAST trial compared to PMFAST (8660.2 ± 12232.5 vs. 5697.0 ± 12027.8 mmol/L. 47.5 h; P<0.05), and PP values for PMFAST greater compared to all trials (155411.9 ± 86064.1 vs. AMFAST 90165.8 ± 91405.6, AMFAST 107162.5 ± 72846.2, PMFAST 105364.0 ± 81320.2 mmol/L. 47.5 h, P<0.05). A time of day effect was seen for cholesterol with PM greater than AM (P<0.05). Fat oxidation was greater during AMFAST and PMFAST exercise compared to FED trials (P<0.05).

Ratings of appetite did not change between trials once all participants consumed the lunch meal post exercise (P=0.05). No differences were seen in AUC between trials for ghrelin, PYY, glucose or insulin. CONCLUSION: Fasted exercise elicited greater NEFA responses, and some appetite hormones appear to respond differently to varying times of day.
exercise conditions and time of day in overweight males. Regardless of the time of day, fasted exercise favours fat metabolism and may induce a short-term negative energy balance.

An overnight fast (10-12 hours) is a popular pre-exercise trial control in fuel use studies, but can lead to premature fatigue during exercise in participants. Measuring substrate oxidation at rest could be an alternative, but it is unclear how length of fasting effects fuel use responses from rest to during exercise. PURPOSE: The purpose was to examine the changes in fat (fatox) and carbohydrate (carbox) oxidation rates during rest and exercise after various fasting lengths. METHODS: Participants (24.5 ± 5.1 yrs) randomly performed 3 experimental trials. Trials were preceded by a standard meal (19.4 ± 1.8% of daily energy expenditure) followed by a fast for 12 hours (hrs), 3 hrs or 1 hr. Each trial consisted of 30 min of rest and 30 min of exercise at 55% of peak oxygen uptake (VO_{2peak}). VO_{2} and carbon dioxide production (VCO_{2}) were averaged over the final 10 minutes of rest and exercise. The equations fatox = 1.695 * VO_{2} - 1.70 * VCO_{2} and carbox = 4.585 * VCO_{2} - 3.226*VO_{2} were used to calculate oxidation rates (g*min^{-1}). Two-way repeated measures (RM) ANOVAs and one-way RM ANOVAs analyzed differences. Significance was established if p<0.05.

RESULTS: Participants exercised at a similar VO_{2} and % of VO_{2peak} in the 12hr (1.58 ± 0.28 L·min^{-1}; 56.8 ± 2.4 % of VO_{2peak}), 3hr (1.60 ± 0.30 L·min^{-1}; 57.7 ± 4.6 % of VO_{2peak}) and 1hr (1.64 ± 0.30 L·min^{-1}; 59.1 ± 1.7 % of VO_{2peak}). There was no significant interactions for fatox and carbox, but there were significant main effects of time. Fatox increased from rest to exercise in the 12hr (0.30 ± 0.04 g·min^{-1} vs. 7.34 ± 3.00 g·min^{-1}), 3hr (0.30 ± 0.10 g·min^{-1} vs. 7.56 ± 3.53 g·min^{-1}) and 1 hr (0.34 ± 0.10 g·min^{-1} vs. 8.43 ± 4.00 g·min^{-1}) trials. Additionally, carbox increased from rest to exercise (12hr = 1.92 ± 0.55 g·min^{-1} vs. 1.90 ± 0.64 g·min^{-1} vs. 2.18 ± 0.81 g·min^{-1}). Relative percent changes from rest to during exercise were not different between 1hr, 3 hrs and 12hrs for fatox (2489.1 ± 1008.9 % vs. 2257.5 ± 853.3 % vs. 2147.0 ± 503.2 %) and carbox (658.2 ± 659.8 % vs. 462.2 ± 674.1 % vs. 470.5 ± 581.3 %). CONCLUSIONS: Fatox and carbox responses from rest to exercise were similar between trials. This suggests that a standard meal and resting oxidation rates could control for differences in substrate use during exercise, regardless of fasting length.

### Board #8 May 29 3:15 PM - 5:15 PM

#### The Effect Of Acute Carbohydrate Restriction On Squat Performance And Serum Energy Substrate Levels

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Carbohydrate restrictive diets have become increasingly prevalent among recreational and professional athletes as a means of losing weight and improving body composition. Currently, few data indicate a clear relationship between carbohydrate restriction (CR) and performance in resistance exercise (RE). PURPOSE: To investigate the acute effects of CR on squat performance and serum energy substrate levels in recreationally trained individuals. METHODS: Seven healthy recreationally trained males (22.6 ± 3.47 yrs., 80.7 ± 8.40 kg, 178.05 ± 5.00 cm) completed RE under two conditions in randomized order: 1) control (CON) and 2) a (CR) condition, which included a carbohydrate depletion exercise trial (CDEX). In CR, subjects first performed the CDEX, which consisted of 60 minutes of cycling at >75% of participants’ heart rate (HR) max following by four 1-minute bouts at >95% HR max with two minute rest in between sets. CDEX was then followed by 48 hours of reduced carbohydrate (CHO) intake (<5% daily caloric intake). RE in both CON and CR consisted of squats, loaded via inertial resistance using a Yo-YoTM 8x8lB system. Fasting blood glucose and triglyceride (TG) levels were measured pre-exercise in both conditions as well as throughout the CDEX. RESULTS: Total caloric intake was significantly (p<0.001) lower during CON (1661 ± 691 kcal) compared to the CDEX (2435 ± 527 kcal). No differences were found in total grams of protein (PRO) or fat intake between conditions. Percent total daily caloric intake from CHO was significantly (p<0.001) lower in the CR condition (7.40 ± 3.32%, CHO), while percent total daily caloric intake from PRO and fat were significantly higher in the CR (32.00 ± 8.54% PRO, 58.17 ± 11.96% fat) compared to CON (37.81 ± 9.26% CHO, 20.03 ± 5.53% PRO, 37.47 ± 11.80% fat). Fasting blood glucose levels (p = 0.017) were significantly lower in the CR (84.57 ± 4.79 mg/dL) compared to the CON (93.28 ± 6.90 mg/dL) yet there was no difference in blood TG levels (p = 0.177; 64.43 ± 14.16 mg/dL). Total average power output (p = 0.05) and total peak power output (p = 0.047) were significantly lower in the CR. Conclusion: While CDEX combined with CR may acutely reduce fasting blood glucose, this may be at the sacrifice of RE performance, especially during the initial phase of CR adaptation.
Affective valence during exercise is thought to switch between positive and negative at the ventilatory threshold (VT), the upper boundary of “moderate” intensity exercise. Cognitive strategies may shift the exercise intensity at which affective responses are positive and negative. The emotion regulation strategy cognitive reappraisal (CR) involves reevaluating emotional stimuli to reduce negative and increase positive emotional experience. PURPOSE: Here we investigated if cognitive reappraisal would increase emotional valence, demonstrated by higher scores on the feeling scale (FS), and reduce felt arousal scale (FAS) scores and ratings of perceived exertion (RPE) during 60-min of exercise performed at the VT.

METHODS: 26 young recreational runners (n = 13 women, Age 25.4 ± 4.3 years old; BMI 21.3 ± 2.3 kg/m²; maximal oxygen consumption (VO2, max) = 55.0 ± 7.31 ml/kg/min) performed three sessions each separated by one week. During the first session, runners performed a maximal exertion test on a treadmill to assess their VO2max and VT. During the next two sessions, runners were trained in CR or UR (unregulated) instructions, in a counterbalanced order. They then ran at their VT for 60 minutes, during which they were reminded of the emotion regulation instructions and were instructed to provide RPE, FS, and FAS during the last 30 seconds of every 10-minute period. FS, FAS, RPE were analyzed for main effects of time and condition with non-parametric repeated measures (Friedman test) with post-hoc pairwise comparisons of Durbin-Consover test.

RESULTS: Runners ran at VT velocity of 6.92 ± 0.46 mph corresponding to 46.8 ± 5.2 % of the VO2 max. Similar levels of RPE were reported during the CR, 11.74 ± 1.64, and UR, 11.82 ± 1.88, sessions. However, they reported marginally higher FAS during CR, 2.9 ± 0.98, than UR, 2.6±0.95, X2=20.3; df=11, p=0.042. They also reported higher FS during CR, 2.54 ± 1.47, than UR, 2.1 ± 1.52, X2=65.2; df=15, p<.001. Post-hoc analysis showed that FS was higher during CR than UR (p<.01) only at time points 30 (CR: 2.57 ± 1.4 vs UR 1.84 ± 1.65), 40 (CR: 2.53 ± 1.54 vs UR 1.76 ± 1.57) and 50 (CR: 2.57 ± 1.52 vs UR 1.88 ± 1.73) minutes of exercise.

CONCLUSION: Cognitive reappraisal can be used as a strategy to increase emotional valence after 30 min of exercise at light to moderate intensity in recreational runners.

Strong evidence shows that physical activity (PA) affects the structure of the nervous system and can improve cognitive function (CF) in older adults. Additionally, recent studies have shown that a healthy diet may protect against aging-related impairments in hippocampal structure or function.

PURPOSE: To investigate the influence of PA and adherence to dietary guidelines on CF in a sample of healthy older adults.

METHODS: Demographics, habitual PA (Baecke’s Questionnaire Sport score), and cognitive function (Montreal Cognitive Assessment; MoCA) were collected at consent in a sample of 339 healthy adults (50-75 years) in a memory function study. Dietary guidelines adherence (Alternate Healthy Eating Index 2010; aHEI), and two indices of cognitive function (Modified Benton Recognition Task (MoBent) and Modified Rey Auditory Verbal Learning Test (MoRey)) were collected in the randomized subsample of these participants (N=211). The relationship between lifestyle factors and three outcomes (MoCA, MoBent, MoRey) were assessed using Pearson correlations in the full sample and subsample. Linear models were fit for MoCA on the full sample, and for each of the three outcomes in the randomized subsample. Each series of models included age, gender, and education. PA and aHEI scores were then added to each model and their standardized regression coefficients (change in R²) were assessed to determine whether they contributed additional predictive value towards CF.

RESULTS: In the full sample, the correlation between MoCA total score and PA was weak (r = -.11). In the subsample, correlations between aHEI and MoCA and between aHEI and MoRey were also weak (r = -.175 and r = .141, respectively). Correlations between PA and aHEI and between age and MoRey were weak (r = -.222 and r = -.219, respectively). Adding PA or aHEI did not significantly explain a greater proportion of variance in cognitive task scores beyond demographic factors alone.

CONCLUSIONS: In an older adult population, there is a weak direct relationship between performance on CF tasks and lifestyle factors. Reviewing the individual standardized regression coefficients finds that education and age were the most sensitive to changes in CF task scores, and adherence to dietary guidelines was more sensitive than a measure of habitual PA.

Major depressive disorder (MDD) is a debilitating mental health condition that presents a major public health burden. Respiratory sinus arrhythmia (RSA) reactivity has been proposed as an index of impaired emotion and self-regulation in depression. Acute exercise has consistently been shown to improve affect, but it is unknown whether exercise affects RSA reactivity to emotional challenge. In addition, previous studies have not addressed nonresponse to sad emotion inductions, which limits understanding of important individual differences in affective processing.

PURPOSE: To determine the effects of a single bout of moderate-intensity aerobic exercise on RSA and affective responses to a sad mood induction. Additionally, to characterize responders and non-responders to the sad mood paradigm and whether acute exercise impacts emotional responding to the emotion induction paradigm.

METHODS: Using a within-subjects design, young adults diagnosed with MDD completed a 30-min exercise and sedentary control session in counterbalanced order on two separate days. Following a recovery period, RSA reactivity was assessed using electrocardiography (ECG) during a 3-min sad mood induction. The Positive and Negative Affect Scale (PANAS) was used to assess affective responses throughout each session and sadness to the mood induction was assessed on a 9-point Likert scale.

RESULTS: Individuals with depression demonstrated dampened RSA withdrawal during the sedentary control day. Following exercise, RSA withdrawal increased, p < .05, although post-exercise changes in NA and PA were not related to neurocardiac reactivity to the sadness induction. There were significantly more responders than non-responders to the sad mood induction following the exercise condition, p < .05.

CONCLUSIONS: These findings suggest that acute aerobic exercise may be an effective approach to increase emotional regulation and behavior flexibility in clinically depressed individuals. Future research should continue to examine individual differences in emotional responding as well as investigating who will successfully respond to exercise treatment.

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**Board #3 May 29 3:15 PM - 5:15 PM**

**Does An Acute Bout Of Aerobic Exercise Bolster Reactivity To A Sad Mood Induction In Clinically Depressed Individuals? A Study Of Responders And Non-responders**

**Anthony J. Bogetti1**, **CJ Brush2**, **Andrew A. Ude3**, **Gregory H. Pappas1**, **Kelsey L. Pierson4**, **Brandon L. Alderman5**

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(No relevant relationships reported)

**Board #4 May 29 3:15 PM - 5:15 PM**

**Effects Of Age, Body Composition, And Inflammation On Cognitive Function In Females.**

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(No relevant relationships reported)
incongruent, and neutral conditions), and memory span test. All cognition tests were conducted in a counter-balanced order. Blood samples were collected to determine the ratio of neutrophil and lymphocyte (NLR) and the ratio of platelet and lymphocyte (PLR) which were considered as indicators of inflammation. The body composition was measured by using Dual Energy X-ray Absorptiometry. The correlation between age, body composition, inflammatory factors, and cognitive variables was analyzed by Pearson’s correlation coefficient (r). P<0.05 was considered statistically significant.

RESULTS: There were negative correlation between age and attention test (r = -0.47, p<0.005), Stroop tests (word: r = -0.65, p<0.001; square: r = -0.69, p<0.001; congruent: r = -0.61, p<0.001; incongruent: r = -0.70, p<0.001; neutral: r = -0.70, p<0.001). The results also showed that the higher the body fat (% BF*), the worse the cognitive test performance (attention test, r = 0.46, p<0.005; Stroop’s word test, r = 0.49, p<0.005; Stroop’s square test, r = 0.44, p<0.011; Stroop’s congruent test, r = 0.44, p<0.011; Stroop’s neutral test, r = 0.59, p<0.001). Similarly, the higher the body lean mass (BLM*), the better the cognitive test performance. There was positive correlation between age, NLR and PLR, but there was no significant correlation between inflammatory markers and cognitive performance. Furthermore, after controlled age, although the above net correlation was eliminated, the correlation between Stroop’s square test and BF* (r = 0.34, p<0.05), square and BLM* (r = 0.33, p<0.040), neutral test and BLM* (r = 0.32, p=0.050) still exists. Besides, after controlled BF*, the age-related correlation effects are unchanged, and only the correlation between BLM* and the speed of answering represent significant (r = 0.393, p<0.015).

CONCLUSION: In addition to age, body fat is an important factor affecting cognitive performance. Supported by MOST 107-2310-H-845-018-MY3

3094 Board #5 May 29 3:15 PM - 5:15 PM Exercise-Based Cardiac Rehabilitation Improves Cognitive Function Among CVD Patients

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(No relevant relationships reported)

PURPOSE: To investigate the effects of cardiac rehabilitation (CR) exercise training on cognitive performance and if the changes are associated with alterations in prefrontal cortex (PFC) oxygenation among patients with cardiovascular disease (CVD).

METHODS: Twenty (M=15, F=5, 64.8±11.6 yrs) participants from an outpatient CR program were enrolled in the study. Each participant completed a cognitive performance test battery (attention test, r = 0.46, p<0.005; Stroop’s word test, r = 0.49, p<0.005; Stroop’s square test, r = 0.44, p<0.011; Stroop’s congruent test, r = 0.44, p<0.011; Stroop’s neutral test, r = 0.59, p<0.001). Similarly, the higher the body lean mass (BLM*), the better the cognitive test performance. There was positive correlation between age, NLR and PLR, but there was no significant correlation between inflammatory markers and cognitive performance. Furthermore, after controlled age, although the above net correlation was eliminated, the correlation between Stroop’s square test and BF* (r = 0.34, p<0.05), square and BLM* (r = 0.33, p<0.040), neutral test and BLM* (r = 0.32, p=0.050) still exists. Besides, after controlled BF*, the age-related correlation effects are unchanged, and only the correlation between BLM* and the speed of answering represent significant (r = 0.393, p<0.015).

CONCLUSION: In addition to age, body fat is an important factor affecting cognitive performance. Supported by MOST 107-2310-H-845-018-MY3

3095 Board #6 May 29 3:15 PM - 5:15 PM IMPACT OF AUTONOMY ON ENJOYMENT AND AFFECTIVE VALENCE DURING HIGH-INTENSITY INTERVAL TRAINING

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(No relevant relationships reported)

High-intensity interval training (HIIT) is a popular modality for conducting intense aerobic exercise. Research indicates that HIIT is generally well-tolerated and produces relatively positive affective valence and enjoyment responses, especially when compared to intense continuous exercise. Recent research has started considering how autonomy and choice might impact psychological responses to HIIT.

PURPOSE: The purpose of this study was to determine the impact of autonomy and variation on enjoyment and affective valence during HIIT exercise.

METHODS: Twenty-one physically active participants (12 male, 9 female; mean BMI = 27.2 ± 3; mean age = 26 ± 6) completed three, 20-minute HIIT trials after completion of maximal testing. Work and recovery were conducted at 90% and 10% of peak work, respectively. All trials included a total of 10 minutes of work and 10 minutes of recovery. Trials included: a standard interval bout with repeating 60-sec work and recovery segments (Traditional), an interval bout with a mix of predetermined 30-, 60-, 90-, & 120-second segments (Varied), and a bout with self-selected number of 30-, 60-, 90-, & 120-second segments (Autonomous). In-task affective valence and enjoyment were measured four times during work and recovery. Data was analyzed using ANOVA.

RESULTS: Affective valence declined during the Traditional and Varied trials (–0.75 units; P < 0.05) but not during the Autonomous trial (P > 0.05). There was also a trend for the Autonomous trial to produce greater pleasure than the Traditional trial (+0.75 units; P = 0.06). Enjoyment increased during the trials (~0.5 units; P < 0.05) and enjoyment was higher in the Autonomous trial than the Varied trial (~0.5 units; P < 0.05).

CONCLUSIONS: Findings indicate that all HIIT trials produced at least moderate levels of pleasure and enjoyment, with Autonomous HIIT resulting in the most desirable responses, especially when compared to Varied HIIT. These findings suggest that HIIT sessions that include self-selected interval durations can produce more positive responses, which provides the basis for recommending autonomy for exercisers participating in HIIT exercise sessions.

Despite mounting evidence supporting the beneficial effects of acute aerobic exercise on cognitive control in children with attention-deficit/hyperactivity disorder (ADHD), little is known regarding the sustained effect of acute exercise training on inhibitory control in children with ADHD. METHODS: Twenty-four children diagnosed with ADHD (mean age = 9.8 ± 1.3 years; 23 boys) underwent a moderate-intensity (60% of heart rate reserve) aerobic exercise session and a video-watching session in counterbalanced order. Following the exercise/video-watching session, each participant was administered congruent and incongruent trials from a modified flanker task under electroencephalography (EEG) for 30 minutes following exercise cessation. Response accuracy, reaction times (RT), and standard deviation of RT (SDRT) were calculated as behavioral outcomes, and the P3 component of an event-related brain potential (P3-ERP) was collected as a measure of brain function.

RESULTS: Higher response accuracy was observed following exercise relative to video-watching across both time points and trial types (Exercise: 90.5±1.4% vs Video: 84.1±1.1%, p<0.002). SDRT, an index of response variability, was smaller during congruent trials following exercise compared to video-watching at the 30-minute time point (Exercise: 129.8±27.4 ms vs Video: 142.2±32.9 ms, p<0.04). Further, P3-ERP latency at the parietal site (Pz) was shorter following exercise relative to video-watching across trial types at the 30-minute time point (Exercise: 426.9±71.5 ms vs Video: 517.9±62.5 ms, p<0.001). CONCLUSION: The data suggest that the beneficial effects of acute, moderate-intensity exercise are only sustained for about 30-40 minutes following exercise cessation in children with ADHD. Such a finding differs from typically developing children, who demonstrate acute exercise benefits to brain and...
cognition for approximately 60-70 minutes. Future research should provide a more direct comparison to better understand the sustained effects of acute exercise across different populations of children.

Supported by MOST grant NSC102-2410-H-003-128.

F-35
Thematic Poster - Functional Movement with Parkinson’s Disease
Friday, May 29, 2020, 3:15 PM - 5:15 PM
Room: CC-2007

3098
Chair: Chris J. Hass, FACSM. University of Florida, Gainesville, FL.
(No relevant relationships reported)

PURPOSE: People with Parkinson’s disease (PD) have impaired balance during walking that contributes to reduced physical activity and lower quality of life. Overground locomotor training (OLT) is one method to improve dynamic balance for people with PD during walking. The purpose of this study is to examine the effect of an OLT program on dynamic balance during overground walking in people with PD.

METHODS: Five participants with PD (age: 68.9±6.7 yrs) were enrolled in a 12-week OLT program with an emphasis on power, stepping and stability within all planes of movement. Participants completed a 10-minute walk test (10MWT) overground, wearing wearable tri-axial motion sensors at baseline (PRE) and after (POST) intervention. Temporospatial data were collected pre- and post-intervention to obtain time in double limb support (TDSLs) and calculate gait stability ratio (GSR) during the 10MWT. TDSLs represents one’s strategy for maintaining dynamic balance during gait. GSR is the ratio between number steps per minute and gait velocity. For both TDSLs and GSR, lower values following intervention represent improved dynamic balance during walking. Gait characteristics were analyzed separately for each limb using paired Student’s t-tests.

RESULTS: Average TDSLs was reduced for both limbs after intervention (PRE L: 82.8±9.58; R: 82.61±8.83); POST (L: 18.88±3.03; R: 18.89±3.04%); POST (L: 15.10±2.66; R: 15.11±2.68), p<.001).

CONCLUSION: Decreased TDSLs and GSR are gait characteristics that provide an opportunity to increase physical activity and improve during walking following the 12-week intervention. Decreased TDSLs and GSR are gait characteristics that provide an opportunity to increase physical activity and improve during walking following the 12-week intervention. Decreased TDSLs and GSR are gait characteristics that provide an opportunity to increase physical activity and improve during walking following the 12-week intervention. Decreased TDSLs and GSR are gait characteristics that provide an opportunity to increase physical activity and improve during walking following the 12-week intervention.

3099
Board #1
May 29 3:15 PM - 5:15 PM
The Influence Of Overground Locomotor Training Program On Dynamic Balance In People With Parkinson's Disease
Randy Jamil Pugh, Clinton J. Wutzke, Andrew E. Pechnstein, Kara B. Rosen, Lorna S. Elsara, Emily M. Leonard, Andrew A. Guccione. George Mason University, Fairfax, VA. (FACSM)
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(No relevant relationships reported)

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F-35
Thematic Poster - Functional Movement with Parkinson’s Disease
Friday, May 29, 2020, 3:15 PM - 5:15 PM
Room: CC-2007

3099
Board #1
May 29 3:15 PM - 5:15 PM
The Influence Of Overground Locomotor Training Program On Dynamic Balance In People With Parkinson's Disease
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PURPOSE: People with Parkinson’s disease (PD) have impaired balance during walking that contributes to reduced physical activity and lower quality of life. Overground locomotor training (OLT) is one method to improve dynamic balance for people with PD during walking. The purpose of this study is to examine the effect of an OLT program on dynamic balance during overground walking in people with PD.

METHODS: Five participants with PD (age: 68.9±6.7 yrs) were enrolled in a 12-week OLT program with an emphasis on power, stepping and stability within all planes of movement. Participants completed a 10-minute walk test (10MWT) overground, wearing wearable tri-axial motion sensors at baseline (PRE) and after (POST) intervention. Temporospatial data were collected pre- and post-intervention to obtain time in double limb support (TDSLs) and calculate gait stability ratio (GSR) during the 10MWT. TDSLs represents one’s strategy for maintaining dynamic balance during gait. GSR is the ratio between number steps per minute and gait velocity. For both TDSLs and GSR, lower values following intervention represent improved dynamic balance during walking. Gait characteristics were analyzed separately for each limb using paired Student’s t-tests.

RESULTS: Average TDSLs was reduced for both limbs after intervention (PRE L: 82.8±9.58; R: 82.61±8.83); POST (L: 18.88±3.03; R: 18.89±3.04%); POST (L: 15.10±2.66; R: 15.11±2.68), p<.001).

CONCLUSION: Decreased TDSLs and GSR are gait characteristics that provide an opportunity to increase physical activity and improve during walking following the 12-week intervention. Decreased TDSLs and GSR are gait characteristics that provide an opportunity to increase physical activity and improve during walking following the 12-week intervention. Decreased TDSLs and GSR are gait characteristics that provide an opportunity to increase physical activity and improve during walking following the 12-week intervention. Decreased TDSLs and GSR are gait characteristics that provide an opportunity to increase physical activity and improve during walking following the 12-week intervention.

3101
Board #3
May 29 3:15 PM - 5:15 PM
Improved Coordination And Coordination Variability In Response To Deep Brain Stimulation In Individuals With Parkinson's Disease
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(No relevant relationships reported)

Parkinson’s disease (PD) is a progressive neurodegenerative disease associated with motor impairments. Deep brain stimulation (DBS) is associated with vast improvements in the motor symptoms of PD. Recent evidence has identified improvements in movement complexity during treadmill walking in response to DBS [1]. However, the effects of DBS on coordination have not been well elucidated.

PURPOSE: to evaluate the effects of DBS on ankle and knee joint coordination and coordination variability during a treadmill walking task. METHODS: Five individuals with PD performed a four-minute treadmill walking task while 3D kinematics were collected over two 30-s periods. Participants completed testing in the DBS-ON followed by DBS-OFF conditions to avoid the confounding factor of fatigue. Kinematics were recorded simultaneously using an 9-camera motion capture system (120 Hz, Qualisys Inc., Gotteborg, Sweden). Visual 3D was used to calculate segmental angles and velocities. Custom software (MATLAB, MathWorks) calculated continuous relative phase angles. Mean absolute relative phase (MARP) and deviation phase (DP) were used to quantify joint coordination (MARP) and coordination variability (DP). A paired samples t-test was used to test the effects of DBS on MARP and DP.

RESULTS: At the ankle, DBS was associated with greater MARP values (p=0.016; DBS-ON: 3.2±1.5; DBS-OFF: 2.1±0.9) and DP values (p=0.047; DBS-ON: 2.2±1.0; DBS-OFF: 1.4±0.4). At the knee, DBS was associated with greater MARP (p=0.021; DBS-ON: 3.2±1.5; DBS-OFF: 2.1±0.9) and DP values (p=0.045; DBS-ON: 2.9±1.5; DBS-OFF: 2.0±0.6). CONCLUSIONS: DBS allows individuals with PD to perform walking tasks with greater freedom of coordination and coordination variability. Increased availability of coordinative patterns may represent a greater number of successful strategies available to the system to optimize mechanical and metabolic efficiency during walking.

Interactive Metronome (IM) could provide rehabilitative training to improve motor rigidity. Rehabilitative training that employs a metronome beat to set a rhythm for motor tasks has been shown to improve balance, posture, and gait in Parkinson’s disease (PD) and healthy older adults. However, these studies have not analyzed the features of body limb control.

**BACKGROUND:** Motor timing is essential for improving motor skills and it is a critical factor to determine the success in a golf swing. However, individuals with Parkinson’s disease have deficits in motor timing due to bradykinesia, tremor, and rigidity. Rehabilitative training that employs a metronome beat to set a rhythm (Interactive Metronome) could provide rehabilitative training to improve motor timing and variability in golf performance. **PURPOSE:** The purpose of this study is to investigate the effects of 10 sessions of Interactive Metronome training on motor timing and variability in the golf performance of older adults with Parkinson’s disease. **METHODS:** The participants with Parkinson’s disease completed 10 sessions, 35–40 minutes per session, three times a week for 4 weeks. The speed and tempo of the golf swing with a seven iron were measured. Motor timing was analyzed by using Long Form Assessment (LFA) which evaluates timing and accuracy when performing golf tasks. Sample Entropy Analysis of Dance Interventions in People With Parkinson’s Disease and Older Adults. Study participants were recruited for this study. Motion capture was used to examine movement patterns and sample entropy analysis was used to calculate the complexity of movements during dance. **RESULTS:** Participants with PD had a greater spread of Sample Entropy in left hip abduction during tango movements than right hip abduction (p < 0.0001). A greater Sample Entropy in right hip rotation during tango movements than left hip rotation (p = 0.0001) was seen during tango but no significant difference during foxtrot. Furthermore, PD group had no significant difference in left/right knee flexion Sample Entropy during tango but left knee flexion Sample Entropy was higher during foxtrot than right knee flexion Sample Entropy (p = 0.006). OA participants saw a much smaller, but still significant, spread in Sample Entropy in left hip abduction during Tango than right hip abduction of pelvic rotation (p = 0.002), with no significant difference in hip rotation Sample Entropy.

**CONCLUSION:** We interpret our entropy results as showing a decrease in PD left hip abduction control compared to the right hip during tango. Our PD participants reported that the left side was more affected. These types of data could be used to optimize dance interventions in regards to dance type, music beat/rhythm in order to improve limb control.
overload, sleep deprivation, and caloric restriction are all factors of occupational stress in the military. This study aims to investigate how Simulated Military Operational Stress (SMOS) affects performance on the operationally relevant tasks both in men and women. METHODS: As part of an ongoing study; Forty male soldiers (26±5yrs, 176±8cm, 85±15kg, 20.7±%BF) and eleven female soldiers (25±5yrs, 167±12 cm, 63±6kg, 26.5±%BF) completed a SMOS protocol lasting 5 days (D) and nights (N). Days 3 & 4 (D3, D4), subjects consumed 50% of caloric demands. N1, 2, 5 (D1, D2, and D5) subjects slept from 2300-0700. N3-4, subjects slept from 0100-0300 and 0500-0700. Familiarization was completed D1. During D2 & 5 participants underwent a Tactical Mobility Test (TMT), consisting of the following: 2-min water can carry (WCC) (20 kg each hand), fire & movement course, 20-m casualty drag (CD) (91kg), 300-m shuttle run unloaded (SRU) and loaded (SRL) (16 kg), 2 mi paced, and 2-mi best effort timed ruck march (RM) (15 kg). Two-way mixed ANOVAs with Bonferroni Post hoc (p<0.05) were used to identify if the difference in TMT performance form D2-5 was different between men and women. RESULTS: Regardless of sex a main effect for SRU across days was found. SRU increased by 6% from D2 to D4 and D5 (D2: 97±20, D4:103.3±22.8, p=0.047; D5: 103.5±18.8, p=0.011); additionally, D5 increased by 4% from D3 (D3: 103.5±18.8, D3: 99.3±20.2; p=0.047). CONCLUSION: Short-term exposure to military operational stress leads to a decline in anaerobic capacity; regardless of sex. Operational tasks involving musculature strength, endurance, and aerobic endurance such as the WCC, CD, and RM were well maintained over 5 days of during SMOS equally between men and women. The preliminary findings of this study suggest simulated military operational stress effects women and men equally. Future investigation into a larger sample size is needed. This study was funded by the Department of Defense (Award #: W81XWH-17-2-0070). The results and opinions herein are those of the authors and do not necessarily constitute endorsement of the Department of Defense.

**Table 108**

| Board #2 | May 29 3:15 PM - 5:15 PM | Abstract Withdrawn |

**PURPOSE:** Females report greater sensitivity in cold compared to hot conditions. However, it is unclear how thermal sensitivity is affected when the change for internal temperature (ΔTin) and metabolic heat production (MHprod) are matched. This project tested the hypothesis that females have enhanced sensitivity to thermal stress during exercise hyperthermia when ΔTin and MHprod is matched. METHODS: Twenty-two healthy active adults (7 day activity: 8620±3008 steps/day; VO2max: 49.10 mL/kg/min) adults (11M/11F, 22.4±4.9y, 169±7.6cm, 68.3±13kg) exercised at similar MH and ΔTin between conditions in random order by separated at least 7 days. The ΔTin, heart rate (ΔHR), and thermal stress indices for comfort (TC,-4 very cold to +4 very hot), sensation (TS, -4 very cold to +4 very hot), and MCAvmean are measured every 10 minutes. A 2-way mixed ANOVAs with Bonferroni Post hoc (p<0.05) were used to identify if the difference in TMT performance form D2-5 was different between men and women. RESULTS: Regardless of sex a main effect for SRU across days was found. SRU increased by 6% from D2 to D4 and D5 (D2: 97±20, D4:103.3±22.8, p=0.047; D5: 103.5±18.8, p=0.011); additionally, D5 increased by 4% from D3 (D3: 103.5±18.8, D3: 99.3±20.2; p=0.047). CONCLUSION: Short-term exposure to military operational stress leads to a decline in anaerobic capacity; regardless of sex. Operational tasks involving musculature strength, endurance, and aerobic endurance such as the WCC, CD, and RM were well maintained over 5 days of during SMOS equally between men and women. The preliminary findings of this study suggest simulated military operational stress effects women and men equally. Future investigation into a larger sample size is needed. This study was funded by the Department of Defense (Award #: W81XWH-17-2-0070). The results and opinions herein are those of the authors and do not necessarily constitute endorsement of the Department of Defense.

**Table 109**

| Board #3 | May 29 3:15 PM - 5:15 PM | Females Have An Increased Sensitivity To Thermal Stress During Matched Exercise Metabolic Heat Production |

**PURPOSE:** Females report greater sensitivity in cold compared to hot conditions. However, it is unclear how thermal sensitivity is affected when the change for internal temperature (ΔTin) and metabolic heat production (MHprod) are matched. This project tested the hypothesis that females have enhanced sensitivity to thermal stress during exercise hyperthermia when ΔTin and MHprod is matched. METHODS: Twenty-two healthy active adults (7 day activity: 8620±3008 steps/day; VO2max: 49.10 mL/kg/min) adults (11M/11F, 22.4±4.9y, 169±7.6cm, 68.3±13kg) exercised at similar MH and ΔTin between conditions in random order by separated at least 7 days. The ΔTin, heart rate (ΔHR), and thermal stress indices for comfort (TC,-4 very cold to +4 very hot), sensation (TS, -4 very cold to +4 very hot), and MCAvmean are measured every 10 minutes. A 2-way mixed ANOVAs with Bonferroni Post hoc (p<0.05) were used to identify if the difference in TMT performance form D2-5 was different between men and women. RESULTS: Regardless of sex a main effect for SRU across days was found. SRU increased by 6% from D2 to D4 and D5 (D2: 97±20, D4:103.3±22.8, p=0.047; D5: 103.5±18.8, p=0.011); additionally, D5 increased by 4% from D3 (D3: 103.5±18.8, D3: 99.3±20.2; p=0.047). CONCLUSION: Short-term exposure to military operational stress leads to a decline in anaerobic capacity; regardless of sex. Operational tasks involving musculature strength, endurance, and aerobic endurance such as the WCC, CD, and RM were well maintained over 5 days of during SMOS equally between men and women. The preliminary findings of this study suggest simulated military operational stress effects women and men equally. Future investigation into a larger sample size is needed. This study was funded by the Department of Defense (Award #: W81XWH-17-2-0070). The results and opinions herein are those of the authors and do not necessarily constitute endorsement of the Department of Defense.

**Table 110**

| Board #4 | May 29 3:15 PM - 5:15 PM | Recovery Of Heart Rate Variability And Hemodynamics After Heated Exercise In Active Females |

**PURPOSE:** The purpose of this study was to assess the recovery of autonomic function in women who performed moderate-intensity exercise in heat. METHODS: Seven women (31.7± 7.6 years, 67.3±4.1 kg, 25.7±5.6% Fat, 43.9±5.1 mL/kg/min) completed two identical bouts of graded treadmill walking (~60% VO2peak). One bout was hot (35-40°C, 40% relative humidity (RH)), and the other served as a control (18-22°C, 40% RH). For 24 h before and after each bout, participants had heart rate variability (HRV), specifically RMSSD, monitored. After each exercise bout, HR and BP were monitored during 30 min of supine recovery and 10 min of orthostatic tolerance assessment. RESULTS: RMSSD was measured and remained lower than in the control condition for one hour (p = 0.05). During supine recovery, heat exposure led to higher HR (p = 0.002) and lower DBP (p = 0.016). SBP (p = 0.037) and DBP (p = 0.008) were both lower after 10 min of supine recovery following hot exercise than after control temperature. Average response did not reveal orthostatic hypotension despite heat causing a higher HR (p = 0.011) and lower SBP (p =0.026) after 10 min of orthostatic exposure. CONCLUSIONS: Exercise in heat causes greater disruptions in cardiovascular autonomic functioning for at least one hour after exercise. Women who exercise in heat should be wary of an exacerbated HR response following exercise in the heat and low recovery blood pressures with associated symptoms.
### 3112 Board #6  May 29 3:15 PM - 5:15 PM

**Post-Exercise Hyperthermia Cerebral Blood Flow Hemodynamics Are Similar Between Males And Females**

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*No relevant relationships reported*

**PURPOSE:** Females have greater orthostatic intolerance and increased adrenergic sensitivity to passive heat stress compared to males. It is unknown how cerebral blood flow is affected during post-exercise heat stress. We tested the hypothesis that females would have lower middle cerebral artery blood flow velocity (MCAvmean) during post-exercise hyperthermia.

**METHODS:** Twenty-two healthy active adults (7 day activity: 8620±3008 steps/day; VO2max: 49±10 mL/kg/min) subjects (11M/11F; 22.4±4.9y, 169±7.55cm, 68.3±13kg) exercised at a similar metabolic heat production (M: 7.1±1.5 W/kg; F: 6.9±1.4 W/kg; P=0.32) for 60 minutes (cycle ergometer) in cool (24±0.0°C; 14.4±3.6%Rh) and hot (42.3±2.0°C; 27±9.5%Rh) conditions in random order with a 7 day washout. During 1-hour post-exercise recovery, Transcranial Doppler examined MCAvmean, pulsatility index (PI) and intracranial pressure (ICP). Systemic vascular responses for mean arterial pressure (MAP), augmentation index (AIx), pulse wave velocity (PWV), systemic vascular resistance (SVR), and change in heart rate (ΔHR) were assessed during heat exposure and during recovery. The data were analyzed in using a mixed model 2-way repeated-measures analysis of variance for interaction (I) and main effects (ME) for Condition x Sex. Alpha priori was set at P<0.05.

**RESULTS:** Exercise thermal (ATin, Cool: 30.1±1.0°C; Hot: 31.5±0.6°C; ME: Condition; P<0.0001) and cardiovascular strain (ΔHRin: 58±15 b/min; Hot: 71±15 b/min; ME: Condition; P<0.0001) were similar between groups that increased in hot compared to cool condition. During recovery both sexes had a similar AUC MCAvmean, however, MCAvmean was lower in hot compared to cool (ME: Condition; P=0.03). Females also showed reduced stiffness (AUC PWV and AIx) compared to males (ME: Condition; P<0.0001; ME: Sex; P=0.0008). Females had greater AUC SVR compared to males in both conditions (ME: sex; P=0.01). There were no differences for MAP, PI, or ICP between the Condition or Sex. **CONCLUSIONS:** These data suggest that no sex difference exists for MCAvmean during recovery. Both sexes have lower MCAvmean in hot compared to cool conditions. However, the peripheral vascular mechanisms for this attenuation may differ as females have lower arterial stiffness and higher SVR.

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### 3115 May 29 3:30 PM - 3:45 PM

**High Intensity Exercise Training In Patients With Hypertrophic Cardiomyopathy**

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Patients with hypertrophic cardiomyopathy (HCM) are excluded from high intensity activities due to perceived fear of sudden cardiac death though data from athletes with HCM suggest competitive sport may be safe for some. Low cardiorespiratory fitness in sedentary HCM patients may confer a greater lifetime cardiovascular event risk than exercise per se. While moderate intensity exercise training in patients with HCM modestly increases fitness, high intensity exercise may be superior. **PURPOSE:** To compare the efficacy of five months of moderate intensity exercise and high intensity exercise training to improve cardiorespiratory fitness (VO2max) in patients with HCM.

**METHODS:** Eight patients with HCM (50 ± 7 years, 3 female) were assessed for maximal oxygen uptake (VO2max, Douglas Bag method), cardiac output (Q, acetylene rebreathing), and peripheral oxygen extraction (av-O2 diff, Fick equation) before randomization and after 5 months of moderate or high intensity exercise training. Patients completed 3-4 sessions of moderate intensity exercise each week, while the high intensity group also incorporated a weekly interval training session. **RESULTS:** Five months of moderate intensity exercise increased absolute VO2max by 3% and relative VO2max by 4%, while high intensity exercise consistently increased absolute VO2max by 6% and relative VO2max by 5% (Figure). Maximum Q did not change after moderate intensity exercise (+0.6L [95% CI -2.0 to 1.7]) but increased in all three patients after high intensity exercise (+1.2L [95% CI -1.4 to 3.5]), while relative Q (av-O2 diff remained stable in both groups (moderate intensity: +0.8L±1.0mmHg [95% CI -1.0 to 2.6]; high-intensity: -0.5mmHg±0.8mmHg [95% CI -3.6 to 2.7]). **CONCLUSION:** Preliminary findings show similar increases in cardiorespiratory fitness following five months of moderate and high intensity exercise training in patients with HCM, although improvements were more consistent after high intensity exercise.

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### 3114 May 29 3:15 PM - 3:30 PM

**Effect Of Pre-Operative Aerobic Exercise On Surgical Outcomes And Cardiometabolic Health In Bariatric Surgery Patients**

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**PURPOSE:** Examine if adding pre-operative aerobic exercise to standard medical care (EX+SC) improves surgical outcomes and enhances cardiometabolic health 30 d after surgery compared to SC only in bariatric surgery candidates. **METHODS:** Patients receiving bariatric surgery were matched pre-operative SC (n=7) or EX+SC (n=7). Pretreatment (P<0.05) was similar between groups and used in hot compared to cool condition. During recovery both sexes had a similar AUC MCAvmean, however, MCAvmean was lower in hot compared to cool (ME: Condition; P=0.03). Females also showed reduced stiffness (AUC PWV and AIx) compared to males (ME: Condition; P<0.0001; ME: Sex; P=0.0008). Females had greater AUC SVR compared to males in both conditions (ME: sex; P=0.01). There were no differences for MAP, PI, or ICP between the Condition or Sex. **CONCLUSIONS:** These data suggest that no sex difference exists for MCAvmean during recovery. Both sexes have lower MCAvmean in hot compared to cool conditions. However, the peripheral vascular mechanisms for this attenuation may differ as females have lower arterial stiffness and higher SVR.

**EX+SC reduced body weight (SC -8.4±0.8% vs. EX+SC -9.3±0.8%), fat mass (SC -9.6±1.1% vs. EX+SC -12.0±1.7%), and waist circumference (SC -5.6±1.4% vs. EX+SC -2.1±2.2%) similarly (all P<0.04). Treatment had no effect on CRP (P=0.58) but lowered fasting systolic blood pressure (SC -4.5±3.1% vs. EX+SC -7.9±3.0%), low-density lipoprotein (SC -20.1±4.5% vs. EX+SC -26.2±4.9%), and total cholesterol (SC -19.7±3.8% vs. EX+SC -21.6±4.6%) as well as AIx total area under the curve (SC -40.7±14.0% vs. EX+SC -19.7±11.2%) similarly for both groups (all P<0.02).**

**CONCLUSION:** Post-intervention to 30 d post-surgery. EX+SC had a shorter length of hospital stay than SC (41.3±4.4 vs. 56.7±5.7 hrs; P=0.05). Although VO2peak (SC -5.8±5.0% vs. EX+SC 1.7±5.2% pre- to post-intervention) and lean mass (SC -2.1±4.0% vs. EX+SC -0.4±1.4% pre- to post-intervention) were not significantly different between groups after the interventions, increased VO2peak prior to surgery correlated to a shorter length of stay (r=0.58, P=0.03). Increased VO2peak (r=0.78, P<0.001) and lean mass (r=0.56, P=0.04) pre- to post-intervention was also associated with decreased CRP 30 days post-operation. **EX+SC did not enhance the effect of SC on cardiometabolic risk factors. However, adding aerobic exercise to SC appears to benefit the bariatric patient as increased pre-operative VO2peak related to a shorter length of stay and increased VO2peak and lean mass prior to surgery correlated to decreased systemic inflammation 30 d post-surgery.**

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**Figure. Similar increases in absolute (A) and relative (B) cardiorespiratory fitness following five months of moderate intensity exercise (ME) and high intensity exercise (HE). The increase in VO2max was consistent in all three patients who completed high intensity exercise training whereas the training response to moderate intensity exercise was more variable.**

Abstracts were prepared by the authors and printed as submitted.
Elevated fasting blood glucose is one of the five components of metabolic syndrome (MetS) which is a cluster of anthropometric, metabolic and cardiovascular derangements. Insulin resistance (IR) has been identified as an important risk factor to develop diabetes (i.e., T2D) and MetS. Both, aerobic (AT) and resistance training (RT) prevent the development of T2D although it is unclear which is most effective. It has been suggested that mechanisms to improve IR are different between AT and RT. Thus, we hypothesized that the combination of both modes of training could provide additive effects to treat IR.

**Purpose:** To determine whether the addition of resistance training (RT) to high-intensity interval training (HIIT) was able to improve glucose metabolism in patients with metabolic syndrome (MetS). **Methods:** One hundred MetS patients (age, 56±8 years; weight, 92±17 kg; and MetS factors, 3.8±0.8 components) were randomized to undergo one of the following 16-wk program: (a) 4 x 4-min high-intensity interval training at 90% of HRpeak, plus 3 sets of 8-12 rep at 60-85% 1RM of 3 legs free-weight exercises (HIIT+RT group; n=34/38 min/session, 114 mins/week); (b) 5 x 4-min high-intensity interval training at 90% of HRpeak, plus 3 sets of 8-12 rep at 60-85% 1RM of 3 legs free-weight exercises (HIIT group; n=43) or (c) no exercise control group (CONT group; n=12). Data reported are estimated mean and 95% confidence interval.

**RESULTS:** Seventy-seven participants completed pre and post testing to assess the effects of different exercise volumes on FFI in adults with MetS. **METHODS:** Ninety-nine adults diagnosed with MetS according to the International Diabetes Federation criteria were randomized to one of the following 16-week intervention: i) moderate-intensity continuous training (MINT) at 60-70% HRpeak for 30 min/session (n=34, 150 min/week); ii) 4 x 4 min bouts of high-intensity interval training (4HIIT) at 85-95% HRpeak, interspersed with 3-min active recovery at 50-70% HRpeak (n=34, 38 min/session, 114 mins/week); and iii) 1 x 4 min bout of HIIT at 85-95% HRpeak (n=31, 17 min/session, 51 min/week). The recently developed fitness-fatness index (FFI) combines these factors of metabolic syndrome (MetS), and consequent cardiovascular disease (CVD)/mortality risk. The FFI was calculated as VO2peak (mL.kg-1 min-1) GEX in patients with CHD. Exercise training is an important component of coronary heart disease (CHD) management; however engagement in gym-based exercise (GEX) remains sub-optimal. Water-based exercise (WEX) may provide an alternative, especially for patients with obesity or arthritis due to the buoyancy effect of water.

**METHODS:** Participants were randomised to 12 weeks of WEX, GEX, or control. Training groups undertook three, one-hour sessions of circuit training per week. Aerobic velocity (VO2peak), muscular strength (one repetition maximum; 1RM), body fat (DEXA) and endothelial function (flow-mediated dilatation; FMD) were assessed at baseline and 12 weeks. Data were analysed using STATA 16 with mixed effects linear regression.

**RESULTS:** Forty-five participants completed the study: WEX (n=15), GEX (n=18), control (n=12). Data reported are estimated mean and 95% confidence interval.
medication; AHM). Aerobic exercise training in hypertensive individuals has been shown to reduce their blood pressure. However, information is scarce on the effects of aerobic training and AHM on the control of hypertension.

**PURPOSE:** To analyze the effects of AHM on 21-h ambulatory blood pressure (ABP) before and after an aerobic exercise training program in hypertensive individuals.

**METHODS:** Twenty-seven participants chronically medicated with angiotensin receptor blockers or angiotensin-converting enzyme inhibitors antihypertensive medicine (AHM) underwent high-intensity interval training (HIIT; 3 sessions per week, 4x4 at 90 HRMAX/3 at 70% HRMAX) during 4-months. Before and after training, 21-h ABP was monitored under 2 conditions in a double-blind, placebo randomized design: a) PLAC trial substituting for 3 consecutive days antihypertensive medicine by placebo, and b) AHM trial, taking their prescribed antihypertensive medicine. Cardiorespiratory fitness (CRF), body weight and aldosterone to plasma renin activity ratio (ARR) were measured as secondary outcomes. Differences among the 4 trials (i.e., PLACPRE, PLACPOST, AHMPOST) were analyzed by one-way repeated-measures ANOVA.

**RESULTS:** CRF increased significantly from 2.45±0.02 to 2.58±0.02 L·min⁻¹ (P=0.025), body weight decreased from 95.6±2.5 to 93.6±2.4 kg (P=0.007), whilst ARR only decreased significantly after training (-10.8±2.6 a.u., P=0.002). At baseline, AHM reduced daytime ambulatory mean arterial pressure by 4.5±1.1 mmHg, being that reduction enhanced to 7.4±1.1 mmHg after 4-months of training (P=0.047). However, at nighttime this difference faded out and the reductions of AHM before (6.1±1.5 mmHg) and after training (4.7±1.2 mmHg) remained similar (P=0.437).

**CONCLUSIONS:** The present data show that 4 months of HIIT enhances the effects of antihypertensive medication on blood pressure during daytime. This effect fades out during the night, a time where BP naturally falls. These results demonstrate that aerobic training could be used as a strategy to improve pharmacological treatment in hypertensive individuals.

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**3121 May 29 5:00 PM - 5:15 PM Effects Of Statins Therapy And Exercise On Postprandial Triglycerides In Overweight Individuals With Hypercholesterolemia.**

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(No relevant relationships reported)

**PURPOSE:** To determine the effects of statins on postprandial lipemia (PPL) and to study if exercise could enhance statin actions.

**METHODS:** Ten hypercholesterolemic (blood cholesterol 204±36 mg·dL⁻¹; LDL-c 129±32 36 mg·dL⁻¹) overweight (BMI 30±4 kg·m⁻²), metabolic syndrome (MetS) individuals chronically medicated with statins (> 6 months) underwent 5-hr PPL tests in four occasions in a randomized order; a) substituting their habitual statin medication by placebo medicine during 96 hours (PLAC trial), b) taking their habitual statin medicine (STA trial), c) placebo medicine combined with a bout of intense aerobic exercise (EXER+PLAC trial) and d) combining exercise and statin medicine (EXER+STA trial).  

**RESULTS:** Before the fat meal, statin withdrawal (i.e., PLAC and EXER+PLAC) increased blood triglycerides (TG; 29%), LDL-c (37%) and total cholesterol (23%; all P<0.05) evidencing treatment compliance. After the meal, statin withdrawal increased 5-h postprandial TG (PPTG) compared to its matched trials (94% higher PLAC vs STA and 45% higher EXER+PLAC vs EXER+STA; P=0.05). EXER+PLAC trial did not lower PPTG below the PLAC trial (i.e., incremental AUC of 699±152 vs 826±190 mg·dL⁻¹·5 h; P=0.09). Neither adding exercise to statin resulted in larger reductions in PPTG (i.e., EXER+STA vs STA iAUC of 421±87 vs 421±84 mg·dL⁻¹·5 h; P=0.99).

**CONCLUSIONS:** In hypercholesteremic MetS individuals, chronic statin therapy blunts the elevations in TG after a fat meal (i.e., iAUC of PPTG) reducing the cardiovascular risk associated to their atherogenic dyslipidemia. However, a single bout of intense aerobic exercise before the high fat meal does not reduce PPTG but neither interferes with the effects of statin treatment.

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**3125 May 29 3:15 PM - 3:35 PM Cardiac-Football**

Brady Fleshman. University of Kentucky, Lexington, KY.

(Sponsor: Robert Hosey, FACSM)

(No relevant relationships reported)

**HISTORY:** A 20 year-old male Division I football player with no significant past medical history presented with syncope and collapse one hour ago. Patient was doing cone drills and was feeling short of breath with mid-sternal chest tightness. The trainers had him sit out the rest of the drill. Five minutes after resting he asked the trainer if he could go back in and they said no. Ten seconds later, he passed out from a standing position. Upon awakening a few seconds later, he was asymptomatic. He was immediately escorted from practice to the clinic. Patient states over the last week he had not been keeping up with his peers in practice.

**PHYSICAL EXAMINATION:** No acute distress. Moist oral mucosa. Heart rate 100, regular rhythm, no murmurs with Valsalva, sitting, standing, squatting or grip squeeze. Lungs are non-labor and clear to auscultation bilaterally without wheezing.

**DIFFERENTIAL DIAGNOSIS:** Vasovagal syncope, hypoglycemia, seizure, arrhythmia, hypotension.

**TEST AND RESULTS:** Labs showed normal CMP and TSH. CBC showed normocytic anemia (Hgb 13.1). Serum protein electrophoresis was normal. Cossackie B virus antibody testing showed a 1:320 titer of Cossackie type B-3. Additional history revealed that four weeks prior to collapse he had upper respiratory symptoms. Cardiac testing: EKG was normal. Echocardiogram showed borderline reduced LVEF 51% and mild hypokinesis of the left ventricle. A Holter monitor showed rare premature atrial and ventricular contractions and patient was asymptomatic while wearing. Stress echocardiogram showed supraventricular tachycardia at nine minutes of exercise, concerning for atrial flutter. The arrhythmia lasted for 10-15 minutes and then resolved spontaneously. Patient wore a Zio patch (heart rhythm monitor) for one week and it showed paroxysmal atrial flutter.

**FINAL WORKING DIAGNOSIS:** Paroxysmal atrial flutter.

**TREATMENT AND OUTCOMES:** It is thought that patient had viral myocarditis syndrome from Cossackie virus causing patients symptomatic atrial flutter. He was started on Flecainide 50mg twice-daily oral tablet. Patient is allowed to continue with full contact football without restrictions while on medication. Cardiology will consider Zio patch monitor and possibility of ablation post-season but will need to briefly be on anticoagulation.
KUBs in 2016 and 2017 showed stool in the colon and nonspecific bowel gas pattern. LFTs, H.pylori, ESR, CRP were normal in 2017. She was diagnosed with constipation and irritable bowel syndrome. She tried a daily probiotic, the low FODMAP diet, and gave up dairy for months without improvement of her symptoms.

**PHYSICAL EXAM:** The abdomen appears distended. Decreased bowel sounds in all quadrants. Dull to percussion. The abdomen is firm, but no guarding or rebound. Prior to a run, abdominal girth measured at 90 cm at the umbilicus. After a run, no change.

**DIFFERENTIAL DIAGNOSES:** Exercise induced bowel ischemia, Inflammatory Bowel Disease, ascites, organomegaly, abdominal mass, pregnancy, diastasis recti.

**TEST AND RESULTS:**
Stool calprotectin negative. WBC 11.6, hematoglobin 13.4, platelets 303. LFTs within normal limits. Serum HCG negative. Creatinine 0.81 CT abdomen and pelvis with contrast: Large cystic lesion in the abdomen and pelvis measuring 28 x 19 x 38 cm. The origin of this lesion is unclear. Secondary moderate to severe right and mild to moderate left hydrophrenomegaly.

**FINAL WORKING DIAGNOSIS:**
Large cystic abdominal mass, originating from the pelvis

**TREATMENT AND OUTCOMES:**
1. Emergent laparotomy showing large left ovarian cyst. 10L of fluid drained. Left salpingo-oophorectomy performed.
2. Pathology consistent with serous cystadenoma. Fallopian tube without significant abnormality. No malignant cells in the pelvic washing.
3. After surgery, abdominal girth measured 75 cm at the umbilicus.
4. Gradual return to running for 2 weeks post-op.

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**Emesis - Football**

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**Denay, FACSM**

**Lauren E. Cianci, Tesa E. Johns, Peter H. Seidenberg, FACSM. Penn State University, University Park, PA. (Sponsor: Peter H. Seidenberg, FACSM)**

**May 29 4:15 PM - 4:35 PM**

**S674 Vol. 52 No. 5 Supplement**

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**Laura Beth Anderson, Amie Kim. Icahn School of Medicine at Mount Sinai Medical Center, New York, NY.**

**Emesis - Football**

**Emesis- Football**

3128 May 29 4:35 PM - 4:55 PM

**General Medicine / Gastroenterology-Cycling**

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**Emesis - Football**

**Emesis- Football**

6) Water samples were collected serially before and after treatment cycles to ensure eradication prior to re-opening the pools.
F-39 Clinical Case Slide - Medical Issues II

Friday, May 29, 2020, 3:15 PM - 4:55 PM
Room: CC-2022

3130 Chair: Robert E. Sallis, FACSM. Kaiser Permanente Medical Center, Fontana, CA.
(No relevant relationships reported)

3131 Discussant: Jill Sadoski. Michigan State University, East Lansing, MI.
(No relevant relationships reported)

3132 Discussant: Brian A. Davis, FACSM. University of California-Davis, Sacramento, CA.
(No relevant relationships reported)

3133 May 29 3:15 PM - 3:35 PM
Cheif Neck Pain In A Tennis Player
Kathryn Elizabeth McLellan, Jeffrey Kovan, Nathan Fitton, Jill Moschelli. Michigan State University, East Lansing, MI. (Sponsor: James Dunlap, FACSM)
(No relevant relationships reported)

History: An 18-year old male D-1 tennis player presented to the office with new onset pain in his chest and neck. It started the night prior to presentation in the center of his chest. He fell asleep without pain, but the next day noted pain in his upper chest and neck. He described it as a stiffness and as a weight pressing down on his chest. The pain was constant and worse with swallowing, speaking, neck extension, and head rotation. He also reported feeling more out of breath than usual. Two days prior to symptom presentation, he performed baseline strength testing. He denied fevers, pain with neck flexion, radiation to either arm, syncope, wheezing, sore throat, N/V/D or headache. He had no personal or family history of asthma, pneumothorax, or cardiac disease. He denied current or prior smoking, drug use, and vaping.

Physical Exam: Vitals: Ht 182 cm, Wt 77.1 kg, BP 119/74, HR 74 bpm, Temp 36.6 C (oral), BMI 23.2 Gen: NAD, nontoxic EN: no pharyngeal erythema or tonsillar swelling Neck: no lymphadenopathy. Supple, full ROM but pain in full extension. No TTP of spine or soft tissues. CV: RRR, no M/R/G Resp: CTA bilaterally, good air entry, no wheeze, no accessory muscle use Chest: No TTP of ribs, sternum, costo-sternal joint, or intercostal spaces. No palpable subcutaneous crepitus to the chest or neck. Skin: no erythema of the skin of neck or chest


Final Diagnosis: Spontaneous pneumonmediastinum

Treatment/Outcome: Patient was held from activity until follow-up weekly X-rays demonstrated resolution of free air in the neck.

Symptoms and X-ray findings resolved within two weeks. He was cleared at 2 weeks with a gradual progression of activity and avoidance of full exertion or weight lifting.

One week later, he was cleared to return to full activity with no restrictions. He was advised to avoid breath-holding with activity. He has had no recurrence of symptoms.

HISTORY: 18 y/o male presents during review of incoming student-athlete health history documents with history of “severe hemophilia A”, self-treated with Factor VIII infusions every other day & “extra doses” as needed. Letter from pediatric hematologist clearing him to participate: “there is no medical reason he cannot participate in competitive water polo.” PHM: Two hospitalizations due to blood infection (2003 & 2005), ADHD diagnosis (2009), Type 2 SLAP lesion right shoulder (2016), Wisdom Teeth Extraction (3/2017).

PHYSICAL EXAMINATION: Visible keloid scarring present at two sites on the right and left side of patient’s chest consistent with port removals. BP: 129/92mmHG. Pulse: 64bpm. Height 77in. Weight 225.2lbs. PE otherwise benign.

DIFFERENTIAL DIAGNOSIS: Hemophilia A
Venous Thromboembolic Disease

TEST AND RESULTS: VWF profile: Normal Random Factor VIII level: 12% (~36hours after infusion) Post-infusion Factor VIII level: 147% down to 77% at 6 hours. Hepatitis A/B/C Immune Status, HIV Antibody: negative Normal PT. Prolonged PTT which corrects with normal plasma mixing. Unremarkable CBC, CMP

FINAL WORKING DIAGNOSIS: Severe Hemophilia A. TREATMENT AND OUTCOMES: Prophylactic Treatment of Advate 5000units daily, during water polo season, just prior to participation in practice or game. If practice/games extend post-infusion 8 hours or beyond, patient to self-infuse additional 5000units. Self-infusion every other day when not participating in water polo. In case of an emergency/life-threatening bleeding, patient to infuse first and then, if stable, seek care at RJW-Rutgers ER (or other regional Hemophilia Treatment Center while traveling). If clinically warranted, patient to seek care at closest ER and bring factor with him. Annual re-evaluations to be performed at Hemophilia Treatment Center Rutgers-RWJ. Patient has been fortunate to participate in competitive collegiate water polo for 2+ seasons with no adverse sequelae.

HISTORY: 29 yo male Brazilian jujitsu fighter with history of Henoch-Schonlein purpura and eczema presents to clinic for 6 months of right anterolateral calf pain without a clear injury. He reports constant, dull, aching pain, worse with dorsiflexion and resisted plantar flexion. He notes associated pitting edema, dry leathery skin, hypopigmentation, and hyperesthesia that began 3-4 months ago. He has stopped jiu-jitsu due to symptoms. Tib-fib x-rays and venous duplex were negative. He tried acetaminophen, ibuprofen, physical therapy, topical clobetasol, and oral prednisone with short-term improvement. PHYSICAL EXAMINATION: Skin of the anterolateral calf is indurated with hair loss, a leathery appearance, and areas of depigmentation. The distal lateral calf is warm and erythematous, with swelling posterior to the lateral malleolus. Tinel’s sign is negative at the fibular head. Pulses are normal bilaterally with ankle plantar and dorsiflexion. Ankle ROM is full. Light touch sensation is intact in L2-L5 dermatomes and strength is 5/5 in lower extremities.

DIFFERENTIAL DIAGNOSIS: Complex regional pain syndrome, Cellulitis, Scleroderma, Eosinophilic fasciitis, Chronic exertional compartment syndrome, Vascular insufficiency

TEST AND RESULTS: Lab work: inflammatory markers and rheumatologic labs negative except for elevated CK (356) of unknown significance. EMG/NCV: low amplitude right vs left sural sensory nerve suggesting sural neuropathy although within normal limits; no fibular neuropathy or radiculopathy. MRI right leg: nonspecific skin thickening of anterolateral shin with fascial edema and mid fibular lucency myositis. Skin biopsy: linear morphea versus eosinophilic fasciitis

FINAL WORKING DIAGNOSIS: Segmental Linear Morphea (localized scleroderma)
TREATMENT AND OUTCOMES: Dermatology referral led to biopsy; subsequently, treatment with PO methotrexate (MTX), high dose IV methylprednisolone for three cycles, and topical clobetasol ointment BID. UVA1 phototherapy was also started due to extensive disease and ankle and knee joint involvement. Subjective improvement in ROM, skin stiffness, and strength per patient after 2 cycles of methylprednisolone. Switched to SQ MTX for better absorption and lower cost. Patient continues to improve as he remains on the above treatment protocol.

3136 May 29 4:15 PM - 4:35 PM
An Unexpected Curveball Causing Fatigue In A Softball Player
Om Sam1, Stanley Hunter2, Nina Millet1, 1UHS, Johnson City, NY, 2UHS, Binghamton, NY.
Email: omsam3288@gmail.com
(No relevant relationships reported)

HISTORY: 19 year old caucasian female softball player with no past medical history presented to the office for fatigue and reduced exercise tolerance for a month. She also complained of muscle cramps in her calves, decreased appetite, intermittent headaches, nausea and one episode of non-bloody, non-bilious emesis. Her athletic performance had decreased despite no changes in her training regimen. She measured her glucose via a glucometer with readings in the 70s. She maintained proper fluids, electrolyte and nutrient intake. She denies any changes in her weight, menstrual cycle, depression and recent illness.

10 point ROS was negative. Social history is unremarkable except for occasional alcohol intake. Regular menstrual cycle.

PHYSICAL EXAMINATION: Vital signs within normal limits. No signs of acute distress. Normal mentation and affect. No jaundice or pallor. Regular rhythm and rate. No murmurs appreciated. Lungs clear to auscultation. Abdomen is soft, non-tender, with normal bowel sounds, no masses appreciated. 5/5 strength and sensation to light touch intact in all extremities. Biceps and knee jerk reflex 2+.


TEST AND RESULTS: CBC: RBC 5.58, HbH 11.6; MCH 7.7, MCHC 30.7. MCH 20.8 - Microcytic anemia. Peripheral blood smear reveals anisocytosis. CMP: Na 133-hypotinorma. Iron panel: Ferritin 20.1, Transferin saturation 36, Total FE binding 576, Serum iron 137 - Normal iron panel TSH 1.120 - normal. Vit D 47 - normal. Haptoglobin 23 (low), LDH 606 (N), Total bilirubin 0.9 (N) - No signs of hepatic involvement. Hgb electrophoresis: Hgb A 95 (low), Hgb A2 4.7 (high), Hgb F 0.3 (N), Hgb variant 0- Beta thalassemia trait. EKG: normal.

FINAL WORKING DIAGNOSIS: Beta-thalassemia trait
TREATMENT AND OUTCOMES: Initial treatment with iron supplementation for 3 weeks showed no improvement. Although it may take 6-8 weeks for Hgb levels to return to normal. Repeat Hgb after 3 weeks should have revealed a mild improvement. Iron panel was ordered to confirm diagnosis, which was normal. Further family history revealed thalassemia, which was then confirmed with Hgb electrophoresis. Folic acid 2 mg daily started, iron supplementation discontinued. Cessation of activity for 4 weeks to promote recovery, then gradual return to full activity. Follow-up in 2 months.

3137 May 29 4:35 PM - 4:55 PM
Almost Vaping Your Way To Medical Disqualification
Eric Emmanuel Coris, William Anderson, Yuri Chulskiy, Sanders Chae, Byron Moran. The University of South Florida, Tampa, FL.
Email: ecoris@usf.edu
(No relevant relationships reported)

HISTORY: 18 year old male freshman Division I football athlete with a history of abnormal pre-participation EKG. Initial EKG was significant for left axis deviation, incomplete right bundle branch block, prominent p wave, t wave inversion in V1 and V2. He had no symptoms, and denied significant past medical history. Echocardiogram revealed significantly enlarged right atrium, pulmonary hypertension.

PHYSICAL EXAMINATION: Normal, except CV: RRR without M/G/R; nl S1, prominent S2 in pulmonic area.

DIFFERENTIAL DIAGNOSIS: Pulmonary hypertension/Anomalous pulmonary return/Arthryhythmic right ventricular dysplasia/Intestinal lung disease/Sarcoid/Intracardiac shunt/Atrial septal defect/Ventricular septal defect/Obstructive sleep apnea/Obstructive lung disease/HIV/Granulomatous lung disease/Hypersensitivity Pneumonitis

TEST AND RESULTS: CT angiogram of the chest revealed mild enlargement of the right atrium. Ill-defined opacities bilaterally with tiny focal luencies which may represent focal developing cavitation. Mixed solid and ground-glass opacities with focal internal luencies mainly located peripherally. Small lucent central regions are suggested within these regions.

Further significant history of two months prior to initial EKG and the day after initial EKG two vaping episodes. No tobacco, no THC reportedly contained but some type of flavoring was present. Believes he split one e cigarette with another person. Prior to that episode he vaped every other weekend, for a few weekends, two months prior to the initial EKG. No symptoms ever noted after vaping that he was aware of. Did have rhinorrhea and sneezing for several months this summer, he felt related to seasonal allergic rhinitis.

FINAL WORKING DIAGNOSIS: Vaping induced hypersensitivity pneumonitis
TREATMENT AND OUTCOMES: Athlete refrained from further vaping. Held from competitive activity until completion of workup, athlete was gradually progressed through increasing cardiopulmonary exercise to return to play. Returned to full play over a 2 week progressive period with no symptoms. Follow up CT of the chest and pulmonary function tests returned to normal.

F-40 Clinical Case Study - Spine
Friday, May 29, 2020, 3:15 PM - 5:15 PM
Room: CC-3020

3138 Chair: Stanley Alan Herring, FACSM. University of Washington, Seattle, WA.
(No relevant relationships reported)

3139 Discussant: Samuel K. Chu. Shirley Ryan AbilityLab, Chicago, IL.
(No relevant relationships reported)

(No relevant relationships reported)

3141 May 29 3:15 PM - 3:35 PM
“Tingling In The Scrum”: Paresthesias And Neck Pain - Rugby
Jonathan Smits1, Pierre Rouzier, FACSM2, John Herbert Stevenson1. 1University of Massachusetts Medical School, Worcester, MA. 2University of Massachusetts, Amherst, MA.
(No relevant relationships reported)

HISTORY: A 19 year old female college student “new to club rugby” presented to the campus health clinic for evaluation of neck stiffness and extremity tingling following last week’s practice. She was unable to recall a specific injury. However, she reported later feeling neck stiffness with associated soreness. She also reported paresthesias involving both hands, left worse than right, and her left foot. Her symptoms were improving but she had not resumed practice.

She reported being a multi-sport high school athlete with participation in varsity field hockey and lacrosse without prior concussion, head or neck pain, or extremity abnormalities. She had also been in an auto accident years prior without subsequent injury. History was notable for resolved low back pain, and a family history of back pain.

PHYSICAL EXAMINATION: Spine exam demonstrated FROM with no C/T/L spino process tenderness. Spinal nerve root feel was negative. Tightness was appreciated in left trapezius muscle compared to right. Shoulders demonstrated FROM with normal rotator cuff strength. Upper and lower extremities with equal sensation, reflexes, and pulses. Grip strength normal. Straight leg raise and slump tests were negative.

TREATMENT AND OUTCOMES: The athlete was initially restricted from rugby activities until follow-up evaluation. She noted interval improvement and wished to pursue strength training at season end. Her symptoms then recurred with overhead lifting, and later with chiropractic treatments. Upon return to campus, brain and cervical MRI were ordered as recommended by a neurologist. Due to the above MRI findings, she stopped recreational activity and was referrals for urgent neurological evaluation. She will undergo decompression surgery.

3142 May 29 3:35 PM - 3:55 PM Neck Injury - Football
Paiyuan Ahsanashari, Robert E. Sallis, FACSM. Kaiser Fontana, Fontana, CA. (Sponsor: Dr Bob Sallis, FACSM)
Email: paiyuan.x.ahsanashari@kp.org
(No relevant relationships reported)

HISTORY: 21-year-old senior high school football offensive line men sustained a neck injury while tackling. During the third quarter of a midseason game, he tackled an opponent player, and they both landed on the ground. The patient was facing down with opposing player just underneath his anterior torso. Shortly after the play, given he was near the ball, a pile up of players landed on his upper back. He sustained a hyperextension injury of his cervical neck since his head was laying on the player he tackled. Patient described an immediate “pop” sensation in his neck and had “complete weakness & numbness” of his R arm and leg. His distal pulses and breathing were within normal ranges.

DIFFERENTIAL DIAGNOSIS: Cervical Cord Compression, Cervical Fracture, Cervical Disc Herniation, Cervical Facet Radiculopathy

TESTS AND RESULTS:
Cervical XRAYS: No oseous abnormality.
Thoracic CT Scan: Normal CT chest, abdomen, pelvic, and thoracic spine.
MRI Cervical Spine: C6-7 where a right paracentral / foramina disc protrusion. Mild central canal stenosis at T1-2 level due to diffuse disc bulge.

FINAL WORKING DIAGNOSIS: C6-7 cervical disc herniation with mild to moderate cervical cord stenosis at C6/7 and T1-2.

TREATMENT AND OUTCOMES: R-sided weakness resolved after 4 weeks of supportive care, watchful waiting and physical therapy.

3143 May 29 4:35 PM - 4:55 PM Trampoline Trauma: A Divier’s Injury
Luting Eckensweiler1, Anne Doran2, Poomon Thaker, FACSM.1
1Resurrection Medical Center, Chicago, IL. 2Lutheran General Hospital, Park Ridge, IL. (Sponsor: Poomon Thaker, FACSM)
(No relevant relationships reported)

Trampoline Training: A Diver’s Injury History:
A 15-year-old male presented to the emergency department with back pain after sustaining an injury while practicing a diving routine on the trampoline. He was in forward rotation when he landed awkwardly on his chin and upper chest, sending his back into hyperextension with his legs landing above his head. He felt immediate low back pain and complete loss of sensory and motor function of his legs for about 30 seconds. All sensory and motor function subsequently returned and he was able to ambulate from the trampoline into the home. He denied ongoing sensory or motor deficits in his legs, loss of consciousness, neck pain, urinary or bowel incontinence, or upper extremity weakness.

Physical examination:
Physical examination revealed a well appearing male who was able to ambulate slowly but independently with normal gait. He had midline tenderness in the upper lumbar vertebrae. There was normal alignment of the spine without step offs. His strength was 5/5 and reflexes were 2+/ in lower extremities. He did not have deficits to touch sensation and did not have saddle anesthesia.

Differential diagnoses:
1. Spinal cord contusion
2. Lumbar vertebral fracture
3. Lumbar sprain
4. Acute spondylosis or spondylolysis
5. Lumbosacral neurapraxia

Tests and results:
Xray of cervical spine, chest, and pelvis: unremarkable
CT cervical spine: unremarkable
MRI cervical-thoracic-lumbar:
- traumatic injury of the lumbar spine with disruption of the interspinous ligament at the L1-L2 level
- small ventral extradural hematoma contained by the posterior longitudinal ligament at L2-L4
MRI lumbar spine, hospital day #2:
- decrease in size and craniocaudal extent of the ventral extradural collection
- edema within posas and paraspinal muscles at L2-L4

Final diagnosis: Extradural hematoma of lumbar spine at L1-L2

Tear of interspinous ligament at L1-L2

Treatment and outcomes:
1. Admission to PICU for close neurologic monitoring with neurosurgery and trauma on consult. He did not report further numbness or tingling in lower extremities
2. Physical therapy
3. Stepped down to general pediatric floor on hospital day #2
4. Discharged on hospital day #3 with lumbar sacral orthosis brace
5. Experienced ongoing headaches for several weeks
6. Back to activity as tolerated, continue to monitor recovery
bilateral shoulder pain. The forearm pain was constant and worsened by single
backhand with tennis, lifting weights. She reported reduced grip strength and her
cracet falling out of her hands.

PHYSICAL EXAMINATION:
Cervical range of motion was within functional limits. Elbow examination showed full
active and passive range of motion, minimal tenderness along lateral epicondyle and
just distal at tendinous origin, and no pain with resisted wrist extension and middle
finger extension. She had finger extension weakness without pain bilaterally 3.5 and
otherwise motor testing was 5/5 C5-T1 myotomes. Sensation was intact in C5-T1
dermatomes bilaterally. Reflexes were 2+ and symmetric of biceps and brachioradialis
and 3+ at the triceps bilaterally.

DIFFERENTIAL DIAGNOSIS:
1. Bilateral lateral epicondylitis
2. Cervical spine stenosis with myelopathy
3. Posterior interosseous neuropathy

TEST AND RESULTS:
Cervical Spine anterior-posterior and lateral radiographs:
- Grade 2 anterolisthesis of C7 on T1 is seen with bilateral pars fracture of C7.
Moderate multilevel degenerative disc disease.

MRI of the Cervical Spine without Contrast:
- Advanced facet arthropathy at C7-T1. Anterolisthesis of C7 on T1 causing moderate/
severe spinal stenosis with mild cord deformity. Severe bilateral foraminal stenosis at
this level.

FINAL/WORKING DIAGNOSIS:
Cervical spinal stenosis with myelopathy

TREATMENT AND OUTCOMES:
1. Neurosurgery referral recommended urgent C7-T1 anterior cervical disectomy and
fusson followed by C5-T2 posterior spinal fusion
2. She was placed in hard cervical collar at all times and surgery was performed 1
week after neurosurgery evaluation
3. At 1 week postoperative, patient felt 80% improvement in pain in forearms
and elbows along with subjectively improved grip strength
4. She continued the hard cervical collar until repeat radiographs at 6 weeks post
surgery.
5. Patient was instructed to avoid playing tennis. She was also informed to avoid
bending, twisting of her neck or lifting greater than 5 pounds until further evaluation
in 6 week visit.

RESULTS:
MRI of the Cervical Spine without Contrast:
- Advanced facet arthropathy at C7-T1. Anterolisthesis of C7 on T1 causing moderate/
severe spinal stenosis with mild cord deformity. Severe bilateral foraminal stenosis at
this level.

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deviation (SD) and normality was checked using the Shapiro-Wilk test. A two-way analysis of variance (ANOVA) with repeated-measures and Tukey post-hoc test were used to analyze the group and time effects. Statistical significance was accepted with p < 0.05. RESULTS: After the training period, body mass did not change in any group (PRE: PC = 76.1 ± 8.1 kg, MF = 74.7 ± 9.8 kg, CG = 73.5 ± 21.5 kg; POST: PC = 76.7 ± 8.9 kg, MF = 74.7 ± 9.4 kg, CG = 74.0 ± 11.3 kg; p > 0.05). All currents produced similar evoked torque and levels of discomfort (p > 0.05). Conclusion: Quadriiceps NMB data trained applied through alternated or pulsed currents produced similar effects and did not change body mass in competitive athletes.

3183 Board #4 May 29 1:30 PM - 3:00 PM
Changes In Body Composition Following A Competitive Season In Division I Collegiate Female Gymnastics Athletes
Monica L. Kearney, Jeremy T. Barnes, Jason D. Wagganer, Seth M. Sievers, Patryk R. Piekarzycz, Michelle L. McIntosh. Southeast Missouri State University, Cape Girardeau, MO.
Email: mlkearney@semo.edu

A large muscle mass to total body mass ratio benefits power athletes such as gymnasts. While collegiate gymnastics athletes train strength and power in the pre-season but reduce training during the competitive season, the degree to which body composition changes during the competitive season is not known. PURPOSE: This study examined changes in body composition in a team of female Division I collegiate gymnastics athletes before and after their competitive season. It was hypothesized that percent body fat (%BF), total fat mass (TFM), and bone mineral content (BMC) would remain unchanged from pre- to post-season. METHODS: Fifteen female collegiate gymnasts (age 19 ± 1 year, ht = 1.62 ± 0.05 m, wt = 62.7 ± 7.2 kg) volunteered to undergo measures of body composition assessment before and after their spring competitive season. During pre-season (PRE), participants were instructed to arrive to the laboratory in a euhydrated state. Following written informed consent, participants provided a mid-stream urine sample which was used to screen for pregnancy and to determine urine specific gravity (USG) using a handheld digital refractometer. Participants then performed a dual-energy x-ray absorptiometry (DXA) scan to determine body fat mass (%BF, and BMC). Immediately after the competitive season, participants returned to the laboratory and repeated all procedures (POST). Data were analyzed using paired-samples t-tests with significance set at p < 0.05. RESULTS: BMC significantly increased across the season (6.422 ± 0.206 g PRE vs. 6.485 ± 0.203 g POST; p < 0.05). While there was a downward trend in both TFM (34.158 ± 2.211 kg PRE vs. 32.905 ± 2.335 kg POST; p < 0.1) and %BF (25.68 ± 1.16 % PRE vs. 24.99 ± 1.23 % POST; p < 0.1), these were not significantly different at the a priori p < 0.05 level. There was no change in body weight. CONCLUSION: The significant increase in BMC, combined with the downward trend in TFM and %BF, with no change in body weight, suggests athletes maintained body composition in a favorable manner during the competitive season. The increase in BMC further suggests that stimuli during the competitive season were strong enough to elicit favorable changes in bone remodeling during in-season competition.

3185 Board #6 May 29 1:30 PM - 3:00 PM
Effects Of Compression Apparel On Body Composition Measurements By Air Displacement Plethysmography In College Males
Scott Murr, Alexandra Hultstrom. Furman University, Greenville, SC. (Sponsor: Anthony Catersiano, FACSM)
Email: scott.murr@furman.edu

Body composition measured by air displacement plethysmography (ADP) accounts for the effects of trapped isothermal air in hair by having the subject wear a swim cap to compress the hair on the head. It is recommended that even subjects with very little hair wear a swim cap. Currently, there are no recommendations that account for the effects of trapped isothermal air in body hair. PURPOSE: The purpose of this study was to investigate the impact of exposed body hair and the effect of wearing limb length single layer compression apparel on body composition measurements using ADP in college males. METHODS: Forty male college students (age 20.0±1.2 yrs; BMI 24.1±3.1 kg/m²) volunteered to participate in the study. Percentage of body fat was evaluated by ADP. To assess the impact of body hair on body composition measurements, ADP measurements were performed in two conditions: wearing single layer compression shorts (CS) apparel with a swim cap (as recommended) and wearing limb length single layer compression (LC) apparel with the same swim cap. The order of apparel was conducted in random order to avoid any potential order effects. RESULTS: Wearing limb length single layer compression apparel to compress body hair increased body mass by an average of 0.3 kg (±0.02); however, there was no significant difference in body density between the CS condition (1.0580±0.014 g/cm³) and the LC condition (1.0629±0.015 g/cm³; p < 0.001). The mean percentage of body fat in the LC condition (15.9±6.5%) was significantly lower than the mean percentage of body fat in the CS condition (18.0±6.2%; p < 0.001). CONCLUSIONS: The effect of trapped isothermal air in body hair impacts body composition measurements by ADP. Covering exposed body hair in males when assessing body composition via ADP results in a significantly lower percentage of body fat compared to the minimal clothing recommendation. Attention should be paid to minimizing exposed body hair on males when assessing body composition by air displacement plethysmography. The present results suggest that this minimization may be achieved with males with wearing limb length single layer compression apparel.

3186 Board #7 May 29 1:30 PM - 3:00 PM
Athlete-specific Prediction Equations For Appendicular Upper And Lower Body Lean Soft Tissue With BIA

Given sport specific physiological demands, knowing the distribution of lean soft tissue among the body segments is of relevance for optimizing athletic performance, monitoring response to specific training regimens, as well as for evaluating potential injury risk. Biological impedance (BIA) is a widely used portable, low cost, and easy technique to assess body composition. However, most equations used by BIA to predict lean tissue are not specific to the athlete population.

Purpose: The aim of this investigation was to develop and cross-validate prediction equations to estimate dual-energy x-ray absorptiometry (DXA)-derived appendicular lean soft tissue (LST) of the arms and legs based on whole body BIA in a population of athletes.

Methods: Two-hundred sixty-five athletes (age 22.2 ± 4.6 yrs) from a variety of sports had LST of the arms and legs assessed by DXA and whole-body reactance (Xc) and resistance (R) measured by BIA. Using measures of height, the resistance index (RI=height/R) was calculated. Prediction equations were established using a cross validation method where 177 athletes (2/3 of the sample) were used for equation development and the remaining 88 athletes (1/3 of the sample) were used for equation validation.

Results: The developed prediction equations were as follows: arm LST=0.940*sex(0=male; 1=female) + 0.042*total body weight (kg) + 0.080*RI + 0.024*Xc – 3.927; leg LST= 1.983*sex(0=male; 1=female) + 0.154*total body weight (kg) + 0.127*R – 3.927; and 

\[ \text{LST}_{\text{ARM}} = 0.940 \times \text{sex} + 0.042 \times \text{body weight} + 0.080 \times \text{RI} + 0.024 \times \text{Xc} - 3.927 \]  
\[ \text{LST}_{\text{LEG}} = 1.983 \times \text{sex} + 0.154 \times \text{body weight} + 0.127 \times \text{R} - 3.927 \]
1.47. Both equations cross-validated very well for the arms (mean difference=0.11 kg, R²=0.89, SEE=0.61) and for the legs (mean difference=-0.05 kg, R²=0.81, SEE=1.95 kg). There were no differences (p >0.05) in the mean values for both arm and leg LS equations and LST assessed with DXA.

Conclusion: The developed BIA-based prediction equations seem to provide a valid estimation of upper and lower body LST in athletes.

**Table 1: ICC, CV, and SEM values for BIA, DXA, and BIS analysis**

<table>
<thead>
<tr>
<th>BIA Fat Mass</th>
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<tr>
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**3189**

### Board #8
May 29 1:30 PM - 3:00 PM

**Test-retest Reliability Of Various Methods For Body Composition Assessments**
Julia C. Blumkaitis¹, Riley Stefan², Patrick S. Harty³, Petey W. Mumford⁴, Alicia Barry⁴, Jessica M. Moon⁴, Kayla M. Ratiliff⁴, Richard A. Stecker⁴, Kyle L. Sunderland⁴, Scott Richmond⁴, Chad M. Kerkisick, FACSM¹. ¹Lindenwood, St. Charles, MO. ²Northern Illinois University, DeKalb, IL. ³Texas Tech University, Lubbock, TX. (Sponsor: Chad Kerkisick, FACSM)

### PURPOSE:
To identify the intra (same day) and inter (between-day) test-retest reliability of BIA, BIS, and DEXA composition assessments conducted on two consecutive days in a healthy population.

### METHODS:
40 healthy, collegiate-aged participants (male: n=20, 24.6 ± 4.1yr, 177.5 ± 6.7 cm, 88.1 ± 13.3 kg; female: n=20, 22.8 ± 4.5 yr, 163.6 ± 6.5 cm, 64.6 ± 14.3 kg) completed two test visits with 24 hours. All participants arrived fasted (10 h) and after abstaining from exercise (24 h). Each visit consisted of two consecutive rounds (four total measurements) of assessments including body weight, BIA (InBody 570), DEXA scan, and BIS. Pearson correlations, intra-class correlation coefficient (ICC), coefficient of variation (CV), and standard error of the mean (SEM) were computed to assess relationship and reliability between measurement techniques. A p-value of 0.05 was used to assess all statistical outcomes.

### RESULTS:
Strong correlations (ICCs > 0.98) were observed for all %fat models between BIA and DEXA (%fat). Measurements of %fat using IND were larger than those using BIA, with IND increasing for the arms (mean differences, 0.7 to 1.6%) and decreasing for the legs (all p < 0.001). However, the magnitudes of the differences were small (Cohen’s d, 0.08 to 0.17). Additionally, the range of individual differences between IND and BIS was less than 4.0%, and 3C and 4C producing especially narrow limits of agreement (-1.4%fat and 1.9%fat) compared to 2C (-3.3%fat).

### CONCLUSIONS:
Multi-compartment models using DIR and IND nitrogen analysis to determine RLV demonstrated strong agreement. The more complex models (3C and 4C) were less affected by RLV method than the 2C model and produced limits of agreement less than ±2.0%fat. The results presented here indicate that DIR and IND nitrogen analysis may be used interchangeably for the assessment of body composition when using 2C and 4C models.

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**3188**

### Board #9
May 29 1:30 PM - 3:00 PM

**The Impact Of Residual Lung Volume Method On Multi-compartment Model Body Composition Assessment**
Zackary S. Cicone, Bjorn Hornikkel, Clifton J. Holmes, Michael V. Fedewa, Michael R. Esco, FACSM. University of Alabama, Tuscaloosa, AL. (Sponsor: Michael R. Esco, FACSM)

### PURPOSE:
Researchers use both direct and indirect nitrogen analysis to determine residual lung volume (RLV) for body composition assessment. However, the agreement between direct and indirect methods, and thus the impact on percent fat (%fat), has yet to be examined. The purpose of this study was to compare multi-compartment %fat using direct and indirect measures of RLV.

### METHODS:
Thirty-four healthy adults (53% female; 37.7 ± 15.5 y; 27.6 ± 7.0 kg m²) participated in this study. RLV was measured via oxygen dilution using direct (DIR) and indirect (IND) nitrogen analysis. Participants also completed hydrostatic weighing, dual energy X-ray absorptiometry, and bioimpedance spectroscopy for body density, bone content, and total body water. Two, three, and four-compartment (2C, 3C, and 4C) model %fat was calculated using RLV from both DIR and IND nitrogen analysis. Agreement for each model was assessed using paired t tests and Bland-Altman analysis.

### RESULTS:
Strong correlations (ICCs > 0.98) were observed for all %fat models between BIA and DEXA (%fat). Measurements of %fat using IND were larger than those using BIA, with IND increasing for the arms (mean differences, 0.7 to 1.6%) and decreasing for the legs (all p < 0.001). However, the magnitudes of the differences were small (Cohen’s d, 0.08 to 0.17). Additionally, the range of individual differences between IND and DIR was less than 4.0%, and 3C and 4C producing especially narrow limits of agreement (-1.4%fat and 1.9%fat) compared to 2C (-3.3%fat).

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strongly related to soccer performance. **Purpose:** To examine body composition of NCAA Division I female soccer players by position and season. **Methods:** One hundred seventy-five female collegiate soccer players from 4 NCAA Division I Universities participated in this study. Athletes were categorized by positions of forward (n=47), midfielder (n=51), defender (n=57), and goalkeeper (n=20). Seasons were defined as pre-season (Aug), in-season (Sep - Oct), post-season (Nov - Dec), winter off-season (Jan), spring season (Feb - Apr), and summer off-season (May - Jul). A whole body dual X-ray absorptiometry scan assessed percent body fat (%BF), total lean muscle mass (LM), total fat mass (FM), arm and leg LM and FM, and visceral adipose tissue (VAT). Separate ANOVAs with linear mixed-effects models to account for repeated measures assessed differences across positions and seasons. **Results:** Goalkeepers had significantly higher height, body mass, FM, and arm and leg LM and FM compared to all other positions (p<0.05). SF (28.1 ± 4.3%) had significantly higher %BF than defenders (24.4 ± 3.4%) and forwards (24.5 ± 4.0%; p<0.01), and midfielders (26.0 ± 3.9%) had significantly higher %BF than defenders (<0.01) and forwards (p<0.04). Goalkeepers had significantly greater LM (50.5 ± 4.3 kg) than all other positions, and defenders (46.2 ± 4.7 kg) had greater LM than forwards (44.2 ± 3.7 kg) and midfielders (44.3 ± 4.0 kg; p<0.01). For all positions, %BF was significantly higher in winter off-season (26.7%) compared to summer off-season (25.7%) and pre-season (25.8%; p<0.01). For all positions, total LM and leg LM was significantly lower in winter off-season compared to all other seasons, and total LM was significantly higher in summer off-season than pre-season (p<0.01). **Conclusions:** Goalkeepers had higher body mass and FM but also had more LM and FM compared to other positions. In winter off-season, %BF increased and LM decreased indicating potential undesired changes in training and/or nutrition over the holiday break. In summer off-season, LM was the highest reflecting the emphasis on resistance training and increased volume of training.

**Board #12**
**May 29 1:30 PM - 3:00 PM**
**Combined Anthropometry And Bioelectrical Impedance To Predicted Body Fat In Female Athletes**
Craig Horswill,1 Doug Foote,2 Max Berkelhammer.1 1University of Illinois at Chicago, Chicago, IL. 2University of Eugene, Eugene, OR.
Email: horswill@uic.edu

**Purpose:** To determine whether combining anthropology (skinfolds, SF) and bioelectrical impedance analysis (BIA), an indicator of hydration status, would accurately approximate the expected percentage body fat (%Fat) value and reliably predict %Fat. Accurate and reliable estimation of body composition in female athletes can be challenging since the methodological assumptions are easily violated. For example, hydration status can vary due to menstrual cycle phase, dehydration, and training, and thereby distort %Fat. We hypothesized that compared to outcomes for SF and BIA alone, %Fat using SF+BIA would not differ from our criterion method, and SF+BIA would account for a greater percent of the variance in %Fat in predicting LM.

**Methods:** Eighteen female athletes (11 NCAA competitors) were recruited from the swim team and gymnastic team and measured for body density (air displacement)

**Results:** The SF estimate (24.0 ± 0.78) did not differ from the 4C value. Regression revealed the highest adjusted variance accounted for in 4C was SF+BIA (r²=0.87) followed by BIA (r²=0.80) and SF (r²=0.76), all of which were statistically significant.

**Conclusions:** Skinfolds alone were more accurate at predicting the mean %Fat in these female athletes but combining SF and BIA might provide greater reliability for predicting percent body fat in female athletes.

**Board #13**
**May 29 1:30 PM - 3:00 PM**
**Increased Body Fat Negatively Impacts Aerobic Capacity Of Elite American Football Players Regardless Of Position**
Matthew E. Darnell,1 Laura E. Kleiber1, Julian R. Chismar2, Paul N. Whitehead1. 1University of Pittsburgh, Pittsburgh, PA. 2University of Alabama Huntsville, Huntsville, AL. (Sponsor: Elizabeth Nagle, FACS)

Aerobic capacity and body composition play an important role in athletic performance and health. Previous research demonstrates an association between lower body fat percentage (%BF) and enhanced aerobic as well as anaerobic capacity, while higher %BF is linked to an increased risk of chronic diseases related to obesity. The amount of research on aerobic performance in elite football players is limited, and even less research has compared maximal oxygen uptake (VO₂ peak) with body composition by position. **Purpose:** To determine the relationship between %BF and VO₂ peak in elite football players by position group. **Methods:** Elite American football players (n = 112, age: 23.0 ± 2.8 yrs, ht: 187.06 ± 7.62 cm, and wt: 110.89 ± 22.71 kg) were split by position into three groups. Small skill (SS) (n=50): running back, corner, safety, and wide receiver; big skill (BS) (n=27): tight end, lineman, and quarterback; and linemen (LM) (n=35): tackle, guard, center, and defensive end. %BF was calculated using air displacement plethysmography. VO₂ peak was measured via indirect calorimetry during a treadmill test using three protocols based on position group. SS and BS ran at 7.5 and 6.5 mph (respectively) with a 2% increase of elevation every 2 minutes, and LM performed a Bruce protocol. Subjects ran until volitional fatigue. A Kruskal-Wallis test with Bonferroni post hoc was used to compare %BF and VO₂ peak values between position groups. A Spearman’s rank-order correlation was used to determine the relationship between %BF and VO₂ peak. **Results:** LM (39.58 ± 5.07 ml·kg·min⁻¹) VO₂ peak was significantly different from BS (47.75 ± 5.47 ml kg⁻¹ min⁻¹) and SS (49.93 ± 4.31 ml kg⁻¹ min⁻¹) (p < 0.001). There was no difference in VO₂ peak between BS and SS (p > 0.05). %BF was significantly different (p < 0.02) between all groups (SS: 12.23 ± 4.83%, BS: 17.81 ± 4.32% and LM: 26.26 ± 5.23%). A statistically significant (p = 0.01) moderate negative correlation was found between %BF and VO₂ peak overall (r = -0.772) and for each position group (SS r = -0.49, BS r = -0.45, and LM r = -0.62). **Conclusions:** Body composition differs between position groups. Lower %BF was associated with higher VO₂ peak in elite football players regardless of position group. Future research should explore the impact of these variables on player performance and risk of injury.

**Board #14**
**May 29 1:30 PM - 3:00 PM**
**Bioimpedance Phase Angle Reliability In Mexican College Students**
Jorge Aburto-Corona,1 Alan D. Torres-Hernández1, Luis M. Gómez-Miranda1, Yamileth Chačón-Araya2, José Moncada Jiménez2. 1Autonomous University of Baja California, Tijuana, Mexico. 2University of Costa Rica, San José, Costa Rica, Email: jorge.aburto@uabc.edu.mx

Bioimpedance (BIA) phase angle (PA) is a body composition measure related to cell structure, integrity and body cell mass. Although PA has been positively correlated to clinical outcomes, there is scarce information on ethnic differences in PA and its overall reliability. **Purpose:** To determine phase angle reliability in Mexican college students. **Methods:** College students from the city of Tijuana, México, were recruited for this study. Volunteers were 26 males (Age = 22.7 ± 3.1 yr., Height = 172.8 ± 5.6 cm, Weight = 70.9 ± 11.7 kg) and 26 females (Age = 21.1 ± 2.2 yr., Height = 159.0 ± 7.1 cm, Weight = 60.8 ± 8.6 kg). Participants arrived hydrated to the testing session (Urine specific gravity = 1.005 ± 0.003) and were measured on a multi-frequency InBody 770 BIA device in two occasions separated by five minutes of seated resting. Body weight, %fat mass, muscle mass (kg) and PA were recorded and analyzed by repeated measures 2 (gender) x 2 (measures) ANCOVA, using hydration status and age as covariates. Intraclass correlation coefficient (ICC) and 95% confidence interval were used to determine reliability between measures. **Results:** Gender differences were found on PA (Males = 6.8 ± 0.1 vs. Females = 5.9 ± 0.1, p < 0.0001), and muscle mass (Males = 31.6 ± 0.7 vs. Females = 22.7 ± 6.7, p < 0.0001). Significant (p ≤ 0.0001) for all ICC reliability coefficients were found between pre- to post-measures of PA (r = 0.998, 95% CI = 0.998 to 1.000) and muscle mass (r = 1.00, 95% CI = 1.00 to 1.00). **Conclusion:** Young college students showed reliable BIA PA, muscle mass and %fat values following five minutes of seated resting. Mexican males showed higher muscle mass and PA than women after controlling for the influence of hydration and age.
Commercially available upper-body (UB) and lower-body (LB) bioelectrical impedance analyzers (BIA) are commonly used to measure body fat percentage (%BF) and classify body composition status. Some evidence suggests that LB BIA underestimate %BF in women, yet it is not clear if UB BIA devices also underestimate %BF in women or if LB and UB BIA devices underestimate %BF in men. PURPOSE: To compare %BF from air displacement plethysmography (ADP), UB BIA, LB BIA, and whole-body (WB) BIA and to determine if the %BF differences between devices are affected by sex. METHODS: 53 women (21.5±5 yrs) and 42 men (23.1±5 yrs) had their %BF measured via ADP, a hand-held UB BIA, a digital scale LB BIA, and a validated eight-electrode multifrequency WB BIA device following each device’s recommended procedures. Paired samples t-tests were used to compare %BF differences between devices within each sex. Independent samples t-tests were used to compare the %BF difference between devices for each sex. RESULTS: In women, UB (23.1±4.5%) and LB (20.4±5.8%) BIA %BF values significantly lower (p<0.001) than ADP %BF (UB: 28.3±7.7%, LB: 23.5±7.7%) and WB %BF (28.3±9.0%), respectively. In men, UB (15.6±5.3%) and LB (15.0±4.0%) BIA %BF values also significantly lower %BF values than ADP (UB: 17.6±7.7%, p=0.012 vs. UB ADP; p=0.008 vs. LB BIA) and WB BIA (UB: 19.1±6.7%, p<0.001 vs. UB and LB BIA). The differences in %BF between devices were greater in women compared to men: WB - UB BIA difference 5.0±2.6 vs. 3.6±3.3%, p=0.021 (women vs. men); UB - LB BIA difference 5.8±2.1 vs. 4.2±1.5%, p=0.001; ADP - UB BIA difference 4.5±5.9 vs. 2.0±5.0%, p=0.028; ADP - LB BIA difference 7.9±6.3 vs. 2.7±6.2%, p<0.001; UL - LB BIA difference 3.4±3.5 vs. 0.7±3.2%, p<0.001.

CONCLUSIONS: These results suggest that commercially available UB and LB BIA devices systematically underestimate %BF in both men and women compared to ADP but underestimate %BF in women or if LB and UB BIA devices underestimate %BF in men. The degree of underestimation in %BF differs between devices within each sex. Independent samples t-tests were used to compare %BF differences between devices for each sex. The results suggest that commercially available UB and LB BIA devices systematically underestimate %BF in both men and women compared to a hand-held UB BIA and ADP. The differences in %BF between devices were greater in women compared to men: UB - LB BIA difference 5.0±2.6 vs. 3.6±3.3%, p=0.021 (women vs. men); UB - LB BIA difference 5.8±2.1 vs. 4.2±1.5%, p=0.001; ADP - LB BIA difference 4.5±5.9 vs. 2.0±5.0%, p=0.028; ADP - MB BIA difference 7.9±6.3 vs. 2.7±6.2%, p<0.001; UL - MB BIA difference 3.4±3.5 vs. 0.7±3.2%, p<0.001.

CONCLUSIONS: These results suggest that commercially available UB and LB BIA devices systematically underestimate %BF in both men and women compared to ADP but underestimate %BF in women or if LB and UB BIA devices underestimate %BF in men. The degree of underestimation in %BF differs between devices within each sex. In independent samples t-tests were used to compare %BF differences between devices for each sex. The results suggest that commercially available UB and LB BIA devices systematically underestimate %BF in both men and women compared to a hand-held UB BIA and ADP. However, the degree of underestimation in %BF differs between devices within each sex. Independent samples t-tests were used to compare %BF differences between devices for each sex. These results suggest that commercially available UB and LB BIA devices systematically underestimate %BF in both men and women compared to ADP but underestimate %BF in women or if LB and UB BIA devices underestimate %BF in men. The degree of underestimation in %BF differs between devices within each sex.

Simple, accurate, and cost-effective methods to estimate body composition in field settings are valuable to practitioners and clinicians. An automated smartphone- or tablet-based method of determining body composition from a single 2-dimensional (2D) digital image has recently been developed. However, the test-retest reliability has yet to be determined. PURPOSE: The purpose of this study was to evaluate the test-retest reliability of total body volume (BV) estimated from a single 2D digital image. METHODS: A convenience sample was recruited for this study (n=30, 21.0±3.1 yrs, 86.7±10.9 kg, 28.8±3.9 kg/m²). Each subject performed a sit-to-stand test with a calibrated digital scale (Tanita BWB-800, Tanita Corporation, Tokyo, Japan). Body mass was measured to the nearest 0.1 kg. Standing height was measured (to the nearest 0.1 cm) with a stadiometer (SECA 213, Seca Ltd., Hamburg, Germany). Two digital images of each participant were taken from the rear/posterior view using a 12.9 inch, 64 iPad Pro. A paired sample t-test was used to examine differences between BV obtained from the images (BV1, BV2). An Intraclass Correlations Coefficient (ICC) assessed the strength of the association between BV1 and BV2. RESULTS: No differences were observed between BV1 and BV2. CONCLUSIONS: This novel method of acquiring BV produced near-perfect reliability within our small sample. The excellent reliability, future research should explore the validity of acquiring body composition from a single 2D digital image using an automated smartphone- or tablet-based application.
Board #19 May 29 1:30 PM - 3:00 PM

Body Composition And Aerobic Fitness Levels In College Freshmen

Nicolé Varone, Vipa Bernhardt. Texas A&M University Commerce, Commerce, TX. (Sponsor: Tony G. Babb, FACSM) (No relevant relationships reported)

Nicolé Varone & Vipa Bernhardt
Texas A&M University Commerce

Background: Research has shown that college students exhibit gains in fat mass that are up to 5.5 times greater than their peers of the same age who do not attend college (Mihalopoulos et al, 2008). Because of concerns over increasing rates of obesity, college campuses nationwide are engaging in campaigns designed to target college youth and educate them about the benefits of healthy lifestyle behaviors. In order to implement effective intervention strategies, a clear picture of current student fitness behaviors must be acquired.

Purpose: The purpose of this study was to examine objective measures of body composition and aerobic fitness levels in current first year students of a rural university.

Methods: 24 participants (17F/7M, 188±5.1 years, 67.9±17.1 kg, 24.5±5.2 kg/m² BMI) underwent dual energy x-ray absorptiometry for body fat determination and performed the Astrand submaximal bicycle ergometer test with metabolic measurements (e.g., VO₂max), from which estimated VO₂max was extrapolated. The International Physical Activity Questionnaire (IPAQ) was administered to gather self-report weekly reports of weekly exercise volume.

Results: The majority of students (13F/11M) fell into the “very active” category for number of days per week exercising and met the national recommendations for physical activity level. In addition, 72% of students (17F/7M) met body fat standards. It is also interesting that 10% of students (9F/5M) were classified as “sedentary” on the IPAQ, yet 13 of the 15 scored “moderate” or “high” in subjective self-evaluation of weekly exercise volume.

Conclusion: Although BMI average was normal, the majority of students failed to meet body fat standards. It is also interesting that all 7 males in the study scored themselves as “high” on the IPAQ, yet 6 of the 7 scored “poor” or “very poor” in the objective determination of VO₂max. Follow-up studies will investigate how these variables change within their first semester and over their entire college life.

Board #20 May 29 1:30 PM - 3:00 PM

Validity Of A 3-Compartment Body Composition Model Derived From A Single 2-Dimensional Digital Image

Katherine Sullivan, Clifton J. Holmes, Bjorn Hornikol, Shengtong Cao, Yu Gan, Michael R. Esco, Michael V. Fedewa. University of Alabama, Tuscaloosa, AL.


Laboratory-based methods for assessing body composition often require specialized equipment, trained administrators, and relatively complex, time-consuming protocols. Simple, accurate, and cost-effective methods to assess body composition in field settings are limited. PURPOSE: The purpose of this study was to evaluate the validity of a digital image derived 3-compartment model estimate of body composition (IMAGE-3C) when compared to a 3-compartment skinfold estimate of body composition (SKF-3C). METHODS: A convenience sample of female participants was recruited for this study (n=24, 20±1.0 yrs., 73±10.3 kg). Body mass was measured to the nearest 0.1 kg with a calibrated digital scale (Tanita BW804). The circumferences were measured with a flexible and inelastic anthropometric plicometer (skinfold thickness) and ultrasound (BodyMetrix - BX 2000) in triceps, subscapularis, biceps, radial, axillary, iliac, supraspinatus, abdominal, mid thigh and middle calf. The circumferences were measured with a flexible and inelastic anthropometric tape measure. ISAK standardization was used to measure skin folds. Descriptive statistics data are expressed as mean ± standard deviation (SD) of absolute values (n=24). The Student’s t-test was used to compare the IMAGE-3C and SKF-3C measurements. The Shapiro-Wilk normality test was used to test for normality. Paired t-tests were used to compare the IMAGE-3C and SKF-3C measurements. RESULTS: No differences in body composition were observed between IMAGE-3C and SKF-3C (17.9±5.1 versus 18.7±5.6, respectively, p=0.08), with excellent agreement between methods (ICC=0.96).

CONCLUSIONS: The IMAGE-3C model appears to be a valid method of estimating body composition. The ability to evaluate body composition from a single digital image provides an accurate and efficient alternative to laboratory methods, which can be utilized by the general public. Data collection is ongoing. A larger and more diverse sample is needed to confirm these findings.

Board #21 May 29 1:30 PM - 3:00 PM

COMPARISON OF BODY COMPOSITION METHODOLOGIES BETWEEN SKINFOLD AND ULTRASOUND IN ELITE CROSSFIT ATHLETES: A PILOT STUDY.

Maraline Santos Sena1, Matheus Lima Caetano1, Adriana Pereira Sampaio1, Marília Cabral Mendes1, Eder Evangelista Costa2, Marcus Leandro Ribeiro de Souza2, Valden Luis Matos Capistrano Junior1.1 (Sponsor: Tony G. Babb, FACSM)

Background: Research has shown that college students exhibit gains in fat mass that are up to 5.5 times greater than their peers of the same age who do not attend college (Mihalopoulos et al, 2008). Because of concerns over increasing rates of obesity, college campuses nationwide are engaging in campaigns designed to target college youth and educate them about the benefits of healthy lifestyle behaviors. In order to implement effective intervention strategies, a clear picture of current student fitness behaviors must be acquired.

Purpose: The aim of the present work was to compare body composition methodologies between skinfold and ultrasound in elite CrossFit athletes.

Methods: The sample consisted of 8 male CrossFit athletes with practice time (mean ± standard deviation) 58.66 ± 11.13 months, age 25.33 ± 4.38 years, height 181.11 ± 6.09 cm, weight 93.8 ± 8.41 kg and participating in national competitions.

The athletes were evaluated through skinfold (ST) (Cescorf pliometer) and ultrasound (BodyMetrix - BX 2000) in triceps, subscapular, biceps, radial, axillary, iliac, supraspinatus, abdominal, mid thigh and middle calf. The circumferences were measured with a flexible and inelastic anthropometric tape measure. ISAK standardization was used to measure skin folds. Descriptive statistics data are expressed as mean ± standard deviation (SD) of absolute values of skinfold thickness measured by pliometer and ultrasound. A t-test for paired measurements was used, the Shapiro-Wilk normality test. Wilcoxon for nonparametric data. The confidence interval (CI) is 95% and Cohen’s d was calculated for effect size. The existence of correlation was analyzed by Pearson’s t-test (Spearman for non-normal data).

Results: The difference between the means generated by ultrasound and pliometer was statistically significant for: -1.53 mm ST subscapular; -1.57 mm ST radial; -1.65 mm ST Axillary; -0.21 mm ST iliac; -3.48 mm ST Thigh; -1.61 mm ST Calf. Comparing each skinfold and ultrasound result it was possible to perform a proportion, and it was noted that the triceps ST was 1.56 times higher, subscapular ST 1.95, axillary ST 1.49, iliac ST 1.67, abdominal ST 1.39, and thigh DC 1.53, comparing pliometer with ultrasound, respectively. In addition, the variables with small correlation (r = 0 - 0.25) were: triceps (r = 0.177); subscapular (r = 0.109); radial (r = 0.005); iliac (r = 0.228); thig (r = 0.044); calf (r = 0.097); variables with weak correlation (r = 0.26 - 0.5) were: abdominal (r = 0.343).

Conclusions: We conclude that there is a significant reduction in the thickness of the anatomical point collected by ultrasound and the skinfold thickness collected by the pliometer. Thus, we suggest that these differences at each anatomical point be taken into account when using a predictive equation to estimate body fat.

Board #22 May 29 1:30 PM - 3:00 PM

Comparison Of Waist And Hip Circumference Measures From 3-dimensional Technology And Manual Measurements

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Three-dimensional (3D) scanning technology is becoming increasingly popular to obtain quick anthropometric and body composition measurements and may be a practical alternative to manual assessment methods. PURPOSE: To compare waist and hip circumferences measured from a 3D scan to manual measurements in healthy adults.

Methods: Data was collected on 66 healthy male (n=22) and female (n=44) young adults (Mean ± SD: Age: 20.6 ± 1.1 yrs, BMI: 22.6 ± 2.0 kg/m²). Manual measurement of the waist was assessed at the narrowest part of the trunk; hip circumference was measured at the widest region of the buttocks. Circumferences were measured twice by the same researcher and averaged. Measurements corresponding to the same waist and hip regions assessed manually were automatically determined by the 3D scanner software. Paired-samples t-tests were utilized to determine differences between methods for the total sample and each sex. Manual measurements were used as the criterion to evaluate prediction error (standard error of the estimate [SEE]).

Results: For the total sample, the 3D scan significantly underestimated waist (Mean difference [3D - manual] [MD]: -6.3 ± 2.2 cm; p<0.001) and hip (MD: 2.8 ± 2.3 cm; p<0.001) circumferences compared to manual assessments. For the men, the 3D scanner significantly underestimated waist (MD: 6.6 ± 2.1 cm; p<0.001) and hip (MD: 2.2 ± 1.9 cm; p<0.001) circumferences. The same trend was seen for women (SEE=2-4.2 cm) compared to men (SEE=1.94 cm); waist circumference prediction error was similar for women (SEE=2.14 cm) and men (SEE =2.05 cm).

Conclusions: 3D technology may underestimate
PURPOSE: Bioelectrical impedance analysis (BIA) is an emerging method to measure body composition. The purpose of this study was to determine 1) baseline values of fat mass (FM), fat-free mass (FFM), skeletal muscle mass (SMM), total body water (TBW) extracellular water to total body water ratio (ECW/TBW), phase angle (PA), bioelectrical vector analysis (BIVA), and visceral adipose tissue (VAT), 2) any gender differences among measures, and 3) test-retest reliability on a newly obtained SECA® BIA device. METHODS: 37 young adults (22 males and 15 females; mean±SD, age 24.4±3.5; BMI 25.6±4.1 kg/m²) were measured in a single trial on the SECA® machine having fasted overnight and abstaining from exercise for 12 hours. Multivariate analysis of variance was used to determine effects of gender on measures. To determine test-retest reliability, a subset of participants (26 healthy young adults) were measured 48 hours after the initial visit under the same conditions. Interclass correlation coefficients (ICC) were used to determine reliability of measures.

RESULTS: Males had higher (p<0.05) FFM, SMM, TBM, and V AT, whereas females had higher (p<0.05) FM, and ECW/TBW ratio. Correlation analysis revealed: Results: Males had higher (p<0.05) FFM, SMM, TBM, and V AT, whereas females had higher (p<0.05) FM, and ECW/TBW ratio. Correlation analysis revealed:

CONCLUSIONS: SECA®-scale measurements have high test-retest reliability. Future investigations should determine the validity of the SECA® compared to standard methods.

PURPOSE: To determine and to compare the body composition and somatotype profiles with anthropometric methods by sex in Mexican candidates that apply to dance and theater university degrees at the University of Guadalajara. METHODS: 264 (95 males, 169 females) Mexican candidates that applied to dance and theater university degrees were evaluated anthropometrically by certified staff by the International Society for the Advancement of Kinanthropometry (ISAK). A complete profile anthropometric evaluation according to ISAK methodology was performed for each subject. We estimated body composition by four compartments according to Kerr equations (adipose, muscle, bone, and visceral tissues), and Somatotype was determined by the Heath and Carter method (decimal equations). The sample was divided by sex. Body composition values (adipose tissue, muscle, bone) and the somatotype components were expressed as mean, standard deviation, minimum and maximum. T-test for independent samples was performed to compare variables by sex.

RESULTS: Subject’s age, weight, height, and body mass index were: 19 ± 3 and 19 ± 2 years, 67 ± 13 and 57 ± 12 kg; 172 ± 8 and 160 ± 8 cm; and 22 ± 4 and 22 ± 4 kg/m², for males and females, respectively. There were significant differences in all three compartments between males and females (percentage and mass). In the case of somatotype, we found that values of Endomorphy were lower and values of Ectomorphy were higher in males than females. Values of Metamerophy were similar among sex. The mean value for males was Central (4-4-3), while in females was Mesomorphic Endomorph (5-4-2).

CONCLUSIONS: In this study, we found that body composition, as well as somatotype, differs by sex. However, the sample was not divided by performing art (dance and theater), being able to find either similarities or differences with the existing literature.

Table 1. Body composition and somatotype profile of the evaluated subjects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total (n=264)</th>
<th>Males (n=95)</th>
<th>Females (n=169)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adipose tissue (%)</td>
<td>27 ± 7.4 (8-40)</td>
<td>20 ± 5.7 (8-32)</td>
<td>31 ± 4.4 (19-40)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Adipose tissue (kg)</td>
<td>16 ± 6.2 (3-36)</td>
<td>14 ± 6.2 (3-32)</td>
<td>18 ± 5.7 (3-36)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Muscle mass (%)</td>
<td>35 ± 5.1 (25-50)</td>
<td>40 ± 4.6 (29-50)</td>
<td>33 ± 3.4 (25-41)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Muscle mass (kg)</td>
<td>21 ± 5.4 (13-43)</td>
<td>26 ± 4.5 (16-43)</td>
<td>18 ± 3.5 (13-40)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bone mass (%)</td>
<td>16 ± 2.1 (10-23)</td>
<td>17 ± 2.3 (10-23)</td>
<td>15 ± 1.8 (10-20)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bone mass (kg)</td>
<td>10 ± 1.7 (7-15)</td>
<td>11 ± 1.5 (7-15)</td>
<td>9 ± 1.1 (7-12)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Endomorphy</td>
<td>4 ± 1.6 (1-8)</td>
<td>4 ± 1.5 (1-8)</td>
<td>5 ± 1.4 (2-8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Ectomorphy</td>
<td>4 ± 1.4 (1-11)</td>
<td>4 ± 1.3 (1-9)</td>
<td>4 ± 1.4 (1-11)</td>
<td>1.000</td>
</tr>
<tr>
<td>Data expressed as mean ± standard deviation (min-max)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dual-energy X-ray absorptiometry (DXA) is one of the most accurate methods to measure body composition, and it has been widely used in both clinical and research settings such as the Appendicular Lean Mass (ALM) in sarcopenia. The body composition results on the same client may vary depending on the manufacture, model and software version of the DXA. Therefore, it is important to compare the measurement results between different systems in longitudinal research studies and clinical practice. PURPOSE: To properly cross calibrate the body composition measurements between the Prodigy and iDXA in young adults. METHODS: Thirty healthy college students, including ten males (23.7 ± 1.9 years; 171.9 ± 6.7 cm; 81.8 ± 11.4 kg) and twenty females (23.1 ± 1.9 years; 161.8 ± 6.1 cm; 64.9 ± 15.3 kg) participated in the study. Body composition was measured using two DXA systems: Prodigy and iDXA, and analyzed by enCORE version 13 and 17, respectively by the same licensed DXA technician on the same day. Paired sample t-tests and regression analyses were performed to compare the body composition variables between the two systems.

RESULTS: No significant differences were found in total body and leg percent fat (%fat), total and leg Fat Mass (FM), and total Bone Free Lean Mass (BFLM) (p > 0.05). However, there were statistically significant differences in total body and leg Bone Mineral Content (BMC) (p < 0.001), arm %fat (p = 0.012), arm FM (p = 0.000), arm and leg BFLM (ALM, p = 0.000) between the two systems (Table 1). Conclusion: Our results suggest that calibration equations are needed for the appendicular lean mass when comparing body composition between the Prodigy and iDXA in young adults. Further study in older adults is needed for the comparison of sarcopenia assessment using the two models of DXA.

Table 1. Comparison of Regional Body Composition Between iDXA and Prodigy

<table>
<thead>
<tr>
<th>Body Composition</th>
<th>iDXA</th>
<th>Prodigy</th>
<th>%Diff</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm BFLM (lbs)</td>
<td>12.3 ± 5.6</td>
<td>12.6 ± 5.8</td>
<td>-2.37</td>
<td>0.012</td>
</tr>
<tr>
<td>Arm FM (lbs)</td>
<td>5.3 ± 2.3</td>
<td>4.3 ± 2.3</td>
<td>22.68</td>
<td>0.000</td>
</tr>
<tr>
<td>Leg BFLM (lbs)</td>
<td>35.6 ± 9.4</td>
<td>34.8 ± 9.4</td>
<td>2.23</td>
<td>0.000</td>
</tr>
<tr>
<td>Leg FM (lbs)</td>
<td>17.5 ± 7.9</td>
<td>17.6 ± 9.1</td>
<td>-0.34</td>
<td>0.83</td>
</tr>
</tbody>
</table>
| BFLM: Bone Free Lean Mass; FM: Fat Mass
Accurate estimation of fitness from skinfolds is highly dependent on using the appropriate skinfold protocol, the methods of training and experience of the trainee. Purpose: To determine the effects of the type of training method and experience level on the accuracy of performing skinfold thickness measurements at the triceps, subscapular and calf skinfold sites.

Methods: This study was designed to test the accuracy of skinfold measurement using two different methods of training in a 2x3 factorial plan with a manual (M), audiovisual (AV) and in person (IP) training group. Half of the trainees were inexperienced in each training method. Three skinfolds (triceps, subscapular and calf) were measured using standardized procedures. To be trained on the skinfold measurement method, the M method group read a description of the skinfold method, the AV method group watched a training video, and the IP method group attended an IP workshop. All trainees measured the skinfolds of from 15 participants and were compared to an expert. An ANOVA was used to determine whether expert versus trainee systematic errors were different due to the method of training, experience level, or their interaction was significant.

Results: The mean systematic errors for the triceps were 1.0±0.9, 1.4±1.0, 1.0±0.6 for the M, AV and IP groups, respectively. For the calf, the mean errors were 1.4±0.7, 1.6±1.1, 0.7±0.3 for the M, AV and IP groups, respectively. Subscapular, the mean errors were 1.1±0.1, 1.2±0.7, 0.8±0.7 for the M, AV and IP groups, respectively. There was no effect (p>0.05) of experience level or training method for all skinfolds except for the training method in the calf with the IP group trending toward the lowest error (p=0.01). The interaction between type of training and experience level was also not significant (p>0.05).

Conclusion: The systematic errors in measuring skinfolds were not influenced by experience level of the trainee or the training method however, outliers were found in every training group which contributed to the variability in the measures.
Coaches may find value in following track and field athletes’ anthropometrics as the extended competitive season requires a unique balance of peak and maintained preparation. Somatotyping may offer a more holistic metric compared with BMI, mass, or body fat percentage alone when tracking changes across competition mesocycles. PURPOSE: The purpose of this study was to record track and field athletes’ somatotype scores to elucidate potential changes across the competitive season according to sex and/or age. METHODS: Division II track and field athletes (n=47) were tested at the start and end of the outdoor season. Somatotype data were collected according to the Heath-Carter manual (skinfolds, girths, breadths, stature & mass). Raw data were converted to mesomorph, endomorph, and ectomorph scores. One-way RM ANOVAs with between subject variables (sex & age) were used to evaluate change in endomorph, mesomorph, and ectomorph scores across the season. RESULTS: Scores for endomorphy (F1,45)=117.9, p<.001, n²=0.72, males (M)=+3.2%, females (F)=−0.15% and mesomorphy (F1,45)=10.1, p=.003, n²=0.18, M=−3.4%, F=+4.6% differed across time by sex, but not ectomorph (F1,45)=0.03, p=.86, n²=0.001, M=−6.2%, F=−6.3%. Age did not influence somatotype scores across the season. CONCLUSIONS: The rigors of a competitive season may influence only certain sex-somatotype combinations. Influencing factors for the divergent changes in somatotype presently found should be identified to optimize training approaches.

Sports nutrition knowledge may impact the quality of an athlete’s dietary intake. It is currently unknown how sport nutrition knowledge (SNK) influences body composition and what factors may contribute to an athlete’s body weight goal. PURPOSE: To examine relationships between SNK and body composition and identify predictors of body weight goal in female collegiate soccer players. METHODS: Twenty-six Division III female soccer athletes (height: 1.61 ± 0.30 m; body mass: 66.7 ± 7.5 kg; fat-free mass: 50.3 ± 6.5 kg; body fat %: 25.6 ± 5.1%) participated in the current study. All players had body composition assessed using air displacement plethysmography and completed a validated questionnaire designed to assess sport nutrition knowledge. Athletes were also asked questions about perceived dietary requirements and body weight goal. Pearson correlation coefficients were assessed to examine relationships between SNK and body fat percentage (BF%), but not ectomorph (BF%) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, triple, and male (n=5); and female (n=3)) showed a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores.

Total and regional body weight compositions are key components of sport performance. Dual energy X-ray absorptiometry (DXA) allows for precise measurements of body composition parameters between athletes who experience different competitive demands. Yet, accurate interpretation of DXA data is dependent on the availability of reference values. Despite the widespread use of DXA to measure body composition in collegiate athletes, positional reference values for men’s lacrosse do not exist.

PURPOSE: To generate descriptive data for total and regional body composition in men’s collegiate lacrosse players using DXA, and examine differences between positions. METHODS: Members of an NCAA Division 1 Men’s Lacrosse team underwent DXA scanning and were categorized according to position. Descriptive statistics were calculated for total and regional body composition measures and differences between positions were examined using a one-way ANOVA or a Kruskal-Wallis test. RESULTS: A total of 98 players (age: 19.2±1.0 yrs; height: 181.1±7.0cm; total mass: 82.4±9.2kg) completed the study (Attack; n=24, Midfield; n=44, Defense; n=25, Goalkeeper; n=6). The mean total body fat percentage (BF%) was 18.9±3.4% (range: 11.0-27.6%). No differences in BF% between positions were identified (Attack=18.9±3.9%, Midfield=18.8±4.2%, Defense=18.9±3.7%, GK=20.5±2.9%; p=0.79). For the android region, no differences between positions were identified for fat mass (Attack=1.01±0.5kg, Midfield=1.00±0.4kg, Defense=0.90±0.4kg, GK=1.10±0.5kg; p=0.9), or lean mass (Attack=4.3±0.5kg, Midfield=4.3±0.4kg, Defense=4.6±0.3kg, GK=4.4±0.8kg; p=0.70). For the gynoid region, no differences between positions were noted for fat mass (Attack=2.6±0.8kg, Midfield=2.5±0.9kg, Defense=2.7±0.8kg, GK=0.3±1.1kg, p=0.48), or lean mass (Attack=10.3±1.6kg, Midfield=10.4±1.0kg, Defense=10.5±0.7kg, GK=10.4±1.4kg; p=0.79). CONCLUSION: Total and regional body composition measures did not vary across positions in a group of men’s collegiate lacrosse players. These data suggest that the athletic demands across positions of men’s collegiate lacrosse are not related to differences in body composition. Therefore, training programs tailored to specific positions may not be needed in order to achieve athletic success.
Coaches and athletes plan for peak physical condition to occur at specified times during the competitive season (e.g. conference championship). Depending upon the event, athletes may or may not have similar somatotypes (endomorph=Endo, ectomorph=Ecto, and mesomorph=Meso). It is currently unclear whether competitive, Division II sprinters and endurance sprinters differ in somatotype. PURPOSE: The aim was to calculate somatotype of male and female collegiate sprinters and endurance sprinters proceeding their outdoor conference championship. METHODS: Athletes (n=18) were tested near the end of their outdoor season. Somatotype data were calculated for, sprinters (n=10; 100m and 200m) and endurance sprinters (n=8; 400m), according to the Heath-Carter manual (b breadths cm), girths (cm), mass (kg), and skinfolds (mm)). Comparisons were made by independent t-tests. Means and standard deviations are presented. RESULTS: Male sprinters (n=5, age: 19.8 ± 5.9 yrs., ht.: 180.3 ± 10.5 cm, wt.: 73.2 ± 10.2 kg, body fat: 6.1 ± 9.5 %) displayed as Endo=474.7 ± 69, Ecto=3.09 ± 92, and Meso=3.71 ± 103 and endurance sprinters (n=4, age: 19.5 ± 6.5 yrs., ht.: 181.9 ± 3.9 cm, wt.: 75.2 ± 4.2 kg, body fat: 6.2 ± 1.6 %) displayed as Endo=4.40 ± 46, Ecto=3.31 ± 26, and Meso=3.84 ± 70. Male sprinters and endurance sprinters were not significantly different on Endo (t(7)=0.85, p=0.424), Ecto (equal variance not assumed; (t(7)=52, p=0.628), or Meso (t(7)=22, p=0.830) scores. Female sprinters (n=5, age: 19.2 ± 1.3 yrs., ht.: 166.4 ± 5.4 cm, wt.: 60.8 ± 4.6 kg, body fat: 15.5 ± 5.3 %) displayed as Endo=745.1 ± 121, Ecto=2.50 ± 75, and Meso=3.21 ± 94 and endurance sprinters (n=4, age: 19.8 ± 1.7 yrs., ht.: 167.9 ± 5.0 cm, wt.: 58.6 ± 2.7 kg, body fat: 15.8 ± 5.5 %) displayed as Endo=739.3 ± 1.37, Ecto=3.13 ± .74, and Meso=2.70 ± .67. Female sprinters and endurance sprinters were not significantly different on Endo (t(7)=0.8, p=942), Ecto (t(7)=1.27, p=245), or Meso (t(7)=91, p=393) scores. CONCLUSIONS: There was no difference in the somatotype of male and female sprinters and endurance sprinters. Further research should be conducted to analyze the relationships between early season somatotype, late season somatotype, and performance season long.

Body composition has a significant impact on athletic performance, as well as overall health and wellbeing. Athletes and coaches often attempt to optimize performance by changing body composition without sport specific guidelines. Several techniques for measuring body composition exist, but the validity compared to the DXA has not been fully elucidated in athletic populations in various sports. PURPOSE: The aim was to calculate somatotype of male and female collegiate sprinters and endurance sprinters proceeding their outdoor conference championship. METHODS: Athletes (n=18) were tested near the end of their outdoor season. Somatotype data were calculated for, sprinters (n=10; 100m and 200m) and endurance sprinters (n=8; 400m), according to the Heath-Carter manual (b breadths cm), girths (cm), mass (kg), and skinfolds (mm)). Comparisons were made by independent t-tests. Means and standard deviations are presented. RESULTS: Male sprinters (n=5, age: 19.8 ± 5.9 yrs., ht.: 180.3 ± 10.5 cm, wt.: 73.2 ± 10.2 kg, body fat: 6.1 ± 9.5 %) displayed as Endo=474.7 ± 69, Ecto=3.09 ± 92, and Meso=3.71 ± 103 and endurance sprinters (n=4, age: 19.5 ± 6.5 yrs., ht.: 181.9 ± 3.9 cm, wt.: 75.2 ± 4.2 kg, body fat: 6.2 ± 1.6 %) displayed as Endo=4.40 ± 46, Ecto=3.31 ± 26, and Meso=3.84 ± 70. Male sprinters and endurance sprinters were not significantly different on Endo (t(7)=0.85, p=0.424), Ecto (equal variance not assumed; (t(7)=52, p=0.628), or Meso (t(7)=22, p=0.830) scores. Female sprinters (n=5, age: 19.2 ± 1.3 yrs., ht.: 166.4 ± 5.4 cm, wt.: 60.8 ± 4.6 kg, body fat: 15.5 ± 5.3 %) displayed as Endo=745.1 ± 121, Ecto=2.50 ± 75, and Meso=3.21 ± 94 and endurance sprinters (n=4, age: 19.8 ± 1.7 yrs., ht.: 167.9 ± 5.0 cm, wt.: 58.6 ± 2.7 kg, body fat: 15.8 ± 5.5 %) displayed as Endo=739.3 ± 1.37, Ecto=3.13 ± .74, and Meso=2.70 ± .67. Female sprinters and endurance sprinters were not significantly different on Endo (t(7)=0.8, p=942), Ecto (t(7)=1.27, p=245), or Meso (t(7)=91, p=393) scores. CONCLUSIONS: There was no difference in the somatotype of male and female sprinters and endurance sprinters. Further research should be conducted to analyze the relationships between early season somatotype, late season somatotype, and performance season long.
Accelerated muscle atrophy is an important factor to consider in several different environments such as spaceflight, paralysis, immobilization, and aging. Understanding optimal exercise countermeasures in such environments is therefore necessary to examine. PURPOSE: To assess muscle and adipose tissue thickness in the calves while using the unconventional training methods of blood flow restriction (BFR) and neuromuscular electrical stimulation (NMES). METHODS: Six sedentary participants (4 males and 2 females; 20.3 ± 1.4 yrs, 73.5 ± 13.8 kg) underwent 6 weeks of calf training with each leg randomly assigned to one of three conditions: 1) BFR (n=4), 2) NMES (n=3), and 3) combined BFR-NMES (n=5). A control group of seven sedentary participants (4 males and 3 females; 23.1 ± 4.3 yrs, 75.1 ± 12.2 kg) were also used. Adipose tissue thickness was measured via ultrasound and skinfolds while muscle thickness of the gastrocnemius and soleus was assessed via ultrasound. Comparisons were made using separate two-way ANOVA’s for each variable. RESULTS: A significant main effect of time was found for ultrasound measurements of the lateral (p = 0.0021) and medial (p = 0.0467) adipose tissue. A significant interaction effect was found for medial adipose tissue (p = 0.0382) with post-hoc comparisons revealing a significant increase in medial adipose tissue thickness with the BFR (p = 0.0176). No differences were found in muscle thickness for both the medial and lateral gastrocnemius, however, there was a significant main effect of time (p = 0.0025) and interaction (p = 0.0013) for soleus muscle thickness. Post-hoc comparisons showed a significant increase in soleus muscle thickness with the BFR+NMES condition (p = 0.0029) only. CONCLUSION: These results suggest that a combined BFR+NMES training condition may be a feasible method for increasing soleus muscle thickness with 6 weeks of training. Additional research is warranted to elucidate the potential use of BFR and NMES for stimulating positive physiological change in the calves. Supported by National Institute of Health grants UL1GM118979; TL4GM118980; R15GM118978.

Children with intellectual disability (ID) have higher rates of obesity than children without ID, and the management of obesity might be facilitated through simple and low-cost methods. PURPOSE: To develop and cross-validate an equation for estimating %BF from BIA and DXA in children with and without ID. METHODS: To develop and cross-validate an equation for estimating %BF from BIA and DXA in children with and without ID. Using the data from the development sample, we derived a %BF prediction equation with hierarchical linear regression. The equation was: %BF = 15.269 + (1.412 × BMI) - (1.350 × age) + (5.362 × sex). The equation had high accuracy during cross-validation as indicated by: (i) strong correlation between actual and predicted %BF (R² = 0.71.0 and 28.6 ± 9.6%, respectively; p > 0.05); (ii) mean absolute and root mean square error of 4.4 ± 4.1% and 5.6%, respectively; and (iii) small mean overestimation of DXA-determined %BF but somewhat wide limits of agreement in the Bland-Altman plot (mean error: -1.53%; 95% CI: 10.2%, -13.3%). CONCLUSIONS: BMI, age and sex significantly predicted %BF in children with ID. The developed equation was cross-validated for estimating %BF in children with ID. Supported by FAPESP Grants 2019/07103-6, 2018/02754-5, 2018/02677-1, and 2017/13071-4.
bioimpedance spectroscopy, and 3-dimensional optical scanning. Select DXA variables were also utilized as predictors. Ordinary least squares regression was conducted to predict the differences in total fat mass (FM) and total lean soft tissue (LST) between DXA and BIA. Standardized model coefficients (β), p-values for coefficients, and R² values were generated. RESULTS: For FM estimates, significant predictors (p ≤ 0.01) of the differences between DXA and BIA were hydration of LST (TBW:LST; β = -0.82), height (β = -0.78), percentage of TBW as extracellular fluid (%ECF; β = -0.36), and the male sex (β = 0.26). For LST, significant predictors of the errors between DXA and BIA were TBW:LST (β = 0.85), height (β = 0.77), %ECF (β = 0.40), the male sex (β = -0.22), and racial identification as Black (β = -0.09). The R² values for regression models predicting differences between DXA and BIA were 0.80 to 0.86 for FM and 0.73 to 0.87 for LST. CONCLUSION: Hydration variables and height are primary predictors of discrepancies between DXA and BIA total body composition estimates.

Interest in evaluating the composition of specific anatomical regions has become commonplace in a variety of settings. Appendicular lean soft tissue (A\textsubscript{LST}) estimates are considered in the diagnosis of sarcopenia. While dual-energy x-ray absorptiometry (DXA) is viewed as a reference method for regional assessments, its availability is limited. Thus, explaining discrepancies in regional body composition estimates between DXA and the more accessible bioelectrical impedance analysis (BIA) is of utmost importance. PURPOSE: To assess the anthropometric and physiological predictors of variations between BIA and DXA regional lean soft tissue (LST) estimates. METHODS: During a single visit, 179 participants (103 females, 76 males; Mean ± SD: 33.6 ± 15.3 years; 73.4 ± 16.2 kg; 171.2 ± 9.2 cm; 28.2 ± 8.9% DXA body fat %) underwent body composition assessments via DXA and 8-point single-frequency BIA. Potential predictors of discrepancies between DXA and BIA LST estimates were obtained from these methods and additional laboratory techniques. Specifically, air displacement plethysmography, 3-dimensional optical scanning, and bioimpedance spectroscopy were used to estimate body volume, anthropometrics, and hydration variables, respectively. Significant predictors (p ≤ 0.05) of the mean difference between DXA and BIA estimates of trunk LST (T\textsubscript{LST}) and A\textsubscript{LST} were established using ordinary least squares regression. Standardized model coefficients, p-values for coefficients, and R² values were generated. RESULTS: For both T\textsubscript{LST} and A\textsubscript{LST}, extracellular fluid percentage, LST hydration, height, total LST mass, the male sex, and racial identification as Black significantly predicted discrepancies between DXA and BIA. Additional predictors for T\textsubscript{LST} discrepancies were DXA total fat mass (FM) to LST ratio and DXA T\textsubscript{LST}, while additional predictors of A\textsubscript{LST} discrepancies included DXA A\textsubscript{LST}, DXA FM to LST ratio of the legs, DXA appendicular FM, and DXA-derived volume of the arms and legs. Regression models including these significant predictor variables produced R² values of 0.92 and 0.95 for T\textsubscript{LST} and A\textsubscript{LST}, respectively. CONCLUSIONS: Hydration variables, the quantity of LST in the region of interest, and height were the most influential predictor variables for discrepancies between DXA and BIA regional LST estimates.
Elastic knee wraps are used to produce blood flow restriction (BFR) but it is unclear how discomfort and perceived exertion may compare to more traditional ways of producing BFR such as nylon cuffs where the pressure is known. PURPOSE: To investigate how elastic knee wraps (practical) compare in ratings of perceived exertion (RPE) and discomfort after exercising to failure when compared to nylon cuffs (traditional) or low and high loads without BFR.

METHODS: Nine participants (male=7, female=2) completed this study. The average age and body mass index were 22 (4) years and 25.4 (1.5) kg/m2. Each participant completed six conditions, in a randomized order, of unilateral knee extension exercise to failure for four sets. Two conditions (30% one-repetition maximum, 1-RM) included elastic knee wraps that were either stretched by two inches from resting length (Practical-Low) or were stretched to a new length that was 85% of the thigh circumference (Practical-High). Two more conditions (30%-1RM) used nylon cuffs that were inflated to either 80% (BFR-High) or 40% (BFR-Low) of arterial occlusion pressure. The last two conditions had no restriction stimulus and were 30% 1-RM (LL) or 70% 1-RM (HL). Discomfort (0-10) and RPE (6-20) were measured before exercise and at the end of every set. Four rounds were performed, and one minute of rest was allotted between rounds. Volume-load and intensity were matched for the subsequent bout of TRAD, during which straight-sets were performed for 90 seconds of rest was allotted between every set. Oxygen uptake (VO2), heart rate (HR), blood lactate concentration ([La]), rating of perceived exertion (RPE), and excess post-exercise oxygen consumption (EPOC) were measured.

Summary of Results: PHA elicited significantly greater %VO2Max (45±7.1 vs. 28±14.3, p<0.0001), %HRMax (80±4.0 vs. 61±15.1%, p<0.0001), EPOC (16±1.8 vs. 12±2.0, p=0.001), and EPOC (9.6±2.4 vs. 7.1±1.4 ml/kg/min, p=0.0001) compared to TRAD. PHA was also completed in less time (20±3.2 vs. 46±3.8 min, p<0.0001). Compared to TRAD, [La] was significantly higher at mid-exercise (8.1±1.5 vs. 5.6±1.9 mmol/L, p<0.0001), post-exercise (10.5±2.8 vs. 5.2±1.8 mmol/L, p<0.0001), and 5-min post-exercise (10.3±3.0 vs. 4.5±1.9 mmol/L, p<0.0001) during PHA. There were no between sex differences for [La] at any time-point for TRAD. During PHA, [La] was significantly higher for males at mid-exercise (9.6±2.0 vs. 6.6±2.4 mmol/L, p<0.008), post-exercise (12.1±2.0 vs. 8.9±2.5 mmol/L, p<0.006), and 5-min post-exercise (12.2±2.1 vs. 8.4±2.4 mmol/L, p<0.002). No between sex differences were detected for HR, VO2, or RPE for either style of RT. Conclusion: PHA is a time-effective and metabolically demanding circuit that may be employed to stimulate musculoskeletal and cardiorespiratory adaptations. Males produced more lactate than females during PHA, and one may speculate this was caused by discrepancies in total-body lean-mass, cross-sectional area per muscle fiber, or Type 1 fiber distribution.

In competitive swimming, overload training is often used to elicit transient states of overreaching in the hopes that subsequent periods of taper will lead to performance supercompensation. However, if the overload stress is too great relative to the level of recovery, fatigue will accumulate and cause both a greater risk of injury and more prolonged decreases in performance. Measurements of vagal control of the heart rate (HR) have been shown to reflect the balance between training-induced fatigue and recovery, and so those measures can provide valuable feedback to help guide coaches as they develop and revise training plans. PURPOSE: The purpose of the present study was to use three different indicators of vagal control of HR to investigate the impact of overload training and tapering in collegiate female swimmers. Those indicators were the resting logarithm of the root mean square of successive R-R intervals (lnRMSSD), HR responses to forced breathing (HR_F), and HR responses to one minute of sustained handgrip exercise (HR_H). METHODS: Thirteen female Division-1 swimmers performed lnRMSSD, HR_F, HR_H assessments three times throughout their competitive season: 1. at the beginning of the season (BL), 2. eleven weeks later during a period of intense overload training (OL), and 3. another eleven weeks later and following a taper (TP). Differences in the cardiovascular variables during BL, OL, and TP were determined using repeated measures ANOVAs. RESULTS: Very large decreases in lnRMSSD (p<0.001) and increases in HR_F (p<0.05) occurred during OL, whereas those values then returned to levels during TP (p<0.05 and p<0.01, respectively). By contrast, HR_H values fell progressively throughout the season, and there was a large difference between the BL and TP measurements (p<0.05).

CONCLUSION: Changes in all three variables demonstrated that OL impaired vagal stimulation of the heart, and the bulk of evidence indicated that vagal stimulation was fully restored during TP. This was one of only a few longitudinal studies that have investigated the control of HR over the course of an entire competitive swim season, and it was the first study to demonstrate that overload training and taper can alter HR responses to both forced breathing and sustained handgrip exercise.
Plyometrics exercises are characterized by rapid stretch-shortening cycle (SSC) muscle actions. While studies have shown the effectiveness of plyometrics training in improving athletes’ sprint ability, limited information is available on which specific method is more effective to athletes improve their sprint ability. PURPOSE: To examine the effect of vertical training (VT) and horizontal training (HT) on sprint ability in athletes. METHODS: Searched databases (MEDLINE, PubMed, websites of science core database) till Oct. 1, 2019. Search keywords included: Vertical, horizontal, countermovement jumps (CMJ), sprint, and speed. The screening conditions were as follows: (a) Randomized controlled trials; (b) Participants were athletes, (c) VT or HT were the training method and there are at least 8 training lessons; (d) The study design consisted of an intervention group and a control group, or a vertical group and a horizontal group. (multiple training methods were excluded); (e) Other training courses (e.g. warm-up, technical, tactical, and strength training, volume, intensity); and (f) The final results of the study should include sprint ability test, and CMJ. RESULTS: A total of 340 articles were screened out and then removing the papers with duplicate titles and abstracts; as a result, 252 articles remained; additional 35 papers were removed after excluding the reviews and reading the abstracts; thereafter, 26 articles were read in full text according to the screening criteria; finally, 7 articles were included in the meta-analysis. The risk of bias was evaluated using the Cochrane collaboration’s tools. Compared with VT, HT is more effective in improving athletes’ sprint ability [0.84(0.05)] (CI: 0.06-0.16), Z=2.10 (P = 0.041), but there is no difference between VT and HT in improving CMJ [0.45 (95% CI: 0.05-0.049), Z=1.78 (P=0.08)]. Through subgroup analysis of 10-M sprint time, the large number of training lessons (≥20) had a significant effect: age (under 17 yr. old) and project soccer player (Others include basketball and handball) were not statistically significant. CONCLUSION: HT is more helpful to improve the sprint ability, but HT and VT were about the same in improving CMJ. 

PFOURSE: To compare the effect of aerobic training using Swiss-ball (SB) and aerobic training using bicycle on postural stability. METHODS: Sixteen healthy adults allocated into two group randomly: SB training group performed two-month aerobic training using SB and bicycle training group (Bike group) performed two-month aerobic training using bicycle ergometer. Subjects were asked to do the training for 30minute in a day and three days in a week. In each group, baseline and post intervention postural stability and peak oxygen consumption were measured. Postural stability was measured using stabilometric platform. During the assessment of stability, subjects were asked to close eyes and stay as still as possible for 30 seconds. Fundamental parameters obtained are: position of the body center of gravity, area and shape of sway density curve and velocity variables. RESULTS: All results show mean (SD). There was no main effect on peak oxygen consumption and no difference between training group (SB group: 33.15(6.0) ml/kg/min to 32.9(5.4) ml/kg/min, Bike group: 32.7(6.7) ml/kg/min to 35.5(8.0) ml/kg/min). On the other hand, significantly interaction was found on some postural stability measurement: area in which the center of gravity (SB group: 2.30(0.4) cm² to 3.00(1.3)) cm², Bike group: 1.98(1.0) cm² to 2.4(1.4) cm²; no significant interaction), total length of center of gravity displacement (SB group: 55.3(9.9) cm to 46.4(8.4) cm, Bike Group: 39.9(11.6) cm to 43.13(1.1) cm: interaction P=0.05), velocity of center of pressure (SB group: 1.80(0.3) cm/sec to 1.60(0.3) cm/sec, Bike Group: 1.30(0.4) cm/ sec to 1.40(0.4) cm/sec: interaction P=0.05). CONCLUSIONS: SB training shows no significant effect on peak oxygen consumption. On the other hand, SB training improved postural stability compared with bicycle ergometer training.

POURPOSE: While the number of overweight and obese Americans increases, fewer people meet recommended physical activity levels. Among Americans, 32 - 56% of Christian clergy have obesity and associated chronic diseases. Seminarians are an optimal group to introduce interventions to decrease the prevalence of obesity, as they have the power to improve both their own health as well as the health of those in their congregation. This study aims to determine whether a physical activity intervention in a seminary population is an effective way to improve physical fitness and body composition, in an effort to decrease obesity and related diseases. METHODS: 59 male seminary students (age range 22 - 66 years; mean age 30.12 years) participated in a 10-week physical activity intervention, attending two trained-exercise sessions per week for 10 weeks, which including cardiopulmonary and resistance training components. Pre- and post-intervention anthropometric measures included weight, BMI, waist-to-hip ratio, and body fat (%). Physical fitness assessments included the Rockport Walk test, cardiopulmonary endurance, and flexibility. Blood panels included a lipid and glucose panel. RESULTS: Results are shown in Table 1 (not all data shown). Body weight, BMI, triglycerides and LDL cholesterol did not change as a result of the intervention. Mean waist circumference decreased 3 cm (P = 0.001). Significant improvements were observed in all physical fitness assessments (all P < 0.05). Mean total cholesterol increased 8.7 mg/dL, HDL cholesterol increased 5 mg/dL, and blood glucose decreased 10 mg/dL (all P < 0.05). CONCLUSIONS: The results of this study show that a 10-week physical activity intervention in seminary students was effective in improving body composition, physical fitness and blood cholesterol and glucose measures. Results of this study suggest that seminarians may be an optimal group for future interventions to improve overall health and fitness.
CrossFit® is a strength and conditioning program recognized as one of the most popular and practiced types of high-intensity functional training today. The goal of participants is to optimize physical conditions in some fitness domains: strength, flexibility, power, cardiovascular or respiratory endurance, coordination, and agility. The exercises are executed quickly, repetitively in a high intensity with little or no recovery time between sets. PURPOSE: This study aimed to verify muscle damage and immune markers parameters in the response of the CrossFit® training session. METHODS: Sixteen male recreational CrossFit® practitioners (Mean±SD: 29.4 ± 5.3 years old) performed a single session of AMRAP (means as many rounds as possible) for 12 minutes. This session followed a sequence of 12 box jumps, 6 thrusters and 6 burpees facing bar. After the rest of 3 minutes, participants were instructed to complete a Wingate test on a cycle ergometer in the fastest time possible. Blood samples were collected immediately before the session of AMRAP (PRE) and after Wingate test (POST). Were analyzed white blood cells and platelet count in EDTA samples. The paired t test was applied to verify PRE and POST statistical differences. Values of $p < 0.05$ were considered significant. RESULTS: The data are presented as mean and SE. There was significant increases in leukocytes (PRE 7.6 ± 0.4 and POST 15.0 ± 0.8x10^6/L, $p < 0.001$); lymphocytes (PRE 2.5 ± 0.1 and POST 6.9 ± 0.4x10^6/L, $p < 0.001$); neutrophils (PRE 4.3 ± 0.4 and POST 6.2 ± 0.6x10^6/L, $p < 0.001$); and platelets counts (PRE 271 ± 6 and POST 344 ± 12 x10^6/L, $p < 0.001$); Creatine Kinase (PRE 363 ± 94 and POST 452 ± 114 U/L, $p < 0.001$) and C-reactive Protein (PRE 7.1 ± 0.9 and POST 8.0 ± 1.1 mg/L, $p < 0.001$). Urine acid concentrations were not different (P< 4.7 ± 0.3 and POS 5.0 ± 0.2 mg/L, P=0.184). CONCLUSION: In conclusion, these results indicate that the AMRAP session associated with the Wingate test elicits an acute immune response, including neutrophils, lymphocytes, and platelets. Besides, this protocol acutely increase muscle damage and inflammatory markers. These blood parameters could be analyzed in the recovery strategies in CrossFit® practitioners.

CrossFit® programs focus on performance of aerobic and strengthening exercises which incorporate multi-joint, functional movements. These variables combine to enhance athletic performance and improve an individual’s ability to perform daily functional movement. A limited amount of research has compared CrossFit® with other training groups regarding aerobic capacity, muscular strength, and body composition. A smaller percentage of research has compared functional movement variables. PURPOSE: Current research supports that CrossFit® athletes demonstrate high symmetry of functional movement patterns. The primary aim of this study was to determine if CrossFit® training was more beneficial to functional movement as compared to a standard exercise regimen. METHODS: This investigation was an exploratory cross-sectional study. Sixty (28 males, 32 females) healthy adults (age, 25±5 yr; ht, 170.5±10.3 cm; wt, 79.2±20.0 kg; BIA 23.10±8.44%) participated. Participants were recruited from the community and assigned to three groups based on their reported exercise lifestyle: CrossFit trained (CF), recreationally trained (RT), and sedentary (SD). The 60 participants underwent a series of tests including a maximal strength test (Deadlift 1-Rep Max assessment; kg deadlift/kg body wt), and an estimated aerobic capacity assessment (Astrand-Rhyming Cycle Ergometer Test; LQ/min). Exclusion criteria, anthropometric data and vital signs were assessed in all patients. RESULTS: The CF group (6.97±1.13) was significantly higher than the sedentary group (5.73±1.41) in the FMS components score. The CF group deadlift score (1.90±0.40) was significantly higher than both the SD (1.18±0.36) and RT groups (1.47±0.51). For aerobic capacity, both the CF (3.09±1.00) and RT (2.84±0.67) groups were significantly higher than the SD group (1.96±1.17). All testing significance was set at $p<0.05$. CONCLUSION: CrossFit® training provided improved fitness and functional performance parameters as compared to sedentary counterparts. For muscular strength, CrossFit® was associated with higher scores as compared to recreationally trained individuals. CrossFit® and recreationally trained groups scored evenly for aerobic fitness and components of functional movement patterns.

Acute Response Of Biochemical And Hematological Markers After A CrossFit® Training Session.

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PREVIOUS INVESTIGATION HAS NOTED THAT NEITHER BUILD nor initial strength level appear to influence upper-body strength gains resulting from a short-term resistance training (RT) program in men. Such information is lacking in young women. With increasing interest of women in RT, it would be beneficial to determine if the same outcome as noted in men is operating in women. PURPOSE: To determine the influence of body build on changes in upper-body strength resulting from different modes of RT in college women.

METHODS: College women (n = 708, age = 19.0 ± 0.9 yrs, HT = 165.0 ± 6.0 cm, Wt = 62.6 ± 10.7 kg) self-selected to train with free weights or machine weights during 12 weeks of periodized RT 3 days/week. 1RM press was measured with free weights (FW, n = 170), supine vertical machine weight (SVP, n = 284), and seated horizontal machine weight (n = 232) before and after training. Fat mass (FM) and fat-free mass (FFM) were determined using a gender-specific skinfold %fat equation. Body build was determined by Delmar allometric formulas on the standing body height and weight. Significant differences were found for lean body mass (p = .001) between FW (58.8 ± 4.1 kg) and SVP (58.8 ± 4.1 kg) and between FW and SVP (58.5 ± 4.1 kg). Significant differences were noted for MVC of the hips (p = .001) between FW (49.9 ± 3.9 kg) and SVP (53.7 ± 8.3 kg) and between FW and SVP (53.6 ± 8.3 kg). No significant differences were noted between FW and SVP (58.5 ± 4.1 kg).

CONCLUSIONS: A SIT and resistance training program is an effective strategy to improve fat mass and muscle strength in inactive, aging women. Muscular strength improvements resulting from this intervention are particularly important as muscular strength losses are strong predictors of morbidity and mortality.
suggest that a pool bottom mirror is an effective tool in coaching for correction of front crawl stroke. Both verbal and visual instruction is valuable in correcting stroke of recreational swimmers and it can be achieved by the mirror.

3238 Board #59 May 29 1:30 PM - 3:00 PM Effects Of Unilateral Resistance Training On Muscular Strength, Power, And Measures Of Core Stability In Trained Individuals

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(NO relevant relationships reported)

PURPOSE: This study examined the effects of unilateral resistance training on lower body muscular strength and power, and measures of core stability in resistance-trained college students.

METHODS: Participants (N=22) underwent either 10 sessions of lower body unilateral (URT) or bilateral (BRT) resistance training on three non-consecutive days per week for three weeks. Training sessions consisted of three sets of five repetitions at 80% 1-RM for each exercise. BRT exercises included the barbell back squat, deadlift, and weighted jump squat. URT exercises included the Bulgarian split squat, single leg of Romanian deadlift, and single leg weighted jump squat. Outcome measures were a one repetition maximum (1-RM) leg press for lower body strength, standing vertical jump (VJ) for lower body power, and double leg lowering (DLL), hip abduction isometric strength (HAIS), and Sorensen (SOR) tests for core stability.

RESULTS: Results: Training elicited a positive main effect of time for all variables (p <0.05). Both groups improved pre to post training in 1-RM (297.9±4.1 to 373.1±14 kg), VJ (56.5±15.0 to 62.2±10.8 cm), DLL (33.9±14.9 to 43.6±13.2 deg), HAIS (29.6±8.6 to 32.6±10.1 kg), and SOR (91.4±33.1 to 112.3±36.7 sec).

The magnitude of change was similar between groups for all variables except HAIS in which the URT group demonstrated significantly (p=0.0155) greater improvement (14.3% vs. 3.3%). However, the effect size was larger in URT for all variables except VJ (Cohen’s d = 0.86 vs. 0.61 for 1-RM, 0.92 vs. 0.55 for DLL, 0.64 vs. 0.19 for HAIS, 0.90 vs. 0.36 for SOR).

CONCLUSIONS: Relative to bilateral training, unilateral resistance training produced similar improvements in measures of lower body strength and power in trained subjects. Additionally, these data suggest that unilateral training may potentially offer the benefit of enhanced core stability.

3239 Board #60 May 29 1:30 PM - 3:00 PM Effect Of Core Strength Exercise On Colon Transit Time In Female University Students

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(NO relevant relationships reported)

PURPOSE: To evaluate the benefit of core strength exercise (CSE) program consisted of 60 minute sessions, two days a week for 12 weeks. Each session included a specific sequence of 12 yoga postures as a component of Vinyasa yoga, consisted of a specific sequence of 12 yoga postures as a component of Vinyasa yoga. Outcome measures were a two-15 min sessions. CSE program to improve overall health, including body weight management. However, research data studying high intensity SN (HSN) are limited.

PURPOSE: The aim of the present study was to assess cardiorespiratory and metabolic demands of HSN performed with 3 s/pose. METHODS: Heart rate (HR) response of twenty-four moderately trained subjects 12 males and 12 females; mean ± sd age: 39 ± 7.3 ± 12.3 ± 4.8. VO peak: 45.48 ± 12.11 ml.kg-1.min-1 and HRmax: 183.54 ± 10.13 bpm was recorded during two-15 min sessions HSN practice 7 days apart. Maximal oxygen uptake (VO peak) and maximum HR (HRmax) had been estimated earlier, after an incremental test to exhaustion. VO2 during HSN was estimated from individual regression equations using the relationship of VO2 and HR values derived from VO2 peak test, while the metabolic rate (kcal.min-1) was calculated from the relationship of HR and kcal.min-1. Total HSN energy consumption was the average value of the two-15 min sessions.

RESULTS: Mean ± sd values of the %HRmax, %VO2 max and rate of energy expenditure during HSN were 71.7 ± 7.5%, 59.0 ± 10.3 and 8.9 ± 3.3 kcal.min-1 (7.9 ± 2.0 METs) respectively. Total session energy expenditure was 133.04 ± 50.14 kcal. CONCLUSIONS: The results of the present study confirm that an HSN session may produce a sufficient training stimulus to promote cardiorespiratory fitness and favor weight loss in moderate trained adults.

3240 Board #61 May 29 1:30 PM - 3:00 PM Chronic Influence Of Inspiratory Muscle Training At Different Intensities On The Serum Metabolome

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PURPOSE: To investigate the chronic effect of inspiratory muscle training (IMT) on the human serum metabolome in healthy male recreational cyclists. METHODS: This study employed a randomized, parallel group design. Recreational male cyclists (n=23, 20-40 y, BMI<30 kg/m²) were randomized to three IMT groups: low intensity (6 cm H2O) (LI, n=11); moderate intensity or 60% of maximal inspiratory pressure (ML, n=10) and high intensity, the critical inspiratory pressure (≈85-90% of maximal inspiratory pressure) (HI, N=11). The IMT was performed for 11 weeks, 3 times per week (3 sets of 15 minutes/session). Another group of participants under the same conditions, who did not perform the IMT but participated in all assessments and procedures, was included as controls (CG, N=6). Blood samples were collected one week before and one week after 11 weeks of IMT and analyzed using 1H NMR spectroscopy. Statistical analysis included a 4 (group) x 2 (time) repeated measures ANOVA using the general linear model (GLM), and multivariate Principal Component Analysis (PCA). RESULTS: The targeted metabolonomics analysis of serum samples identified 23 metabolites, including amino acids, lipids, and tricarboxylic acid cycle intermediates. No significant interaction effects from GLM were found for the 23 metabolites, and this was confirmed by PCA. CONCLUSION: These data indicate that IMT at three intensity levels did not alter the serum metabolome relative to the control group. These results are consistent with other exercise training studies showing negligible alterations in the serum metabolome compared to the large but transient perturbations linked to prolonged and intensive exercise.

3241 Board #62 May 29 1:30 PM - 3:00 PM Cardiorespiratory And Metabolic Responses Of High Intensity Yoga-surya Namaskar Session

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(NO relevant relationships reported)

The recent global rise in obesity appears to be a threat to public health as it is connected with various cardiovascular and metabolic diseases. Surya Namaskar (SN), a component of Vinyasa yoga, consisted of a specific sequence of 12 yoga postures performed with controlled breath, is often used as an alternative of a typical fitness program to improve overall health, including body weight management. However, research data studying high intensity SN (HSN) are limited. PURPOSE: The aim of the present study was to assess cardiorespiratory and metabolic demands of HSN performed with 3 s/pose. METHODS: Heart rate (HR) response of twenty-four moderately trained subjects 12 males and 12 females; mean ± sd age: 39 ± 7.3 ± 12.3 ± 4.8. VO peak: 45.48 ± 12.11 ml.kg-1.min-1 and HRmax: 183.54 ± 10.13 bpm was recorded during two-15 min sessions HSN practice 7 days apart. Maximal oxygen uptake (VO peak) and maximum HR (HRmax) had been estimated earlier, after an incremental test to exhaustion. VO2 during HSN was estimated from individual regression equations using the relationship of VO2 and HR values derived from VO2 peak test, while the metabolic rate (kcal.min-1) was calculated from the relationship of HR and kcal.min-1. Total HSN energy consumption was the average value of the two-15 min sessions.

RESULTS: Mean ± sd values of the %HRmax, %VO2 max and rate of energy expenditure during HSN were 71.7 ± 7.5%, 59.0 ± 10.3 and 8.9 ± 3.3 kcal.min-1 (7.9 ± 2.0 METs) respectively. Total session energy expenditure was 133.04 ± 50.14 kcal. CONCLUSIONS: The results of the present study confirm that an HSN session may produce a sufficient training stimulus to promote cardiorespiratory fitness and favor weight loss in moderate trained adults.
A simple vigorous exercise training can improve cardiorespiratory fitness. Few studies, however, have examined the efficacy of basic bodyweight exercises that can be performed in a small space, without the need for specialized equipment. Practical, time-efficient approaches of this sort have been advocated for decades, including the 11-minute “Five Basic Exercises” (5BX) program developed by the Canadian government in the 1960s. PURPOSE: We determined the effect of a 5BX-style program on peak oxygen uptake (VO_{2peak}) in inactive but healthy young men and women (20±1 y; body mass index: 20.5±3 kg/m^2; mean±SD). METHODS: Participants were randomized to a training group that performed 18 sessions over six weeks (n=9), or a non-training control group (n=10). Each session involved a 1-minute warm-up (jumping jacks), followed by 1-minute bouts of five exercises (burpees, high knees, split squat jumps, high knees, squat jumps), each interspersed with 1-minute of active recovery (walking around the room). Participants were instructed to complete as many repetitions per bout as possible, at a self-determined “challenging” pace. All sessions were supervised and compliance was 100%. RESULTS: Mean intensity during training was 82.5±% of maximal heart rate. Borg Scale ratings of perceived exertion for the five exercises ranged from 12±2 to 15±3 out of 20. ANCOVA revealed a significant difference between groups after the intervention, such that VO_{2peak} was higher in the training group compared to control (34.2±6.4 vs 30.3±11.1 ml/kg/min; p=0.004). Peak power output during the VO_{2peak} test was also higher after training compared to control (211±43 vs 191±50 W; p=0.004). There were no changes in leg muscular endurance, trunk flexion under all testing conditions. CONCLUSIONS: A simple bodyweight interval training program, requiring 11 minutes per session, increased cardiorespiratory fitness in previously sedentary young adults when performed three times per week for six weeks. Supported by NSERC.

Acute aerobic exercise has been shown to improve mood and affect in adult humans. Lower body positive pressure treadmills (LBPPt) have been utilized to reduce loading on the musculoskeletal system and to provide an alternative to running and cross-training. While the biomechanical and physiological responses to the LBPPt have been well-researched, little is known about psychological responses and how this compares to other forms of exercise. PURPOSE: To investigate mood, affect, and self-efficacy, following an acute, high-intensity exercise session and compare these responses across three modalities: cycling, LBPPt running, and treadmill running (NT). METHODS: 10 active adults (average age = 30 years, SD = 10 years) completed a 30min, high-intensity exercise session on each of the three modalities in a randomized order: bike, LBPPt, and NT. Intensity was determined as 85% age-predicted maximum heart rate. Before and after each session, feeling, arousal, affect and self-efficacy were determined using the Feeling and Arousal scale (FAS), Activation-Deactivation Adjective Checklist (ADACL), and Generalized Self-efficacy scale (GSE). RESULTS: From baseline to post-exercise, there was a significant increase in feeling (2.4 ± 0.31 vs 3.3 ± 0.29, p=0.021), arousal (3.23 ± 0.23 vs 4.07 ± 0.31, p=0.006), and self-efficacy (31.83 ± 0.83 vs 33.97 ± 1.16, p=0.013) across all three modalities. However, when compared among the three modalities, there was no observed significant change in self-efficacy values from baseline to post-exercise (p=0.708). For affect (ADACL), there was an observed significant increase in energetic arousal (25.9 ± 1.12 vs 29.4 ± 1.36, p=0.023) and a decrease in state anxiety (20.93 ± 1.73 vs 17.36 ± 1.08, p=0.041) from baseline to post-exercise across all modalities, however, this did not significantly differ among the modalities. There were no other significant changes in affect observed. CONCLUSION: Self-efficacy, feeling, energetic arousal, and anxiety improves following acute, high intensity exercise sessions; however, these changes do not differ based on exercise modality. Psychological responses to acute exercise differs between runners and non-runners. Future research should investigate how these responses may differ between the two groups based on modality.
Tracking and monitoring bilateral limb asymmetries is an increasingly common practice to provide information associated with athlete performance, injury risk, as well as guiding return-to-play or return-to-performance protocols following injury. It is speculated external training loads (eTL) during sport specific practice may influence subsequent jump tests, repeat squats tests, and repeat block jump tests while capturing during the CMJ between conditions and across time, with significance set during a bilateral countermovement jump (CMJ) immediately following high versus low eTL basketball practices in a group of NCAA men’s collegiate basketball players.

METHODS: Twelve NCAA Division I collegiate men’s basketball players performed three CMJs on dual cell force platforms immediately prior to and immediately following basketball practices of high and low eTL. A dependent T-test was used to determine means differences in practice intensities. A 2-way (condition x time) repeated measures analysis of variance (ANOVA) was performed to examine differences in Concentric Impulse (ConcImp), Concentric Peak Force (ConcPF), Eccentric Peak Force (EccPF), and Peak LandForce (PeakLandf) captured during the CMJ between conditions and across time, with significance set at α ≤ 0.05.

RESULTS: There was a significant difference in practice intensities (High: PlayerLoad/min = 5.3 ± 0.9, Low: PlayerLoad/min = 4.7 ± 1.0, p < 0.001). There were no significant condition or time main effects (p > 0.05), and there were no significant condition by time interactions for ConcImp, ConcPF, EccPF, and PeakLandf (p > 0.05).

CONCLUSION: Although there were significant differences experienced in eTL intensities between practices (PL/min), these differences did not result in alteration of acute lower inter-limb asymmetries during the bilateral CMJ.
Balance is defined as the ability to maintain a stable position while remaining steady. Balance is extremely important to dancers to help prevent injury and to maximize aesthetic and athletic performance. While other studies support the improvement of balance among dancers following a core exercise training program, the effects immediately following one core exercise session are less clear. PURPOSE: The purpose of this study was to examine the immediate effects of a core and abdominal exercise program on balance for dancers, with the hypothesis that a core exercise program would cause an immediate improvement in balance for college-aged dancers. METHODS: Eighteen female collegiate dancers (19.83 ± 1.58 years, 7-18 years of dance experience) completed two sets of eight exercises, engaging the upper and lower abdominal, obliques, gluteals, and erector spinae muscles. Two static balance tests, the Balance Error Scoring System (BESS) test and the Stork Balance Standing test, and two dynamic balance tests, the Y Balance and the Pirouette test, were conducted prior to and after the core exercises. RESULTS: The core exercise program significantly improved balance results for the Y Balance Test composite score (86.0 ± 6.3% pre vs 87.4 ± 5.3% post, p<0.05) and the BESS Test (22.7 ± 8.0 errors pre vs 16.1 ± 7.0 errors post, p<0.05). There were no significant differences between pre and post intervention scores of the Stork Balance Standing test or the Pirouette test. CONCLUSIONS: Including core exercises in a dancer’s warm-up before practices and performances may have an acute positive effect on balance for dancers, which could translate to improvements in performance. It is unclear if a core exercise program can acutely improve dance skill-specific balance, such as during pirouettes.
The cardiovascular response induced by resistance exercise with blood flow restriction (BFR) seems to be lower or comparable to traditional exercise in healthy individuals. However, the potential for BFR to be used for at risk populations highlights a need to further attenuate the cardiovascular response, potentially via the modality of exercise.

**METHODS**: Participants randomly performed 3 interval (INT) exercise protocols: BFR, LIIE, and BFR and LIIE combined (BFR + LIIE). The first 30 minutes of work was at either 70% of VT may provide similar cardiovascular and local physiological stress to traditional HIIE, albeit at a lower work rate.

**RESULTS**: Arm LOP measurement showed a mean bias of 0.6 (-1.3 - 2.4) mmHg, p = .547, and limits of agreement (LOA) calculated. Two one-sided tests of equivalence with a 95% CI was used. The LOAs were calculated after the first 5 minutes of exercise, because it takes time for the cuff pressures to stabilize. The LOAs were calculated after the first 5 minutes of exercise, because it takes time for the cuff pressures to stabilize.

**CONCLUSIONS**: This study suggests that cycling with the addition of intermittent BFR at an intensity equivalent to 70% of VR may provide similar cardiovascular and local physiological stress to traditional HIIE, albeit at a lower work rate.

**REFERENCES**

CONCLUSIONS: The SonoTrax measured LOP equivalently to the MD6. Physical therapists wanting to use BFR therapy should feel comfortable using either vascular doppler in their clinic.

3258 Board #79 May 29 2:30 PM - 4:00 PM
Endothelial-dependent Cutaneous Vasodilatory Responses To Single Bout Of Remote Ischemic Preconditioning
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Remote ischemic preconditioning (RIPC) induces protective effects from endothelial ischemic reperfusion injury in two phases. Initial protection occurs in the first 1-2 hrs post-RIPC and disappears after 4 hrs. Delayed protection occurs ~24 hours after RIPC and lasts for 2-3 days in human conduit arteries. The extent to which this timeline occurs in human cutaneous microvasculature is not clear. Purpose: To assess the timeline of skin microvascular functional changes after a single bout of RIPC. Methods: Sixteen participants (23±4 yrs; 7 males, 9 females) underwent a single bout of RIPC. Using laser speckle contrast imaging, acetylcholine (Ach)-mediated skin blood flow responses were assessed immediately prior to RIPC as well as 24 hr, 48 hr, 72 hr, and a week afterwards. RIPC consisted of 4 repetitions of 5 min of arm blood flow occlusion interspersed by 5 min reperfusion. Ach was prepared with saline solution (2% Ach) and administered by iontophoresis (20 μA for 200 s). Skin blood flow was expressed as cutaneous vascular conductance (CVC; perfusion units/mean arterial pressure, PU∙mmHg⁻¹). Ach-induced CVC changes throughout this timeline were analyzed by one-way repeated ANOVA and post hoc tests were conducted by the SNK method to locate significant differences. Results: Ach-mediated CVC increased during the time line (p<0.05). However, CVC was significantly increased only 48 hours after the single bout of RIPC (0.71±0.07 vs. 0.94±0.12 PU∙mmHg⁻¹; p<0.05, pre-RIPC vs. 48 hrs), returning to baseline levels after a week (0.61±0.10 PU∙mmHg⁻¹; p=0.7). Conclusion: Responses to Ach infusion are an indicator of global endothelial cell function and reflects endothelial dependent vasodilation. These data suggest that a single bout of RIPC induces a response to Ach-induced endothelial dependent-cutaneous vasodilation that peaks at 48 hours post-RIPC. This response to a single bout of RIPC does not persist a week afterwards. Thus, a single bout of RIPC elicits a delayed window response of endothelial dependent vasodilation in human skin microvasculature.

3259 Board #80 May 29 2:30 PM - 4:00 PM
Feasibility And Effectiveness Of High-intensity Interval Training With Blood Flow Restriction In Heart Failure
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Reduced aerobic capacity (VO₂peak) is a key characteristic of heart failure with reduced ejection fraction (HFrEF). Peripheral vascular dysfunction, the result of an imbalance between endothelial damage and endogenous repair mechanisms, is both a precursor to and a consequence of HFrEF. This may contribute to the reduction in VO₂peak by increasing peripheral vascular resistance, impairing blood flow distribution and reducing O₂ delivery to locomotor muscles. High-intensity interval training (HIIT) can ameliorate vascular dysfunction and increase VO₂peak in HFrEF. Whether the effectiveness of HIIT can be increased by combining it with leg blood flow restriction (BFR), a novel technique that alters peripheral vascular shear stress and augments the intramuscular metabolic stress of a given exercise protocol, is unknown.

PURPOSE: To investigate the feasibility and effectiveness of HIIT vs. HIIT with BFR to improve CD34+/KDR+ progenitor cell number (marker of vascular repair), exercise tolerance and VO₂peak in HFrEF.

METHODS: 13 males with HFrEF (72 ± 11 y; LVEF 35 ± 9 %) completed HIIT (5 x 2 min cycling bouts at 80 % ramp-incremental peak power, separated by 2 min recovery) twice per week for 4 weeks, either with BFR (HIIT+BFR; n = 7; thigh cuff pressure 100 mmHg) or without BFR (HIIT; n = 6; thigh cuff pressure 10 mmHg). CD34+/KDR+ number (flow cytometry), exercise tolerance and VO₂peak (ramp-incremental exercise test), and quality of life (QoL) were measured pre- and post-training.

RESULTS: All HIIT+BFR participants tolerated 100 mmHg cuff pressure. There was a pre- to post training increase in CD34+/KDR+ number (HIIT: 78 ± 11 vs. 88 ± 28 per 10⁶ total events; HIIT+BFR: 67 ± 21 vs. 102 ± 44 per 10⁶ total events; time effect, P < 0.05) and ramp-incremental exercise tolerance (HIIT: 494 ± 160 vs. 537 ± 162 s; HIIT+BFR: 469 ± 136 vs. 529 ± 108 s; time effect, P < 0.05). However, the effect of training was not different for HIIT vs. HIIT+BFR. VO₂peak was unchanged with training (HIIT: 16.7 ± 8.5 vs. 18.7 ± 9.8 ml/min/kg; HIIT+BFR: 17.0 ± 3.8 vs. 16.4 ± 3.7 ml/min/kg; time effect, P > 0.05). QoL was also unchanged with training.

CONCLUSIONS: HIIT+BFR is feasible in HFrEF. However, the increases in CD34+/KDR+ progenitor cell number and exercise tolerance following HIIT+BFR are not greater than the increases conferred by HIIT alone in HFrEF.

3260 Board #81 May 29 2:30 PM - 4:00 PM
Effects Of Exercise Under Different Levels Of Blood-flow Restriction On Autonomic Modulation And Muscular Fatigue
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(No relevant relationships reported)

PURPOSE: To assess the acute cardiac autonomic and peripheral muscular responses to eccentric exercise combined with different levels of blood flow restriction (BFR) in young women. METHODS: Twenty-five women (21.22±0.61 year) performed 4 sets of leg extension (30 ± 15 + 15 + 15 repetitions) at 20 % one repetition maximum, with four different BFR conditions (0, 40, 60, and 80 %). Restrictive pressures were calculated based on blood-flow measurements taken at rest on each subject. Heart rate variability (HRV) and muscular fatigue were recorded at rest and during 24 hour of recovery by calculating time (RMSD) and frequency domain (LF, HF, LF/ HF) indices and analyzing muscle displacement (Dm) and contraction velocity (Vc) values, respectively. RESULTS: All parameters in CON (0%BFR) did not significant change (P>0.05). In BFR, there was a slight reduction in RMSD (18.51%) and HF (12.19%) compared to CON (P<0.05). In BFR, RMSD and HF nu decreased 27.91% and 13.98% while LF nu increased 13.77% compared to CON (P<0.05), and LF/HF recovered within 30min post exercise (P<0.05). In BFR, LF nu increased 16.43% while RMSD, HF, Dm and Vc dramatically declined 39.92%, 15.41%, 37.34% and 48.85% respectively when compared to CON (P<0.01), so it took longer time to restore LF/HF balance (within 24 hours). Correlation analysis showed that RMSD was positively correlated with Dm (r = 0.65) and Vc (r = 0.62), respectively (P<0.05), while LF nu was negatively correlated with Dm (r = -0.57) and Vc (r = -0.59) (P<0.05). CONCLUSION: On the basis of low load resistance exercise, 40% BFR can withdraw vagal regulation, but sympathetic activity and parasympathetic balance can be enhanced when the restriction increased to 60%BFR. Peripheral muscular fatigue can just be obviously evoked in 80% BFR, and this fatigue is highly related to cardiac autonomic modulation. Therefore, we do not recommend 80% BFR for women with cardiovascular risk.
research reporting blood flow characteristics in the dominant and non-dominant limb in both males and females is lacking. PURPOSE: This study compared femoral artery occlusion pressure (AOP) and femoral artery blood flow characteristics at different percentages of AOP between both legs in males and females. METHODS: Participants in this study included 31 physically active and healthy males (n=18) and females (n=13) years of age. Blood flow in the superficial femoral artery (SFA) was measured using Doppler ultrasound and BFR was controlled using a Hokanson E20 Rapid Cuff Inflator with a 10 cm cuff placed on the upper thigh. After measuring the AOP of the SFA, blood flow was measured in a random order at 0%, 20%, 40%, 60%, 80%, and 100% of AOP. This was repeated in the opposite leg. Blood flow was recorded in absolute (mL/min) and relative terms (% unoccluded bloodflow).

RESULTS: There was significant difference (p=0.008) in the AOP in the dominant leg (234 vs 188 mmHg) and nondominant leg (206 vs 177 mmHg) between males and females, respectively. After accounting for differences in leg circumference (p=0.001), sex remained a significant (p=0.001) factor in accounting for differences in AOP. The difference in AOP between the dominant and nondominant leg in males (234 vs 206 mmHg) and females (188 vs 177) was not significant (p=0.123). At each of the occlusion pressures (0%, 20%, 40%, 60%, 80%, 100% of AOP), there were no differences in absolute or relative blood flow between males and females. The relationship between SFA blood flow at occlusion pressures between 0 and 100% of the AOP was curvilinear in both males and females. Blood flow at occlusion pressures between 40% and 80% of AOP was relatively constant. CONCLUSIONS: Significant differences in AOP in males and females can be attributed, in part to differences in leg circumference and sex. The curvilinear relationship between blood flow and occlusion pressure indicates that BFR during exercise can be equally effective a lower pressures (40% AOP) as at higher pressures (80% AOP).

PURPOSE: This study aimed to reveal whether the somatosensory input from lower limb and skin influences the transfer function from the aorta to the brain. METHODS: Thirty-nine healthy adults (39) were divided in an 1:1 ratio into two groups (control and experimental). The experimental group underwent 10 consecutive 6-min orthostatic stimulations with lower body negative pressure (LBNP) (-50 mmHg) while the control group remained supine. Hemodynamic response was monitored using non-invasive methods. RESULTS: HR was significantly higher, and SV and CO were significantly lower in the experimental group compared to the control group. Aortic pressure, stroke volume, cardiac output, CO, and cerebral blood flow velocity were also lower in the experimental group. The transfer function gain of the aortic pulse pressure to the CBFV was significantly lower in the experimental group compared to the control group. CONCLUSIONS: These results suggest that the aorta-brain admittance at the first harmonic is augmented by the LBNP stimulation but not altered by the somatosensory input from the lower limbs.

F-56 Free Communication/Poster - Vascular Function II

3262 Board #83 May 29 2:30 PM - 4:00 PM The Effect Of The Somatosensory Afferent On Hemodynamic Transmission From The Aorta To The Brain

Marina Fukuike, Tuskuba university, Ibaraki, Japan. (No relevant relationships reported)

Purpose: To examine whether the somatosensory input from lower extremities can affect hemodynamic transmission from the aorta to the brain during orthostatic stimulation.

Methods: Thirty-nine healthy adults (39) were divided in an 1:1 ratio into two groups (control and experimental). The experimental group underwent 10 consecutive 6-min orthostatic stimulations with lower body negative pressure (LBPN) (-50 mmHg and -50 mmHg) under following two conditions in random order: (1) placing feet on the board with short knee flexion (RESISTED) and (2) feet untouched using a harness (FREE) inside the LBPN chamber. Heart rate (HR), aortic pressure, stroke volume (SV), cardiac output (CO), and cerebral blood flow velocity (CBFV) from the middle cerebral artery were continuously recorded. Hemodynamic transmission (i.e., admittance) from the aorta to the brain was evaluated by transfer function analysis.

Results: HR was significantly higher, and SV and CO were significantly lower during -50 mmHg LBPN stimulation than baseline values irrespective of foot conditions. Aortic mean pressure and mean CBFV were not affected by the leg condition. In contrast, aortic pulse pressure and pulsatile CBFV were significantly reduced during -50 mmHg LBNP and the degree of reduction (from baseline to -50 mmHg LBPN) smaller in the RESISTED condition than in the FREE condition (aortic pulse pressure: -17 % vs. -35 %, P=0.047; CBFV: -15 % vs. -26 % vs. P<0.09, respectively). Transfer function gain increased at the first harmonic from the aortic pressure to the CBFV was not affected significantly by LBPN stimulation or the somatosensory input. The transfer function gain was significantly increased with LBPN (1.3±0.1 vs. 1.5±0.1 cm/s/mmHg, P=0.048) but did not differ by the somatosensory input.

Conclusions: These results suggest that the aorta-brain admittance at the first harmonic is augmented by the LBPN stimulation but not altered by the somatosensory input from the lower limbs.

From the evolutionary perspective, water immersion skin wrinkling (WISW) is the perceived water drainage to enhance grip in wet conditions. In modern medicine, it is a noninvasive test of limb sympathetic function and can be used to assess peripheral neuropathy. WISW occurs as sympathetically-mediated contraction of subcutaneous glomus bodies after perturbation of ion concentration in palmar sweat glands. This phenomenon has not been studied well and it is not clear if common demographic variations (e.g. age, sex, and adiposity) that impact overall cardio-autonomic health status also affect WISW. Purpose: The purpose of the present study is to determine if peak WISW is modulated by age, sex, and body adiposity, additionally, we addressed if this phenomenon is associated with osmotic reactions or edema. Methods: So far 12 apparently healthy adults (5 females) aged 34.5±17.6 years were studied. Participants hands were submerged in 40°C water for 30 minutes with degree of wrinkling being assessed via 5-point scale (0 to 4) at 10-minute intervals. Final ratings for digits 2-5 were summed and used to determine peak WISW with a score of 16 being the highest and 0 being the lowest possible scores. Additionally, hand and forearm volume were measured via water displacement before and after submersion to quantify hand volume expansion. Results: Peak WISW ranged from 5 to 16 with the mean (±SEM) score of 13.2±1.3. Peak WISW was moderately correlated with age (r=0.54), BMI (r=0.39), body fat percentage (r=0.51). Males demonstrated a greater degree of WISW with a mean rating of 16 compared with females with a mean rating of 9 (p<0.01). Hand and forearm volume did not change with water immersion (497±29 vs. 500±30 ml). Changes in hand and forearm volume were not associated with peak WISW (r=0.03). Conclusion: The preliminary results indicate that water immersion skin wrinkling varies widely with age, sex, and body adiposity and is not associated with edema or osmotic reactions.

Assessment of body water and compartmentalization is an important experimental outcome in many studies. Whole-body impedance spectroscopy permits assessment of body water and composition; however, the expense of commercially available systems can be prohibitive. Purpose: The purpose of this project was to develop an affordable, open-source, and precise system to perform whole-body impedance spectroscopy in rats. Methods: Commercially validated circuit components, as described in the literature, were evaluated and compiled. An impedance spectroscopy system was designed using KiCad. Simulation and modeling of the circuit and instrumentation output was performed using LTSpice. The software was developed using Python, Arduino IDE. The system includes an internal per measurement calibration system and a constant current supply. The system was tested using serially-diluted KCl cells and an equivalent thorax circuit (RRC circuit). Validation studies were performed in anesthetized rats (2% isoflurane in 95% O2, 5% CO2) rats in vivo (n=4, ~350 g). Results: The impedance spectroscopy system was based on a built-in Arduino-Mega and ADS1933 integrated circuit (Analog Devices) using open-source software. The system includes an internal per measurement calibration system and constant current supply, and was able to stably iterate through excitation frequencies from 1 to 300 kHz. Admittance data obtained from rats were plotted in a complex plane. After least-squared semicircular regression analysis, there were consistent correlations within rats (triplicate) and among individual rats (n=4) on consecutive days. Total costs of the system was less than $250. Conclusion: We developed an affordable (open-source) platform that precisely and repeatably provides whole-body impedance spectroscopy measurements in rats. The rat impedance results were qualitatively consistent with published data. This system can also be reprogrammed and reconfigured for use in other physiologic applications.

3263 Board #84 May 29 2:30 PM - 4:00 PM Arduino-based Impedance Spectroscopy: An Open-source Platform For Physiological Impedance Spectroscopy Measurements In Rats

Andrew L. Allison, Loriann M. Clark, William D. Howell, William L. Sexton, FACSM. AT&T Still University of Health Sciences, Kirksville, MO. Email: sa200988@atsu.edu (No relevant relationships reported)
Arterial stiffness is an independent risk factor for cardiovascular disease. Different measures of arterial stiffness have been used to assess the impacts of exercise training interventions. One of the primary problems faced by investigators conducting systematic reviews and meta-analyses is the lack of standardized methodology to evaluate and compare efficacies of the existing and newly conducted exercise interventions on arterial stiffness. The reference standard measure of arterial stiffness is pulse wave velocity (PWV) while other commonly-used methodologies are ultrasound-derived arterial compliance and distensibility. PURPOSE: To describe standardized equations to convert common ultrasound-based measures of arterial stiffness (arterial compliance, distensibility, β-stiffness index, elastic modulus) to local PWV. METHODS: We first conducted a literature search to derive conversion equations. For measures of arterial stiffness that conversion equations cannot be used, we generated regression equations using the accumulated dataset available in the laboratory. Subsequently, these equations were cross-validated in a well-controlled laboratory-based study, in which all measures of arterial stiffness were collected in 49 apparently healthy participants. RESULTS: The literature search revealed that some measures of arterial stiffness such as distensibility coefficient (DC) can be converted to local PWV using the Brannwell-Hill model (PWV = p[DC]-1) with an assumption of p=1059 kg/m3. Ultrasound-based measures of arterial stiffness were strongly and significantly associated with local PWV for Pearson r ranging from 0.74 to 0.99 (p<0.01). Converted local PWV using regression models were correlated with each other (r=0.73 to 0.99, p<0.01). The correlations between converted local PWV and directly measured carotid-femoral PWV ranged from weak to moderate correlations with the range of r from 0.08 to 0.41. CONCLUSION: Our findings indicate that commonly-used measures of ultrasound-based arterial stiffness can be converted to local PWV and can be compared with a reference standard measure. These conversions can be used in systematic reviews and meta-analyses to synthesize evidence across studies to detect effects.

BACKGROUND: Greater time spent in sedentary behaviour is associated with an increased risk of cardiovascular disease, type-2 diabetes, and mortality. Regularly interrupting prolonged sitting with 2-min low-intensity and 2-min moderate-intensity walking every 20 minutes without matching for energy expenditure has been shown to reduce resting blood pressure. However, little is known whether interrupting the prolonged sitting with 3-min low-intensity walking and 1.5-min brisk walking every 30 min when the energy expenditure of these trials is matched provides similar benefits on resting blood pressure. PURPOSE: To compare the effects of 1.5-min moderate-intensity walking every 30 minutes and 3-min light-intensity walking every 30 minutes on resting blood pressure in young men with central obesity when the energy expenditure of these trials is matched.

RESULTS: Sixteen East-Asian men with central obesity (mean age: 22.3 ± 4.2 years; body mass index: 29.9 ± 1.7 kg/m2; waist circumference: 100.3 ± 5.9 cm) completed three, 7-h laboratory-based trials in a randomised order: 1) prolonged sitting (SIT), 2) 3-min condition (mean ± SEM; 119 ± 2 mmHg, β-stiffness index: 3.5 ± 0.1, pulse wave velocity: 7.3 ± 0.2 m/s), and 3) 1.5-min condition (120 ± 2 mmHg) when compared with SIT condition (123 ± 3 mmHg, β-stiffness index: 3.6 ± 0.1, pulse wave velocity: 7.4 ± 0.2 m/s) but not in 1.5-min condition (120 ± 2 mmHg) when compared with β-stiffness index: 3.6 ± 0.1, pulse wave velocity: 7.4 ± 0.2 m/s). The energy expenditure of these trials is matched. Interrupting local PWV using regression models were correlated with each other (r=0.73 to 0.99, p<0.01). The correlations between converted local PWV and directly measured carotid-femoral PWV ranged from weak to moderate correlations with the range of r from 0.08 to 0.41. CONCLUSION: Our findings indicate that commonly-used measures of ultrasound-based arterial stiffness can be converted to local PWV and can be compared with a reference standard measure. These conversions can be used in systematic reviews and meta-analyses to synthesize evidence across studies to detect effects.

Glibenclamide (GLI), prescribed to Type II diabetes patients, enhances insulin release by inhibiting pancreatic K ATP channels. K ATP channels support maximal aerobic capacity (VO 2max) and blood flow during treadmill running in male rats. Whether high-intensity exercise tolerance (i.e. critical speed, CS) and muscle O 2 delivery-utilization (P O 2) is impaired, and whether sex differences exist in K ATP function, are unknown. PURPOSE We hypothesized that systemic inhibition of K ATP channels via GLI would decrease VO 2max and CS, while local inhibition would decrease contracting P O 2 and blood flow within fast-twitch oxidative (mixed gastrocnemius (MG)) and slow-twitch oxidative (soleus (SOL)) muscles with females (F) and F+OVX expression of the greatest reduction. METHODS: Male (n=12), female (n=10, proestrus) and ovarioctomized female (F+OVX, n=12) Sprague-Dawley rats and with and without GLI (10 mg kg -1 in DMSO i.p.), VO 2max and CS were assessed using state-of-the-art treadmill. Pre-treatment P O 2 was determined, before and after GLI superfusion (5 mg kg -1), via phosphorescence quenching (G4) in the exposed MG and SOL muscles during electrically-induced contractions and blood flow by fluorescent-labeled microspheres (15 μm). RESULTS: GLI decreased VO 2max in female (71.5 ± 1.0 vs 67.9 ± 1.5) and F+OVX (76.4 ± 1.4 vs 74.4 ± 1.4; p<0.05 for both) but not male (81.3 ± 1.0 vs 74.2 ± 1.0; p=0.05). CS was reduced equivalently in all groups (8-11%; p<0.05). GLI reduced MG blood flow (female: 49.9 ± 9 vs 34.5 ± 5; male: 50.0 ± 5 vs 35.4 ± 4) and P O 2 (female: 7.3 ± 0.5 vs 6.1 ± 0.5; male: 8.9 ± 1.1 vs 7.2 ± 0.5), but not SOL, of female and male rats (p>0.05). Conversely, in F+OVX, P O 2 was reduced in the SOL (14.5 ± 1.5 vs 10.2 ± 0.5).
Arterial stiffness (AS) has been shown to underpin the development and progression of many cardiovascular diseases. Regular exercise promotes favorable changes in arterial health; however, investigations on the impact of resistance training (RT) alone on AS have shown mixed results. Moreover, the frequency design in which an RT program is completed on a weekly basis (i.e., the ‘weekend warrior’ approach) may impact overall changes to arterial health.

PURPOSE: We sought to examine the dose response impact of RT frequency over a 4-week period on arterial stiffness and blood pressure in college-aged resistance trained individuals.

METHODS: Twenty-seven resistance trained males (n=16) and females (n=11) were randomized into three training groups differing in weekly RT frequency: a) 1-day (1D) per week (n=8), b) 2-days (2D) per week (n=9), or c) 3-days (3D) per week (n=9). Resistance training exercises included: dumbbell chest press, seated cable row, leg press, calf raise, lateral pulldown, seated shoulder press, seated leg extension, and prone leg curl. Exercises were completed either two (3D), three (2D), or six (1D) sets of 10 repetitions at 65% 1-repetition max, depending on group. Arterial stiffness indices (augmentation index (AIx75), pulse pressure (PP), and augmentation pressure (AP)) were measured at baseline, midpoint, and after completing the 4-weeks using the Sphygmocor XCEL. A two-way (group x time) ANOVA with repeated measures was employed to examine differences in AS indices between groups.

RESULTS: Total weekly load volumes were similar (p = 0.247). Without any negative or favorable impact on AS.

CONCLUSION: Given no differences between groups, a total weekly load volume of RT can be completed in a single weekly session or across multiple sessions without any negative or favorable impact on AS.
POST-OCCULUSIVE REACTIVE HYPEREMIA AS INDICATORS OF MICROVASCULAR FUNCTION

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BACKGROUND: Post-occlusive reactive hyperemia (PORH) is often used as a test of microvascular function. However, the method of PORH measurement and the reporting of PORH values varies widely between studies, from measurements on the skin or whole forearm to reporting peak or cumulative PORH values. As such, the optimal measurement and reporting of PORH values remains unclear.

PURPOSE: To compare whole-forearm and skin PORH between older adults with conditions typically associated with microvascular dysfunction (type 2 diabetes, T2D), macrovascular dysfunction (non-diabetic coronary artery disease, CAD) and healthy controls (no lesion or disease).

METHODS: We retrospectively analyzed data obtained from 13 T2D patients (61 ± 9 years, 6 M ; 7 W), 21 CAD patients (65 ± 9 years, 18 M ; 3 W) and 13 CTRL (65 ± 9 years, 7 M ; 6 W). Leg skin or whole-forearm cutaneous vascular conductance (CVC, laser-Doppler) were measured simultaneously with the cutaneous oxygen saturation (FVC, pulse oximetry) and pulse wave velocity (PWV).

RESULTS: Baseline FVC (P=0.84) and CVC (P=0.31) were similar between groups. Peak FVC was similar between groups (P=0.24), while ΔFVC tended to be reduced in T2D compared to CAD (P=0.06) and CTRL (P=0.07). FVC AUC was reduced in T2D compared to CTRL (P=0.03), while values in CAD did not differ from T2D or CTRL. Peak CVF (T2D, P=0.04; CAD, P=0.02) and ΔFVC (T2D, P=0.03; CAD, P=0.01) were reduced in T2D and CAD. There was a trend for CVF AUC to differ between groups (P=0.06). The different indices of PORH for a given measurement (forearm vs skin) were strongly correlated (r=0.755 to 0.906 between FVC descriptors, r=0.768 to 0.991 between CVC descriptors, all P<0.001). However, FVC indices of PORH weakly correlated with CVF indices (r=0.23 to 0.374, P=0.01 to 0.11).

CONCLUSIONS: Whole-forearm and skin PORH provide different information on microvascular function in older adults. A decreased PORH in the whole-forearm appears to be a feature of T2D and not CAD, while a decreased PORH in forearm skin seems to be detectable in both T2D and CAD.

Abstracts were prepared by the authors and printed as submitted.
difference in hemodynamic variables including systolic BP, diastolic BP and HR (p < 0.05 for all). In addition, PWV (HF vs. LF; 5.5 ± 0.5 vs. 5.3 ± 0.4 m/s) and AIX (HF vs. LF: 13.8 ± 8.8 vs. 6.5 ± 5.3) were not statistically different between groups (p = 0.05 for both) CONCLUSION: Although HF group exhibited significantly lower aerobic capacity, BFDP does not affect arterial stiffness in young casually active Hispanic males. Future study with more participants will be needed.

3278 Board #99 May 29 2:30 PM - 4:00 PM Impact Of Smoke Exposure On VO2peak And Arterial Stiffness In Wildland Firefighters: A Pilot Study Zachary Zeigler, Laura Verduzco, Peyton Greer, Devin Vigneault, Greta Gardner, Lourdes Herrera, Justin Mcelflesh, Trevor Nordin. Grand Canyon University, mesa, AZ. Email: zachary.zeigler@gecu.edu (No relevant relationships reported)

Purpose: Inhalation of wildfire smoke can cause reduced lung function, chest pain, fatigue, and depressed respiratory immune defenses. Those at increased risk for these adverse effects would be wildland firefighters (WLFF). Aerobic fitness is a key component of WLFF performance. Additionally, it is known that higher levels of aerobic fitness correlate with lower levels of cardiovascular (CV) morbidity and mortality. The impact of wildland smoke exposure on CV health among WLFF is unknown.

Methods: WLFF from the Arizona high country were recruited for this study. WLFF were asked to come to the lab at Grand Canyon University before and after their annual fire season. WLFF were asked to fill out a survey assessing the number of seasons they have actively engaged in wildland firefighting. Following anthropometric measurements, subjects had their carotid-femoral Pulse Wave Velocity (cfPWV) and VO2peak measured. Identical measurements were taken before and after fire season. Hierarchical regression was completed to assess the relationship between the number of fire seasons completed and VO2peak. Paired t-test was used for pre-post testing.

Results: Twenty-eight subjects completed initial testing while 22 returned for post-testing. Subjects were 31.0±5.7 yrs., with a BMI of 25.7±3.0 kg/m², systolic BP of 191.2±0.71 mmHg, and VO2peak of 43.7±2.8 mL/kg/min. VO2peak was correlated with height, age, and BMI. Subjects completed 9.4±1.2 fire seasons. Subjects increased their VO2peak (6.0±1 vs. 6.6±.7 m/s, P<0.042) and significant increases in cfPWV (6.0±1 vs. 6.6±.7 m/s, P<0.042) were seen following fire season. Conclusion: This pilot study suggests that the duration of a WLFF career may negatively impact CV health.

3279 Board #100 May 29 2:30 PM - 4:00 PM Exercise Mediates Epigenetic Suppression Of LTCC And BKβ Channel Expression In Mesenteric Arteries Of Hypertensive Rats Lijun Shi, Yanyan Zhang. Beijing Sport university, Beijing, China. Email: l_j_shi72@163.com (No relevant relationships reported)

Regular exercise is a lifestyle intervention for controlling hypertension and has an improving effect on vascular function. Voltage-gated L-type Ca2+ (LTCC) and large-conductance Ca2+-activated K+ (BKβ) channels are two principal mediators of vascular smooth muscle contractility and arterial tone. Exercise-induced LTCC and BKβ channel alterations in arterial myocytes may contribute to the improvement of vascular function in pathological conditions. However, the mechanism underlying the functional changes of these ion channels is still unclear but critical for understanding the mechanistic basis of reliable arterial performance. The role of DNA methylation in exercise-induced reprogramming of LTCC and BKβ channel expression is still unclear but critical for understanding the mechanistic basis of reliable arterial performance. Therefore, the present study aimed to investigate the effect of exercise training on the expression of the LTCC and BKβ channel proteins and the promoter DNA methylation in the mesenteric arterial myocytes of Zucker diabetic fatty (ZDF) rats.

METHODS: Two-week-old male SHR and normotensive Wistar-Kyoto rats (WKYs) were assigned into sedentary and exercise groups. Exercise groups were performed a moderate-intensity treadmill running (about 55%-65% of maximal aerobic velocity, 20 min/min, 0% grade, 60 min, 5 days/week). After 12 weeks, patch clamp study, Western blot, qPCR and bisulfite sequencing PCR were used to detect the LTCC and BKβ channel currents, protein expression and mRNA level of LTCC α1c and BKβ β1 subunits, DNA methylation level of α1c and β1 promoter region.

RESULTS: Exercise training significantly decreased the systolic blood pressure in both WKYS (139.5±0.48 vs. 132.3±0.56 mmHg, P=0.05) and SHRs (199.4±0.45 vs. 191.2±0.71 mmHg, P=0.05). Exercise inhibited hypertension-induced upregulation of LTCC (16.0±1.6 vs. 11.4±1.5 pA/pF, P=0.05) and BKβ (43.7±2.8 vs. 23.3±1.6 pA/pF, P=0.05) and decreased the density of mesenteric arterial myocytes by repressing LTCC α1c (2.8±0.3 vs. 1.7±0.2, P=0.05) and BKβα1 (1.7±0.3 vs. 0.8±0.2, P<0.05) subunit expression. DNA bisulfite sequencing PCR showed that chronic exercise increased CpG methylation at α1c (81.3±1.6 vs. 87.9±0.8%, P=0.05) and β1 (17.7±0.4 vs. 25.2±2.0%, P<0.05) gene promoter in SHR mesenteric arteries. CONCLUSION: Exercise suppresses LTCC α and BKβ channel function via hypomethylation of α1c and β1 subunits, which contributes to the restoration of mesenteric arterial function and vasodilation during hypertension.

3328 Board #101 May 29 2:30 PM - 4:00 PM Evaluation Of Functional Sympatholysis Occurring Within Contracting Skeletal Muscle Microvasculature In Humans Masashi Ichinose1, Mikie Nakabayashi2, Nozaki Kanichiro2, Shotaro Sasaki2, Yumie Ono3. 1Meiji University, Tokyo, Japan. 2Meiji University, Kanagawa, Japan. Email: ichinose@meiji.ac.jp (No relevant relationships reported)

The ability of contracting skeletal muscle to blunt sympathetic vasoconstriction, termed functional sympatholysis, is thought to contribute to supplying adequate blood to the exercising muscle despite increased sympathetic tone. However, previous studies in humans primarily investigated vascular responses of exercising limb as a whole that reflects not only responses of contracting skeletal muscles but also responses of inactive tissues such as skin, adipose and bones. PURPOSE: We aimed to more directly investigate the functional sympatholysis occurring within exercising skeletal muscle in humans. METHODS: In 26 healthy male volunteers, we examined the effects of acute sympathoexcitation by 90° forearm cooling at rest and during dynamic handgrip exercise at 10% and 30% of maximum voluntary contraction (10%Ex and 30%Ex), respectively. The handgrip exercises were continued 3 min and forearm cooling was applied at latter half of the exercise period. The subjects also performed handgrip exercises without forearm cooling as control conditions. We employed near-infrared diffuse correlation spectroscopy, an emerging optical technique for noninvasive measurement of deep tissue hemodynamics, to continuously measure the microcirculatory blood flow index (BFI) within the flexor digitorum superficialis muscle, the muscle primarily responsible for handgrip. RESULTS: The acute sympathoexcitation induced significant decrease in vascular conductance (BF1 / mean arterial pressure) at rest (baseline vs. forearm cooling: 1.00 ± 0.75 ± 0.03 AU, p < 0.05) and during 10%Ex (control vs. forearm cooling: 1.66 ± 0.08 vs. 3.2 ± 0.10 AU, p < 0.05), but not during 30%Ex (control vs. forearm cooling: 4.00 ± 0.56 vs. 3.66 ± 0.50 AU, p > 0.05). In addition, the percentage reduction in vascular conductance by forearm cooling was significantly decreased during 30%Ex compared to rest (-25.2 ± 2.5 vs. -4.9 ± 5.1%, p < 0.05). CONCLUSIONS: Our study demonstrated the functional sympatholysis occurring within the contracting skeletal muscle microvasculature in humans. Furthermore, our results revealed the clear intensity-dependent response such that mild exercise hardly interferes with sympathetic vasoconstriction, whereas moderate exercise substantially attenuates it.

3329 Board #102 May 29 2:30 PM - 4:00 PM Continuous Physical Activity Modulates Arterial Stiffening In Young People: A Prospective Longitudinal Observational Study Masato Nishiwaki1, Naoyuki Matsumoto2. 1Osaka Institute of Technology, Osaka, Japan. 2Prefectural University of Kumamoto, Kumamoto, Japan. Email: masato.nishiwaki@oit.ac.jp (No relevant relationships reported)

PURPOSE: Higher physical activity is well known to prevent age-related increases in arterial stiffness in middle-aged and older people. However, no data are available concerning prospective longitudinal studies between physical activity and arterial stiffness, especially in young people. Therefore, this prospective longitudinal observational study aimed to examine the effects of continuous physical activity on arterial stiffening in young people.

METHODS: The data of the longitudinal study analyzed from 79 normal healthy young men and women (19.2 ± 0.2 years at baseline). At baseline (pre) and after 4-year follow-up (post), arterial stiffness, which was measured by using Cardio-Ankle Vascular Index (CAVI) and regular physical activity levels, which were measured by using International Physical Activity Questionnaire (IPAQ), were assessed. At each time point, participants were classified as having high (H) or low (L) physical activity at each time point. Participants were classified as having high (H) or low (L) physical activity at each time point. Participants were classified as having high (H) or low (L) physical activity at each time point. Participants were classified as having high (H) or low (L) physical activity at each time point.

RESULTS: After follow-up period, in addition to body weight, body mass index, and blood pressure, CAVI values of all participants significantly increased (Pre, 5.7 ± 0.1 unit; Post, 6.1 ± 0.1 unit). There were no significant differences in baseline CAVI values across the groups (LL, 5.7 ± 0.1 unit; HL, 5.7 ± 0.1 unit; HH, 5.8 ± 0.1 unit). However, the changes in CAVI were significantly lower in HH group than in LL group (P < 0.05). The status of continuous physical activity increasing, significant decreasing trends were observed in CAVI (LL, 0.6 ± 0.1 unit; HL, 0.4 ± 0.1 unit; HH, 0.1 ± 0.1 unit; P < 0.05).
CONCLUSIONS: These findings indicate that age-related increase in arterial stiffness is observed even in young healthy people. However, continuous higher physical activity can prevent this age-related arterial stiffening in young people.

3282 Board #103 May 29 2:30 PM - 4:00 PM

The Diversity Effect Of Exercise On Endothelialfunction In Postmenopausal Women With ACE D/I Polymorphism

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(No relevant relationships reported)

PURPOSE: Increased incidences of cardiovascular disorder and metabolic syndrome particularly in postmenopausal women have set curiosity for the underlying factors. One potential mechanism by which endothelial dysfunction may promote early arterial stiffness is by causing estrogen deficiency. It is reported that physical exercise counteracts the occurrence of above disorders, while a few others show no change. The training response differs among individuals partly due to genetic composition. Angiotensin-converting enzyme (ACE) insertion/deletion (D/I) polymorphism relates to physical performance in athletes has been well-reported. The present study was to observe the effects of 12 weeks exercise (aerobic exercise and resistance training) on endothelial function in postmenopausal women with different D/I polymorphism of ACE gene.

METHODS: 122 postmenopausal women aged 45-75 years were randomly divided into aerobic exercise group (DII=65, DD=6) and resistance training group (DII=42, DD=9). Body composition, TC, HDL, LDL, endothelial function, endothelium-derived relaxing factor and contracting factor were analyzed.

RESULTS: TC, blood lipid abnormality rate, blood glucose and visceral fat in DI/II type were decreased more significantly after aerobic exercise compared with DD type. Aerobic exercise showed markedly positive effects in LDL, hyperglycemia, overweight/obesity, high body fat rate, abnormal waist-hip ratio and visceral fat in DI/II, while resistance training in LDL, blood glucose (5.34±0.73 vs 4.46±0.34mmol/l, P<0.01), waist-hip ratio and visceral fat (96.60±13.84 vs 61.33±8.65cm, P<0.05) in DD type. Aerobic exercise showed more obviously increased FMD (9.65±1.85 vs 11.001±1.99%, P<0.05), NO (68.31±4.67 vs 76.38±4.01umol/l, P<0.05), NO/ET-1 (0.91±0.16 vs 1.04±0.11, P<0.05) and decreased SBP (123.84±15.98 vs 109.89±13.56mmHg, P<0.05), DBP in DII than in DD type. Resistance training increased FMD (7.12±0.70 vs 9.56±0.78%, P<0.05), NO/ET-1 and decreased SBP, DBP, baPWV, ET-1. AngII more significantly in DD type than in DI/II type.

CONCLUSIONS: Exercise positively influences endothelial functions, independent of ACE D/I polymorphism; and DI/II carriers show a better response to aerobic exercise, while DD carriers to resistance exercise.

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Endothelial Function In Young Adults Reporting Histories Of Chronic Resistance Activity

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Endothelial dysfunction is a risk factor for cardiovascular disease (CVD) and is predictive of adverse events. However, endothelial function is rarely measured in apparently healthy young individuals who benefit from early detection. Chronic cardiorespiratory endurance (CRE) activity appears to improve endothelial function and decrease CVD risk, but the role of chronic resistance activity is less clear. The primary aim of this study was to describe endothelial function in young adults reporting histories of chronic resistance activity and minimal CRE activity.

METHODS: Eight males (23.8±2.2 yrs., 180.3±7.6 cm, 100.8±18.1 kg) and five females (24.6±3.1 yrs., 164.9±4.0 cm, 68.5±4.2 kg) volunteered for digital peripheral arteriolar toneometry (PAT) and a one-repetition maximum (1-RM) barbell bench press. Endothelial function was measured as the logarithmic function of the reactive hyperemia index (LnRHI). Absolute strength was measured as the highest 1-RM lift (kg), and relative strength was measured as the bench press to body weight ratio (1-RM in kg / body mass in kg). Before PAT, participants fasted for 4 h and forwent alcohol, tobacco, vitamins, and ergogenic aids for 8 h. Before the 1-RM, participants fasted for 3 h, forwent the aforementioned substances for 8 h, and abstained from vigorous physical activity for 12 h. Independent t-tests compared the LnRHI between sexes. Effect size was calculated as Cohen's d. Pearson's r evaluated the relationships between absolute and relative strength and the LnRHI. Alpha level was set to .05 for all statistical tests.

RESULTS: Males' LnRHI was significantly lower than females' (t0.36.0.12 vs 0.84 ± 0.22); (0.739) -0.462, p = .005, d = -2.61

and abnormal according to the manufacturer (LnRHI > 0.51 is normal and ≤ 0.51 is abnormal). There were significant, moderate, and negative correlations between the 1-RM and the LnRHI (r = -0.48, p = .03) and between the bench press to body weight ratio and the LnRHI (r = -0.66, p < .01). CONCLUSIONS: Endothelial function was lower in males than in females reporting chronic resistance activity and minimal CRE activity. Males who develop considerable upper-body strength via chronic resistance activity may exhibit endothelial dysfunction as young adults. More research is warranted.

3284 Board #105 May 29 2:30 PM - 4:00 PM

Vascular And Blood Flow Responses To Upper Limb Exercise In Individuals With Posttraumatic Stress Disorder

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(No relevant relationships reported)

The physiological manifestations of posttraumatic stress disorder (PTSD) have been associated with an increase in risk of cardiovascular disease (CVD) independent of negative lifestyle factors. Peripheral vascular dysfunction may be a mechanism by which PTSD increases CVD risk. PURPOSE: This study sought to determine if blood flow regulation and peripheral vascular function are altered during exercise in individuals PTSD when compared to age-matched controls. METHODS: Sixteen individuals with PTSD (10 women, 6 men; age 24 ± 4 years), and twenty-four age, and sex-matched healthy controls (CTRL); 15 women, 9 men, 24 ± 4 years, participated in the study. Upper limb vascular function and blood flow was assessed during rhythmic, progressive handgrip exercise (at rest, 3 and 6 kilograms (kg)) with Doppler ultrasound. Exercise involved maximal and submaximal intensity, with increased arterial pressure (MAP), brachial artery (BA) flow mediated dilation (normalized for BA shear rate), BA blood flow, and arm vascular conductance (VC) were quantified at each workload. RESULTS: Although no significance was noted in MAP, BA flow mediated dilation, or blood flow between groups, the PTSD group reported significantly lower VC at the highest exercise workload (6 kg - PTSD: 2.01 ± 0.9; CTRL: 2.87 ± 1.0 mL·min−1·mmHg−1; p<0.008), when compared to the CTRL group. CONCLUSION: Individuals with PTSD reported lower vascular conductance during upper limb arm exercise when compared to healthy controls. Further research is needed to determine if this finding translates to larger muscle mass exercise, potentially leading to exercise intolerance, as well as the potential mechanisms may be driving this dysfunction in individuals with PTSD, such augmented sympathetic activity during exercise and/or microvascular dysfunction.

3285 Board #106 May 29 2:30 PM - 4:00 PM

Impaired Cardiovascular Responses To Acute Exercise In Adults With Cerebral Palsy

Gustavo Aldama, Allison T. Bui, Ramon C. Ronquillo, Arekum J. Jensen. San Jose State University, San Jose, CA.

(No relevant relationships reported)

Cerebral palsy (CP) is a non-progressive and permanent neurological disorder leading to musculoskeletal dysfunction and immobility. A major clinical problem with CP is early development of cardiovascular diseases with increased rates of mortality. Due to the inevitability of motor dysfunction adults with CP can develop health risk factors, such as obesity and hypertension, at a higher rate compared to the general population. To date, the physiological basis for CP has not been established; how cardiovascular dynamics, such as heart rate (HR), blood pressure (BP), and blood flow (BF), are controlled in individuals with CP has never been identified. PURPOSE: To determine differential cardiovascular responses to acute dynamic exercise in adults with CP. METHODS: Total of ten adults with and without CP participated in the study. HR from ECG, beat-to-beat arterial BP from Finapres and brachial BP, and respiration via pneumotach were continuously measured before, during and after 2 minutes of dynamic handgrip exercise at 35% and 50% of maximal voluntary contraction. In addition, diameter, blood velocity, and flow of the brachial artery were measured using Doppler ultrasound on the contracting arm throughout the experiment. RESULTS: HR was significantly increased to exercise from rest in both groups with no group differences (258±11.8 vs. 250±11.8 bpm; p=0.06). Both CP groups had increases in BF during exercise compared to at rest (Δ132±22 control vs. Δ75±32 CP, ml/min). Mean BP was significantly increased to exercise from rest in all groups (190±13.9 vs. 184±13.1 mmHg p<0.001). Both CP groups had increased BP during exercise compared to at rest (Δ132±22 control vs. Δ75±32 CP, ml/min). Mean BP was significantly increased to exercise from rest in control; however, there were only minor changes in BP to exercise from rest in CP group (Δ72±1.6 control, Δ22±0.1 CP, mmHg). CONCLUSION: While HR and BP increased to exercise from rest in similar fashion, BP did not change to exercise in CP with CP. Our preliminary data indicate that other mechanisms, possibly peripheral vascular contribution from non-contracting limbs, may contribute to impaired BP response during exercise in CP. Supported by CASA RSCA Infusion, Central RSCA, and Undergraduate Research Grant, SJSU

Abstractions were prepared by the authors and printed as submitted.
BACKGROUND: Central Pulse Wave Velocity (PWV) is the gold-standard measure of arterial stiffness and an important clinical parameter for evaluating cardiovascular risk. It is well-established that hypertensive individuals have an exaggerated systolic blood pressure in response to exercise. Pulse pressure (PP) is an indicator of LV pulsatile ventricular (LV) mass in hypertensive individuals via exaggerated increases in blood pressure during aerobic exercise. Increased PP is associated with LV hypertrophy and dysfunction on PWV. It was hypothesized that endothelial dysfunction would increase PWV. METHODS: Twenty-two young, healthy adults (23.8 years [SD 4.1], 16 F, BMI 22.8 kg/m^2 [SD 2.8]) were recruited for Aim 2. Using Doppler ultrasound, cfPWV was measured using the foot-foot method on ECG-gated Doppler waveforms captured from the common carotid and superficial femoral arteries. hfPWV was measured using the R wave to the foot of the superficial femoral artery Doppler waveform. To induce change in cfPWV (Aim 2), the upper leg was occluded to 60 mm Hg. To estimate intra-individual associations between cpPWV and hfPWV (Aim 1), Pearson’s product moment correlation was used. To estimate intra-individual associations between change (cuff vs. baseline) in cpPWV and hfPWV (Aim 2), the repeated measures correlation package for R was used. RESULTS: There was a large positive correlation ($r = 0.72$, CI 0.48-0.86, P < 0.001) between hfPWV and cpPWV (Aim 1). There was also a large positive correlation between change in cpPWV and change in hfPWV ($r = 0.83$, CI 0.61-0.93, P < 0.001). CONCLUSION: The current findings indicate that cpPWV and hfPWV are strongly associated, and that change in cpPWV is strongly associated with change in hfPWV.

METHODS: Nine normotensive (NTN) and hypertensive (HTN) young adults aged 18-30 years, respectively, underwent a simultaneous assessment of Flow-Mediated Dilation (FMD) and Pulse-Wave Velocity (PWV) at baseline and immediately following 30min of an endothelial dysfunction protocol. FMD was measured to confirm the presence of endothelial dysfunction protocol. FMD was measured to confirm the presence of endothelial function, indicating that PWV could be a useful tool for assessing endothelial function changes.

RESULTS: There was a large association between FMD and PWV ($r = 0.60$, CI 0.33, 0.81). Following the endothelial dysfunction protocol, there was a moderate significant increase in PWV ($Δ = 3.10$, CI -4.15, -2.05, ES = -1.3) and a large significant decrease ($Δ = -3.10$, CI -4.15, -2.05, ES = -1.3) in FMD.

CONCLUSIONS: The validation of Flow-mediated Slowing as a measure of endothelial function is a potentially simple, automated and user-objective test for assessing endothelial function. FMS can be defined as the minimum pulse wave velocity (PWV_m) during reactive hyperemia.

PURPOSE: The purpose of this study was to determine the effects of acute endothelial dysfunction on PWV_m during reactive hyperemia.

METHODS: 22 young, healthy adults (23.8 yrs ± 4.1, 73% F, 22.8 kg/m^2 ± 2.8) underwent simultaneous assessment of Flow-Mediated Dilation (FMD) and PWV_m at baseline and immediately following 30 min of an endothelial dysfunction protocol. FMD is the current gold-standard test of endothelial function and was used to confirm endothelial dysfunction. Endothelial dysfunction was induced by increasing retrograde shear stress in the brachial artery via inflation of a pneumatic tourniquet to 75 mm Hg around the forearm. PWV was measured from the upper-arm to the wrist using an oscillographic-based device, and brachial FMD was measured using Doppler ultrasound. FMD (%) was calculated as the mean increase in diameter during reactive hyperemia, and PWV_m as the minimum pulse wave velocity during reactive hyperemia. Linear mixed models were used to assess baseline versus endothelial dysfunction changes in PWV_m and FMD, controlling for within-subject changes in mean arterial pressure. Inter-individual associations between baseline PWV_m and FMD were examined using Pearson’s product moment correlation, and intrapersonal associations between change (baseline vs. endothelial dysfunction) in PWV_m and change in FMD using the repeated measures correlation package for R.

RESULTS: The endothelial dysfunction protocol resulted in large effect size (ES) decrease in FMD ($Δ = -3.10$, CI -4.15, -2.05, ES = -1.3), and a moderate significant
MicroRNAs (miRs) are short noncoding RNAs that regulate gene expression post-transcriptionally. It is well documented that exercise improves endothelial function, possibly, by modifying flow-responsive miR expression (e.g. miRs-126*, -92-a and -21). MiR-126* is an anti-atherogenic miR that regulates vascular integrity, angiogenesis, and inflammation. Whereas, miR-92a and -21 are pro-atherogenic miRs that result in a reduction in endothelial nitric oxide synthase (eNOS) activity. 

**RESULTS**

MiR-92a targets the transcription factor Kruppel-like factor 4 (KLF4) leading to lower eNOS expression. Whereas miR-21 targets phosphatase and tensin homologue (PTEN) to inhibit activation of the PI3K/Akt signaling pathway involved in activating eNOS. While show that African Americans (AA) exhibit a lower grade of chronic systemic inflammation, exaggerated responses to inflammatory cytokines, and a higher prevalence of endothelial dysfunction compared to Caucasians (CA). PURPOSE: To investigate potential racial differences in miRs expression and downstream target proteins in activated endothelial cells (EC).

**METHODS:** Human Umbilical Vein Endothelial Cells (n=6 cells lines; 3 CA & 3 AA) were cultured under two conditions: Control or TNF-α (10 ng/mL) for 4 hours. Protein expression was measured for PTEN, KLF4, p-eNOS<sup>117</sup> and eNOS. Total RNA was harvested to measure miR-21, miR-126<sup>*</sup>, and miR92a. A two-way ANOVA was used to assess the effects of race and condition.

**RESULTS:** No racial differences were found in protein expression of PTEN, KLF4, and eNOS at baseline or with TNF-α stimulation. AA had lower p-eNOS expression (p=0.008) compared to CA ECs under both conditions. No racial differences were found in miR-126 and miR-21 in either condition. However, AA were trending towards higher miR-92a expression (p=0.07) compared to CA ECs under both conditions. 

**CONCLUSIONS:** Although we show significantly lower levels of p-eNOS and higher miR-92a expression in activated ECs of AA compared to CA, KLF4 protein levels were not significantly different. Therefore, the specific miRs studied do not explain the racial differences observed in endothelial dysfunction in an inflammation model. Future research should investigate potential racial differences in how miRs respond to high laminar shear stress, as an exercise metric.

The Hispanic population is at a high risk of developing cardiovascular disease (CVD), especially cerebrovascular disease. High blood pressure (BP) and inadequate BP regulation are related to future CVD events. Sympathoexcitatory stimulation through high intensity exercise temporarily increases risk of cardiovascular events and alters hemodynamics. It is unknown whether there is an ethnic difference in the regulation of BP and pulse wave characteristics—including forward or reflected pressure waves—between Hispanic and White populations. PURPOSE: To investigate the ethnic differences in BP and pulse wave characteristics measured with wave separation analysis in response to high intensity exercise. METHODS: 10 male volunteers (9 Hispanic; 23 ± 3 yr, 1 White; 21 yr) completed the study. Aerobic capacity was measured by indirect calorimetry and a treadmill graded exercise test (GXT). Brachial BP was measured by an automated BP monitor. Central hemodynamic variables and pulse waves were obtained at baseline, immediately after, and 3 minutes after high intensity treadmill exercise (GXT). Pulse waves were further separated into forward pulse height (FFH) and reflected pulse height (RH) for analysis. A 2 x 3 repeated measure analysis of variance was performed to investigate ethnic differences in BP and pulse wave responses to high intensity exercise. RESULTS: (See table 1) There were no significant ethnic differences in brachial systolic BP, brachial diastolic BP, aortic systolic BP, aortic diastolic BP, and central mean arterial pressure (p < 0.05 for all). Furthermore, FFH and RH were not statistically different between Hispanic and White males at rest and following high intensity exercise (p > 0.05). CONCLUSION:
Results suggest that blood pressure, forward and reflected pulse height exhibited similar at rest and following high intensity exercise in young, healthy, casually active Hispanic and white males.

Table 1. Blood pressure and pulse wave characteristic responses to high intensity exercise in Hispanic (H) and White (W) individuals

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Hispanic (H)</th>
<th>White (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>H: 124/78</td>
<td>W: 118/68</td>
</tr>
<tr>
<td>1 minute post</td>
<td>H: 134/82</td>
<td>W: 128/72</td>
</tr>
<tr>
<td>2 minute post</td>
<td>H: 134/82</td>
<td>W: 128/72</td>
</tr>
<tr>
<td>3 minute post</td>
<td>H: 134/82</td>
<td>W: 128/72</td>
</tr>
</tbody>
</table>

**Purpose:** To examine the influence of age and sex on non-invasive measures of oxygen consumption rate and microvascular reactivity. **Methods:** Seven young females (YF; mean ± SD, age = 20.9±2 y), 6 older females (OF; 57.5±10 y), 14 younger males (YM; 22.2±2 y), and 8 older males (OM; 59.5±5 y) visited the laboratory on one occasion during which skeletal muscle oxygen utilization and microvascular function were assessed following a 10-h fast using the near infrared spectroscopy with vascular occlusion test (NIRS-VOT). During the NIRS-VOT, tissue saturation (SO2) was monitored, and the rate of decrease in SO2 (Slope 1) during cuff inflation (i.e., ischemia) was quantified, as were the reperfusion magnitude (Repermag) rate of increase in SO2 (Slope 2), and the reperfusion area under the curve (SO2AUC) following cuff deflation. Two-way (age x sex) ANOVAs were used to examine the differences in Slope 1, Repermag, Slope 2, and SO2AUC among the YW, OW, YM, and OM. Means ± 95% CIs are reported. **Results:** There were significant age and sex effects for Slope 1 (p = 0.01 and 0.02, respectively), which was more negative (i.e., steeper) in males versus females (-0.132±0.012 vs. -0.108±0.015 %/s) and in the young versus older adults (-0.135±0.013 vs. -0.107±0.014 %/s). There was an age effect for Repermag (p < 0.001), which was greater in the younger than older adults (50.7±4.0 vs. 38.5±4.6%). While there was no effect of age on Slope 2, Slope 2 was steeper (p = 0.002) in males than females (1.71±0.24 vs. 1.06±0.34 %/s). Finally, there were age (p = 0.02) and sex (p = 0.03) main effects for SO2AUC, which was greater in males versus females (1228.5±148.8 vs. 960.1±178.9 %/s) and in the young versus older adults (1240.7±148.8 vs. 947.9±178.9 %/s). **Conclusions:** Overall, our results suggest that there are age and sex-related differences in skeletal muscle oxygen consumption rate and microvascular reactivity, as assessed using the NIRS-VOT technique. However, because the degree of tissue desaturation is the stimulus for subsequent reperfusion responses and the rate of desaturation was greater in the younger than older adults and in males than females, it is not clear if the differences in Slope 2 and SO2AUC reflect differences in microvascular reactivity, per se. Additional studies are needed to more fully explore this interplay.

**Purpose:** To examine the impacts of acute mitochondrial antioxidant intake on vascular function and exercise tolerance in patients with peripheral artery disease. **Methods:** Thirty-one individuals (14 females/17 males, 30±10 yrs, 24.7±3.2 kg/m2) free of cardiovascular disease, diabetes, and not using medications were enrolled. Subjective sleep habits were characterized using the Pittsburgh Sleep Quality Index to generate a composite score (PSQI score) ranging from 0 (better) to 21 (worse). Vascular health including brachial and aortic pressures, pulse pressure, and augmentation pressure (a measure of arterial stiffness) was quantified via arterial pressure waveforms. **Results:** Mean PSQI score was 4±3, where a score >5 is deemed to be “poor” sleep quality. Initial regression models for age, gender, body mass index, and PSQI score predicted (P<0.01) pulse pressure (31.2±5.9 mmHg) and augmentation pressure (24.2±3.7 mmHg). The final model including only significant predictors for pulse pressure (P<0.01, R2=0.36) included PSQI score (β=0.47, P<0.01) and BMI (β=0.38, P=0.02). Meanwhile, the final model for augmentation pressure (P<0.01, R2=0.31) included PSQI score (β=0.34, P<0.04), BMI (β=0.36, P=0.03), and gender (β=0.46, P<0.01). PSQI score was not associated (P>0.05) with brachial or aortic systolic (123±11 and 108±10 mmHg) or diastolic (76±9 and 77±9 mmHg) pressures. **Conclusions:** These data demonstrate that self-reported sleep habits, quantified via PSQI score, are related to indices of arterial stiffness (i.e., pulse pressure and augmentation pressure) in apparently healthy individuals. Large artery stiffening resulting from sleep deficiency may play a role in the development of hypertension and cardiovascular disease.

**Purpose:** To examine the impacts of acute mitochondrial antioxidant intake on vascular function and exercise tolerance in patients with peripheral artery disease. **Methods:** Thirty-one individuals (14 females/17 males, 30±10 yrs, 24.7±3.2 kg/m2) free of cardiovascular disease, diabetes, and not using medications were enrolled. Subjective sleep habits were characterized using the Pittsburgh Sleep Quality Index to generate a composite score (PSQI score) ranging from 0 (better) to 21 (worse). Vascular health including brachial and aortic pressures, pulse pressure, and augmentation pressure (a measure of arterial stiffness) was quantified via arterial pressure waveforms. **Results:** Mean PSQI score was 4±3, where a score >5 is deemed to be “poor” sleep quality. Initial regression models for age, gender, body mass index, and PSQI score predicted (P<0.01) pulse pressure (31.2±5.9 mmHg) and augmentation pressure (24.2±3.7 mmHg). The final model including only significant predictors for pulse pressure (P<0.01, R2=0.36) included PSQI score (β=0.47, P<0.01) and BMI (β=0.38, P=0.02). Meanwhile, the final model for augmentation pressure (P<0.01, R2=0.31) included PSQI score (β=0.34, P<0.04), BMI (β=0.36, P=0.03), and gender (β=0.46, P<0.01). PSQI score was not associated (P>0.05) with brachial or aortic systolic (123±11 and 108±10 mmHg) or diastolic (76±9 and 77±9 mmHg) pressures. **Conclusions:** These data demonstrate that self-reported sleep habits, quantified via PSQI score, are related to indices of arterial stiffness (i.e., pulse pressure and augmentation pressure) in apparently healthy individuals. Large artery stiffening resulting from sleep deficiency may play a role in the development of hypertension and cardiovascular disease.
Autism Spectrum Disorder (ASD) is a complex neurological disorder identified in early childhood and is characterized by impaired social interaction and atypical behaviors. Limited studies reported that children with ASD tend to have higher heart rate (HR) and blood pressure (BP) at rest compared to typically developing children (TDC). Previously, we reported that HR and blood flow (BF) did not alter while BP increased from rest to acute exercise in ASD. Thus, we thought that ASD may have impaired autonomic nervous system activity to differentially control HR and stroke volume (SV) to regulate BP through changes in cardiac output. PURPOSE: To determine autonomic and cardiovascular responses to acute dynamic exercise in children with ASD. METHODS: 36 adults, TDC and children with ASD participated in the study. HR from ECG, beat to beat arterial BP from Finapres and brachial BP, and SV from Modelflow, were continuously measured before, during and after 2 minutes of dynamic hand grip exercise at 60% of maximal voluntary contraction. Diameter, blood velocity, and flow of the brachial artery were measured using Doppler ultrasound on the contracting arm throughout the experiment. Time and frequency domains of HR variability indices were used. RESULTS: Mean BP was significantly increased to exercise from rest in all groups with no group differences (59.8±1.8 adults, 58.3±1.2 TDC, and 66.9±1.8 ASD, mmHg). HR was significantly increased to exercise from rest in adults and TDC; however, there was no change in HR to exercise from rest in ASD (51±1 adults, 57±1 TDC, and 63±1 ASD, bpm). SV was unaltered from rest to exercise in all groups. Both adults and TDC had similar increase in BP during exercise compared to rest (47±3 adults vs. 45±2 TDC cm/s); however, BF did not change from rest to exercise (4.6±0.2 ASD cm/s) in ASD. The tMODD and high frequency of HRV were similar in all groups while very low frequency HV was significantly lower in ASD. CONCLUSION: While HR and BF were altered to exercise in both adults and TDC groups in similar fashion, HR and BF did not change in ASD children indicating impaired autonomic and vascular function. Higher total peripheral resistance may contribute to increased BP during exercise in ASD children without a significant contribution of cardiac output.
3304  Board #125 May 29 2:30 PM - 4:00 PM
Effects Of Resistance Exercise Training On Estradiol, Gh, IGF-1, Dhea-s, And Blood Pressure In Postmenopausal Women With Stage 1 Hypertension
Jung-Jun Park1, Song-Young Park2, Kook-Eun Seo1, Liz Pekas3, Won-Mok Son4. 1Pusan National University, Busan, Korea. 2 republic of University of Nebraska at Omaha, Omaha, NE. Email: jjparkpnu@pusan.ac.kr

PURPOSE: Menopause is often accompanied by decreased estradiol, growth hormone (GH), insulin-like growth factor-1 (IGF-1) and dehydroepiandrosterone sulfate (DHEA-s) and increased blood pressure (BP), which may collectively increase risks for cardiovascular disease (CVD). It is important to combat the negative effects on estradiol, GH, IGF-1, DHEA-s, and BP in improving appropriate lifestyle interventions, such as exercise. We sought to examine the effects of resistance exercise training program on estradiol, GH, IGF-1, DHEA-s, and BP in postmenopausal with stage 1 hypertension.

METHODS: : Postmenopausal women (n=20) were recruited and randomly assigned to a resistance exercise group (EX, n=10) or control group (CON, n=10). The EX group performed a total-body resistance band exercise training program for 12 weeks. Levels of estradiol, GH, IGF-1, DHEA-s, as well as BP were assessed before and after 12 weeks

RESULTS: There were significant group by time interactions (p<0.05) for estradiol (Δ0.8±0.0), GH (Δ0.5±0.1), IGF-1 (Δ 5.7±1.2), and DHEA-s (Δ 10.4±5.5) which significantly increased (p<0.05), and systolic BP (Δ 3.0±1.7) which significantly decreased (p<0.05) after exercise training compared to no changes in CON. There were no significant differences (p>0.05) in diastolic BP after 12 weeks

CONCLUSIONS: These results indicate that resistance exercise training may be an effective, easily accessible, and cost efficient intervention for improving estradiol, GH, IGF-1 and DHEA-s and decline BP in postmenopausal women with stage 1 hypertension.

3305  Board #126 May 29 2:30 PM - 4:00 PM
Blood Flow And Arterial Stiffness In Amputated Subjects.
Anna Pedrinolla, Valentina Cavedon, Chiara Milanesi, Massimo Venturelli. University of Verona, Verona, Italy. Email: anna.pedrinolla@univr.it

(NO relevant relationships reported)

PURPOSE: To investigate arterial adaptations in amputated soccer players of the Italian National Amputated team.METHODS: Basal blood flow (BF, corrected for muscle volume), and pulse wave velocity (PWV) were measured in 11 amputated soccer players (35±13 years; 141.8 years from the amputation) of the Italian National Amputated team. BF and PWV of amputated limbs were compared with the non-amputated limbs. RESULTS: Basal BF was found to be reduced in amputated limbs compared with the contralateral non-amputated limbs (~30%, p<0.05). However, PWV was not found to be statistically different between amputated and non-amputated limbs (3%, p=0.32). CONCLUSIONS: Although an adaptation of basal BF seems to take place in amputated limbs. BW and PWV seems to be unaltered in the amputated side in national soccer players. Since PWV reflects cardiovascular risk and vascular adaptation, based on this results we can speculate that soccer training served as a good stimulus to maintain vascular health even in amputated subjects.

3306  Board #127 May 29 2:30 PM - 4:00 PM
Reliability Of Non-invasive Vascular Function Tests And Their Responsiveness To A High-fat Meal In Females
Emily M. Rogers, Nile F. Banks, Hannah F. Bryan, Claire M. Smith, Nathaniel D.M. Jenkins. Oklahoma State University, Stillwater, OK.

(NO relevant relationships reported)

PURPOSE: To examine the reliability of non-invasive assessments of micro- and macrovascular function and their responsiveness to a high-fat meal (HFM) in females. METHODS: During 2 visits (T1 and T2) separated by 28 ± 2 days, 11 women (age = 30.7 ± 17.2 y, BMI = 24.4 ± 3.1 kg/m²) consumed a standardized HFM (12 kcal/kg body weight; 63% fat) after a 10 h fast. Before (BL) and 3 h after the HFM, blood triglyceride (TG) levels were measured to quantify the lipemic response, and micro- and macrovascular function were assessed using the NIRS-VOT and FMD technique, respectively. During the NIRS-VOT assessment, the occlusion slope (Slope 1), the minimum tissue saturation (StO2MIN), the reperfusion slope (Slope 2), and the reperfusion area under the curve (StO2AUC) were calculated. Reliability was assessed on BL values using one-way ANOVAs, intraclass correlation coefficients, and standard errors of measurement reported as coefficients of variation (CV). We also examined the responsiveness of each of the assessments to a HFM, as well as the extent of the response by examining differences and relationships between the 3-h values at T1 and T2 for each of the variables.

RESULTS: The reliability of each of the variables is reported in Table 1. All variables demonstrated moderate to strong relative reliability, although the CVs for TG, StO2MIN and FMD were moderately high. Interestingly, only TG responded to the HFM at 3-h. There were also no differences between the 3-h values at T1 versus T2 for any of the dependent variables (all p > 0.05), which were statistically different (p = 0.06 - 0.72, p ≤ 0.04) related, except for StO2MIN and FMD (p = 0.46-0.47, p ≥ 0.16).

CONCLUSION: Each of the variables assessed displayed sufficient repeatability and were significantly (non-responding to a HFM before and after a 28-day period. Further, it appears that StO2MIN and FMD may display lower absolute reliability and studies may require greater sample sizes when using these as outcomes in intervention studies.

Previous research suggests that prolonged sitting attenuates vascular function. It is common for people to sit for prolonged periods of time in places such as offices and classrooms which are accompanied by mild hypercapnic conditions due to poor ventilation. However, the effects of prolonged sitting with mild hypercapnic conditions on vascular function has not been investigated. PURPOSE: The purpose of this study is to investigate the responses in heart rate (HR), blood pressure (BP), vascular function, and autonomic function in healthy young adults to a single bout of prolonged sitting in mild hypercapnic conditions. METHODS: In a randomized crossover design, 12 subjects (65±6% fat) sat for 2.5 hours in a control condition (PSIT) or a mild hypercapnic condition (HCAP; CO2=1,500 ppm). During each visit, HR, central and peripheral BP, brachial and popliteal artery endothelial function (flow-mediated dilation, FMD), arterial stiffness (pulse-wave velocity (PWV)), augmentation index (AIx)) and heart rate variability (HRV) were assessed before and after prolonged sitting. RESULTS: Both brachial and popliteal FMD were significantly reduced (p<0.05) in HCAP and PSIT, and the reduction in popliteal FMD was significantly greater in HCAP than PSIT (p<0.05). Additionally, there were trends for increased carotid-to-distal (cd) PWV (p=0.083) in HCAP compared to PSIT. HR was significantly reduced (p<0.05) and carotid-to-radial (cr) deceleration time (DT) and cdDT were significantly increased (p<0.05) in HCAP. There were also trends for reduced augmentation pressure (AP) (p=0.07) and LF/HF ratio (p=0.09). AP, AIx, AIx normalized to 75 beats per minute, and crAIx were all significantly reduced (p<0.05) in PSIT. There were no significant changes in BP and HRV in either group (p>0.05).

CONCLUSIONS: These results indicate that prolonged sitting in mild hypercapnic conditions attenuate endothelial function to a greater extent than prolonged sitting in normal atmospheric conditions. Our findings suggest that mild hypercapnic conditions in our daily life exacerbate the negative effects of prolonged sitting.
Chronic increases in arterial stiffness are associated with increased risk of cardiovascular disease. Estrogen (E2), the primary female sex hormone, has been shown to influence inter-individual differences in arterial stiffness over time, suggesting a need to investigate the mechanisms resulting in inter-individual variability in arterial stiffness. Future research is needed to determine the impact of menstrual phase on PWV.

METHODS: At the group level, arterial stiffness was not impacted by menstrual phase over two cycles. Individual changes in arterial stiffness were inconsistent, with phase changes in cycle 1 not reflecting phase changes in cycle 2. Variability in phase changes in arterial stiffness does not appear to be driven by inter-individual differences in E2 fluctuation across phase. Future research is needed to investigate the mechanisms resulting in inter-individual variability in arterial stiffness and inconsistency between cycles.

Supported by NIH NIAMS R01 AR072735 (to MDB) and ACSM NASA Space Physiology Research Grant (to SD).

F-57 Free Communication/Poster - Basic Science Applications in Skeletal Muscle

Our laboratory recently reported a significant decline in muscle-resident pericyte quantity following hindlimb immobilization, and subsequently demonstrated the capacity for pericyte transplantation to accelerate recovery of skeletal muscle mass during the rehabilitation period. PURPOSE: The purpose of this study was to determine the extent to which pericyte-derived extracellular vesicles (EVs) effectively recover skeletal muscle mass following hindlimb immobilization. METHODS: Two groups of donor mice (n=6/group) were used to isolate serum EVs before (“Pre”) and after (“Post”) an acute bout of contraction using a sciatic nerve stimulation procedure. Serum EVs were isolated using ultracentrifugation followed by magnetic bead sorting to isolate CD146+ EVs and CD146- EVs. Five groups of mice (n=4/group) were used to isolate serum EVs before (“Pre”) and after (“Post”) an acute bout of contraction using a sciatic nerve stimulation procedure. Serum EVs were isolated using ultracentrifugation followed by magnetic bead sorting to isolate CD146+ EVs and CD146- EVs. Five groups of mice (n=4/group) were used to isolate serum EVs before (“Pre”) and after (“Post”) an acute bout of contraction using a sciatic nerve stimulation procedure. Serum EVs were isolated using ultracentrifugation followed by magnetic bead sorting to isolate CD146+ EVs and CD146- EVs.

RESULTS: At the group level, PWV did not differ between phases (p=0.97) or cycles (p=0.58; FF ~8.1±1.0, LF ~8.1±1.1, EF ~7.9±1.4, LF ~8.0±1.3). Phase changes in EF were not associated with phase changes in PWV in cycle 1 (FC: r=0.38, p=0.20; FF: r=0.11, p=0.73) or cycle 2 (FF: r=0.38, p=0.36). Classification of individuals as responders or non-responders revealed that no participants were consistently positive or negative responders for both cycles. CONCLUSION: At the group level, arterial stiffness was not impacted by menstrual phase over two cycles. Individual changes in arterial stiffness were inconsistent, with phase changes in cycle 1 not reflecting phase changes in cycle 2. Variability in phase changes in arterial stiffness does not appear to be driven by inter-individual differences in E2 fluctuation across phase. Future research is needed to investigate the mechanisms resulting in inter-individual variability in arterial stiffness and inconsistency between cycles.

Funded by NSERC

3309 Board #130 May 29 1:30 PM - 3:00 PM The Impact Of CD146- Serum Extracellular Vesicles On Recovery Of Skeletal Muscle Following Hindlimb Immobilization

Svyatoslav Dvoretsky, Yu-Fu Wu, Christian Konopka, Gabriela Garcia, Eric Jung, Megan Kalinowski, Noah Kim, Lawrence Dobrucki, Marni D. Boppart, FACSM. University of Illinois at Urbana-Champaign, Urbana, IL.

Email: sdvore@illinois.edu

(No relevant relationships reported)

Our laboratory recently reported a significant decline in muscle-resident pericyte quantity following hindlimb immobilization, and subsequently demonstrated the capacity for pericyte transplantation to accelerate recovery of skeletal muscle mass during the rehabilitation period. PURPOSE: The purpose of this study was to determine the extent to which pericyte-derived extracellular vesicles (EVs) effectively recover skeletal muscle mass following hindlimb immobilization. METHODS: Two groups of donor mice (n=6/group) were used to isolate serum EVs before (“Pre”) and after (“Post”) an acute bout of contraction using a sciatic nerve stimulation procedure. Serum EVs were isolated using ultracentrifugation followed by magnetic bead sorting to isolate CD146+ EVs and CD146- EVs. Five groups of mice (n=4/group) underwent unilateral hindlimb immobilization for 14 days. At 14 days, the mice were intramuscularly (tibialis anterior) injected with 1 PBS, 2 CD146+ Pre EVs, 3 CD146+ Post EVs, 4 CD146- Pre EVs, or 5 CD146- Post EVs (40 µL of PBS), then remobilized for 2 weeks to determine therapeutic capacity. RESULTS: A significant decrease in serum CD146+ EVs was observed following 14 days of hindlimb immobilization (p<0.05). CD146-Post EVs demonstrated significant recovery of myofiber cross-sectional area compared to PBS control (p<0.05). CD146-Pre and CD146-Post EVs significantly restored capillary density compared to PBS control (p<0.05). CD146-Pre EVs recovered capacity for collagen remodeling compared to PBS control (p<0.05). CONCLUSIONS: The results from this study suggest that CD146- serum EVs positively benefit regrowth of skeletal muscle following a period of disuse. Additionally, CD146+ serum EVs enhance skeletal muscle capillarization. Overall, a combination of both EV fractions may optimize recovery of skeletal muscle mass following disuse. Supported by NIH NIAMS R01 AR072735 (to MDB) and ACSM NASA Space Physiology Research Grant (to SD).

F-58 Free Communication/Poster - Basic Science Applications in Skeletal Muscle

The Impact Of CD146 +/- Serum Extracellular Vesicles To Isolate CD146+ EVs and CD146- EVs.

Lindsay A. Lew, Kaitlyn R. Liu, Amanda C. Byrne, Tarrah S. Ether, Hashim Islam, Kyra E. Pyke. Queen’s University, Kingston, ON, Canada.

(No relevant relationships reported)

3310 Board #131 May 29 1:30 PM - 3:00 PM PHITE: Precision High Intensity Training Through Epigenetics

Jeremy McAdam1, Kristie Williams1, Craig Tuggle1, John Reams1, Brandon Peoples1, Grace Cunningham1, Gina Seay1, Derek Wiggins1, Christian Kelley2, Kaleen Lavin1, Inmaculada Aban1, Billy Tingle1, Michael Downes2, Jin Zhang2, Cesar Barragan2, Madhavi Kadakia2, Ron Evans3, Joseph Eckert4, Timothy Broderick5, Marcos Bamman, FACSM.1 University of Alabama at Birmingham, Birmingham, AL; 2Salt Institute for Biological Studies, San Diego, CA; 3Wright State University, Dayton, OH; 4Institute for Human & Machine Cognition (IHMC), Pensacola, FL. (Sponsor: Marcos Bamman, FACSM)

Email: jmcardam@uab.edu

(No relevant relationships reported)

Purpose: To investigate and mechanistically link acute molecular changes in the mRNA transcriptome and splice variant profile, miRNA profile, DNA methylation, and histone acetylation profiles to changes in performance from exercise training. PHITE will: (1) Reveal potential molecular mechanisms underlying training and detraining adaptations; (2) Differentiate molecular responses to moderate vs. high intensity training, and identify potential underpinnings of inter-individual response heterogeneity; (3) Perform a rigorous proof-of-concept epigenomic biomarker study that scales to and improves Navy physical training. Methods: This is an ongoing single-blind randomized trial of 18-27 y/o untrained adults. Participants are randomized to moderate or high intensity combined training 3 x wk x 12 wk, followed by a 4-wk detraining period. Participants perform an acute exercise bout at Wks 0 and 12 to assess acute molecular responses to exercise in untrained and trained states with serial biopsy specimens (muscle, blood) collections; repeated every wk of detraining. Performance/phenotyping at Wks 0 and 12 include aerobic power (VO2peak), strength, anaerobic power, explosive power, body composition (DXA), and phenotyping of blood and muscle. Because the trial is ongoing, randomized assignment remains blinded as groups A and B. Blinded phenotyping data were analyzed using repeated measures ANOVA for the effects of time (T), dose (A vs. B) and dose x time interaction.

Results: Phenotyping data on the first 11 completed participants confirm significant training effects and early indices of differential adaptations by exercise dose, along with substantial inter-individual response heterogeneity. Differential molecular responses mapping demonstrate sensitivity to exercise dose (A vs. B), timing of sample collection post-exercise, and training state (untrained vs trained vs detrained). Conclusion: Molecular response patterns to dose A vs. dose B share limited commonality, and differential responses across individuals provide novel preliminary evidence that dose-specific and individual-specific molecular response patterns may enable discrimination of adaptability.

3311 Board #132 May 29 1:30 PM - 3:00 PM Mitochondrial Biogenesis Is Dysregulated In Thyroid Hormone Depleted Muscle Cells Despite Stimulatory Effects Of Formoterol


(No relevant relationships reported)

Skeletal muscle (SKM) is an important regulator of metabolism and adaptations from exercise training influences mitochondrial function. Thyroid hormone (TH) is a regulator of SKM biogenesis, including mitochondrial biogenesis. PURPOSE: To use an in vitro model of hypothyroidism to test the hypothesis that SKM cells will have dysregulated mitochondrial homeostasis. Additionally, the exercise mimetic, formoterol, was used to determine the effects of exercise signaling on mitochondrial biogenesis. METHODS: Human SKM myoblasts (n = 6 per group) were cultured and differentiated until mature myotube formation (Day 4). Groups included control cells (CON), TH depleted cells (ThD), and TH depleted cells plus formoterol stimulation (ThD+F; 30nM for 3h). Total RNA was extracted during mid-myogenesis (Day 4) and at terminal differentiation (Day 6). Gene expression for Peroxisome

Abstracts were prepared by the authors and printed as submitted.
Proliferator-Activated Receptor Gamma Coactivator-1 Alpha (PGC-1α), Mitochondrial Transcription Factor A (TFAM), and Nuclear Respiratory Factor 1 (NRF1) was determined by qPCR. Data was analyzed by repeated measures ANOVA.

**RESULTS:** Significant differences between conditions and time points are detailed in Table 1.

**CONCLUSION:** ThD media resulted in reduced NRF1 signaling in both D4 and D6 with a subsequent decrease in D6 only for TFAM. Formoterol resulted in the expected stimulation of PGC-1α at both D4 and D6, but subsequent signaling for genes associated with mitochondrial biogenesis common to PGC-1α stimulation were lost as a result of TH depletion at D6 only for TFAM and both D4 and D6 for NRF1.

This work was supported by a Texas ACSM SRDA grant.

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**RESULTS:**

Effects Of Angiotensin Receptor Blockade On Overload-induced Muscle Growth And Function In Mice

Kimberly Huey, FACSM1, MacKenzie Tempey1, Zachary Conroy1, Ken Echevarria1, Rudy Valentine2. 1Drake University, Des Moines, IA. 2Iowa State University, Ames, IA.

Email: kimberly.huey@drake.edu

(No relevant relationships reported)

Delayed aging in various tissues has been observed for Snell dwarf mice (Pit1<sup>dw/dw</sup>) yet muscular performance has not been characterized for this model. PURPOSE: The purpose of the present study was to characterize muscle mass and performance following an initial SSC RTET stimulus are supported by altered TF methylation and expression in adult skeletal muscle. The molecular underpinnings of this response is unknown. Therefore, we sought to determine whether this TRT paradigm has positive effects on transcription factor (TF) methylation and expression in adult skeletal muscle. METHODS: F344xBN hybrid rats were SSC RTET on an in vivo dynamometer 3 days/week for 1 month at 3 months and again at 6 months of age (TRT), or just at 6 months (T). Gene expression and DNA methylation were quantified via PCR Arrays (Qiagen®). RESULTS: TRT group had 17 significantly differentially expressed genes (SDEGs) in the TF pathway, including Myf5; T expressed only 3 SDEGs. TRT had decreased TF methylation compared to NL at D4 (TRT: 55 ± 12 vs. 70 ± 12 pg/mg protein, for sham and FO, respectively, p<0.05). Myf5; T expression was increased with FO compared to sham, independent of treatment (Placebo: 53 ± 6 vs. 65 ± 10 pg/mg protein, for sham and FO, respectively, p<0.05).

**CONCLUSIONS:** The hypertrophic response to FO was attenuated with ARB in spite of greater IGF-1 and FGF responses compared to placebo. Comparing FO-associated changes in muscle force between treatments suggests ARB may positively impact muscle specific tension which could be associated with the augmented growth factor responses with ARB. Supported by Iowa Space Grant Collaborative Research Grant to KH and RV

**Purpose:** Recently, a training-retraining (TRT) paradigm in which 3 month old rodents underwent an initial cycle of SSC RTET followed by another bout at 6 months led to increases in isometric/dynamic peak force and muscle mass relative to naïve 6 month old rats, thus augmenting the trainability of muscle into adulthood. However, the molecular underpinnings of this response is unknown. Therefore, we sought to determine whether this TRT paradigm has positive effects on transcription factor (TF) methylation and expression in adult skeletal muscle. METHODS: F344xBN hybrid rats were SSC RTET on an in vivo dynamometer 3 days/week for 1 month at 3 months and again at 6 months of age (TRT), or just at 6 months (T). Gene expression and DNA methylation were quantified via PCR Arrays (Qiagen®). RESULTS: TRT group had 17 significantly differentially expressed genes (SDEGs) in the TF pathway, including Myf5; T expressed only 3 SDEGs. TRT had decreased TF methylation compared to NL at D4 (TRT: 55 ± 12 vs. 70 ± 12 pg/mg protein, for sham and FO, respectively, p<0.05). Myf5; T expression was increased with FO compared to sham, independent of treatment (Placebo: 53 ± 6 vs. 65 ± 10 pg/mg protein, for sham and FO, respectively, p<0.05).

**Conclusions:** Adaptive benefits at adulthood following an initial SSC RTET stimulus are supported by altered TF methylation and gene expression. These results advocate RTET at early life to preserve muscle as one ages through an epigenomic muscle memory.

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**REFERENCES:**

3312 Board #133 May 29 1:30 PM - 3:00 PM

Age-Dependent Skeletal Muscle Outcomes Following Resistance-Type Training Improve With Pit1 Mutation And Training Frequency M Odulation

Erik P. Rader, James Ensey, Marshall A. Naimo, Brent A. Baker. CDC/NIOSH, Morgantown, WV. (Sponsor: Stephen E. Alway, PhD, FACSM)

Email: yr5ccc@gov

(No relevant relationships reported)

Delayed aging in various tissues has been observed for Snell dwarf mice (Pit1<sup>dw/dw</sup>) yet muscular performance has not been characterized for this model. PURPOSE: The purpose of the present study was to characterize muscle mass and performance for 3 month old and 12 month old Snell dwarf mice in non-trained and resistance-type trained states. METHODS: Muscles of Snell dwarf mice and their wild-type littermates were exposed to 1 month of stretch-shortening contraction training. RESULTS: For non-trained muscles at both ages, muscles of Snell dwarf mice and their wild-type littermates were exposed to 1 month of stretch-shortening contraction training. Adaptive benefits at adulthood following an initial SSC RTET stimulus are supported by altered TF methylation and expression in adult skeletal muscle. The molecular underpinnings of this response is unknown. Therefore, we sought to determine whether this TRT paradigm has positive effects on transcription factor (TF) methylation and expression in adult skeletal muscle. METHODS: F344xBN hybrid rats were SSC RTET on an in vivo dynamometer 3 days/week for 1 month at 3 months and again at 6 months of age (TRT), or just at 6 months (T). Gene expression and DNA methylation were quantified via PCR Arrays (Qiagen®). RESULTS: TRT group had 17 significantly differentially expressed genes (SDEGs) in the TF pathway, including Myf5; T expressed only 3 SDEGs. TRT had decreased TF methylation compared to NL at D4 (TRT: 55 ± 12 vs. 70 ± 12 pg/mg protein, for sham and FO, respectively, p<0.05). Myf5; T expression was increased with FO compared to sham, independent of treatment (Placebo: 53 ± 6 vs. 65 ± 10 pg/mg protein, for sham and FO, respectively, p<0.05).

**CONCLUSIONS:** The hypertrophic response to FO was attenuated with ARB in spite of greater IGF-1 and FGF responses compared to placebo. Comparing FO-associated changes in muscle force between treatments suggests ARB may positively impact muscle specific tension which could be associated with the augmented growth factor responses with ARB. Supported by Iowa Space Grant Collaborative Research Grant to KH and RV

3313 Board #134 May 29 1:30 PM - 3:00 PM

Effects Of Angiotensin Receptor Blockade On Overload-Induced Muscle Growth And Function In Mice

Kimberly Huey, FACSM1; MacKenzie Tempey1; Zachary Conroy1; Ken Echevarria1; Rudy Valentine2. 1Drake University, Des Moines, IA. 2Iowa State University, Ames, IA.

Email: kimberly.huey@drake.edu

(No relevant relationships reported)

Muscle hypertrophy induced by functional overload (FO) provides an in vivo model to study muscle growth. Angiotensin II (ANG II) has been associated with muscle atrophy and reduced growth hormone levels while ANG II Receptor Blockers (ARBs) may protect against atrophy and restore insulin-like growth factor 1 (IGF-1) signaling. However, the effects of ARB during muscle growth is unclear. PURPOSE: It was hypothesized that ARB treatment would positively impact skeletal muscle growth as evidenced by greater hypertrophy, increased growth factor levels, and improved contractile function compared to placebo.

METHODS: Mice underwent FO of the plantaris or sham surgery. *In vivo* plantaris force and fatigue resistance (5% of max force after 10 contractions) were measured 14 days after FO or sham in mice receiving daily candesartan (6 mg/kg body mass) or placebo (n=7-9/group). IGF-1 and fibroblast growth factor (FGF) were measured in the plantaris by ELISA. Data were analyzed by 2-way ANOVAs.

RESULTS: FO increased plantaris mass in both groups; however, ARB attenuated hypertrophy compared to placebo (Placebo: 13 ±0.5 vs. 26 ± 2 mg and ARB: 13 ± 0.6 vs. 20 ± 1 mg; for sham and FO, respectively, p<0.05). Maximal force relative to body mass was unchanged with FO, independent of ARB. However, force tended to decrease only in placebo group with FO compared to sham. Fatigue resistance was increased with FO compared to sham, independent of treatment (Placebo: 53 ± 6 vs. 65 ± 5% and ARB: 48 ± 4 vs. 61 ± 4%; for sham and FO, respectively, p<0.05). Plantaris IGF-1 levels were increased with FO, with a significantly greater response in ARB than placebo (Placebo: 51 ± 7 vs. 79 ± 12 pg/mg protein and ARB: 36 ± 3 vs. 148 ± 17 pg/mg protein, for sham and FO, respectively, p<0.05). Plantaris FGF levels were increased in FO in ARB group only (Placebo: 788 ± 88 vs. 901 ± 88 pg/mg protein and ARB: 649 ± 31 vs. 1075 ± 104 pg/mg protein, for sham and FO, respectively, p<0.05).

**CONCLUSIONS:** The hypertrophic response to FO was attenuated with ARB in spite of greater IGF-1 and FGF responses compared to placebo. Comparing FO-associated changes in muscle force between treatments suggests ARB may positively impact muscle specific tension which could be associated with the augmented growth factor responses with ARB. Supported by Iowa Space Grant Collaborative Research Grant to KH and RV
of age—when mice became moribund. Muscle tissue was homogenized and analyzed for gene expression via RT-qPCR. Gene expression data were analyzed via Two-Way ANOVA, followed by a Fisher’s LSD post-hoc to determine between group differences when significant F-ratios were found. The relative frequency of tumor polyp size was analyzed via a Student’s t-test. Significance set at p<0.05.

RESULTS:
- Body weight for APC-NL mice was ~14% lower than both WT-NL and WT-L (p<0.05).
- Body weight for APC-L mice was ~25% lower than all WT, and ~13% lower than APC-NL (p<0.05).
- There were main effects of APC genotype and L supplementation for lower GA mass and GA/TL (p<0.05). In APC mice, there was a ~20% increase in the relative frequency of polyps <1mm in diameter, and a ~15% decrease in the relative frequency of polyps 1-2mm in diameter due to L supplementation (p<0.05).
- There was no difference in the relative frequency of polyps >2mm. There was a main effect for APC mice to have elevated expression of IL-6, IL-1β, Atox1, and Murf-1 when compared to WT mice (p<0.05).

CONCLUSION:
Surprisingly, leucine supplementation appeared to exacerbate cancer cachexia. Cancer cachexia has previously shown marked increases in skeletal muscle atrophy, commonly through atrophy and inflammatory related markers such as Atox1, Murf-1, IL-6 and IL-1β. Leucine supplementation may not influence these markers directly, but may alter the catabolic environment to induce greater overall wasting.

Table 1.

<table>
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Cancer cachexia is a syndrome characterized by weight loss, anemia, and skeletal muscle wasting. Muscle mass in males and females is a strong predictor of quality of life and morbidity during cancer treatment. Mitochondrial dysfunction during cancer-cachexia has been well described in males, specifically our laboratory has found mitochondrial deteriorations to precede muscle loss in male models of cachexia. However, if these aberrations are conserved between biological sexes has yet to be investigated.

PURPOSE:
To investigate muscle mitochondrial health during cancer-cachexia development in female mice. METHODS: ~40 female C57BL/6J mice were implanted with ~1X10⁶ Lewis Lung Carcinoma (LLC) cells in the right hind flank. Tumors were allowed to develop up to 4 weeks. After 3-4 weeks of tumor development, a clear dichotomy was noted in tumor burden. As such, tumor injected females were divided into high tumor (HT, tumor size > 2000 mg) and low tumor groups (LT, tumor size < 1300 mg). CON animals were age-matched to tumor mice and injected with phosphate buffered saline (PBS); therefore creating 3 experimental groups HT, LT, and CON (n=12-14/group). Mitochondrial health was measured by fluorescent histology of pMitoTimer. Results were analyzed by one-way ANOVA with Tukey’s post hoc when significant F ratios were found (p<0.05). RESULTS: Tibialis anterior, plantaris and gastrocnemius muscle masses were ~10%, ~11% and ~5% lower in HT compared to LT and CON. Analysis of pMitoTimer demonstrated no differences between groups. Circulating progesterone and estrogen were ~42% and ~60% lower in HT and LT animals compared to CON with no differences between HT and LT. CONCLUSION: HT had negligible muscle wasting when compared to HT, these differences in muscle loss did not correspond to alterations in mitochondrial health. This directly contrasts prior literature in male models of cancer-cachexia suggesting divergent mechanisms between males and females in the development of cancer-cachexia. As such, further examination of why females had a dichotomy in tumor development and subsequent wasting mechanisms are necessary in order to further understand mechanisms contributing to development of cancer-cachexia. This study was funded by the National Institutes of Health, Award: R15 AR069913/AR/NIAMS.
A New Muscle Disuse Model Using A Removable Tissue-engineering Muscle

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(No relevant relationships reported)

**Purpose:** Physical inactivity and subsequent skeletal muscle disuse may cause muscle atrophy, which is associated with a reduction in muscle function, physical performance, quality of life, and loss of independence, particularly in elderly. Traditionally, 2D muscle cell cultures (e.g. C2C12) have been used to study biological processes and identify and validate pharmacological and/or nutritional compounds to treat skeletal muscle disease including muscle atrophy. However, cell culture studies basically use a pharmacological method to induce muscle atrophy, and not an actual muscle disuse induced by a reduction of mechanical stress (i.e., mechanical unloading). Previously Nakamura et al. (2017) developed 3D engineered muscle (OITem: Osaka institute technology engineered muscle) with artificial tendons at both ends of the muscle, which is removable, thereby allowing us to mechanically release muscle tension by taking off (removing) one side of the muscle. Therefore, the purpose of the present study was to investigate whether removable tissue-engineering muscle effectively induce muscle disuse.

**Methods:** OITem was made from C2C12 skeletal muscle cells and a collagen gel and placed between two artificial tendons (Nakamura et al., 2017). OITem was differentiated for 2-weeks and then divided into two groups: 1-week stretched on control group (CON; n = 6) in which the both ends of the muscle fixed with tendons, and 1-week stretched off group (OFF; n = 6) in which the one side of the muscle was removed. We analyzed expressions of muscle atrophy-related proteins MuRF-1 and Atrogin-1, and myogenesis-related protein myogenin using Western blotting. As well, we analyzed expression of MHC-fast or -slow (fast- or slow-twitch muscle fiber specific myosin heavy chain (MHC), respectively).

**Results:** The protein expression of MuRF-1 array, and western was significantly lower in the OFF than those in the CON (P < 0.05). Moreover, the protein expression of MHC-fast and -slow was significantly lower in the OFF than those in the CON (P < 0.01). However, the protein expression of Atrogin-1 did not differ between two groups.

**Conclusions:** The present findings suggest that OITem may be useful model for muscle disuse.

**Abstract**

Extracellular matrix (ECM) remodeling in skeletal muscle is a potential mechanism linking obesity with metabolic dysfunction. It is also a constructive feature of skeletal muscle adaptation to exercise training. **Purpose:** To test the hypothesis that skeletal muscle ECM remodeling associated with insulin resistance, muscle atrophy, and thus is useful for muscle disuse model.

**Methods:** Male Sprague-Dawley rats were randomly divided into a control group (C, n=16) and a suspension group (T, n=40). Rats in the T group were suspended by a tail suspension system for two weeks. Rats in the C group were further divided into a post-suspension blank group (C1) and a post-exercise blank group (C2), and rats in the T group were further divided into a post-suspension control group (T1), a post-exercise control group (T2), an endurance exercise group (TA), a resistance exercise group (TR) and a combined endurance and resistance exercise group (TAR). Rats in the TA, TR, and TAR groups were subjected to exercise training for four weeks. Body weight and wet weight of gastrocnemius muscle were measured immediately after suspension or at 24 hours after the last training session. Protein expression levels of Muscle Ring Finger 1 (MURF1), Muscle Atrophy F-Box (MAFbx), Insulin-Like Growth Factor-1 (IGF-1) and Cysteinyl Aspartate Specific Protease 3 (Caspase-3) in gastrocnemius muscle were determined by western blot. Student t-tests and one-way ANOVAs were used for data analysis.

**Results:** After suspension, body weight and wet weight of gastrocnemius muscle in the T1 group were significantly lower than those in the C1 group (p<0.05 to p<0.001). After exercise intervention, body weight, wet weight of gastrocnemius muscle, and the protein expression levels of MAFbx in the TA, TR, and TAR groups were significantly higher than those in the T2 and C2 groups, the protein expression levels of Caspase-3 in the TA, TR and TAR groups were significantly lower than those in the T2 and C2 groups, and the protein expression levels of MuRF1 in the TA and TR groups were significantly lower than those in the T2 group (p<0.05 to p<0.01).

**Conclusions:** Exercise interventions, such as endurance exercise, resistance exercise, and combined endurance and resistance exercise, can effectively reverse disuse atrophy of gastrocnemius muscle in rats, which may be through altering the expression levels of several atrophy-related proteins.
time effect was found for FOXO3A. FOXO3A expression decreased at +12h (0.33 ± 0.07-fold) and +24h (0.25 ± 0.07-fold) from PRE. A trend was found for Becn1 (p=0.055) towards an increased in expression from PRE to +12h (1.94 ± 0.65-fold). A significant time effect was found for the AUC of cortisol with a greater AUC of cortisol for EX than CON.

Conclusion: These results suggest that the RE-induced hormone response can be important to the initiation of the phagophore after muscle damage in untrained young women.

### RESULTS

**CONCLUSION**

of the myogenic regulatory factors at both D4 and D6. Additionally, ThD+F resulted in the expression of both Myf5 and MyoD at both D4 and D6. CONCLUSION: These results suggest that the RE-induced hormone response can be important to the initiation of the phagophore after muscle damage in untrained young women.

**METHODS:** Human SKM myoblasts (n = 6 per group) were cultured and differentiated until mature myotube formation (Day 6). Groups included control cells (CON), TH depleted cells (ThD), and TH depleted cells plus formoterol stimulation (ThD+F). Total RNA was extracted during mid-myogenesis (Day 4) and at terminal differentiation (Day 6). Gene expression for myogenic regulatory factors (Myf5, MyoD, MyoG) was determined by qPCR. Data were analyzed by repeated measures ANOVA.

**RESULTS:** Significant differences between conditions and time points are detailed in Table 1.

**CONCLUSION:** TH depletion had no effect on MyoG but did reduce the expression of both Myf5 and MyoD at both D4 and D6. Additionally, ThD+F resulted in the lowest expression of MyoG and MyoD for both time points. These results indicate TH depletion and formoterol stimulation may inhibit myotube maturation.

This work was supported by a Texas ACSM SRDA grant.

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### PURPOSE

Osteoporosis is associated with reductions in muscle mass and regeneration. Although chronic inflammation and oxidative stress may play a role, the way in which these processes regulate catabolism in obese muscle is unclear. Since the catalytic subunit of the immunoproteasome (LMP7) is increased in muscle of other atrophic diseases, we sought to determine the impact of diet-induced obesity (DIO) on muscle mass, LMP7 protein content, and regeneration in response to exercise-induced muscle damage (EIMD) in mice. Intramuscular levels of pro- (CD11b and CD38) and anti- (CD206 and EGR2) inflammatory macrophages and oxidative stress (8-isoprostanate) were also assessed.

**METHODS:** Sixty male C57BL/6J mice (4 weeks old) were randomly assigned to either a high-fat diet (HFD, 45% fat) or lean diet (LD, 10% fat). After 12 weeks of feeding, the mice were randomly subdivided into EIMD or non-exercise, no muscle damage (NMD) control groups. EIMD was achieved via a downhill treadmill run at 13-14m/min for 68min. The gastrocnemius muscle (GS) was excised 1 or 5 d after EIMD, resulting in 6 experimental groups (n = 10/group) at study completion. **RESULTS:** Total body mass was greater (HFD 43.3 ± 6.5g vs LD 30.5 ± 6.5g, p < 0.000), however, GS mass relative to body mass was lower (HFD 4.1 ± 1.5 g/g vs LD 5.3 ± 1.1 mg/g, p < 0.000) in mice with DIO. Despite no change in pro- or anti-inflammatory macrophages (p > 0.5), GS oxidative stress was increased in mice with DIO (HFD 46.0 ± 5.1 pg/ml vs LD 29.2 ± 4.6 pg/ml, p < 0.029). Oxidative stress was enhanced 1 d post-EIMD, but only in DIO mice (HFD 77.9 ± 8.6 pg/ml vs LD 31.4 ± 3.3 pg/ml, p < .015). Muscle LMP7 was also elevated with DIO (HFD 3.6 ± 2.1 ng/ml vs LD 2.6 ± 1.1 ng/ml, p < 0.000), and increased 5 d post-EIMD (3.5 ± 2.1 ng/ml vs CON-NMD compared to NMD (2.7 ± 1.4 ng/ml, p < 0.000). However, the impact of LMP7 to EIMD did not differ between obese or lean mice (p < .504). When controlling for muscle damage group assignment, LMP7 was correlated with 8-isoprostane (r = 0.59, p = .027) and both markers were inversely correlated with relative GS mass (r = -0.48 (LMP7), 0.62 (8-isoprostane), p < 0.5). Muscle regeneration (myogenic differentiation protein) was unaltered by DIO (p = .741) or EIMD (p = .455). **CONCLUSIONS:** The immunoproteasome may be a critical link between obesity-induced oxidative stress and diminished muscle mass.

### RESULTS

**PURPOSE:** To use an in vitro model of hypothyroidism to test the hypothesis that SKM cells will have dysregulation in transcription factors regulating myogenesis. Additionally, the exercise mimetic, formoterol, was used to determine the effects of exercise signaling during myogenesis.

**METHODS:** Human SKM myoblasts (n = 6 per group) were cultured and differentiated until mature myotube formation (Day 6). Groups included control cells (CON), TH depleted cells (ThD), and TH depleted cells plus formoterol stimulation (ThD+F). Total RNA was extracted during mid-myogenesis (Day 4) and at terminal differentiation (Day 6). Gene expression for myogenic regulatory factors (Myf5, MyoD, MyoG) was determined by qPCR. Data were analyzed by repeated measures ANOVA.

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The regulation of gene transcription is essential for muscle adaptations resulting from endurance exercise training. Recent findings implicate hypoxia inducible factor 1α (HIF-1α) in this adaptive process as it regulates genes involved in O2 homeostasis and mitochondrial biogenesis. Exercise-induced improvements in skeletal muscle glucose metabolism follow a distinct time-course profile, with immediate increases in glucose uptake followed by improved insulin sensitivity. Molecular mediators controlling this temporal effect could be targeted to optimise the efficacy of exercise in preventing insulin resistance and associated metabolic abnormalities. PURPOSE: To characterise the transcriptional changes associated with time-dependent changes in glucose metabolism following muscle contraction. METHODS: C2C12 myotubes were exposed to either 24 h of contrac¬tive activity (electrical pulse stimulation; EPS) or rest (no EPS), followed by a further 0, 6, 18 or 24 h rest (no EPS). Temporal profiling of the contraction-mediated responses in functional (basal and insulin-stimulated glucose uptake) and transcriptional (RNA sequencing and bioinformatics) outcomes was evaluated at all time points. Data are presented as mean ± SEM. RESULTS: Compared to time-matched control cells (no EPS), contraction-mediated glucose uptake (i.e. without insulin) was increased 0 h post-EPS only (162.1 ± 28.5% relative to control, P<0.05), whereas insulin sensitivity was increased at 24 h post-EPS only (163.5 ± 35.2% relative to control, P<0.05). This distinct temporal profile for contraction-induced changes in muscle glucose metabolism was associated with a similarly distinct temporal transcriptional profile. Firstly, EPS-induced improvements in contraction-mediated glucose uptake (0 h post-EPS) and insulin sensitivity (24 h post-EPS) coincided with differential expression of 143 (76 up-regulated; 67 down-regulated) and 145 genes (75 up-regulated; 70 down-regulated), respectively. Notably, only 35 genes were differentially regulated at both 0 and 24 h post-EPS. Of these, only 20 were regulated in the same direction (e.g. miR-206, miR-207), with the remaining 15 oppositely regulated (e.g. miR-99a, miR-6790). CONCLUSION: Similar to exercise in vivo, our model of in vitro skeletal muscle contraction induced distinct temporal profiles for contraction-mediated glucose uptake and insulin sensitivity. These time-dependent changes in skeletal muscle glucose metabolism are associated with an equally distinct contraction-specific transcriptional profile. Supported by: The Physiological Society of musculoskeletal aging. Identifying a model to study muscular aging that mimics human conditions but in a shortened time frame, will potentially allow for effective screening and treatment interventions.

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Introduction: Cancer cachexia is characterized by severe muscle mass loss associated with increased autophagy. Unc-51 like kinase 1 (ULK1) plays a primary role in initiating autophagy. Under conditions of energetic stress, AMPK activates ULK1 at serine 555 to initiate autophagosome formation for removal of damaged proteins. Daily physical activity and feeding behaviors in mice exhibit diurnal fluctuations that can impact skeletal muscle ULK1 activation. Purpose: We investigated the effect of diurnal regulation of skeletal muscle ULK1 phosphorylation in tumor bearing mice. We also examined the impact of increased physical activity on skeletal muscle ULK1 phosphorylation. Methods: Free living male C57BL/6 (B6; N=24) and ApoE-/- (MIN; N=22) mice were single housed with wheel access. An additional cohort of B6 (B6;N=16) and MIN (MIN;N=19) mice were given wheel access for 2-weeks. To examine diurnal fluctuation, all mice were sacrificed at 7:00AM and 7:00PM under ad libitum conditions. ULK1 was measured in the gastrocnemius muscle as phosphorylation to total ratio at serine 555 by western blot. Results: Free living MIN mice exhibited body weight loss (p<0.001) and reduced gastrocnemius mass (p<0.001) and increased diurnal fluctuation in ULK1 phosphorylation, being increased at 7AM when compared to 7PM. This diurnal variation was not present in B6 or B6+W mice. Interestingly, regardless of sacrifice time ULK1 phosphorylation was inversely related to total wheel distance (R=-0.498; p<0.049). Conclusion: ULK1 demonstrated diurnal fluctuation in MIN mice but not in B6 mice. This change in ULK1 phosphorylation was associated to body weight loss and reduced activity. These data suggest that ULK1 phosphorylation is dependent on the time of day in the tumor environment, further research is warranted to examine if this induction of ULK1 is sufficient to induce autophagy.

Omi/HtrA2 is known to be a pro-apoptotic protein and also participates in the regulation of autophagy. Previous studies have found that curcuminic exercise can induce an increase in Omi/HtrA2 protein expression in damaged skeletal muscle cells. Omi/HtrA2-Hax-1/Beclin1, as the newly discovered autophagy signaling pathway in cells since 2010, has not been reported whether can be specifically expressed in injured skeletal muscle.

Purpose: This study was designed to explore the role of Omi/HtrA2 during autophagy in skeletal muscle induced by exercise injury. Methods: 168 SD rats were randomly divided into control group (C), dummy control group (D), ucf-101 group (E), exercise group (Ex) and exercise-ucf-101 group (Ex-E). The U group injected with ucf-101, a specific inhibitor of Omi/HtrA2; D injection of equal amount of normal saline;for group E with acute heavy load treadmill exercise, the slope was −16°, the speed was 16m/min, and the continuous exercise was 90 min;the EU group were randomly divided into control group (C), dummy control group (D), ucf-101 group (E) and exercise-ucf-101 group (Ex-E). These rats were sacrificed at 7:00AM or 7:00PM under ad libitum conditions. The expression of Omi/HtrA2 protein was decreased in the U group (0h,0.406±0.178,P<0.01), and a reduction in mitophagy, further supporting mitochondrial function in ET individuals. The binding levels of Hax-1 and Beclin1 protein was weakened(0h,0.805±0.095,P<0.05).The expression of Hax-1 and Beclin1 protein was weakened(0h,0.805±0.095,P<0.05).The expression of Hax-1 and Beclin1 protein was weakened(0h,0.805±0.095,P<0.05).
The effect of high intensity interval exercise (HIIT) combined with Vitamin E (VE) in the intervention of aging degeneration of skeletal muscle is still unclear. PURPOSE: In this study, the effects of 16-week HIIT intervention and VE supplementation on the mitochondrial autophagy related Ros-NFkB-Bnip3 pathway and the number of mitochondria in aged rat skeletal muscle were observed. To provide theoretical basis for delaying sarcopenia by means of exercise and nutrition.

METHODS: 60 male Wistar rats aged 8 months were randomly divided into the control group (C, n=20), the HIIT intervention group (H, n=20) and the HIT group supplemented with VE (EH, n=20) according to the random number table. H and EH adjusted the exercise intensity with the results of the VO2max test every two weeks. The HIIT group was given 25m/min and 5% grade exercise daily for 10 weeks. The VE was given orally according to 50mg/kg body weight every day at 1 hour before each training. Rats were taken from each group randomly at the basic state, week 8 and 16 for sampling. During sampling, the soleus muscle of rats was removed. The mitochondria were photographed using a transmission electron microscope, the fluorescence intensity of ROS was measured by Multifunctional enzyme marker, and the number of mitochondria in aged rat skeletal muscle were observed. To provide theoretical basis for delaying sarcopenia by means of exercise and nutrition.

RESULTS: At week 8, the number of mitochondrial in H and EH were increased (P=0.001, P=0.001), and was higher in H than in EH (P=0.036). At week 16, beclin-1 expression of soleus muscle in H increased (P=0.010). Although the content of NF-κB changed in each group, no significant difference occurred. At week 16, beclin-1 expression of soleus muscle in H increased (P=0.036). EH was lower than H and C (P=0.004, P=0.002). The expression of Bnip3 in soleus muscle in C increased at 8 weeks and 16 weeks (P=0.030, P=0.001). H increased at 8 and 16 weeks (P=0.001, P=0.001), and was higher in H than in EH (P=0.006, P=0.020).

CONCLUSIONS: The 16 week HIIT intervention and the combined effect of HIIT and VE to alleviate the reduction of mitochondrial number caused by aging may be due to the delayed protein expression of the Ros-NFkB-Bnip3 pathway in the soleus muscle of rats.
demonstrated increased expression of the senescence markers G0h1, CDKN1A and Trp53 while no satellite cells become senescent. These findings were confirmed in vivo through IHC analysis of SA-β-gal and markers of senescence (PGDF/Er), endothelial cells (CD31) and macrophages (F4/80). Importantly, senolytic treatment during regenerative myogenesis in vivo reduced the number of SA-β-gal+ cells by 44% which coincided with significant reductions in muscle fibre cross-sectional area (25%) and the number of nuclei/fibre (12%). **CONCLUSION:** A transient wave of cell death from senescent contributors to endogenous muscle repair to influence muscle fibre size following injury.

3334 Board #155
May 29 1:30 PM - 3:00 PM
Inhibiting Drp1-Mediated Mitochondrial Fission Attenuates High-Fat Diet Induced Skeletal Muscle Insulin Resistance
Benjamin A. Kugler1, Wenqian Deng1, Abigail Duguay2, Meaghan Nasta1, Kai Zou1. 1University of Massachusetts Boston, Boston, MA. 2Chengdu Sport Institute, Chengdu, China.
Email: Benjamin.Kugler002@umb.edu

(Dinmy related protein 1 (Dp1) is a critical mediator of mitochondrial fission. Recent studies have reported increased Drp1 activation in obese skeletal muscle, which is associated with reduced mitochondrial function and insulin sensitivity. **Purpose:** To determine if inhibiting Drp1-mediated mitochondrial fission by a pharmacologic inhibitor attenuates skeletal muscle insulin resistance induced by a high-fat diet (HFD) in mice. **Methods:** 6-week old male C57BL/6J mice (n=9/group) were assigned to either a HFD (45% Fat) or low-fat diet (LFD, 10% Fat) group for a total of 5-weeks. A subgroup of HFD-fed mice received intraperitoneal injections of Mitochondrial Division Inhibitor 1 (MDIVI-1) (20 mg/kg) while the other mice received saline every other day for the last week of diet intervention. A glucose tolerance test was performed after 4 hours of fasting. Twenty-four hours after the final injection, quadriceps and gastrocnemius muscles were collected for further analysis. H2O2 levels were detected using Amplex Red Hydrogen Peroxide kit. Insulin signaling and protein markers of mitochondrial dynamics were measured by immunoblot analysis.

**Results:** HFD significantly increased glucose area under the curve (AUC) than LFD mice (1097 ± 2137 vs. 1072 ± 1254; p < 0.05), but MDIVI-1 treatment attenuated glucose AUC of mitochondrial dynamics were measured by immunoblot analysis.

**Conclusion:** These data suggest that inhibiting Drp1-mediated mitochondrial fission attenuates skeletal muscle insulin resistance and improves whole-body glucose homeostasis in mice fed by HFD.

3335 Board #156
May 29 1:30 PM - 3:00 PM
Activation Of Specific Estrogen Receptor Isotype Mediates Skeletal Muscle Force Potential In Ovariectomized Mice
GENGYUN C. LE, Dawn A. Lowe, FACSM. University of Minnesota, Minneapolis, MN. (Sponsor: Dawn A. Lowe, FACSM)
Email: gle@umn.edu

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3336 Board #157
May 29 1:30 PM - 3:00 PM
Myogenic Regulatory Factor Expression Time Course Following Doxorubicin Injection In Rats Supplemented With Dietary Creatine
Raquel B. Buskekus, Brandon C. Jones, David S. Hydock, University of Northern Colorado, Greeley, CO.
Email: Raquel.Buskekus@uncouco.edu

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3337 Board #158
May 29 1:30 PM - 3:00 PM
The Mechanism Of Fam134b Mediated Endolysosomal Reticulum Autophagy In Skeletal Muscle After Heavy Load Exercise
Lunyu Li1, Haili Ding2, Quansheng Su1, Zaifang Ren1, Zenghao Huang2, Songlin Jin3. 1Chengdu Sport University, Chengdu, Sichuan, China. 2Chengdu Sport University, Chengdu, China. 3China-Japan Friendship Hospital, Beijing, China.
Email: leolly007@163.com

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RESULTS: (1) Compared with group C, the change rate of skeletal muscle protein expression in rats showed that ① CRT (2.08 ± 0.096* 1.325 ± 0.105” * E 1.395 ± 0.142” & E 1.315 ± 0.096”; HCR: 1.009 ± 0.052”); in group E, it was significantly increased at 12 h and 48 h after exercise, 96.7% and 50% respectively. ② LCR: 1.376 ± 0.132” 1.799 ± 0.063” 0.562 ± 0.063” 1.659 ± 0.084” 1.300 ± 0.067” ; it was significantly increased in Group E from 0 h to 72 h after exercise. (2) The results of CO location of fam134b and CRT, and co-location of LC3 and CRT showed that compared with group C, group E significantly increased from 0 h to 48 h after exercise. CONCLUSIONS: The expression of fam134b and CRT in ER increased and co-located with CRT after heavy load exercise, indicating that fam134b may be involved in the occurrence of ER autophagy after heavy load exercise.

However, LC3II ratio 3 hours post-exercise was different between HIIT (108.1 ± 54.5%) and MICT (64.3 ± 47.5%; p < 0.05) in skeletal muscle. There were no differences in LC3II in PBMCs between HIIT and MICT. Our findings show that HIIT and MICT exercise results in distinct changes in autophagy flux as suggested by LC3II in human skeletal muscle, but not in PBMCs. Our data suggest that the autophagy response to acute exercise in skeletal muscle and PBMCs are dissimilar which may indicate that distinct exercise thresholds exist.

Differential expression of Myosin Heavy Chain (MHC) isoforms in skeletal muscle determines its metabolic and functional characteristics. Endurance exercise training is associated with fast-to-slow MHC isoform transition, and which is considered to mediate the beneficial effects of exercise on metabolic health. Rats genetically bred for low-capacity running (LCR) and high-capacity running (HCR) were characterized to determine whether HIIT and MICT exercise results in distinct changes in autophagy in skeletal muscle and PBMCs using western blot analysis. The results show that HIIT and MICT exercise results in distinct changes in autophagy in skeletal muscle and PBMCs.

PURPOSE: By observing HIIT group rats and MICT group rats’ changes in the timing and content of AMPK and PGC-1α in skeletal muscle, changes in aerobic capacity given the same load and training time and then stop the training. To provide a reasonable arrangement of retraining programs. METHODS: 27 4-month-old male Wistar rats were randomly divided into 3 groups (N=9): control (Group C), MIT (Group M), HIIT (Group H). C do not exercise, H training at 50%-70%-90% VO2max for 50min/day, 5 days/week for 6 weeks of training. Both H and M were performed for 5min/day, 5 days/week for 6 weeks of training. Rats were randomly selected from 3 groups on the 1st, 3rd, 5th, and 10th day after the training was stopped. They were intraperitoneal injection with 5% chloral hydrate to get soleus muscle. Using western blot analysis, the expression of AMPK and PGC-1α in skeletal muscle was quantified using reverse transcriptase polymerase chain reaction (RT-PCR), and standardized to the 18S rRNA content in muscle. Differences between groups were calculated using the comparative CT method (2^-ΔΔCT). CONCLUSIONS: The expression of mRNA of the MHC isoforms differed between groups. The results indicate that HIIT and MICT exercise results in distinct changes in autophagy in skeletal muscle.

Abstracts were prepared by the authors and printed as submitted.
MEDICINE & SCIENCE IN SPORTS & EXERCISE®

The content of AMPK (related)

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<th>Group H</th>
<th>Group M</th>
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<td>1.50±0.26</td>
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<tr>
<td>10 days</td>
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The content of PGC-1α (related)

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<tr>
<td>10 days</td>
<td>0.84±0.24</td>
<td>1.02±0.26</td>
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**PURPOSE:** Notch signaling is a prominent pathway necessary for repair of injured muscle. The interactions of Notch with other signaling pathways, specifically mechanistic/mammalian target of rapamycin (mTOR), in regulating myogenesis is not well known. Studies have been conducted on Notch inhibition, but little research has been performed on activated Notch and the interactions with mTOR. This study was implemented to develop a Notch force activation protocol and to measure the effect of overexpressed Notch on C2C12 proliferation, differentiation and mTOR signaling.

**METHODS:** Notch signaling was force activated via suspension or adhesion. For suspension, Notch-1 antibody was introduced to a 12-well plate with C2C12 cells at a concentration of 1:10. For adhesion, Notch ligand, Delta-like Ligand 1 (DLL1), was mixed with Extracellular Matrix (ECM) and coated on a 12-well plate at different concentrations (control, 2.5ug, 5ug, and 10ug) for 12 hours. C2C12 cells were seeded at a concentration of 15,000 cells/well and differentiated for 96 hours. Following designated time period, lysates were collected for Western Blots. Primary antibodies probed for Notch (Hes1), total mTOR signaling (pT OR), and β-actin. Results: Preliminary data for suspension was analyzed via a two-way ANOVA (time x treatment). There is a significant difference in percent change of proliferation at 48 hours (p=0.02). Preliminary data of adhesion was analyzed via one-way ANOVA. There is a trend between Hes1 concentration in ligand differentiation of 2.5 ug (p=0.0739). It shows no significant difference in TN5OR concentrations between the various Notch force activation concentrations in proliferating C2C12 cells (p=4298).

**CONCLUSIONS:** Preliminary data shows a stronger effect of suspension over adhesion for force activating Notch. A concentration of 2.5ug of ligand is possibly sufficient to force activate Notch, any higher appears too concentrated to activate Notch. Preliminary data also suggests that force activating Notch does not affect mTOR signaling. Experiments are currently testing the ideal DLL1 to activate Notch signaling, as well as examining the effect of force activating Notch on proliferation, differentiation and other markers of mTOR signaling. Different time points for differentiation should be tested in future research.

**EXERCISE MODIFIES K_ATP CHANNEL KIR6.X SUBUNITS EXPRESSION IN SLOW-TWITCH AND FAST-TWITCH MUSCLES OF DIABETIC RATS**


Email: ea.villicanagomez@ugto.mx

(No relevant relationships reported)

Diabetes Mellitus (DM) and the associated hyperglycemic state may adversely affect muscle, which has been called diabetic myopathy. In skeletal muscle, ATP sensitive potassium (K_ATP) channels link metabolic cell state and electrical excitability. It has been reported that DM is associated with a K_ATP channel dysfunction, reducing their protective role in preventing fiber damage and contractile dysfunction. While regular exercise can improve hyperglycemic status in DM, its impact on the expression of K_ATP channels subunits is unknown, and could vary in different types of muscle.

**PURPOSE:** To assess the effect of regular exercise on mRNA expression of the K_ATP channel Kir6.x subunits (Kir6.1 and Kir6.2) in slow-twitch and fast-twitch muscles of streptozotocin-induced diabetic rats.

**METHODS:** Male Wistar rats (25 days old) were randomly divided into four groups: sedentary control, trained control, sedentary diabetic, trained diabetic. Diabetes was induced by a single streptozotocin injection (100 mg/kg body weight), animals with fasting blood glucose levels ≥ 300 mg/dL were considered as diabetic. Groups with training program performed exercise on a treadmill (30 minutes daily, 5 days/week) for 8 weeks. At the end of the intervention, gastrocnemius (fast-twitch) and soleus (slow-twitch) muscles were dissected and real-time quantitative PCR experiments were performed to quantify Kir6.1 and Kir6.2 expression.

**RESULTS:** In control conditions, the regular exercise increased Kir6.2 subunit mRNA levels significantly in slow and fast muscle (60 ± 13.49% and 132±43.81%, respectively), while Kir6.1 mRNA levels did not differ, respect to sedentary control group. In diabetes, relative mRNA expression of the subunit Kir6.1 were significantly higher in both muscles (229.7% and 152%), whereas the mRNA levels of Kir6.2 were downregulated only in slow muscle by 66.8%. These effects were counteracted by the exercise, Kir6.1 expression was decreased in slow and fast muscle (47.28 and 47.57%, respectively), instead the expression of kir6.2 was increased in both muscles.

**CONCLUSION:** Our results indicate that regular exercise modifies the gene expression patterns of Kir6.x subunits during diabetes, by increases the expression of Kir 6.2 subunits and regularizes Kir6.1. These effects are dependent on muscle fiber type.

**MiRNAs As Possible Predictors For Training Efficacy**

Manuel Widmann1, Felipe Mattioni Maturana1, Ansgar Thiel1, Andreas M. Nieß2, Barbara Münz2. 1University Hospital Tübingen, Tübingen, Germany. 2Institute of Sports Science, Tübingen, Germany.

(No relevant relationships reported)

Recent research suggests that genes encoding micro RNA (miRNA) molecules are differentially expressed in response to training.

**Purpose.** To determine whether specific miRNAs serve as possible predictors for training efficacy.

**Methods.** In healthy, sedentary female subjects (mean ± SD: age 23.2 ± 3.1 years, peak oxygen uptake (VO2peak) 31.7 ± 1.6 mL·kg⁻¹·min⁻¹, body mass index 23.0 ± 1.2 kg·m⁻²), aged between 20 and 27 years, performed exercise training on a cycle ergometer, three times a week, for 6 weeks. Participants were randomly assigned to either moderate intensity continuous training (MICT, n=3) or high intensity interval training (HIIT, n=3). The MICT group performed 60 min of continuous cycling at the power output (PO) calculated as corresponding to 90% of the first lactate threshold (LT). The HIIT group performed a warm-up for 10 min at the PO calculated as corresponding to 70% of the maximal heart rate (HRmax), followed by four 4-min intervals at the PO calculated as corresponding to 90% of HRmax, with 4-min recovery periods at 30 W in between. Muscle biopsies were taken pre- and post-training from the vastus lateralis muscle, followed by isolation of total RNA. Samples were then analyzed using a commercial miRNA array.

**Results.** Participants increased their VO2peak after 6 weeks of training by 4.2 mL·kg⁻¹·min⁻¹ in mean (SD: 0.9). MICT and HIIT induced significant changes in miRNA expression patterns, part of which were specific for one of the two training regimens. For instance, there was a significant (p<0.006), 5.5-fold upregulation of the anti-apoptotic miRNA 21-5p in both training groups. Furthermore, we could identify distinct shift in miRNA patterns that correlated with exercise-induced changes in physiological parameters, such as changes in VO2peak (delta VO2peak vs delta expression of miRNA 503, r=-0.9, p<0.01) or microvascular properties.

**Conclusions.** Our data suggest that MICT and HIIT exert distinct, but also overlapping effects on miRNA expression patterns. In addition, basal miRNA expression patterns might be associated with the individual response to training. Furthermore, the data are currently reproduced using semi-quantitative RT-PCR (qPCR). Our results might have important implications for the development of personalized exercise recommendations and therapeutic strategies.

**EFFECT OF FORCE ACTIVATION OF NOTCH SIGNALING ON MITOCHONDRIA**

Julia R. Rebello1, Joshu R. Huot2, Joseph Marin01, Cassandra Beach1, Jeffrey Gerrard, Kendra Morris3, Matthew Bomkap4, Nicole Stott1, Susan T. Arthur1. 1UNC Charlotte, Charlotte, NC, 2Indiana University School of Medicine, Indianapolis, IN, 3University of Florida, Gainesville, FL.

(No relevant relationships reported)
The cause is unknown but could be related to the immune cell infiltration.

CONCLUSIONS: however, the lateral gastrocnemius exhibited signs of inflammation with no necrosis.

revealed an 88% decrease in the number of skeletal muscle fibers with a corresponding and functions but relatively little about the specificity and response is known.

PURPOSE: Collagen is the most abundant protein in the body and functions to provide the mechanical strength of connective tissues. In muscle, collagen fibrils function both to hold muscle fibers together and transmit force laterally between fibers. With aging, force transmission is reduced; however, how changes to specific collagen isoforms or the matrix orientation contribute to force loss is currently unclear. The current study was designed to compare lateral force transmission in the gastrocnemius muscle of young and old people with changes in specific collagen proteins and the orientation of the matrix.

METHODS: The calf strength of 12 subjects, 5 between 18 and 30 years old and 7 over the age of 65, was measured with an MRI. Images were taken to determine lateral force transmission. Following strength testing, biopsies were obtained under local anesthetic from the gastrocnemius muscle. Biopsies were pinned to cork at resting length and frozen in isopentane cooled in liquid nitrogen. Cross-sections were taken to determine collagen I, III, IV, and V content, whereas longitudinal sections were stained with picrosirius red to determine matrix orientation. The collagen IV image was also used to determine muscle fiber cross-sectional area (CSA).

RESULTS: Collagen I and V were evenly dispersed throughout the cross-sections, whereas Collagen IV and VI were densest around individual muscle fibers. Collagen IV content was similar in young and old. As expected, fiber CSA tended (p = 0.61) to decrease in the old subjects. Picrosirius red staining showed that the collagen matrix is oriented at a 22.3±3.1% angle to the fibers in young and 30.2±8.7% in old subjects.

CONCLUSIONS: Preliminary data suggests that, in the old, fiber CSA decreases and the extracellular matrix becomes less aligned. By establishing the role of specific collagen proteins during aging, we hope to better understand the relationship between the extracellular matrix and force transmission in muscle and how this relationship is modified by age.

There are very rare reports in the biomedical literature of entire human skeletal muscles being replaced by adipose tissue and thereby affecting lower limb function. There are very rare reports in the biomedical literature of entire human skeletal muscles being replaced by adipose tissue and thereby affecting lower limb function.

PURPOSE: Determine the difference of PGC-1α isoform expression following an acute bout of cycling in cold and room temperature conditions. METHODS: 8 male participants cycled for 1 hour at 65% W\text{max} at -2°C and 20°C. A muscle biopsy was taken from the vastus lateralis before, 3 h post, and 6 h post exercise. qRT-PCR was used to analyze gene expression of total PGC-1α and NT-PGC-1α expression.

RESULTS: Gene expression of both total PGC-1α and NT-PGC-1α increased due to the exercise intervention at both 3 h and 6 h time points (p<0.05), with mRNA expression peaking at 3 h (p<0.05). At 3 h total PGC-1α was higher in the cold (13.2 ± 6.3 fold increase) compared to room temperature (7.4 ± 2.0 fold increase, p = 0.03). NT-PGC-1α was also higher in cold (20.8 ± 12.5 fold increase) compared to room temperature at 3 h (10.7 ± 3.7 fold increase, p<0.029). Total PGC-1α and NT-PGC-1α were similar in cold and room temperature at 6 h (p>0.05). CONCLUSION: Exercise and cold exposure induced alterations in gene expression for total-PGC-1α and its truncated isoform, NT-PGC-1α. It appears that NT-PGC-1α contributes to the reported alterations in the cold-induced PGC-1α exercise response.

The process of myogenesis within skeletal muscle (SKM) is essential for growth and repair and is coordinated via the expression of myogenic regulatory genes. Previous animal studies have reported that formoterol, a beta-adrenergic receptor agonist, has stimulating effects on genes related to SKM mitochondrial function and biogenesis, similar to effects found for exercise. Lesser known is the potential “exercise mimetic” influence that formoterol stimulation may have during the stages of myogenesis, especially in human SKM cells. PURPOSE: To investigate the effects of formoterol stimulation on expression of myogenic regulatory genes during myogenesis in human SKM cells.

Methods: Human SKM myoblasts (n = 6 per group) were cultured and differentiated until mature myotube formation (Day 6). Groups included control cells (CON) and cells stimulated with 30 nM formoterol for 3 h prior to RNA extraction points (FORM). Total RNA was extracted during mid-myogenesis (Day 4) and at terminal differentiation (Day 6) (a cell culture model of investigating myogenesis). Gene expression for Myogenic factor 5 (Myf5), Myogenic differentiation 1 (MyoD), and Myogenin (Myog) was determined by qPCR. Data were analyzed using repeated measures ANOVA.

Results: Significant differences between conditions and time points are detailed in Table 1.

Conclusions: For the FORM group, Myf5 expression was elevated at D6 compared to CON while Myog and MyoD expression was lower than CON for D4 and D6. The interpretation is that FORM stimulation increased stimulus of D4 myoblast proliferation and, thus, delayed initiation of differentiation. These results, coupled with other preliminary data from our lab showing increased mitochondrial biogenesis with this model of investigation, suggests that this exercise mimetic stimulation may cause shift in the cell towards bioenergetic preference rather than fusion of myotubes.

Table 1.

<table>
<thead>
<tr>
<th>Gene</th>
<th>Comparison</th>
<th>Fold Change</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myf5</td>
<td>D6 FORM &lt; D6 CON</td>
<td>-0.25</td>
<td>&lt;0.05</td>
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<tr>
<td>D6 FORM &gt; D4 FORM</td>
<td>0.65</td>
<td>&lt;0.001</td>
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<tr>
<td>MyoD</td>
<td>D4 FORM &lt; D4 CON</td>
<td>-0.57</td>
<td>&lt;0.001</td>
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<tr>
<td>D4 FORM &lt; D4 FORM</td>
<td>0.85</td>
<td>&lt;0.05</td>
<td></td>
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<tr>
<td>Myog</td>
<td>D4 FORM &lt; D4 CON</td>
<td>-0.72</td>
<td>&lt;0.001</td>
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<tr>
<td>D4 CON &lt; D4 CON</td>
<td>-0.44</td>
<td>&lt;0.001</td>
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PGC-1α mRNA Isoform Specific Response to Exercise And Cold

PURPOSE: To examine the histological characteristics of a bilateral conversion of the medial gastrocnemius, presumably from skeletal muscle to adipose tissue.

METHODS: Small specimens were collected for preservation, wax embedding, and histological analysis of the affected muscle, unaffected lateral head of the muscle, nerve, and a control muscle. METHODS: Small specimens were collected for preservation, wax embedding, and histological analysis of the affected muscle, unaffected lateral head of the muscle, nerve, and a control muscle.

RESULTS: Hematoxylin and Eosin staining revealed an 88% decrease in the number of skeletal muscle fibers with a corresponding increase in the number of adipocytes. Connective tissue was similar between samples; however, the lateral gastrocnemius exhibited signs of inflammation with no necrosis.

CONCLUSIONS: This is to our knowledge the first full histological analysis of a seeming conversion of the bilateral gastrocnemius medial heads into adipose tissue. The cause is unknown but could be related to the immune cell infiltration.

PGC-1α mRNA Isoform Specific Response to Exercise And Cold

Ben Meister, Camille Larson, Dustin Sliwka, FACSIM. University of Nebraska at Omaha, Omaha, NE. (Sponsor: Dustin Sliwka, FACSIM)

PGC-1α mRNA Isoform Specific Response to Exercise And Cold

Ben Meister, Camille Larson and Dustin Sliwka

University of Nebraska at Omaha.

Cold exposure in conjunction with aerobic exercise has been shown to increase the gene expression of PGC-1α, the master regulator of mitochondrial biogenesis. PGC-1α can be expressed as multiple different isoforms due to alternative splicing mechanisms. The current study was designed to compare lateral force transmission in the gastrocnemius muscle of young and old people with changes in specific collagen proteins and the orientation of the matrix.
**3348 Board #169** May 29 1:30 PM - 3:00 PM Diaurnal Regulation Of Exercise-induced Anabolic And Catabolic Signaling In White Adipose Tissue

Purpose: Autophagy is a degradation system where damaged cellular components can be recycled, resulting in higher cellular efficiency. White adipose tissue has been shown to have a catabolic response to exercise where autophagy will increase immediately after exercise. mTOR is an anabolic signaling pathway that inhibits autophagy, and plays a key role regulating cell size. Autophagy is sensitive to bioenergetic stressors such as exercise and has been shown to be regulated in a circadian fashion. However, it is currently unknown if exercise-induced autophagy is sensitive to the time-of-day at which exercise occurs. The purpose was to assess anabolic and catabolic signaling in white adipose tissue following exercise at two times of day: Zeitgeber time (ZT) 0 (light phase) and ZT12 (dark phase).

Methods: 21 week old male C57BL/6 mice (n=38) were habituated to treadmill exercise for 5 days under red light during the active phase, and allowed to recover for 2 days. Following a single 60-minute bout of treadmill exercise at 10 m/min, mice were sacrificed at 3 time points, pre exercise (SED), immediately post exercise (POST), and 1-hour post exercise (1HR). Tissue was analyzed for anabolic (p-mTOR (Ser244/248)) and catabolic (LC3II/I) signaling pathways via western blotting. Results were analyzed with a 2x3 ANOVA and significance was accepted at p<0.05.

Results: Following exercise, there was a significant repression of mTOR (SED=0.990±0.17 vs POST=0.747±0.14, p<0.05) and S6 (SED=0.702±0.39 vs POST=0.816±0.14, p<0.05) activation (Main Effect (ME) Exercise; p<0.05, both), which was significantly following stronger exercise performed at ZT12 (Interaction Effect for S6; p<0.05); Autophagy signaling (LC3III/I) was increased at ZT12 (ZT0=1.22±0.33 vs ZT12=2.28±1.09, p<0.05), which appeared to be driven by changes in LC3I expression. LC3III (normalized to total protein) was increased following exercise (SED=0.81±0.26 vs POST=1.28±0.43 and 1HR=1.22±0.28, p<0.05, both) and was higher at ZT0 (ZT0=1.33±0.33 vs ZT12=0.91±0.33, p<0.05), although no interaction was present.

Conclusion: Autophagic and catabolic signaling in adipose tissue may be differentially impacted by exercise performed at different times of day.

**3349 Board #170** May 29 1:30 PM - 3:00 PM The Role Of Mitochondrial Dysfunction And Redox Disturbances After Non-invasive Anterior Cruciate Ligament Injury
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Anterior cruciate ligament (ACL) injury results in protracted quadriceps atrophy, however the mechanisms that drive atrophypathways remain undefined. Mounting evidence has revealed that mitochondrial dysfunction and redox disturbances are causal events in the initiation of muscle atrophy, yet the extent to which mitochondria damage play a role in quadriceps muscle atrophy after ACL injury has yet to be explored.

PURPOSE: Using a pre-clinical animal model of ACL injury, a time course study was performed to investigate the role of mitochondria and Reactive Oxygen Species (ROS) after injury.

METHODS: 48 Long Evans rats (n=8 per group; 4m/4f) underwent non-invasive rupture of the right ACL and were euthanized at 1, 3, 7, 14, 28, 56 days post-injury. 8 rats (4m/4f) served as healthy controls (HC). Respiration was measured by high-resolution respirometry in paralysed muscle fibers from the right vastus lateralis (VL). ROS production was determined using Amplex Red assays. VL weight was normalized to total body mass for measuring muscle mass loss. One-way ANOVAs with Bonferroni post-hoc were used to determine differences between groups (P < 0.05). RESULTS: Reductions in complex 1-1 state 3 respiration were observed at 7 and 56 days post-injury (HC: 33.92±4.26 pmol s⁻¹ mg⁻¹; 7D: 15.95±1.38 pmol s⁻¹ mg⁻¹; 56D: 18.80±2.15 pmol s⁻¹ mg⁻¹; F = 5.99, P = 0.013 and P = 0.044 respectively). State 4 respiration did not differ between groups (P > 0.05). Respiratory Control Ratio (RCR), defined as respiration in state 3 divided by respiration in state 4, significantly decreased 7 through 56 days post-injury (HC: 4.00±1.13; 7D: 1.54±0.16; 56D: 1.82±0.20; F = 13.29, P = 0.001 respectively) along with increased mitochondrial ROS production 7 through 56 days post-injury (HC: 10.16±0.41 pmol s⁻¹ mg⁻¹; 7D: 12.23±0.54 pmol s⁻¹ mg⁻¹; 56D: 26.83±0.54 pmol s⁻¹ mg⁻¹; F = 178.05, P = 0.001 and P = 0.001 respectively). VL atrophy was observed at 7 and 14 days post-injury (HC: 3.52±0.08 mg g⁻¹; 7D: 3.14±0.07 mg g⁻¹; 14D: 3.18±0.07 mg g⁻¹; F = 5.06, P = 0.013 and P = 0.944 respectively).

CONCLUSION: Mitochondria are an important source of muscular ROS production after ACL injury. Mitochondrial dysfunction and redox disturbances contribute to ACL injury-induced quadriceps atrophy.

Funding Source: NIH grant K01AR071503

**3350 Board #171** May 29 1:30 PM - 3:00 PM Relationship Between Content Of Mitochondria And Z-disk Or Fiber Types
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(NO relevant relationships reported)

PURPOSE: To estimate the relationship between mitochondrial volume contents and z-disks width determined by electron microscopy, analyzed from 13968 images from 582 fibers. METHODS: Eleven recreationally active individuals were recruited. Each subject had three endurance tests at 75% VO2max following three different diets and nine biopsies in total. We obtained ten muscle fibers from each of the nine biopsies and used z-disks width as the discriminator of fiber types. From each fiber 24 EM images were obtained in each biopsy (12 intermyofibrillar, IMF, and 12 subsarcomemal, SS, images, respectively), and point counting method was used to quantify IMF and MS mitochondrial content, and the total content. Relationships between fibers’ mitochondrial contents and z-disks width were tested by Pearson’s correlation coefficient and linear regression. Interactions and main effects were tested by a mixed effect model with fiber type and diet as fixed factors. RESULTS: The total mitochondria volume contents correlated highly significant with fiber z-disks width (Fig 2A, P<0.001, R²=0.90). Also, there were strong correlations between the mitochondrial volume contents in the IMF as well as SS and fiber z-disks (P<0.001, R²=0.18; P=0.001, R²=0.14, respectively, Fig. B, C). The type I fibers have, on average, a higher total mitochondrial content compared to the type 2 fibers, with 67% higher in SS and 41% in IMF, respectively (P=0.001, Means±SD: IMF:0.065±0.023μm² vs 0.046±0.021μm²; SS: 0.450±0.298μm² vs 0.270±0.253μm²; Total: 0.087±0.033μm² vs 0.059±0.031μm²; Fig D, E, F) CONCLUSIONS: The total mitochondrial volume contents, as well as the IMF and SS mitochondrial volume contents are strongly correlated with z-disks width in human muscle fibers (P<0.001, R²=0.90). Thus, fiber typing based on z-disks width is a strong predictor of fiber typing based on mitochondrial volume.
the gastrocnemius muscle of the right leg of SD rats after eccentric exercise. The rats were randomly divided into four groups: one day D1, three days D3, seven days W1 and fourteen days W2 post eccentric exercise. Skeletal muscle ultrastructure was observed by electron microscopy. The content of serum creatine kinase (CK), skeletal muscle troponin I (STnI), myostatin (MSTN), follistatin (FST) were measured by ELISA. Real-time PCR was used to detect the expressions of MSTN, ACVR2B, FST mRNA in skeletal muscle. The expression of MSTN, ACVR2B, FST, p-Smad2/3 were detected by western blot.

RESULTS: Compared with group PBS, adipose mesenchymal stem cell injection significantly promoted the repair of muscle fibers. Compared with group D1, the level of CK in group W2 was significantly decreased, the content of STnI level in group D3 and group W1 were remarkably increased, the serum MSTN contents in group W1 were significantly decreased, which in group W2 was remarkably increased. Compared with group PBS, the relative expression quantities of MSTN mRNA were significantly decreased at time point D3 and which were extremely significantly down-regulated at time point W2. Compared with group PBS, the expression of MNT protein were significantly decreased at time point D3, D1 and W1, however, which was significantly increased at time point W2. Compared with group PBS, the phosphorylation of Smad2/3 shown significantly decreased at the time point W2 of group ASCs.

CONCLUSIONS: After eccentric exercise, allogenic adipose mesenchymal stem cells injected intramuscularly can decrease the transmigration of MSTN in skeletal muscle. Adipose mesenchymal stem cells injected intramuscularly may improve the regeneration and repair of skeletal muscle after eccentric exercise through affecting the downstream signaling pathway of MSTN.

MicroRNAs (miRNAs) are increasingly being studied as regulators for biological processes in skeletal muscle. However, little information relating to biological process regulated by aerobic exercise-affected miRNA is available. Bioinformatics analysis provides a perspective on the direction of future research.

PURPOSE: To analyze the functions of miRNAs which were affected by 8-week aerobic exercise in skeletal muscle of mice. METHODS: C57BL/6J mice were randomly divided into exercise (E) and control (C) groups. The E group were trained on a treadmill with a program of slope 0°, 12m/min, 60min/day, and 5 days/week. The C group lived normally without training. After 8-week of training, skeletal muscle were harvested for RNA extraction. Subsequently, miScript miRNA PCR Arrays was conducted to identify the differentially expressed miRNAs between two groups. Target gene prediction was performed by using TargetScan and microT-CDS tools. Gene Ontology analysis (GO) on the target gene was performed with Cytoscape Bingo. MirPath v3.4 from the DIANA tools was used to execute the Kyoto Encyclopedia of Genes and Genomes (KEGG) analyses. RESULTS: 44 miRNAs were upregulated (Fold Change≥2.0, P<0.05) and 14 miRNAs were downregulated (Fold Change<2.0, P>0.05) after the aerobic exercise. Prediction of target genes showed that there were a total of 9122 target genes (Ptpn9, Gria3, Zfp219, etc.) for the up-regulated miRNAs, while 3636 target genes (Nrf1, Lmbr1l, Zbp1, etc.) for the down-regulated miRNAs. GO analysis revealed that the differentially expressed miRNAs participated in a variety of molecular functions and biological processes including nucleic acid binding, protein binding, catalysis of gene expression, macromolecule metabolic process and others. KEGG analysis showed that the up-regulated miRNAs were significantly enriched in MAPK, Wnt and mTOR signaling pathway. The down-regulated miRNAs were mainly enriched in MAPK, Wnt signaling pathway. CONCLUSION: miRNAs induced by aerobic exercise potentially regulate downstream signaling pathway of MSTN.

We have developed a method to evaluate motoneuron plasticity by real-time RT-PCR analysis for whole spinal cord. PURPOSE: In this study, we examined effects of mild hypoxic conditions on mRNA expression of spinal cord as well as skeletal muscle in young and old mouse. METHODS: Young (12-week old, n=16) and old (20-month old, n=17) mice were divided into three groups of control, continuous hypoxia, and intermittent hypoxia. Both hypoxic groups were subjected to exposure for 5 days under oxygen concentration of 16%. The intermittent hypoxic group was exposed six times to an oxygen concentration of 16% intermittently every hour for 12 hours of the light day of the day. Immediately after completion of the exposure, the spinal cord (Cervical 3 - 6 and Lumber 2 - 5) as well as muscles (diaphragm and gastrocnemius muscles) were removed and mRNA expression levels were investigated using real time RT-PCR system. RESULTS: Although the mRNA expression levels of PGC1α and VEGF-A were significantly (P<0.05) higher in diaphragm than gastrocnemius muscles, these mRNA expression levels were not affected by hypoxic stimulation. While, the mRNA expression levels of muscle remodeling factors (Pax7, MyoD, BDNF, and MHCe) were significantly (P<0.05) higher in hypoxic condition than control group. Compared with young mice, the expression levels of inflammatory cytokine receptor (IL-6Rα) and neurotrophic factors (BDNF, VEGF-A) of muscles increased in old mice. The increased expressions may be considered to be an indispensable adaptive change for age-related changes in skeletal muscle including neuromuscular junction. In the both hypoxia groups, the mRNA expression level of neurotrophic factors (VEGF-A, FGF2) significantly (P<0.05) increased in the cervical, but not in the lumbar spinal cord. CONCLUSIONS: We concluded that the mRNA expressions of trophic factors were hypoxia induced not only in the muscle but also in the cervical spinal cord.
control(NC),moderate intensity exercise(MIE)and acute exhaustive exercise(AEE) groups.NC and AEE:outcomes were run at 15/min per day for 60min until the end of the 8th week.Slope:10% AEE:the rats were subjected to acute exhaustive exercise after 8 weeks.They were sacrificed 48h after the last experiment.

PHB1 expression,ATP content,F$_{1}$F$_{-}$ATPase,oxidative stress (ROS),cellular oxygen consumption rate (OCR),and mitochondrial respiratory function(RCR)in skeletal muscle were measured by animal and cell experiments.

RESULTS:Compared with NC,MIE group RCR4% (p<0.001),ATP content (+49%, p<0.01),F$_{1}$F$_{-}$ATPase activity(+79%,p<0.05),PHB1 expression(+42%,p<0.01),ROS level(-75%,p<0.001) decreased;AEE group RCR5% (+8%,p<0.05),ATP content (-55%,-p<0.05),F$_{1}$F$_{-}$ATPase activity(-56%,p<0.01),PHB1 expression(-31%,p<0.01) increased and ROS(-79%>p<0.05)increased.In C2C12 cells,PHB1 overexpression group,ATP content (+86%,p<0.01),F$_{1}$F$_{-}$ATPase mRNA level (+59%,p<0.05),F$_{1}$F$_{-}$ATPase protein expression (+98%, p<0.01),ATPase activity (+90%, p<0.01),PHB1 expression (+42%, p<0.01) and OCR (-25%, p<0.01),ROS level(-74%,p<0.01),significant enhancement of cellular respiratory function.In the low expression group of PHB1,ATP content (-21%,p<0.01),F$_{1}$F$_{-}$ATPase mRNA level(-64%,p<0.05),F$_{1}$F$_{-}$ATPase protein expression(-49%,p<0.05),F$_{1}$F$_{-}$ATPase activity (-93%,p<0.01)and OCR(-190%,p<0.01),ROS production was significantly increased(+104%,p<0.01),and cellular respiratory function was significantly reduced.CONCLUSION:In energy metabolism,PHB1 may play a role in stabilizing the mitochondrial structure and positively regulating F$_{1}$F$_{-}$ATPase activity,thereby enhance mitochondrial function and promoting energy metabolism.Supported by NSFCNo.31470611.

In preparation for upcoming space missions to the Moon and Mars, there is a need to understand how space stressors (e.g. microgravity, radiation) affect different physiological systems. As skeletal muscle is a critical organ, not only for locomotion but also for overall body homeostasis, defining the molecular impact of microgravity and radiation on this tissue will help developing new, or fine-tuning current countermeasures to maintain health and physiological function of space travellers.

PURPOSE:To investigate the effects of combined radiation and unloading on anabolic/catabolic and immune/inflammatory processes on skeletal muscle in mice.

METHODS:Ten C57/B6J mice were subjected to 14-d hind-limb unloading by tail suspension with an acute radiation session (dose=25 mGy, X-ray) on day 7 of the unloading (HLUR). Ten mice were used as control (CTRL; similar cages, sham unloading). Results were displayed as mean (SD).

CONCLUSION:Compared with CTRL, HLUR mice showed significantly decreased muscle weight and increased myostatin levels, these two space stressors immediately following the week 7 unloading compared to TA (p=0.001) and AA (p=0.003) subjects.

CONCLUSION:To our knowledge, our investigation is the first that demonstrates that the MCT-1 genotype effects lactate clearance in women. Our findings differ from the body of literature carried out using male participants, which suggests that the T allele adversely effects lactate clearance. Further, our findings indicate that peak lactate clearance occurs earlier in the TT group compared to the TA and AA group in resistance trained females. Future research should continue to examine the MCT-1 polymorphism in women and how this genetic information can be integrated into exercise prescription protocols.

Purpose: BFR during RT has been reported clinically to rehabilitate/prevent injury in healthy people and people with orthopedic conditions. Further, subjective accounts of minimal muscle soreness post-training suggest a reduction in exercise induced muscle damage compared to traditional RT. We sought to compare the effects of BFR eccentric RT at low loads on muscle performance to traditional eccentric RT and to explore the feasibility of multisite bioelectric impedance analysis (BIA) to assess muscle damage and hypertrophy.

Methods: 25 healthy young adults 25 ± 5yo (11female,14male) were randomized into two groups (BFR L, BFR R and trained 2x/wk for 6 wks). The contralateral leg was trained traditionally to serve as the control (CT) after baseline testing (single-leg vertical jump, Nordbord bilateral eccentric hamstring strength, legcral bilateral 1RM, legcral hamstring endurance).At the conclusion, participants re-tested. BIA data was collected pre (0, 24, 48hrs) and post (0, 24, 48hrs). Pre-post paired t-tests and coefficient of determination were used for analysis.

Results: There was 96% compliance. There were no significant changes in single leg vertical jump (left=p<0.14, right=p<0.26), hamstring strength (left=p 0.17, right= p< 0.38), or hamstring endurance in either leg (left=p<0.95, right= p<0.12) or condition. There were significant increases (7.5-9.5%) in hamstring 1RM in both legs (left=p<0.01, right=p<0.01) and both training conditions (BFRp<0.01, Tp<0.01).There was low SD correlation between phase angle and participant perceived soreness (r=0.15), but scores were significantly lower in BFR leg immediately (p<0.04) and 24hr (p<0.04) post training.

Conclusions: Eccentric BFR resistance training exhibited similar outcomes to traditional training with less reported soreness. However, interpretation of these data are limited by methodologic approach.

Purpose: This investigation was to examine the role of the MCT-1 T1470A polymorphism on blood lactate clearance rates in females following a 30 second Wingate test.

METHODS: Lactate was measured before the test, immediately following the test and -10, -20, -30 and -40 minutes post. Lactate decreases were calculated for each 10-minute period. Participants were divided into three groups based on their T1470A genotype (TT, TA, AA). RESULTS: There was no significant interaction between genotype and lactate clearance (p=0.12), however the TT genotype group had significantly higher clearance rates when collapsed across time points (p=0.003). Lactate clearance was higher in the TT genotype when compared to both the TA genotype (p=0.002) and the AA genotype (p=0.009). This effect was caused by significantly higher lactate accumulation in TT genotype subjects immediately following the Wingate test when compared to TA (p=0.003) and AA (p=0.003) subjects.

CONCLUSION: To our knowledge, our investigation is the first that demonstrates that the MCT-1 genotype effects lactate clearance in women. Our findings differ from the body of literature carried out using male participants, which suggests that the T allele adversely effects lactate clearance. Further, our findings indicate that peak lactate clearance occurs earlier in the TT group compared to the TA and AA group in resistance trained females. Future research should continue to examine the MCT-1 polymorphism in women and how this genetic information can be integrated into exercise prescription protocols.

Purpose: To examine acute changes in muscle thickness, isometric strength, and arterial occlusion pressure (AOP) following NO LOAD exercise with and without the application of blood flow restriction (BFR) in the upper body. METHODS: Changes in muscle thickness, isometric strength and AOP were examined following four sets of twenty repetitions of unilateral elbow flexion exercise. Participants performed maximal muscle contractions with no external load throughout a full range of motion with and without the application of a moderate BFR (40% of AOP). Results are displayed as means (SD). RESULTS: Changes in muscle thickness, isometric strength and AOP were examined following four sets of twenty repetitions of unilateral elbow flexion exercise.
the BFR and control conditions demonstrated a decrease in torque immediately following exercise [mean change = 4.5 (4.5) and 1.82 (4.5) Nm for BFR and control conditions respectively, which remained decreased below baseline 15 minutes post exercise [mean change = 2.39 (5.5) and 2.28 (3.19) Nm for BFR and control conditions respectively]. For muscle thickness, there was a main effect for time (p < 0.001). Muscle thickness increased from pre [3.52 (3.78) cm] to post [3.68 (8.1) cm] exercise and remained increased above baseline 15 min post exercise [3.6 (8.0) cm]. For AOP, there was a group x time interaction (p = 0.027). The reduction in AOP was greater in the BFR group [16.6 (13.42) mmHg] compared to the control group [11.1 (11.84) mmHg].

CONCLUSIONS: NO LOAD exercise with the application of BFR led to greater reductions in isometric torque compared to NO LOAD exercise without the application of BFR. In addition, the application of BFR led to an exaggerated cardiovascular response compared to NO LOAD exercise alone. There were no differences in acute muscle swelling between NO LOAD exercise with and without BFR. These results suggest that the application of BFR to NO LOAD exercise may lead to a greater level of muscle fatigue when performing four sets of twenty maximal repetitions. This is accompanied with an exaggerated cardiovascular response.

In immobilized patients, passive movement (PM) with blood flow restriction (BFR) reduces atrophy over PM alone; whether these effects are greater than BFR alone is uncertain. PURPOSE: To determine if acute muscular responses are unique when combining BFR and PM compared to PM alone or BFR alone. METHODS: 20 participants performed four conditions (randomized order): time control (TC), PM, BFR, and PM combined with BFR (PM+BFR) over two visits (one condition each leg, per visit). For PM, a dynamometer moved (45°/second) the leg through 3 sets of 15 knee extensions/legions (90°). For BFR, a cuff was inflated to 80% arterial occlusion pressure on the proximal portion of the leg. Muscle thickness (MT) was measured at 60% and 70% of the anterior upper leg before, immediately after, five minutes after, and ten minutes after each condition. Oxygenated, deoxygenated (HHb), and total (tHb) hemoglobin of the vastus lateralis were monitored throughout conditions via near-infrared spectroscopy. Ratings of perceived effort (RPE-E) and discomfort (RPE-D) were reported before and after conditions and each set. Data [presented as mean (SD)] were analyzed using Bayesian RMANOVA. RESULTS: 60% MT [A before to immediately after: TC = 0.04 (0.09), PM = -0.01 (0.15), BFR = -0.00 (0.11)] and 70% MT [A before to immediately after: TC = 0.01 (0.09), PM = -0.01 (0.15), BFR = -0.02 (0.11)] did not change (BFr = 0.014 and 0.015, respectively). HHb and tHb changes were generally greater with BFR compared to PM and PM+BFR [i.e. channel 2 HHb: A start set to end set 3: TC = 1.07 (2.12), PM = -1.23 (1.86), BFR = 9.58 (2.81), PM+BFR = 10.11 (3.16) cm]. RPE-E increased with time and condition (BFr = 2.882±ε8.84), [A before to end set 3: TC = 0.0 (0.2), PM = 0.7 (1.0), BFR = 0.9 (2.1), PM+BFR = 1.3 (1.7)]. RPE-D changes were greater for BFR and PM+BFR (BFr = 1.877±13.13), [A before to end set 3: TC = 0.0 (0.2), PM = 0.4 (1.1), BFR = 3.2 (1.8), PM+BFR = 2.6 (1.5)].

CONCLUSION: PM and/or BFR alone are not sufficient to acutely increase MT (generally associated with a hypertrophic stimulus) in healthy people. Changes in tissue oxygenation seem to be driven by BFR rather than a unique effect of combining PM with BFR. The extent of this effect and what it would mean for adaptation in either healthy or bed-ridden patients warrants further investigation.

3361 Board #182 May 29 1:30 PM - 3:00 PM The Acute Muscular Response To Passive Movement And Blood Flow Restriction
Joonsun Park1, Daphney M. Stanford2, Samuel L. Buckner3, Matthew B. Jessee1. 1The University of Mississippi, Hattiesburg, MS; 2The University of Mississippi, University, MS; 3University of South Florida, Tampa, FL.

(Neutral relationships reported)

Muscle strength gains following blood flow restricted (BFR) resistance training are consistently lower than those observed after HL training and this may be due to differences in neuromuscular activation. Integrating high-velocity muscle contractions and BFR resistance exercise may increase neuromuscular activation. PURPOSE: To compare torque and neuromuscular activation before and after sessions of HL knee extension exercise and high-velocity BFR knee extension exercise in young and older adults. METHODS: Ten young males and females (20.3±1.5 years, 1.73±0.06 m, 69±14.0 kg) and 10 older males and females (72.6±4.7 years, 1.70±0.06 m, 74.3±14.6 kg) performed randomized sessions of HL (80% 1-RM for 3 sets of 10 isometric knee extension repetitions) and low-load, high-velocity BFR (30% 1-RM coupled with a vascular restriction for one set of 30 knee extension repetitions and 3 sets of 15 repetitions completed as quickly as possible). Knee extension isometric torque was assessed before and after each session of exercise and neuromuscular activation was quantified with surface electromyography (EMG). RESULTS: The young participants had higher isometric torque than the older participants (213.4±54.8 Nm 160.1±56.3 Nm; P<.01). There was a large decrement in torque of 31.4±9.2% among all participants from baseline to post exercise (P<.01). The magnitude of this decrement was similar between conditions (P=.19), age (P=.12), and the interaction of time, condition and age (P=.16). EMG amplitude normalized to pre isometric torque in the first 5 knee extension repetitions of the HL condition averaged 106±57% and 90±33% in the BFR high-velocity condition. In the last 5 repetitions, EMG amplitude averaged 117±56% and 113±46% in the HL and BFR conditions respectively. This was a significant increase in EMG amplitude (P=.01) but there were no interactions or main effects of condition or age (P>.05). CONCLUSION: Combining high-velocity contractions with BFR resistance exercise results in decrements in torque and heightened neuromuscular activation similar to HL exercise in both young and older adults. Future studies should evaluate the training adaptations from high-velocity BFR resistance training. Supported by University of New Hampshire Grimes Family Fund.

3362 Board #183 May 29 1:30 PM - 3:00 PM Muscle Swelling Following Low Load Blood Flow Restriction Exercise Does Not Differ Between Cuff Widths In The Lower Body
Zachary W. Bell1, Takashi Abe2, Vickie Wong1, Robert W. Spitz1, Ricardo B. Viana1, Raksha N. Chattakandi2, Scott J. Dankel2, Yuijiro Yamada3, Jeremy P. Loeckme, FACSM4, 1The University of Mississippi, University, MS; 2Rowan University, Glassboro, NJ; 3The University of Mississippi, University, MS; 4Fresno State University, Fresno, CA.

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(Neutral relationships reported)

Acute muscle swelling is a purported mechanism for muscle hypertrophy following blood flow restriction (BFR) training. Currently there are numerous cuff widths used within the lower body BFR literature. However, studies suggest that growth may be attenuated with a wider cuff. Whether this is related to a differential acute swelling response has not been previously shown. PURPOSE: To examine the acute changes in muscle swelling following low load BFR exercise in the lower body, in response to different cuff widths inflated to the same relative pressure. METHODS: Ninety-six (43 men, 53 women) participants completed two conditions (one each leg). Participants completed four sets of unilateral knee extension exercise to failure using 30% of their one repetition maximum (1RM) with BFR applied with either a narrow (5 cm) or a wide (12 cm) cuff inflated to 40% of their arterial occlusion pressure. Muscle thickness and echo intensity were measured at two sites (proximal and distal) before and after each exercise bout as surrogate markers of swelling. A repeated measures analysis with a between subject factor of sex was used to assess changes. Bayes Factors (BF10) were used to quantify evidence. RESULTS: The difference in acute changes in muscle thickness (BFr = 0.43) and echo intensity (BFr = 0.87) between cuff widths was not different between the proximal (i.e. wide cuff covered this site) and distal (no cuff was over this site) location. Further, changes in muscle thickness at the proximal [5cm: 0.58 cm vs. 12 cm: 0.57 cm; median difference (95% credible interval) of 0.009 (-0.04, 0.06) cm] and distal [5 cm: 0.63 cm vs. 12 cm: 0.63 cm; median difference (95% credible interval) of 0.00002 (-0.04, 0.04) cm] site did not differ based on cuff width or sex (Men: 0.58 cm vs. Women: 0.57 cm and Men: 0.64 cm vs. Women: 0.63 cm for proximal and distal sites, respectively). Echo intensity appeared to decrease at the proximal and distal sites with no differences between cuff widths. However, there was some evidence that this change at the distal site may be different between sexes (BFr = 49.8; Men: -1.9 vs. Women: -4.2AU). CONCLUSIONS: Acute muscle swelling occurs in men and women, even when using a wider cuff. Thus, if there is to be attenuation in growth with a wider cuff, it is unlikely to be due to differences in acute swelling.
Tissue Engineering and Regenerative Medicine are promising interdisciplinary fields regarding tissue and/or organ repair and regeneration. Due to the extremely high incidence of osteoarthritis in such an aging population, it is critical to put all efforts in developing a successful implant for osteochondral tissue regeneration; although there has been a huge amount of work aiming to regenerate it, a tailored construct has not been achieved yet. PURPOSE: To develop a 3D in vitro model to test cartilage regeneration, as well as to verify the construct and its function. METHODS: Multichannel computer simulations were performed to explore which combination of stimuli (temperature, humidity and culture medium) is optimal for cartilage repair. The model was validated by comparing the physical and mechanical properties of the produced cartilage with those of control tissues. RESULTS: The model was able to regenerate cartilage tissue with a similar physical and mechanical properties to the control. CONCLUSION: This model can be used to test different stimuli combinations and to optimize the regeneration process.

Significant loss in skeletal muscle mass and function can occur following periods of extended bed rest or immobilization. Physical therapy is recommended, but recovery may be incomplete in some populations due to injury and functional limitations. Our lab recently demonstrated the capacity for pericytes, or vascular stromal cells, to accelerate recovery of skeletal muscle following a period of disuse. METHODS: Twenty-four 4-month old C57BL/6 mice were randomly divided into four groups (n=6/group). Mice hindlimbs were immobilized in full dorsiflexion via a surgical staple and either pericytes (CD146+ and NG2-) or saline (control) were injected into the tibialis anterior muscle. RESULTS: Mice receiving pericytes had a significant increase in muscle mass compared to controls, with a 20% increase in muscle mass observed. CONCLUSION: Pericytes have the potential to accelerate recovery of skeletal muscle following disuse.

Skeletal muscle functions as an endocrine organ. Exosomes, small vesicles containing mRNAs, miRNAs, and proteins, are secreted from muscle cells and facilitate cell-to-cell communication. Our recent work found greater exosome release from oxidative compared to glycolytic muscle. Peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1α) is a key driver of mitochondrial biogenesis, a characteristic of oxidative muscle. It was hypothesized that PGC-1α regulates exosome biogenesis and secretion in skeletal muscle. PURPOSE: To determine if PGC-1α regulates skeletal muscle exosome biogenesis and secretion. METHODS: Twenty-four 4-month old C57BL/6 mice were randomly divided into four groups (n=6/group). Mice hindlimbs were immobilized in full dorsiflexion via a surgical staple inserted through the center of the foot and body of the gastrocnemius for 2 weeks. At 2 weeks post immobilization, staples were removed and either pericytes (CD146+ and NG2-) or saline (control) were injected into the tibialis anterior (TA) muscle. TA muscles were excised for analysis after 2 weeks of remobilization and the extent of recovery was assessed. RESULTS: One-way ANOVA was used to compare the extent of improvement between treatment groups. RESULTS: There was no significant improvement in TA muscle weight or myofiber CSA with pericyte transplantation in the current study (p>0.05). However, a trend toward significant improvement in myofiber CSA was noted for fibers ranging 2000-3000 μm² in mice receiving CD146+NG2–Lin pericytes (p=0.072). Significant improvements in capillarization and collagen remodeling were detected in mice receiving CD146+NG2–Lin pericytes (p=0.03) and CD146–Lin (p=0.05) pericytes compared to controls. CONCLUSION: CD146+ Lin pericyte transplantation effectively recovered capillary quantity and collagen remodeling following a period disease compared to controls, whereas NG2-Lin pericytes did not demonstrate similar capacity for recovery. Supported by NIH Grant NIAIMS R01 AR072735 to MDB.

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F-59 Free Communication/Poster - Cellular and Molecular

Friday, May 29, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

**Board #185**

**Proposal Of A New In Vitro Exercise Model For Cartilage Regeneration**
Pedro G. Morouco. Polytechnic Institute of Leiria, Leiria, Portugal.
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(No relevant relationships reported)

**Board #186**

**Therapeutic Potential Of Different Pericyte Populations In The Recovery Of Skeletal Muscle Mass Following Disuse**
Samuel Lapp, Yu Fu Wu, Svyatoslav Dvoretzky, Amanda Tannehill, Gabriela Garcia, Marni Boppart, FACS, University of Illinois at Urbana-Champaign, Urbana, IL. (Sponsor: Marni Boppart Sc.D., FACS)
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(No relevant relationships reported)

**Board #187**

**A Novel Umbilical Cord Derived Wharton's Jelly Formulation For Regenerative Medicine Applications**
Ashim Gupta¹, Sobrasa E. Ibihm², Howard Levy¹, Rebecca Sze Tu¹, Saadig F. El-Amin III¹. ¹BiolIntegrate LLC, New York, NY. ²Morris Brown College, Atlanta, GA. ³Columbia University, New York, NY.
Email: ashim786@gmail.com
Reported Relationships: A. Gupta: Salary; BiolIntegrate LLC. Ownership/interest/stock; Right Mechanics Inc.

PURPOSE: Musculoskeletal injuries have traditionally been treated with activity-modification, physical therapy, pharmacological agents and surgical procedures. These modalities have limitations, as well as potential side-effects. Over the last decade, there has been an increased interest in the use of biologics for regenerative medicine applications (RMA), including umbilical cord (UC) derived Wharton’s Jelly (WJ). Despite this increase, there is insufficient literature assessing the amount of growth factors, cytokines, hyaluronic acid (HA) and extracellular vesicles (EV) including exosomes in these products. The purpose of this study was to develop a novel WJ formulation and evaluate the presence of growth factors, cytokines, HA and EV including exosomes.

METHODS: WJ was isolated from human-UC obtained from consenting C-section donors and formulated into an injectable form. Randomly selected samples from different batches were analyzed for exosome characterization and verified for presence of growth factors, cytokines, HA and particles in EV size range.

RESULTS: The results showed all samples passed the sterility test. Growth factors including IGF-1, 2, 3, 4 and 6, TGF-α, PDGF-AA were detected. Expression of various immunomodulatory cytokines, RANTES, IL-6R, IL-16, were also detected. Expression of pro-inflammatory cytokines M-CSFR, MIP-1α, anti-inflammatory cytokines TNF-RI, TNF-RII, IL-1RA; and homeostatic cytokines TIMP-1 and TIMP-2 were observed. Cytokines associated with wound-healing, ICAM-1, G-CSF, GDF-15, and regenerative properties, GF were also expressed. High concentrations of HA were observed. Particles in the EV size range (30-150nm) were detected and were enclosed by the membrane, indicative of true EV.

CONCLUSIONS: Our results confirmed the presence of numerous growth factors, cytokines, HA and EV in the WJ formulation. More studies are underway to confirm the presence of exosomes in detected EV using exosome-specific markers. We believe the presence of multiple factors within one WJ formulation may play a role in reducing inflammation, pain and augment healing of musculoskeletal injuries. This offers a potential expanded use for RMA.

**Board #188**

**Overexpression Of PGC-1α In Human Primary Myotubes Increases Regulators Of Exosome Biogenesis And Secretion**
Derek Middleton¹, Christopher Kargl², Jeffery Brautl³, Timothy Gavin, FACSM, ¹Purdue University, West Lafayette, IN. ²Indiana University, Indianapolis, IN. (Sponsor: Timothy P. Gavin, FACSM)
(No relevant relationships reported)
Obesity increases the susceptibility of skeletal muscle to damage and impairs the regenerative response following muscle damage. Obesity is associated with an increase in ectopic lipid accumulation and inflammatory cell infiltration in skeletal muscle. It is unclear if the impairments in skeletal muscle regeneration and increased susceptibility to damage is due to these factors or if defects in integrity and repair are inherent to muscle of obese subjects. **PURPOSE:** To investigate if myotubes isolated from obese donors are (1) more susceptible to damage and (2) have a blunted regeneration response. **METHODS:** Differentiated myotubes from lean (LN) and obese (OB) donors were treated with 0.5 µM of cardiotoxin (CTX) for 1 hr. Cells were allowed to recover in skeletal muscle growth media for 3 days and then differentiation media for 2 days. Cells were isolated immediately (ImmPost), and 3 days following CTX treatment. **RESULTS:** CTX significantly reduced the fusion index of differentiated cells, but there were no differences between LN and OB at ImmPost (no-CTX: LN 28% vs. OB 28%; CTX: LN 15% vs. OB 12%), 3 Days (no-CTX: LN 38% vs. OB 38%; CTX: LN 30% vs. OB 29%), or 5 Days (no-CTX: LN 41% vs. OB 39%; CTX: LN 37% vs. OB 34%). CTX significantly reduced cell viability assessed via MITT but no differences were observed between LN and OB at ImmPost (no-CTX: LN 0.20 au vs. OB 0.21 au; CTX LN 0.11 au vs. OB 0.14 au), 3 days (no-CTX: LN 0.37 au vs. OB 0.37 au; CTX: LN 0.30 au vs. OB 0.12 au), and 5 days (no-CTX: LN 0.34 au vs. OB 0.19 au vs. OB 0.22 au). No differences were observed in the expression of key metabolic proteins PFK-1, Citrate Synthase, or β-Had following CTX treatment and similar regenerative responses compared to myotubes from lean donors.

**CONCLUSION:** Skeletal muscle contains numerous stem and progenitor cell populations that reside within the interstitium between myofibres. These cells directly and indirectly support muscle repair; however, the identities and functions of these cells remain poorly characterized in human muscle. **PURPOSE:** To apply a novel genetic tool, single cell RNA sequencing (scRNAseq), to identify progenitor cell populations within uninjured human skeletal muscle. **METHODS:** Total mononuclear cells were isolated from the hamstrings of n=5 orthopedic surgery patients (2 males, 3 females, mean age ~23.4) and combined for droplet based scRNAseq using the 10x Genomics platform. **RESULTS:** Ongoing analysis is examining the function of SMMCs and extracellular vesicles. **PURPOSE:** To determine the effects of inflammation of muscle cell on the myokine expression in exosome-like vesicles (ELVs), and the effects of electric pulse stimulation (EPS), as an exercise mimetic on the myokine expression using C2C12 myotubes. **METHODS:** Inflammation of C2C12 was induced by treatment of a cytokine mixture (CM, TNF-α, INF-γ), and insulin resistance was induced by palmitate (0.75 mM) for 24 hrs. ELVs were enriched from conditioned media by differential ultracentrifugation. EPS was set as 11.5V, 2ms, 2Hz for 24 hrs. We considered P < 0.05 as significant, using GraphPad Prism ver 2.0 program. **RESULTS:** Treatment of C2C12 by CM significantly inhibited the expression of myogenic regulators (myogenic transcription factors, myogenic myokine, and signaling proteins), while induced the expression of atrophic factors (atrogin-1, myostatin and signaling proteins). In addition, the inflamed C2C12 myotubes released anti-myogenic ELVs which contain abundant myostatin and scanty level of decorin, comparing with control ELVs. EPS was set as 0, 5, 10, 20 Hz for 24 hrs. EPS increases the rate of myogenic regulators (MyoD and myogenin), myogenic myokines (FND5C1, decorin, FGF21 and cathepsin B), and metabolic function of myotubes were significantly increased, however the levels of myostatin and atrogin-1 were down-regulated. Furthermore, EPS increased the mitochondrial activity and activated mitochondrial biogenesis pathways. **CONCLUSIONS:** Inflammation, expression of anti-myogenic regulators and mitochondrial dysfunction are major contributors in metabolic diseases- or aging-induced sarcopenia. Therefore, our results suggested that activation of anti-myogenic activity in muscle cells by contraction (i.e., EPS in vitro and skeletal muscle contraction during PE in vivo) through myokine-containing ELVs may be a mechanism of beneficial effects of PE against sarcopenic factors.
protein Drp1 ser198 phosphorylation was significantly reduced following EPS in both groups (1.09 ± 0.07 vs. 0.95 ± 0.06, P < 0.05). No differences of mitochondrial fusion proteins were found between study groups.

CONCLUSIONS: Our data reveal that EPS induces similar intrinsic adaptations in mitochondrial dynamics in cultured myotubes derived from lean and severely obese humans.

3372 Board #193 May 29 1:30 PM - 3:00 PM Gene Expression Responses Of Skeletal Myotubes To Mechanical Loading In Vitro Athanasios Moustogiannis, Evangelos Zevolis, Michael Koutsilieris, Anastassios Philippou. National and Kapodistrian University of Athens, Athens, Attiki, Greece.

Email: moustogi@gmail.com (No relevant relationships reported)

Skeletal muscle can adapt to mechanical loading by changing its mass and overall contractile phenotype via the activation of mechanotransduction and intracellular signaling mechanisms. In vitro mechanical loading of differentiated myoblasts (myotubes) has been utilized for mimicking the mechanical loading conditions of skeletal muscle in vivo. PURPOSE: This study investigated the effects of mechanical loading of myotubes on their gene expression responses associated with various aspects of cellular function, such as differentiation, hypertrophy and apoptosis. METHODS: C2C12 myoblasts were cultured on elastic membranes up to day 9 of their differentiation and then underwent a passive, cyclic stretching protocol (elongation, at a frequency of 0.25 Hz, for 12 hours). Myotubes were harvested and lysed 12 hours after the completion of the stretching protocol. Real-Time PCR was utilized to measure changes in mRNA expression levels of myogenic regulatory factors (MRFs: MyoD, Myogenin, MRF4), as well as growth (IGF-1 isoforms: IGF-1Ea, IGF-1Eb), atrophy (Murf1, Atrogin, Myostatin), apoptotic factors (Foxo4, Fuc3, p53) and inflammatory factors (IL-6, IL-1b) in response to mechanical loading of the differentiated myoblasts. RESULTS: Mechanical loading of the myotubes resulted in increased expression of MyoD (1.5-fold; p < 0.05) and MRF4 (2.0-fold; p < 0.05) while Myogenin expression decreased by 0.4-fold (p < 0.05). Expression of muscle atrophy factors Atrogin(0.5-fold), Myostatin (0.4-fold), and Murf1 (0.4-fold), and of the inflammatory factor IL-1b (0.5-fold) was significantly decreased (p < 0.05). No significant changes were revealed in the expression levels of IGF-1 isoforms (IGF-1Ea: 0.9-fold, IGF-1Eb: 1.1-fold) and apoptotic factors (Foxo: 0.8-fold, Fuc3: 1.1-fold, p53: 1.0-fold), as well as of IL-6 (0.8-fold) in response to the selected stretching protocol of the differentiated myoblasts. CONCLUSIONS: These findings suggest that the specific mechanical loading protocol can further affect the myogenic differentiation program and protein synthesis of skeletal myotubes by influencing the expression of myogenic factors and downregulating muscle atrophy genes.

3373 Board #194 May 29 1:30 PM - 3:00 PM Novel Method To Visualize AMPK Protein Localization In Single Human Muscle Fibers Via Confocal Microscopy Carlos S. Zepeda1, Christopher E. Pardini2, Kara K. Lazaarus3, Irene S. Tobias2, Andrew J. Galpin2, James R. Bagley2, 1San Francisco State University, San Francisco, CA. 2California State University Fullerton, Fullerton, CA. Email: czepeda3@mail.sfsu.edu (No relevant relationships reported)

Purpose: AMP-activated protein kinase (AMPK) is the energy regulator of skeletal muscle cells. Current methods can identify the magnitude of AMPK expression in skeletal muscle cells via Western blotting and Capillary Nano-Immunosay (CNA); however, these methods lack the ability to visualize AMPK localization within single muscle fibers. Identifying AMPK in human muscle is important because it is involved in various exercise training adaptations such as mitochondrial biogenesis and glucose transport. Therefore, we aimed to develop a novel confocal microscopy method to identify AMPK protein expression (relative intensity) and localization within human single muscle fibers. Methods: A vantage lateralis muscle biopsy was obtained from a healthy male and immediately fixed (4% PFA). Twenty fibers were isolated, placed on microscope slides, incubated in 0.1% Triton (15min), then incubated in 5% normal goat serum (blocking solution; 4h). This was followed by exposure to a 1 antibody (Ab) (anti-AMPKα2) in 5% bovine serum albumin (1h at 4°C). Fibers then exposed to a 2 Ab (anti-rabbit IgG conjugated w/ AlexaFluor 488) and phalloidin (AlexaFluor 568) to label actin (2h). Finally, fibers were mounted under coverslips with AntiFade Gold w/DAPI for myonuclei detection. Confocal microscopy imaging was conducted using a Zeiss LSM 710 with 63x plan apochromatic objective (oil emission). Images were processed via ImageJ. Results: Muscle fiber contractile proteins (actin; red), myonuclei (blue), and AMPK proteins (green) were successfully visually identified at rest (AMPK fluorescence intensity = 1199.64 ± 630 AU). To ensure that no auto-fluorescence or non-specific binding was observed, images were compared to control slides: 1) DAPI only, 2) 1 Ab only, 3) 2 Ab only, and 4) no staining. Conclusions: These methods allow for the successful visualization (relative intensity) and localization of AMPK protein within single human muscle fibers. This method could be used in future research to investigate the response and myonuclear co-localization of AMPK following exercise in human skeletal muscle to elucidate how they may play a role in these physiological processes.
by the mass-drop method on the right calf muscle of rats. After the injury, the rats were divided into non-treated (NT) and HBO-treated groups. The HBO protocol consisted of 100% oxygen inhalation at 2.5ATA for 120 minutes once a day for 5 consecutive days. We measured VEGF levels and histologically evaluated blood vessel formation and muscle regeneration in the contused muscles. In a functional analysis, we measured performance, possibly indicating approaching dominant elbow soft-tissue risk, no investigation, to our knowledge, has examined relationships between performance, biomechanics, and hyperemic-induced changes in collegiate baseball pitchers during game-simulated pitching sessions of 40, 80, or 120 pitches.

METHODS: Following informed consent, 5 male subjects (age = 18.8±0.8 years; BMI = 27.8±2.8 kg/m²; VO₂max = 59.9±3.8 ml/kg/min; peak power output = 283.6±32.5 W) delivered from an artificial mound with 1-2 mins rest between bouts. HR and RPE were recorded immediately following each 10-pitch bout. A MOTUS sensor and compression sleeve measured elbow valgus torque. A Stakeholder II Radar Gun measured fastball velocity. Pre-test and post-test upper- and lower-extremity limb girths were measured, signifying reactive hyperemia. Wilcoxon non-parametric testing determined pre- to post-test differences. Pearson correlation identified relationships between variables. Alpha was set at p ≤ 0.05.

RESULTS: No group differences were found on any performance, biomeetric, demographic, or hemodynamic variable. HR (72.6±8.9bpm vs. 97.6±10.0bpm, p = 0.02) and dominant forearm limb girth (29.4±1.5cm vs. 30.9±1.5cm, p = 0.04) increased from pre-test to post-test for subjects combined. Significant correlations were found for: pitching volume & post-test HR (r = 0.90, p = 0.039); post-test dominant upper arm circumference & RPE (r = 0.89, p = 0.042); and; valgus torque % change & pitching volume (r = 0.91, p = 0.031).

CONCLUSIONS: Forearm limb girth increased for subjects combined, and; given this metric’s indication of reactive hyperemia, future research focused on elucidating and quantifying the biological components of the tissue (compartments), as well as their contribution to performance- and/or injury-specific outcomes, is warranted.

Interval Training On Performance And Skeletal Muscle
Comparison Of Flat, Uphill And Downhill High Intensity Interval Training On Performance And Skeletal Muscle
Kathryn H. Myburgh, FACSM, Cameron Sugden, Evan E. Knight, Tracey Ollewagen, Stellenbosch University, Stellenbosch, South Africa.
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(No relevant relationships reported)

Skeletal muscle and exercise performance adapt to high intensity interval training (HIIT). Downhill running is an eccentric-biased exercise modality whereas uphill running is concentric-biased and flat running has aspects of both. Therefore, variation in adaptation may differ with HIT done on flat (F) or uphill (UH) or downhill (DH) gradients. PURPOSE: To compare the training effect of three modes of HIT on laboratory and outdoor performance and muscle cross-sectional area (CSA) and satellite cell number per fiber (SC). METHODS: 17 fit, but not elite, young male adult runners volunteered for HIT: 6 sets of 3 minutes and 1-minute rest between, for 10 sessions over 4 weeks. Gradients were phase-randomized: 15% or -10% and running speeds 50% 80% or 90% of peak treadmill speed (PTS) respectively. Performance tests included PTS (0% gradient), maximum isometric quadriiceps force (Iso) and 5km road time trial (TT). Muscle biopsies were taken at baseline and 6 hours after the 10th session. Data analyzed using mixed models ANOVA, presented as mean ± SD. RESULTS: HIT increased PTS (kN) in F (pre: 17.7±1.3, post: 18.9±1.5, p<0.05) and UH (pre: 17.6±0.8, post: 18.7±0.8, P<0.01), but not DH (pre: 17.8±1.3, post: 18.0±1.3), whereas only DH significantly increased Iso strength (25% P<0.05 compared to F: -1% and UH: -4.4%). Similarly, only DH increased muscle fiber cross-sectional area (CSA) (31% P<0.05 compared to F: -5% and UH: 10%). DH increased muscle SC number/ fiber highly significantly (pre: 0.097±0.01 post: 0.297±0.04 P<0.0001). Interestingly, UH HIIT group did not change SC content (pre: 0.102±0.01, post: 0.106±0.02), but that HIT increased significantly (pre: 0.115±0.01, post: 0.148±0.01 P<0.01), although not nearly as much as DH HIIT (F: 30%, DH: 208%). 5km TT improved in all groups (F: 3%; UH: 3.5% and DH: 3.5%, all P<0.05). CONCLUSION: Muscle adapted differently in response to different gradients of HIIT. Neither SC number/fiber nor CSA changed with UH HIIT. CSA also did not change with F HIIT, although SC number/fiber increased. DH HIIT increased both CSA and SC number/fiber to a greater extent. Although laboratory performance test changes differed between groups, all 3 groups improved outdoor TT performance. Therefore, different training specific adaptations in skeletal muscle conferred similar race performance improvements.
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**Purposive Exercise Training:**

The purpose of this study was to examine the effects of low-intensity eccentric exercise performed before maximal eccentric exercise which causes muscle damage and oxidative stress on muscle injury markers and oxidative stress.

**Methods:**

Thirteen healthy males (22 ± 3 years) were randomly divided into three groups: control (C), low intensity eccentric (LE), and maximal eccentric (ME). All subjects performed a 90-minute exercise session to induce fatigue and oxidative stress. The LE group performed a low-intensity eccentric exercise protocol (10% of the maximal muscle strength) before the ME session. The C group performed only the ME session. The ME group performed only the ME session.

**Results:**

There were no significant differences between groups in muscle damage markers (creatine kinase, lactate dehydrogenase) or oxidative stress markers (8-isoprostane, 8-hydroxydeoxyguanosine) at baseline. However, after the exercise session, the LE group showed a significant decrease in muscle damage markers compared to the ME group. Additionally, the LE group showed a decrease in oxidative stress markers compared to the ME group.

**Conclusion:**

Low-intensity eccentric exercise training before maximal eccentric exercise can attenuate muscle damage and oxidative stress.

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Low-intensity eccentric exercise training before maximal eccentric exercise can attenuate muscle damage and oxidative stress.
PURPOSE: The purpose of this study was to examine the acute androgen receptor (AR) and glucocorticoid receptor (GR) response to a moderate intensity resistance exercise bout in resistance trained (RT) and untrained men (UT).

METHODS: RT men (n = 10; X ± SD, age = 21.3 ± 1.7 yrs, height = 175.8 ± 6.8 cm, body mass = 84.5 ± 13.5 kg, back squat 1RM = 154.3 ± 19.3 kg, training history = 5.4 ± 2.0 yrs) and UT men (n = 9; X ± SD, age = 20.8 ± 3.1 yrs, height = 178.7 ± 8.9 cm, body mass = 81.0 ± 14.0 kg, squat 1RM = 108.1 ± 13.7 kg, training history = 0.7 ± 1.7 yrs) volunteered for this study. Prior to the RE bout, subjects were strength tested for back squat (BS) and leg extension (LE). Subjects returned 4-7 days later between 10am-2pm, and completed a RE bout consisting of 6 sets of 10 repetitions of BS at 75% 1RM, immediately followed by 4 sets of 10 repetitions of LE at 75% 1RM with 1 min rest between all sets. Muscle samples were collected from the vastus lateralis prior to exercise (PRE) and 10 min (10P), 30 min (30P), 60 min (60P), and 180 min (180P) post exercise. Total AR and GR expression was determined via western blotting. Receptor data were not normally distributed, thus all receptor data were analyzed using Mann-Whitney U test, Friedman test, and Wilcoxon signed-rank test.

RESULTS: For total AR expression, there were no differences between time points within the RT group (p > .05); however, there were differences between time points within the UT group (p < .016). In the UT group, total AR expression decreased at 30P (19%, z = -2.192, p = 0.027) and 60P (-11%, z = -2.192, p = 0.027) post exercise, but returned to baseline values by 180P (z = -1.78, p > .05). For total GR content, there were no differences between time points within the RT or UT groups (p > .05). Total GR content was significantly greater in the RT group compared to the UT group at 10P (Mann-Whitney U = 19, z = -2.123, p = 0.035).

CONCLUSIONS: While no changes were observed for AR expression in the RT group, the UT subjects experienced a significant decrease in AR expression at 30P and 60P suggesting acute AR responses vary depending on training status. No differences were seen across time for the GR in either group; however, RT and UT subjects were different from each other at 10P. It is unclear if these responses are related to the acute hormonal response; therefore, future research will address this.

F-61 Free Communication/Poster - Skeletal Muscle Fatigue

Board #208 May 29 1:30 PM - 3:00 PM
Room: CC-Exhibit Hall

Do Decreases In Voluntary Activation Account For Fatigability Differently In Males And Females?
Rob J. MacLennan1, Alina P. Swafford2, Dennis P. Kwon3, Jason M. DeFreitas4, Matt S. Stock5, Oklahoma State University, Stillwater, OK. 1University of Central Florida, Orlando, FL. Email: robmaclellan@gmail.com

Muscular fatigue has been reported to have varying effects depending on sex. Both males and females incur deficits in strength resulting from strenuous activity but males suffer greater relative deficits. Similarly, in a fatigued state, males may be relatively less able to activate muscles. PURPOSE: We sought to determine whether the decrease in strength that males and females suffer is related to changes in their voluntary activation (%VA). METHODS: Twenty-two untrained, college-aged, males (11) and females (11) participated. Subject’s dominant lower leg was strapped to an attachment set at an angle of 110° (180° = full extension) for isometric knee extensions. At pretesting, subjects performed maximal voluntary contractions (MVC) and the interpolated twitch technique was applied to assess %VA. Following initial testing, a fatigue protocol was performed which consisted of 20 six-second MVCs with 3 seconds in between. In the fatigued state, subjects again performed an MVC and %VA was assessed. Linear regression was performed to determine if the variance in fatigability, as measured by change in MVC, can be accounted for by changes in %VA for each sex. RESULTS: Regression showed that 15.3% and 1.1% of the variance in force loss could be explained by changes in %VA in males and females, respectively. However, neither of these models were significant (p = 0.233 and p = 0.760). The results are shown in the figure below for both males (circles) and females (triangles). A 2-way mixed-factorial ANOVA showed neither a group × time interaction (p = 0.296), nor a main effect for time (p = 0.288) for %VA. CONCLUSIONS: The findings suggest that voluntary activation was not responsible for the force loss with fatigue in either males or females. For the females, this could be partially due to the fact that many of them had minimal changes in MVC from the fatigue protocol, whereas all of the males showed at least a 10% deficit. However, there were no differences in %VA between males and females.

The characters and mechanisms of surface electromyography (sEMG), Sm02 and [Hb] in active and antagonistic muscles were recorded and analyzed using multiple 2x2 (group x gender) analysis of variance (ANOVA) at a significance level of p<0.05. The EMG signals were recorded from the biceps brachii (BB) and triceps brachii (TB) muscles using linear electrode arrays composed of sixteen electrodes (10mm inter-electrode distance). The monopolar EMG signals were amplified.
Ultramarathon running has increased in popularity over the past decade. However, the effects of prolonged running on novel circulating inflammatory factors, such as calprotectin, and their relationship to muscle strength are not completely understood. Purpose: Determine the effects of prolonged running on quadriceps strength and plasma calprotectin levels and examine the relationship between these two factors. Methods: Trained men and women (n=11) age 39 ± 7 years participated in a 50-kilometer (k) trail run consisting of five 10k laps. Seated knee extensor force was measured before the race, after each lap, immediately post-race and 24h post-race using a hand-held dynamometer. Quadriceps torque (N·m) was calculated by multiplying tibial length by force. Blood was drawn 30 minutes after participants finished eating their pre-race meal, after the first lap (10k), within 60 minutes of finishing the race and 24h post-race. Plasma calprotectin was measured using an enzyme-linked immunosorbent assay (ELISA). Results: Quadriceps torque did not significantly change from pre-race to lap 1 (P=0.64), but significantly declined post-race (-10%; P=0.047) and returned to pre-race values by 24h post-race (P=0.1). Compared with lap 1, quadriceps torque declined significantly by lap 2 (-9%; P=0.024) but remained unchanged from lap 2 through post-race (between -10% and -8% from lap 2 through post-race; P>0.05 for each timepoint). Plasma calprotectin increased 63% at lap 1 (P<0.001), and returned to pre-race values by 24h post-race (P=0.66). Pre-race calprotectin levels directly correlated with quadriceps torque at lap 1 (r=0.627, P=0.023), post-race (r=0.771, P=0.005) and 24h post-race (r=0.767, P=0.006). Plasma calprotectin levels 24h post-race directly correlated with 24h post-race quadriceps torque (r=0.604, P=0.04). Conclusion: Athletes participating in a 50k ultramarathon experienced an acute decline in quadriceps torque that coincided with an acute increase in plasma calprotectin concentrations. Both torque and plasma calprotectin returned to pre-race values after 24h. The relationships between calprotectin levels and muscle torque before, during, and after the race suggest a potential novel role for calprotectin in muscle recovery from an ultramarathon.
Purpose: To compare the potential contralateral repeated bout effect (conRBE) in both biceps brachii and first dorsal interosseous (FDI) muscles.

Method: Fifteen adults (Age: 25.2 ± 4.4 years; Weight: 76.0 ± 11.4 kg; Height: 171.7 ± 7.3 cm) participated in this study. Participants were randomly assigned to either arm (n = 8) or the other group (n = 7). After the first visit as the familiarization, Visit 2 was the eccentric exercise visit, during which the participants performed 6 sets of 10 repetitions eccentric exercise at 50% maximal voluntary isometric contraction (MVIC) in the designated muscle group (randomly chosen between dominant and non-dominant sides). Before (pre) and after (post) exercise, MVIC, submaximal isometric torque production at 0° (met) and 30° (met), MVC, mean force (MNF), and delayed-onset muscle soreness (DOMS) were measured. Specifically, the trapezoid contraction task required the participants to gradually increase the force from 0 to 30% MVIC in 3 seconds, held it for 10 seconds, and then gradually decrease the force to 0% in 3 seconds. During the Visits 3 and 4 (24-hour post- and 48-hour post-exercise), all measurements were collected. One week after Visit 2, the exact same exercise was performed and the measurements were obtained for the contralateral muscle group with EMG signals from the biceps brachi or FDI muscles were collected, and separate three-way [group (arm vs. hand) × bout (bout 1 vs. 2) × time (pre vs. post vs. 24 post vs. 48 post)] repeated measures analysis of variances (ANOVA) were used to examine the mean differences in dependent variables.

Results: For the biceps brachii muscle, the pre to 24 post change (delta) in ROM showed a significant difference between first bout and second bout (first vs. second bout: 27.01 ± 11.84 vs. 16.81 ± 9.88, p = 0.042). There were significant differences between first bout and second bout at 24 post (55.06 ± 11.44 vs. 37.38 ± 12.67, p = 0.006) and 48 post (65.38 ± 10.00 vs. 47.44 ± 14.99, p = 0.007) for DOMS. In addition, normalized EMG amplitude showed a significant difference between first bout and second bout at post (69.87 ± 25.41% vs. 41.37 ± 17.13%, p = 0.009). However, there was no conRBE in all independent variables on FDI muscle.

Conclusion: The elbow flexor muscles showed conRBE, but hand muscle did not have any protective effect. Therefore, conRBE seems to be muscle specific.

Abstracts were prepared by the authors and printed as submitted.
The number of jumps figure skaters perform daily has never been formally quantified, though it has been suggested that skaters perform 50-100 jumps per training day. The magnitude of force, high loading rates, and frequent repetitions likely contribute to the high injury rate of competitive skaters. Monitoring the number of jumps performed may help decrease risk of injury, similar to the institution of pitch counts in youth baseball.

Activity monitors that are commonly used for activities such as walking and running record many false positives during figure skating jump quantification due to the variety of skating movements that generate similar acceleration profiles. Previously, we developed an algorithm that successfully counted 39 of 40 jumps performed during the competitive routines of 7 local skaters whose isolated jumps were used to create the algorithm.

**Purpose:** To test the performance of the algorithm on an independent sample of skaters of varying skill levels.

**Methods:** 18 healthy competitive figure skaters participated in this study (ages 8-26y, 12 female). Each skater wore an IMU affixed to the lower back while they performed a variety of jumps, spins, and footwork. A high speed video camera recorded all trials for validation purposes. Custom software was used to analyze the IMU data to quantify the number of jumps performed with >1 rotation.

**Results:** Analysis of the videos showed that we recorded a total of 200 jumps with >1 rotation. The algorithm correctly quantified 94.5% of the jumps in this dataset (189 successful jumps). It also identified 11 jumps with <1 rotation.

**Conclusions:** These results show that this algorithm can be successfully applied to a unique dataset. Many of the jumps with <1 rotation that were counted were “popped” jumps, where a skater intends to perform a multijump revolution jump prior to take-off, but perform a single instead. Multi-revolution jumps that were not counted included falls and those with too much rotation that occurs on the ice prior to take-off. Finally, this dataset showed that the algorithm may need to be customized for smaller and/or low-level skaters as it failed to identify 7 of 12 jumps performed by a small, beginning level skater (8y, 122cm, 23.6 kg). Further improvements may be made by using machine learning algorithms to differentiate types of jumps as well as jump count.

**Test-retest Reliability And Concurrent Validity Of An In-shoe Pressure System During Two Landing Maneuvers**

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**Purpose:** To determine the test-retest reliability of the peak plantar pressure measured by an in-shoe pressure system during landing from long-jump (LLJ) and landing from heading-jump (LHJ) performed by healthy soccer players. A second purpose was to evaluate the concurrent validity of the peak plantar pressure in relation to the peak vertical GRFs obtained using a force plates system as a criterion reference during both landing maneuvers.

**Methods:** Ten healthy soccer players (age: 25.6 ± 2.67; BMI: 22.74 ± 2.33) participated in this study. LLJ included jumping forward and landing on the force plates, whereas LHJ included jumping forward to head a soccer ball and landing on the force plates. Each participant performed five trials of each landing maneuvers. Within three days from initial testing, participants were asked to perform the same five trials of each landing task. Peak plantar pressure and peak vertical GRFs were measured during the landing phase (from initial contact to maximum bilateral knee flexion).

In-shoe pressure sensor systems have been used to measure vertical ground reaction forces (GRFs) during functional tasks in clinical settings. However, no study has evaluated their reliability and validity during functional tasks in healthy soccer players.

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**Conclusions:** Ten healthy soccer players participated in this study. LLJ included jumping forward and landing on the force plates, whereas LHJ included jumping forward to head a soccer ball and landing on the force plates. Each participant performed five trials of each landing maneuvers. Within three days from initial testing, participants were asked to perform the same five trials of each landing task. Peak plantar pressure and peak vertical GRFs were measured during the landing phase (from initial contact to maximum bilateral knee flexion).

**Intra-class correlation coefficients [ICC (3,2)] were used to determine test-retest reliability. Pearson product-moment coefficient of correlations (r) were calculated to compare the peak plantar pressure with the peak vertical GRFs.

**RESULTS:** Test-retest reliability exhibited good reliability: ICC values ranged from 0.916 to 0.981 for left limb peak acceleration and 0.903 to 0.978 for right limb peak acceleration. ICCs for RMS of left and right limb ranged from 0.908 to 0.979 and 0.899 to 0.977 respectively. **Conclusions:** The IMUs showed good to excellent reliability for both peak and RMS total acceleration across both limbs during the forward lunge. This demonstrated the potential for their integration as a clinical tool to provide quantified measures of an individual’s forward lunge performance.

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Incorporating inertial measurement units (IMU) into screening tools affords the ability to ‘quantify’ commonly used functional tasks using angular velocity and acceleration as an outcome variable. These ‘quantified’ tasks have may have greater depth, accuracy, and sensitivity than that achieved with standard clinical evaluation tools. Angular velocity can quantify how fast a segment or joint rotates, and provide a preliminary understanding of neuromuscular control during dynamic tasks including a forward lunge. PURPOSE: To determine the reliability of IMU-derived knee joint angular velocity during a forward lunge. METHODS: Twenty-three healthy individuals participated in this study (12M/11F, 30.8 ±8.6years, 1.7 ±0.9m, 65.3±10.8kg). Participants performed a set of 5 lunges on the right limb and 5 on the left limb, repeated 3 times separated by 10 minute rest periods. Lunge distance was normalized to 100% (±5%) of leg length. IMUs were worn on the lateral thigh and shank of each limb. The following anchor points were defined for segmentation: initiation, initial contact 1 (IC1), midpoint and initial contact 2 (IC2), termination. Peak and average thigh and shank angular velocity were extracted from the 2-axis gyroscope signal for each lunge segment and for a 50ms window either side of IC1. Peak and average knee joint angular velocity in each segment was calculated from thigh and shank data. Intraclass correlation coefficients (ICCs) were calculated based on a mean rating (k=3), absolute agreement, 2-way mixed-effects model. Intra-session reliability was defined as poor (ICC<0.5), moderate (0.50-0.75), good (0.75-0.9) or excellent (>0.9). RESULTS: ICC values ranged from 0.841 to 0.911 for peak left knee joint angular velocity and 0.760 to 0.939 for peak right knee joint angular velocity. Average left knee joint velocity had ICCs ranging from 0.912 to 0.972, and 0.922 to 0.965 for average right knee joint angular velocity. CONCLUSIONS: IMU-derived knee joint angular velocity had good to excellent intra-session reliability during a forward lunge and demonstrate good potential for providing quantitative data on forward lunge performance. IMUs may provide a more accessible alternative to 3D motion analysis or screening tools for lower limb function and neuromuscular control in a clinical setting.

Individuals who rely on wheeled mobility have unique fall risk factors (e.g. seated postural control) and recommended fall risk screening tools are predominantly designed for ambulatory individuals. Consequently, most non-ambulatory adults do not undergo comprehensive fall risk screening or receive targeted fall prevention strategies. PURPOSE: To examine the validity of smartphone-based postural control assessment tools in non-ambulatory adults. METHODS: Eleven participants (age: 35.4 ± 17.9) completed three clinical tests: The Trunk Control Test, Function in Sitting Test (FIST), and the concept of the Vestibular Scoring Scale (VSS). The AUC for ROC plots were significant for RMS ML sway during the eyes open test and functional stability boundary (p=0.045 and 0.018, respectively). CONCLUSION: This study illustrated that smartphone technology may be able to provide a valid assessment of seated postural control and have the potential for providing objective fall risk assessments for non-ambulatory adults.

Reported Relationships: No relevant relationships reported

**Verification of A Wearable Inertial Sensor Unit To Measure Balance And Stay During Postural Tasks**

Jason M. Avedesian, Mathew Sunil Varne, Ryan Tingle, Janet S. Dufek, FACSIM. University of Nevada, Las Vegas, Las Vegas, NV. (Sponsor: Janet S. Dufek, FACSIM)

**Purpose**: To assess the validity of a wearable IMU against a force platform (FP) during postural control tasks in adults. METHODS: Twenty-four participants completed three trials of four stance conditions (double-leg, tandem, left leg, and right leg) with eyes open (EO) and eyes closed (EC). Concurrent measures of postural control (anterior-posterior and mediolateral sway, path length, and sway area) during each stance were collected as participants stood on a single FP while wearing the IMU on the sternum. Statistical analyses were conducted on mean percentage change (MPC) from EO to EC for sway parameters from the FP and IMU during the four stance conditions. Multiple multivariate analyses of variances were conducted to determine whether statistical differences existed between instruments (p < 0.05). RESULTS: The differences in MPC when comparing the IMU to the FP were 5-33% for double-leg stance, 8-130% for tandem stance, 0-82% for left leg stance, and 12-178% for right leg stance across postural control measures. Significant multivariate differences were found for double-leg [F = 12.233, p < .001], tandem [F = 13.927, p < .001], left leg [F = 3.725, p = .011], and right leg [F = 4.031, p = .007] stance. Pairwise comparisons indicated significant differences for anterior-posterior sway (p < 0.010) and path length (p < 0.01) during double-leg stance and path length (p < 0.005) during tandem stance. CONCLUSIONS: Preliminary results indicate large differences in postural control when utilizing this IMU versus a FP for assessing sway in direct comparisons. It must be noted that sway from this IMU is projected from its center of mass. Thus, direct comparison may be misleading. Further study is suggested to incorporate the IMU projection algorithm, in order to make more appropriate direct comparisons between instruments. It is important for researchers to understand algorithms that are implemented in IMU software to determine reliability of measurement, prior to stating experimental outcomes.

Reported Relationships: No relevant relationships reported

Velocity-based training (VBT) has demonstrated to be a valid and useful approach to promote greater neuromuscular adaptations in resistance training (RT). This approach typically requires velocity monitoring during RT sessions for appropriate adaptations. The validity and reliability of a chronometer-based mobile App for RT monitoring in the half-squat exercise have been previously shown with a 10 repetition maximum (RM) load, when compared to a linear encoder. However, no data exist with other exercises and different loads. PURPOSE: To determine the validity and reliability of a chronometer-based mobile App for velocity monitoring in the bench press exercise with different loads. METHODS: Twenty-handball players (23.0 ± 2.6 yrs, 1.76 ± 0.06 m, 79.6 ± 13.0 kg), completed a 1RM determination, 5 repetitions with the 25, 40, 55 and 70% of 1RM in the bench press exercise, with the maximal intended velocity, in 2 days separated by 48-72 hrs. Bar velocity (m/s) was monitored simultaneously by means of a linear encoder with a sampling rate of 1,000 Hz (reference method), and a chronometer-based mobile App. Validity was examined through paired samples t-test, the Hedge’s effect size (ES), the Pearson’s correlation coefficient (r), and the standard error of estimate (SEE). Reliability was assessed by the coefficient of variation (CV) and the standard error of measurement (SEM). RESULTS: Regarding validity, all relative loads evaluated demonstrated significant differences (P < 0.05) and small to moderate ES (range: 0.31-1.19) between devices, with the mobile App exhibiting greater bar velocities than the linear encoder. However, bar velocities measured with both devices were highly correlated (r ≥ 0.74) with a very low SEE (≤ 0.09 m·s⁻¹). The App exhibited for all loads a low SEM (≤ 0.11 m·s⁻¹), and acceptable CV (< 10%) with the exception of the highest load (70%1RM) (CV = 12.1%). CONCLUSIONS: A chronometer-based mobile App may be considered a valid and reliable method for VBT monitoring in the bench press exercise.

Current postural control tests for baseline concussion analysis and return to play decision making are of moderate reliability, attributed to subjective scoring. A recently developed inertial measurement unit (IMU) may offer clinicians a feasible, objective tool for postural control analysis surrounding a concussive event. PURPOSE: To validate the use of an inertial sensor-based postural control assessment tool during a concussive event.

**Board #225** May 29 2:30 PM - 4:00 PM

**Validation Of A Wearable Inertial Sensor Unit To Measure Balance And Stay During Postural Tasks**

Jason M. Avedesian, Mathew Sunil Varne, Ryan Tingle, Janet S. Dufek, FACSIM. University of Nevada, Las Vegas, Las Vegas, NV. (Sponsor: Janet S. Dufek, FACSIM)

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Reported Relationships: No relevant relationships reported

Abstracts were prepared by the authors and printed as submitted.
Lower body positive pressure treadmills (LBPPT) allow patients to walk in a gravity reduced environment of their total body weight with new embedded gait analysis module capable of documenting gait outcomes. PURPOSE: To validate step length (SL) measurement calculated by the LBPPT against a two-dimensional camera system. METHODS: Nine participants (5 male and 4 females; mean age 30.8 years) walked and ran for five minutes at 3 mph, 4 mph, 5 mph, and 6 mph on a lower body positive pressure treadmill (LBPPT). At each speed the subjects were unweighted at 80%, 60%, 40% and 20% of their total body weight (BW). A side camera view was employed to record step length. Five SL measurements from the middle minute were taken from each video from heel to heel and averaged to represent SL for each BW and speed. The right and left SL measurements from the treadmill were averaged as a composite SL measurement for analysis. Intra-class correlation coefficients were estimated for the average of five trials of the video data. Pearson correlations were calculated between step length from the treadmill and video. Correlations were considered significant at p<0.05.

RESULTS: All speeds and body weight conditions exhibited excellent reliability (ICC > 0.90) for the average of five trials for the video analysis. The correlations between the treadmill and video analysis for the speeds of 3 and 4 mph showed varied correlations fluctuating from poor to good (r=.21-.98) with correlations greater than r=.85 showing statistical significance. The correlations between treadmill and cameras for the 5 and 6 mph speeds showed no statistically significant correlations ranging from r=0.02-0.69.

CONCLUSIONS: The gait analysis module of the LBPPT does not measure direct step length from the instrumented belt after the transition from walking to running. The LBPPT might be using an algorithm to extrapolate the anticipated step length if the goal is to use that model to estimate a particular quantity (i.e. GRFvert).

Advances in wearable technology provide opportunities to collect biomechanical data in real time and non-lab settings. However, there are currently no standards for best practice use of wearable sensors for gait applications. PURPOSE: Provide best practice recommendations for use of wearable accelerometers (WA) in gait biomechanics. METHODS: Literature was reviewed to determine appropriate WA range for gait biomechanics and establish procedures for calibrating and processing WA data for gait applications. Drop tests of three, simultaneously initialized, commercially available WAs were performed to determine signal time synchronization and 1 g acceleration accuracy. WAs were secured to different lower limb locations (pelvis, knee, ankle) and walking and running trials performed. Peak acceleration magnitude and timing were compared within and among WAs by location and gait type. Vertical ground reaction force (GRFvert) was estimated using a regression model, developed based on pelvis acceleration data, to determine the sensitivity of the GRFvert estimates to WA placement. RESULTS: Peak lower limb accelerations can exceed 25 g during running. WAs initialized at the same time had significant temporal differences (up to 1.66 s). Accelerations during slow-walking were within 17% of 1 g. After synchronizing WA signals based on the drop test results, there were no significant differences in WA magnitude and timing among three WAs located around the right iliac crest, but there were significant acceleration differences among WAs located at the right iliac crest, knee, and ankle. Walking and running peak GRFvert estimates based on accelerations of the iliac crest differed from estimates based on accelerations of the knee (<1.5 ± 0.28 N and 142 ± 20 N, respectively) and ankle (261 ± 28 N and 274 ± 66 N, respectively). CONCLUSIONS: WAs should be: (1) selected to measure a range greater than 25 g, (2) calibrated to ensure accuracy, (3) manually time synced if using multiple sensors, (4) placed carefully though exact placement is not critical to anatomical site acceleration estimates near the hip, and (5) located at the same anatomical site that was used to develop an acceleration-dependent model if the goal is to use that model to estimate a particular quantity (i.e. GRFvert).
Instantaneous power output measured at the cranks when cycling in a non-seated posture is not equivalent to the instantaneous joint power produced by the rider. This discrepancy is due to additional power that is generated on, and by, the rider’s centre of mass (CoM). Capturing CoM motion in a laboratory setting is relatively straightforward; however, an accurate and reliable method for measuring this in the field remains elusive.

PURPOSE: To test whether a single Inertial Measurement Unit (IMU) placed on the torso of the rider at L4-L5 can provide an accurate and precise measure of vertical CoM displacement during non-seated cycling.

METHODS: We first assessed whether the IMU could track its own vertical displacement by comparing it to an attached marker cluster tracked using three-dimensional motion capture. We then compared vertical displacement of the IMU to a kinematic estimate of vertical CoM displacement using a full body musculoskeletal model. IMU (100 Hz) and motion capture (200 Hz) data was collected synchronously during isometric ramp contraction up to 30% MVC. On two separate occasions, surface electromyography (EMG) activity in the vastus lateralis (VL) muscles during low-force knee extensions.

RESULTS: In all trials, the IMU performed well with a dynamic RMS error of 0.17 ± 0.04 radians/s across all orientation components. The IMU measured vertical displacement of the marker cluster with high accuracy (0.002 ± 0.002 m) and precision (0.009 ± 0.005 m) with an average error of 1.7% and 5% at 70 rpm and 120 rpm, respectively. Agreement between the IMU and the kinematic prediction of CoM displacement was lower with an accuracy of 0.016 ± 0.003 m and precision of 0.010 ± 0.004 m.

CONCLUSIONS: These results suggest that a single IMU can provide a highly accurate and precise measure of its own orientation and amplitude of vertical displacement. Further research is required to test whether agreement between the IMU and the model’s CoM can be improved by placing the IMU in different positions on the torso.

Previous findings have suggested that the distribution of motor units within a muscle may display region-specific muscle activation. Consequently, if regionalization of motor units indeed exists, then force generating capacities would be highly task and joint dependent. PURPOSE: To examine for regional motor unit control from proximal and distal locations of biarticular [rectus femoris (RF)] and monoarticular [vastus lateralis (VL)] muscles during low-force knee extensions. METHODS: Following 2 maximal voluntary contractions (MVC), eighteen resistance-trained men (n = 9, age = 23 ± 3 yrs) and women (n = 9, 22 ± 2 yrs) performed a 10 sec isometric ramp contraction up to 30% MVC. On two separate occasions, surface electromyographic (EMG) signals were collected from proximal and distal locations of either the VL or RF. These were used to record EMG amplitude and were also decomposed into the constituent motor unit action potentials. The slope and intercept values were calculated across the motor units for relationships between mean firing rate, recruitment threshold, and action potential size for each subject. Paired samples t-tests were used to compare regression coefficients and EMG amplitude between proximal and distal locations of biarticular [rectus femoris (RF)] and monoarticular [vastus lateralis (VL)] muscles during low-force knee extensions.

RESULTS: There were no differences in EMG amplitude between locations in the RF (p = 0.31, d = 0.39), however, amplitude in the distal location of the VL was greater than the proximal (p < 0.05; d = 0.64). There were no significant differences in slope or intercept coefficients for any of the motor unit relationships (see Table 1) (p = 0.08 - 0.91, d = 0.01 - 0.64).

CONCLUSION: Although there was a regional difference in the activation across the VL, there were no region-specific differences in the motor unit firing properties. The differences in amplitude were likely due to other factors that affect EMG signals, such as the underlying morphology (muscle size, subcutaneous fat thickness, etc.).

**Table 1. Comparison of ground reaction forces from force plate and motion-capture system (MCS) during counter-movement vertical jumps**

<table>
<thead>
<tr>
<th>Force Plate (N)</th>
<th>MCS (N)</th>
<th>r</th>
<th>r^2</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Force</td>
<td>887.9±131.0</td>
<td>972.9±147.8*</td>
<td>0.97</td>
<td>0.93</td>
</tr>
<tr>
<td>Peak Force</td>
<td>1662.0±386.6</td>
<td>1823.9±355.5*</td>
<td>0.92</td>
<td>0.84</td>
</tr>
</tbody>
</table>

(n=5); ( X ± SD); * indicates significant difference (p<0.01)
Physiological Determinants Of The Rate Of Torque Development In Older Men: A Pilot Study
Mitchel Magrini1, Ryan J. Colquhoun2, Syndie Fleming2, Matthew C. Ferrell2, Nathaniel D.M. Jenkins3, Jason M. DeFreitas4,1 Creighton University, Omaha, NE. 2University of South Alabama, Mobile, AL. 3Oklahoma State University, Stillwater, OK. (Sponsor: Joan Eckerson, FACSM)

In young, healthy adults, early phase (i.e., 0-50 ms) rate of torque development (RTD) is primarily determined by neural characteristics. However, it is unclear if this remains the case in older adults. PURPOSE: To examine the physiological characteristics of early phase RTD in older men. METHODS: Seventeen older males (age = 73 ± 6 y) completed 2 maximal (MVIC) and 2 rapid (rMVIC) isometric knee extensions. Early phase RTD values were calculated from the first 50 ms (aRTD50) of the rapid contractions and normalized (nRTD50) to maximal torque (%MVIC/s). Muscle activation amplitude (EMG) was calculated during the first 50 ms (nEMG50) of EMG onset and was normalized to the peak-to-peak M-wave amplitude (%M_max). Relationships between the predictor variables (nEMG50, nRTD50, TT, MQ) and RT (aRTD50 and nRTD50) were analyzed via Pearson’s correlation coefficients. Stepwise multiple regression was used to examine the amount of variance in nRTD50 and aRTD50 accounted for by each of the predictor variables. RESULTS: Amplitude (nEMG50 [137.5 ± 97.7 %M_max; r = .673, p = .003], and TT [20.34 ± 12.5 Ns, r = .504, p = .039], nRTD50 [433.2 ± 175.4 %MVIC/s] was related to MUNE (r = .533, p = .028) and nEMG50 and TT were significant determinants (p = .001) that accounted for 45.3% and 15.5% of the variance in aRTD50, respectively. nEMG50 was the only significant predictor (p = .01), explaining 36.4% of the variance in nRTD50.

CONCLUSIONS: These pilot data support the notion that early phase RTD is primarily determined by neural factors, even in older adults. These data also suggest that possessing a higher number of viable MU's may influence early phase absolute RTD in older men.

Lower Extremity Neuromuscular Alteration During Dual Cognitive Standing Balance Tasks In Adults Diagnosed With Hiv
Leah R. Jamison1, Jonathan Marshall1, Ashley Richmond1, Melanie Stephens1, Martin Rosario1, Texas Woman’s University, Dallas, TX. 2Texas Woman’s University, Denton, TX.

Individuals diagnosed with human immunodeficiency virus (HIV) often present with impaired postural control as a consequence of proprioceptive alteration, due to secondary effects of prescription medication. PURPOSE: This study seeks to evaluate lower extremity neuromuscular activation during dual postural control tasks in individuals living with HIV.

METHODS: Twenty-three participants of Hispanic-latino origin diagnosed with HIV (18 male and 5 female, average age 55± 1.7 years) with an average CD4 count of 698.8 (22 years of HIV diagnosis) enrolled in this study. Surface electromyography (EMG) on the tibialis anterior (TA) and gastrocnemius (GA) muscles was used on the participant’s dominant leg. Each task took approximately 15 seconds to finish. Each participant was instructed to quietly stand in a bi-pedal posture on a balance foam.

RESULTS: The variables of interest in this study were 1) time to peak, 2) decay and, 3) duration of muscle activation for TA and GA. A repeated measure ANOVA analysis was used to compare all variables of interest. No significant difference is indicated between duration and decay of muscle activation for TA and GA across the various tasks assessed. Throughout the cognitive balance task, GA time to peak activation was slower (P<0.001) during eyes closed (EC) head movements (H/UD) (7.7 ± 0.7 seconds) when compared to HUD with eyes open (EO) (3.0/3.0 ± 0.2 secs) and, eyes open (EO) (3.0/3.0 ± 0.2 secs).

CONCLUSIONS: As the GA plays a major role in static balance, an increased fall risk could be resultant of this delay in time to peak onset. As such, our research recommends lower extremity electromyography and strength assessment in this population to forestall or decrease fall hazards.
Anterior cruciate ligament (ACL) injuries are common in female athletes. Performance-based feedback (FB) may alter landing mechanics. PURPOSE: To provide peak vertical ground reaction force (PvGRF), loading asymmetry (LA), and frontal-plane (FP) video as post-trial landing FB to evaluate and train female collegiate athletes during single- and dual-task (ST and DT) landing. METHODS: 88 athletes performed both ST and DT (with/without jumping for a suspended ball) landings onto constant, portable force plates sampled at 2000 Hz. FP video showing knee-to-ankle (KA) ratio, a surrogate for knee valgus, was recorded at 100 Hz. Performance trials were conducted in blocks of 3 ST and 6 DT pre-tests, 6 ST and 6 DT with post-trial visual FB (PvGRF in body weight (BW), LA, and FP video), and 3 ST and 3 DT post-tests. RESULTS: Quarters were determined from PreST PvGRF to determine groups (Grp 1 = 3.45 BW; Grp 2: between 3.45-4.10 BW; Grp 3: between 4.01-4.72 BW; Grp 4 > 4.72 BW). PVGRF and KA ratio between task (ST or DT) and over time (pre-test, post-test) were compared using a two-way repeated measures ANOVA where a group*time interaction was observed (p<0.05). Follow-up tests revealed that Grp 3 and 4 improved PVGRF and KA ratio from PreST to PostST that were maintained in PostDT (PvGRF: PreST to PostST Grp 3 = -20.6%, Grp 4 = -32.2%, PostST to PostDT Grp 3 = 3.5%, Grp 4 = 5.2%; KA ratio: PreST to PostST Grp 3 = 4.1%, Grp 4 = 11.0%, PostST to PostDT Grp 3 = 0%, Grp 4 = 1.0%). Grp 1 and 2 demonstrated no change in K:A ratio despite the reduced PvGRF from PreST to PostST. These changes were not maintained during PostDT (PreST to PostST Grp 1 = -11.2%, Grp 2 = -18.3%, PostST to PostDT Grp 1 = 7.8%, Grp 2 = 2.3%). CONCLUSIONS: Collegiate athletes with PreST PvGRF > 4.01 BW may benefit more from performance-based landing FB that are maintained during DT scenarios.

A responsive equine simulator therapy (REST) system is a sitting device replicating motions experienced during horse riding. The mild motion introduced by the REST could promote a more active sitting experience for users. Although the REST system could potentially provide the benefits associated with active sitting, the effect of a REST system on trunk motion, trunk and leg muscle activations over that of sitting on a normal chair has yet to be examined. Purpose: To quantify trunk motion patterns and trunk and leg muscle activity during sitting on a REST system compared to an office chair. Methods: 20 healthy participants (22±2 yr, 75±10 kg, 1.71±7.9 cm) were seated in an office chair and in the REST system on trunk motion, trunk and leg muscle activities through it via a randomized order. Electromyography (EMG) sensors were placed bilaterally on the external oblique (6.13±0.34 mv vs. 5.95±0.30 mv) (p=0.037), tibialis anterior (18.96±0.37 mv vs. 18.73±0.30 mv) (p=0.007), and soleus (5.85±0.65 mv vs. 8.70±1.10 mv) (p=0.018) were significantly higher in the REST condition than those in the Chair condition. Furthermore, average RMS EMGs of the external oblique (6.13±0.34 mv vs. 5.95±0.30 mv) (p=0.037), tibialis anterior (18.96±0.37 mv vs. 18.73±0.30 mv) (p=0.007), and soleus (5.85±0.65 mv vs. 8.70±1.10 mv) (p=0.018) were significantly higher in the REST condition than those in the Chair condition during a 10-second interval. Conclusion: Using a REST device resulted in a significant increase in trunk motion. The elevated activities in trunk and leg muscles serve to maintain and control upper body posture. These biomechanical responses imply that people could assist in helping to establish an active lifestyle by using the REST device on a regular basis.
Stiffness in females was higher than in males, with females demonstrating greater % increase in stiffness (MMG AMP) compared to males. This finding suggests that females may have a greater capacity for stiffness adaptation during fatigue.

**Conclusion:** The study highlights the importance of considering sex differences in neuromuscular responses during fatigue. Females exhibited greater stiffness and force output than males, with females demonstrating a greater capacity for stiffness adaptation during fatigue. These findings have implications for understanding the mechanical and physiological adaptations in females during fatigue, which may be relevant for the design of fatigue-resistant training programs.

**References:**

fatiguating contractions. Sex differences in intermuscular control pattern changes following fatigue have not yet been investigated. **Purpose**: To investigate differences in VMO-VL activation level changes pre- vs. during and post-fatigue between females and males. **Method**: Five healthy females and 5 healthy males performed 5 trials of step-up before and after a sustained fatiguing isometric contraction (MVC). VMO and VL EMG signals were recorded and normalized to percent maximum. **Results**: Males took longer to perform the step-up than females (p=0.05), but the speeds did not change with fatigue. With sexes pooled, the activation levels of both the VMO and the VL during step-up were lowered following fatigue (pre- vs. post-fatigue: VMO: 21.2% vs. 16.7% EMG; VL: 28.3% vs. 21.7% EMG, both P<0.05). Normalized pre-fatigue VL activation levels were lower in males than in females (11.6% vs. 45.0% respectively, P=0.05), whereas pre-fatigue VMO levels were similar between the sexes (males: 13.1% vs. females: 29.4% EMG). After fatigue, there was no difference in VMO and VL activation levels between the sexes, indicating greater fatigue in the VL relative to the VMO in females (activation % Pre-Post females VL vs. VMO: -11% vs. -5%, P<0.05). In males, the VMO and VL fatigued to a similar degree (VL vs. VMO: -2.5% vs. -3.3%). During the sustained isometric fatiguing contraction, the female VL tended to be activated to a greater degree than the VMO, whereas males activated both muscles more equally (VL/VMO activation ratio, 1.55 vs. 0.86, females vs. males, P=0.084). **Conclusion**: Our results show that males and females exhibit different relative VMO-VL neuromuscular fatigue patterns. Females tend to rely more on the VL than the VMO during fatigue while males tend to use both muscles equally.

### Signal Decay of Muscle Activation

**Board #244** May 29 2:30 PM - 4:00 PM

**Quadriiceps Function In Chronic Anterior Knee Pain With Or Without A History Of Knee Surgery**

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(No relevant relationships reported)

It is unclear if a history of knee surgery additively affects quadriceps dysfunction in patients with chronic anterior knee pain (AKP). **PURPOSE**: To compare quadriceps function (strength, activation, and power) in chronic AKP patients with or without a history of knee surgery, to matched healthy controls. **METHODS**: Twenty-eight chronic AKP patients with (n=14; ACL reconstruction=5, meniscectomy=4, and both combined=5) or without (n=14) a history of knee surgery, and 20 matched (age, height, mass, BMI, thigh circumference, and physical activity) healthy controls participated in this cross-sectional study (average values of all three groups in the height, mass, BMI, thigh circumference, and physical activity) healthy controls both combined=5) or without (n=14) a history of knee surgery, and 20 matched (age, height, mass, BMI, thigh circumference, and physical activity) healthy controls participated in this cross-sectional study (average values of all three groups.

- **PURPOSE**:
  - To compare quadriceps function (strength, activation, and power) in chronic AKP patients with or without a history of knee surgery, to matched healthy controls.
  - To examine corticospinal activity during BH, BNH, and unilateral maximal contractions, and resultant changes from task practice.

- **METHODS**: Eleven healthy adults (6 women/5 men, 25.6±3.7 years; 171.8±11.4 cm; 74.4±21.2 kg) participated in the counterbalanced repeated measures study. TCI and VA were assessed with transcranial magnetic stimulation for BH, BNH, and unilateral dominant flexion (DF) sessions 1 and 7. For sessions 2-6, each of five BH elbow flexion, BNH flexion/extension, and DF maximal voluntary isometric contraction (MVIC) tasks were practiced. Paired t-tests or Wilcoxon signed-rank tests, as appropriate, were used to test TCI and VA between sessions 1 and 7. Pearson or Spearman correlation coefficients, as appropriate, between VA and TCI measures and BLD and peak force measures were used to assess any association between neurologically and performance variables on test days 1 and 7. **RESULTS**: There were no differences in VA or TCI between BH, BNH, and DF. BH VA decreased from day 1 (95.1±4.3%) to day 7 (92.2±4.4%, P=0.014), but did not exceed the minimal detectable change (6.4%). VA for BH (r=-0.655; p=0.039) and DF (r=-0.636; p=0.035) was associated with BH BI on day 1. When associated with peak force, day 7 BH (r=-0.627; p=0.039) and BNH (r=-0.682; p=0.021) TCI was corrected. **CONCLUSION**: BI was similar to prior research, but neurophysiological measures did not explain these differences. This is similar to previous equilvalent research between BH and unilateral maximal force and TCI and/or VA, suggesting differences in BH and BNH BI are not solely influenced by neural drive modifications.

**The Bilateral Deficit Phenomenon**

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(No relevant relationships reported)

The bilateral deficit (BLD) phenomenon is an inability to maximally contract bilaterally as compared to the sum of the corresponding unilateral contractions, and is expressed as an index (BI). The underlying mechanism is unknown, but altered transcallosal inhibition (TCI) and diminished voluntary activation (VA) during bilateral homologous (BH), as compared to bilateral non-homologous (BNH) and unilateral tasks, is considered the most likely mechanism. **PURPOSE**: To examine corticospinal activity during BH, BNH, and unilateral maximal contractions, and resultant changes from task practice. **METHODS**: Eleven healthy adults (6 women/5 men, 25.6±3.7 years; 171.8±11.4 cm; 74.4±21.2 kg) participated in the counterbalanced repeated measures study. TCI and VA were assessed with transcranial magnetic stimulation for BH, BNH, and unilateral dominant flexion (DF) sessions 1 and 7. For sessions 2-6, each of five BH elbow flexion, BNH flexion/extension, and DF maximal voluntary isometric contraction (MVIC) tasks were practiced. Paired t-tests or Wilcoxon signed-rank tests, as appropriate, were used to test TCI and VA between sessions 1 and 7. Pearson or Spearman correlation coefficients, as appropriate, between VA and TCI measures and BLD and peak force measures were used to assess any association between neurologically and performance variables on test days 1 and 7. **RESULTS**: There were no differences in VA or TCI between BH, BNH, and DF. BH VA decreased from day 1 (95.1±4.3%) to day 7 (92.2±4.4%, P=0.014), but did not exceed the minimal detectable change (6.4%). VA for BH (r=-0.655; p=0.039) and DF (r=-0.636; p=0.035) was associated with BH BI on day 1. When associated with peak force, day 7 BH (r=-0.627; p=0.039) and BNH (r=-0.682; p=0.021) TCI was corrected. **CONCLUSION**: BI was similar to prior research, but neurophysiological measures did not explain these differences. This is similar to previous equilvalent research between BH and unilateral maximal force and TCI and/or VA, suggesting differences in BH and BNH BI are not solely influenced by neural drive modifications.
Of interest, TCI was highly correlated with force, revealing neurophysiological influence between tasks, but differences in bilateral and unilateral force may be influenced by outside mechanisms.

**RESULTS:** Placebo and ECC-CON (a priori controlled eccentric lowering of the load followed by an explosive concentric contraction) induced declines in neuromuscular performance (e.g. power, force and velocity). However, there is limited research comparing the kinetics (force) and kinematics (velocity and power) of different types of RT contractions, and specifically concentric only (CON-ONLY) and eccentric-concentric (ECC-CON) contractions aiming to throw the load as far as possible. **PURPOSE:** To compare the kinetics and kinematics of ballistic contractions performed as CON-ONLY (explosive concentric contraction performed from rest) vs ECC-CON (a priori controlled eccentric lowering of the load followed by an explosive concentric contraction) in an older adult population.

**METHODS:** Twelve healthy active older adult males (age: 66.5±5.5 years; height: 1.81±0.1 m; body mass: 78.5±10.1 kg; activity: 2175±1450 MTE min-week) completed 3 sessions (1 familiarisation and 2 measurement) using an instrumented isoinertial (30°) leg press dynamometer that facilitated recording of force and displacement that were used to derive velocity and power. Participants performed a series of attempts using both types of contraction (CON-ONLY and ECC-CON: counterbalanced) with a range of loads in ascending order during each measurement session (day 1: 20, 35 and 50; day 2: 50, 65 and 80%1RM).

There was a significant (p<0.001) increase in EMG from rest to peak contraction for all contractions compared to CON-ONLY at 50%1RM (8.7 ± 0.3 vs 7.6 ± 0.3 cm, p < 0.05) and 75% MVC (8.7 ± 0.3 to 7.6 ± 0.3 cm, p < 0.05) across all muscles. There was a significant increase in EMG from peak contraction to the HDbas (7.89% ± 3.20; 47.92% ± 20.59; 36.54% ± 16.83; 46.64% ± 26.05, respectively) and HDadv (9.89 ± 3.08; p=0.001; p<0.001; p<0.001; p=0.002, respectively) exercises as compared to the HDbas (7.89% ± 3.20; 47.92% ± 20.59; 36.54% ± 16.83; 46.64% ± 26.05, respectively). A main contraction effect was found for peak force (p=0.001) and mean velocity (p<0.001), with post hoc analysis revealing that mean power was higher for ECC-CON at 65% (310 vs. 430W, +23.0%, p<0.01) and 80%1RM (229 vs. 337W, 47.3%, p<0.01). Mean velocity was higher in ECC-CON across all loads (+13.7 - 49.5%; all p<0.01).

**CONCLUSIONS:** CON-ONLY and ECC-CON ballistic contractions produced similar peak neuromuscular performance in an older adult population. However, ECC-CON contractions involved greater mean power and mean velocity. In conclusion, it may be beneficial for older adults to perform ECC-CON contractions as they provide equi-peak neuromuscular performance as CON-ONLY, but superior mean neuromuscular performance.

**F-64 Free Communication/Poster - Posture and Balance**

**Board #251 May 29 2:30 PM - 4:00 PM**

**Reliability Of The Repeated Unilateral Partial Squat As A Neuromuscular Control Screening Activity**

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**No relevant relationships reported**

**PURPOSE:** A single leg squat task is often used to assess dynamic strength, flexibility, coordination, and balance of an athlete. The composite of these physical components provides insight to the clinician about an athlete’s overall neuromuscular control. However, the variation in the non-weight bearing limb’s position influences body alignment causing variability in movement patterns. The repeated unilateral partial squat (RUPS) activity is designed in hopes to limit this variability. The purpose of this study is to assess the within-subject kinematic repeatability of the RUPS activity.

**METHODS:** A 20 Vicon MX® T-series motion capture system (240 hz) was used to construct a 15-segment model of 33 study consenting female adolescent athletes (mean age=17.4 ± 3.1 y). Each stood on one leg at the edge of a 20-cm box, with opposite

There was a discrepancy in relation to the pre-classification intensity of Pilates exercises (PE) and their real impact on muscular activation compromising training prescription. **PURPOSE:** To compare five muscles EMG activation during seven PE. **METHODS:** Surface EMG were recorded for lower (LRA) and upper rectus abdominus (URA), internal (IO) and external obliques (EO) and multifidus (MS) muscles, while seventeen women performed the Rolling Like a Ball basic (RLBas), Rolling Like a Ball intermediate (RLBInt), Rolling Like a Ball advanced (RLBadv), The Seal, Open Leg Roller (OLR), The Hundred basic, The Hundred advanced (HDadv) exercises. **RESULTS:** For the URA, LRA, IO and EO muscles, the exercises RLBas (21.94% ± 7.3; 26.31% ± 9.79; 31.59% ± 11.65; 35.90% ± 13.5, respectively), RLInt (32.1% ± 7.3; 29.72% ± 9.8, 36.76% ± 16.44, 44.91% ± 15.95, respectively), RLAdv (25.29% ± 7.33; 30.89% ± 9.66; 35.35% ± 8.87, 43.88% ± 13.09), SL (24.11% ± 13.53; 33.28% ± 13.87; 35.15% ± 16.37, 37.67% ± 17.24, respectively), OLR (21.91% ± 10.78; 30.94% ± 11.39, 33.65% ± 13.87; 34.26% ± 10.26, respectively) and HDbas (53.92% ± 16.3; 47.92% ± 20.59; 36.54% ± 16.83; 46.64% ± 26.05, respectively) exercises presented significant less EMG percentage when compared to HDadv (71.69% ± 18.03; 75.69% ± 17.44; 57.86% ± 16.49; 88.71% ± 30.40, respectively). Besides, for the URA muscle significant (p<0.001) more EMG percentage was found comparing the HDbas to the RLBbas, RLBInt, RLBadv, SL and OLR exercises. Furthermore, for the MS muscle, significant greater EMG was found when compared the RLBas (27.59% ± 10.95), RLInt (27.68% ± 12.9), RLBadv (32.26% ± 13.91) and SL (32.1% ± 13.81) exercises to the HDbas (7.89% ± 3.20, p<0.001) and HDadv (9.89 ± 3.08; p=0.001; p<0.001; p<0.001; p=0.002, respectively). **CONCLUSIONS:** The HDbas was the most effective exercise in producing muscle activity of the spinal flexors, while the other exercises could be grouped at the same moderate level of intensity for the URA, LRA, IO and EO muscles. Contrary to the current PE prescription, the RLBas, RLInt, RLBadv and SL exercises, although indicated as spinal flexors exercises (less than 30% of maximum for spinal flexor muscles), seem to play a more significant role in the activation of MS, resulting in a moderate EMG activation. Supported by Capes and CNPq.
PURPOSE: Visual feedback of one’s balance has potential to augment balance training. However, natural visual cues of the environment already provide robust stabilization, and therefore additional visual biofeedback may have little effect on body sway. We quantified the extent to which different types of visual feedback influence sway in a novel trunk balancing task.

METHODS: Twelve healthy young adults sat on a motorized bench that tilted up and down in direct proportion to trunk sway. This paradigm greatly increases the difficulty of the balance task and requires subjects to rely on visual and vestibular systems. In each trial, participants were provided different types visual feedback through a rotating needle-gage display on a 15 by 20 cm computer monitor located 0.85 m in front of the participant. Trials lasted 100 s, were randomly ordered, and included direct feedback (needle rotated in proportion to body sway), inverted feedback (needle rotated in the opposite direction of sway), time delayed feedback (0.5 s), random feedback RF, eyes closed, and control (eyes open with screen off). Participants were informed “visual feedback might be helpful”.

RESULTS: Direct feedback trials had a large and significant (p<.05) impact on sway resulting in lower positional variability (root-mean-square, RMS): 62% of control trials. Despite moving in the opposite direction, inverted feedback also reduced sway to appreciable amounts of 80% RMS compared to control, but was not statistically significant. Time delayed feedback only reduced sway to 90% of control RMS. In contrast, random feedback actually significantly (p<.05) increased participants’ sway by 44%, similar to the anticipated significant (p<.05) increases in sway in the eyes closed trial (90% increase). RMS velocity was less impacted by visual feedback with only eyes closed trials associated with significant changes.

CONCLUSION: Real-time position-based visual feedback had a significant effect on balance, reducing body sway, while random feedback increased sway. Interestingly, even when participants were trying to ignore the random feedback, it still increased body sway. Results suggest that carefully selected real-time visual feedback could be useful in augmenting balance training during challenging balance tasks. Funding: NSF DARO 1803714

3432 Board #253 May 29 2:30 PM - 4:00 PM Visual Biofeedback Improves Balance Control-- Until It Doesn’T
Adam Goodworth1, Sara Fitzhuge2, Amy Kratzer2, Makenna Lommar1, Mark Rowley1, Jerunique Robertson1, Sandra Saavedra2, 1Westmont College, Santa Barbara, CA. 2University of Hartford, West Hartford, CT.

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FRIDAY, MAY 29, 2020

(No relevant relationships reported)
Anterior pelvic tilt is associated with excessive foot pronation, excessive hip internal rotation (HIR), and knee valgus, which may lead to hip muscles strains, sciatic nerve compressions, and sacroiliac and lumbosacral joint instability. Posterior pelvic tilt is associated with feet supination and increased hip external rotation (HER), which may lead to tibial stress fractures, medial tibial stress syndrome, knee pain, anterior cruciate ligament injury, and low back pain. Hip adductors/abductors (add/abd) torque ratio (TR) below 80%, was associated with adductor strains. The average hip flexors/extensors (flex/extension) TR in sport performance was found to be 70%. There is a lack of evidence that correlates pelvic tilt angle with limited HIR, HER, add/abd TR, and flex/extension TR. PURPOSE: to examine the correlation between pelvic tilt angle and the dependent variables for the right and left limbs, were recorded. Hip torques were collected with an isokinetic dynamometer, five trials at 30 deg/s and 60 deg/s. RESULTS: The mean value for NPT was 5.7 ± 5.4 deg. There were no significant correlations between NPT and the dependent variables for the right limb: HIR (r = 0.16, p = 0.43), HER (r = 0.11, p = 0.58), add/abd TR at 30 deg/s (r = 0.19, p = 0.34), add/abd TR at 60 deg/s (r = 0.13, p = 0.51), flex/extension TR at 30 deg/s (r = 0.32 p = 0.10) and flex/extension TR at 60 deg/s (r = 0.70, p = 0.01). Similar results were observed for the left limb: HIR (r = 0.20, p = 0.89), HER (r = 0.25, p = 0.21), add/abd TR at 30 deg/s (r = 0.17, p = 0.38), add/abd TR at 60 deg/s (r = 0.12, p = 0.55), flex/extension TR at 30 deg/s (r = 0.60, p = 0.75) and flex/extension TR at 60 deg/s (r = 0.19, p = 0.33). CONCLUSION: the measurement of NPT angle in standing natural position is not a good predictor of hip flexors/extensors TR. The two balance assessments were then completed. Test one consisted of the Balance Error Scoring System (BESS) with the second test utilizing a baseline balance task. Significant differences were observed for most of the postural variables between the two conditions. RESULTS: A Shapiro test was used to ensure the sample points were normally distributed and the Brown-Forsythe test was used to account for unequal variances between the matched pairs. The flexion values for the left (p-value < .008) and right (p-value < .001) hip joints were found to be significant. All other hip ROM values demonstrated no significance. Significance was found for total errors of the BESS (p-value < .01). No significance was recorded for the force plate balance test. CONCLUSION: These results demonstrate the presence of a warm-up increased hip flexion range of motion in both hip joints and also impacted BESS balance scores. In conclusion, this suggests the addition of a warm-up to baseline balance assessment. A larger sample size is needed to further validate these findings.

Supported by American College of Sports Medicine - Central States Region Chapter Undergraduate Research Grant

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

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Three main sensory systems (somatosensory, visual, and vestibular) contribute to human postural control. These three sensory systems can compensate for each other if one of them lose their orientation information. Adjusting sensory input is referred to as sensory re-weighting. However, due to experimental limits, little is known how disrupted vision affects sensory re-weighting during dynamic postural control. PURPOSE: Therefore, this study examined the effect of impaired visual sensory input on dynamic postural control through the use of stroboscopic glasses. METHODS: Subjects were 24 physically active adults (male: 12, female: 12, height: 172.1 ± 7.5cm, weight: 67.5 ± 10.4kg) recruited from a university population, aged 18-35 years. Each subject performed the star excursion balance test (SEBT), which includes 3 trials comprised of 3 directions (anterior, postero-medial, and lateral) on the force plate and 3 trials lateral on the force plate and 4 trials on the foam surface. Each trial was run on both firm and foam surface. Reach distance was analyzed 3 times (3 trials) by use of a custom program (MoV & VMP, University of California, San Francisco). RESULTS: Similar results were observed for the right and left limb. Hip torques were collected with an isokinetic dynamometer, 5 trials at 30 deg/s and 60 deg/s. Flexion values for the right (p-value < 0.01) and left (p-value < 0.001) hip joints were found to be significant. All other hip ROM values demonstrated no significance. Significance was found for total errors of the BESS (p-value < 0.01). No significance was recorded for the force plate balance test. CONCLUSION: These results demonstrate the presence of a warm-up increased hip flexion range of motion in both hip joints and also impacted BESS balance scores. In conclusion, this suggests the addition of a warm-up to baseline balance assessment. A larger sample size is needed to further validate these findings.

Dynamic visual acuity (DVA) requires visuo-perceptual processing to resolve the critical details of a target in motion. Athletes demonstrate superior DVA performance compared to non-athletes in a seated position. PURPOSE: To investigate the effects of different postures and exertion levels on DVA in athletes. METHODS: 24 male rugby players (age: 20.6 years ± 1.4) without recent concussion (≥ 2 years) and/or vestibular-ocular abnormalities were included. DVA was assessed using a custom program (mov&VMP). University of Waterloo, Ontario, Canada. RESULTS: The difference in LogMAR scores from the seated condition were calculated for each of the other conditions. There were no interaction effects of target motion and posture (F=1.02, p=.382), and no main effect of target motion (F=0.30, p=.598). However, there was a trending main effect of posture (Stand: 0.00 vs. Walk Low: -0.14 vs. Walk Mod: 0.04 p=.056, p=.25). These findings indicate that athletes’ DVA improved from seated to moderate speed walking more so than both standing and low-intensity treadmill walking. CONCLUSION: Athletes appear to have improved DVA in sport-specific conditions of greater postural and exertional demands. Therefore, sport training experience may enhance visuo-perceptual skills. These findings may inform clinicians to consider the assessment of DVA with progressive, dynamic contexts for rehabilitation, such as for return to sport from concussion.
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Mal de debarquement (MdD) is the subjective perception of self-motion experienced after prolonged episodes of passive motion (PM) such as a boat ride (e.g. sea legs). Transient MdD (<48 hours) occurs frequently and is described as a rocking, bobbing, or swaying sensation accompanied by unsteadiness and disequilibrium after cessation of the PM stimulus, and is suggested to impact postural control. PURPOSE: To examine changes in postural control after prolonged exposure to boat movement at sea. METHODS: Postural control of 24 adults (13 M, 11 F; age = 35 ± 12 y; height = 170.3 ± 8.8 cm; mass = 84.2 ± 17.0 kg) was assessed in bilateral stance on a force platform with eyes open (EO), eyes closed (EC), foam surface eyes open (FOE), and foam surface eyes closed (FEC) before (PRE) and after (POST) a 7-hour deep sea fishing excursion. Postural control measurements including average sway (cm, sway range (cm), sway velocity (cm/s), and maximum sway velocity (cm/s)) were analyzed in the medial/lateral (ML) and anterior/posterior (AP) directions. Time-to-boundary (TBB) measures of postural control (minimum, average, SD of minima) were computed for all variables were compared PRE/POST using a paired t-test and Cohen’s d effect sizes were calculated. RESULTS: Greater ML sway excursion was observed POST in EO (t = 2.37, p = 0.03, d = 0.66, PRE = 0.13 ± 0.04, POST = 0.18 ± 0.10), FEO (t = 2.95, p = 0.04, d = 0.46, PRE = 0.40 ± 0.14, POST = 0.47 ± 0.17), and FEC (t = 2.03, p = 0.027, d = 0.42, PRE = 0.50 ± 0.12, POST = 0.55 ± 0.15). Greater AP sway excursion was observed POST in FEO (t = 1.77, p = 0.045, d = 0.34, PRE = 0.63 ± 0.17, POST = 0.72 ± 0.30) and FEC (t = 2.18, p = 0.02, d = 0.48, PRE = 0.87 ± 0.21, POST = 0.98 ± 0.24). ML sway range (t = 3.34, p = 0.001, d = 0.54, PRE = 2.42 ± 0.66, POST = 2.87 ± 0.99) and AP sway range (t = 2.18, p = 0.020, d = 0.53, PRE = 4.01 ± 0.80, POST = 4.64 ± 1.56) increased POST in FEO. Maximum AP sway velocity increased POST in EO (t = 1.73, p = 0.049, d = 0.45, PRE = 4.42 ± 1.26 cm/s, POST = 5.14 ± 2.93 cm/s). Analysis of TBB measures did not reveal PRE/POST differences among any condition. CONCLUSION: Extended durations on a boat at sea increase postural sway upon returning to land. These findings suggest that ‘sea legs’ impairs the ability to re-weight appropriate sensory information in conditions dependent on somatosensory and vestibular feedback.
balance required for reactive athletic movements. The Push-and-Release (P&R) test is a standardized clinical tool used to assess reactive postural control in balance-impaired populations.

**PURPOSE:** To examine differences between sport team and task (single [ST] and dual task [DT]) in reactive postural response measures.

**METHODS:** 40 healthy, male athletes (age 18.50 ± 0.75; body mass index [BMI] 24.11 ± 2.38) were recruited from 3 collegiate teams: baseball (n=12), lacrosse (n=17), and swimming (n=11). Reactive postural responses were assessed using the P&R in backward and forward directions under ST and DT (concurent verbal cognitive task) conditions. All conditions were performed with eyes closed. Inertial sensors on the sternum, lumbar, feet, and right tibia were used to assess step latency (L), time of first heel contact (HC), and time to stabilization (TTS). A sensor on the tester’s hand was used to determine release time. To assess if postural response measures differ by sport and task, linear mixed effects models with random intercepts and stratified by direction (forward or backward), were used and adjusted for age and BMI.

**RESULTS:** Lacrosse players had faster L compared to baseball players in the forward direction (p=0.018). No other differences by sport were observed. In the forward direction, DT outcomes were slower than ST outcomes (L: p=0.0001; HC: p=0.0004; TTS: p=0.0064). In the backward direction, L was slower in the DT condition (p=0.0034), but no task differences were found for HC or TTS (p=0.0628 and p=0.8733, respectively).

**CONCLUSION:** In the forward direction only, DT slowed all postural responses. While L differed between lacrosse and baseball in the forward direction, no other differences were found across sports. As most outcomes were unaffected by sport, the P&R may be a clinically relevant assessment in athletics. However, due to the limited sample size, caution should be applied when interpreting these findings and future studies are needed.

Supported by PAC 12 Student Athlete Health & Wellbeing (PI: Fino, Dibble); University of Utah Study Design and Biostatistics Center through NCATS Grant 8UL1TR000105.

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**3442 Board #263 May 29 2:30 PM - 4:00 PM**

**REACTIVE POSTURAL RESPONSES IN COLLEGIATE ATHLETES**

Amanda Morris, Benjamin Cassidy, Ryan Pelo, Nora F. Fino, Nick E. Monson, Daniel M. Cushman, Angela P. Presson, Leland E. Dibble, Peter C. Fino. University of Utah, Salt Lake City, UT.

(No relevant relationships reported)

Athletes frequently need to recover balance after an external disturbance during tasks with high cognitive demand. Mobility impaired populations demonstrate deficits in reactive postural responses to backward and lateral perturbations but, little is known about postural responses in college athletes.

**PURPOSE:** To examine differences in direction and task (single [ST] and dual task [DT]) in reactive postural response measures during the push-and-release (P&R) test.

**METHODS** Reactive postural responses in 98 healthy (F=42, age 19.3 ± 1.60 years, BMI 23.56 ± 3.29 kg/m²) college athletes were assessed using the P&R in four directions (forward, backward, right, left), with eyes closed, under ST and DT (concurent verbal cognitive task) conditions. Inertial sensors on the sternum, lumbar, right tibia, and feet were used to assess step initiation latency, time of first heel contact (HC), and time to stabilization (TTS). A sensor on the tester’s hand determined release time. Linear mixed models with random intercepts were used to determine if postural response measures differed by direction and task.

**RESULTS** There was a significant interaction between direction and task for HC (p=0.04), with the largest difference in ST and DT in the forward direction (95%CI = [0.03, 0.08]), and the smallest difference in the backward direction (95%CI = [0.02, 0.05]). There were also significant main effects for direction (p <0.0001) and task (p=0.001) for each postural response (latency, HC, TTS). Means adjusted for age, sex, and BMI are presented below.

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**3443 Board #264 May 29 2:30 PM - 4:00 PM**

**THE EFFECTS OF GOLF SPECIFIC FOOTWEAR ON MUSCLE ACTIVATION DURING STANDING POSTURAL CONTROL**

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(No relevant relationships reported)

Postural control in golf represents an unusual challenge as players are on their feet four hours or more. Several golf specific footwear are available, though, little is known about how these footwear affect human balance. **PURPOSE:** To examine the effects of durations of walking/standing while barefoot (BF) and wearing a dress shoe (DS), tennis shoe (TS), and minimalist (MIN) style golf shoe, on muscle activity of the lower extremity during balance.

**METHODS** Six male adults completed this study. Balance was recorded under six conditions: eyes open (EO), eyes closed (EC), eyes open sway referenced vision (EOSRV), eyes open sway referenced platform (EOPSP), eyes closed sway referenced platform (ECPSP), and eyes open sway referenced vision and platform (EOSRVP). Surface electromyography (EMG) was recorded during balance testing from the left leg tibialis anterior (DF), and medial gastrocnemius (PF). Raw EMG data were collected at 1.500 Hz, Band-pass filtered (20-250Hz) and rectified. Variables of interest were the mean muscle activity (mV) of each muscle. Testing sessions consisted of a counterbalanced allocation of footwear over 4 separate days, separated by at least 48 hours. Each session included muscle activity measures during balance every 60 minutes, for 4 hours (pre, 60, 120, 180, 240 minutes). A 4x5 repeated measures ANOVA was used, with an alpha level of 0.05. **RESULTS** A significant interaction was observed in the EO condition for PF muscle activity (F(12,60) = 1.94, p = 0.04). With the MIN muscle activity significantly lower than TS, and DS at 2 hours (4.16 <6.86 & 6.58). An interaction was also observed in the EOSRVP condition for the PF (F(12,60) = 1.97, p = 0.048), suggesting that at 4 hours, the DS was significantly higher than the MIN (9.96 >5.83). A footwear effect was observed for the EC condition.
Layci J. Harrison, Lindsey K. Lepley, Sandra L. Stevens, Dana K. Fuller, John M. Coons, Jennifer L. Caputo. University of Houston, Houston, TX. University of Michigan, Ann Arbor, MI. Middle Tennessee State University, Murfreesboro, TN. (Sponsor: Don Morgan, FACSIM).

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(No relevant relationships reported)

Balance is a functional activity that must be worked on in rehabilitation of every type of back and lower extremity pathology or trauma. With these types of issues, balance generally will become impaired, requiring activities to increase the patient’s stability.

PURPOSE: To identify the impact of balance activities with visual cues on lower extremity muscle activation timing.

METHODS: This study assessed muscle activation and postural strategies during different visual feedback activities on a balance board with a fixed middle fulcrum. Fifteen young, healthy adults were recruited and performed seven tasks on two different levels of difficulty. The various visual activities were projected to a wall, 10 feet away from the balance board. Participants had to follow a target by moving the balance board horizontally and vertically. Surface electromyography data were collected for tibialis anterior, gastrocnemius, and bilateral ankle activation. Data were analyzed using standard linear regression analysis. The dependent variable was muscle activation timing, and the independent variables were the different visual feedback conditions.

RESULTS: The ANCOVA result showed a significant main effect of visual feedback on muscle activation timing. The model explained a large proportion of the variance in muscle activation timing. A post-hoc test indicated that the visual feedback conditions significantly differed from each other.

CONCLUSIONS: Visual feedback can improve muscle activation timing and can be used as an effective tool for balance rehabilitation.

3444 Board #265 May 29:23 PM - 4:00 PM The Relationship Between Functional Movement And Balance

Layci J. Harrison, Lindsey K. Lepley, Sandra L. Stevens, Dana K. Fuller, John M. Coons, Jennifer L. Caputo. University of Houston, Houston, TX. University of Michigan, Ann Arbor, MI. Middle Tennessee State University, Murfreesboro, TN. (Sponsor: Don Morgan, FACSIM).

Email: lharris5@central.uh.edu

(No relevant relationships reported)

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CONCLUSIONS: Visual feedback can improve muscle activation timing and can be used as an effective tool for balance rehabilitation.
Impact group. Total number of impacts (54.8±33.5) significantly predicted POST hyperconnectivity between the L lateral prefrontal cortex and L pallidum (r=0.79, p<0.001).

CONCLUSIONS: Post-season hyperconnectivity between ROIs involved in executive function was found in athletes who regularly sustain impacts compared to those who do not, which is consistent with previous rs-fc RHI findings in different networks. Hyperconnectivity has been suggested to represent brain injury and players who sustain more impacts may be more likely to have neurological damage that results in deficits in executive function.

3448 Board #269 May 29 1:30 PM - 3:00 PM

Identifying The Educational Needs Of 9th And 10th Grade High School Students Regarding Concussion

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(No relevant relationships reported)

PURPOSE: To evaluation adolescent concussion knowledge and behaviors regarding concussion using a modified Rosenbaum Concussion Knowledge and Attitudes Survey (RoCKAS) questionnaire.

METHODS: RoCKAS questionnaire was taken by female and male 9th and 10th-grade high school students (n=190) with a mean age of 15.1 ± 0.8 years (64.7% female; 35.3% male). 59.4% reported belonging to a competitive sports team. A sampling of questions from the RoCKAS questionnaire was used to assess groups for (1) general concussion knowledge and (2) the demonstration of safe attitudes and behaviors in situational decision making (“safe” or “unsafe”).

RESULTS: Validity scale scores were appropriate, meaning participants were actually reading and answering the questions thoughtfully. General concussion knowledge was correctly answered by 86.1% of the sample (r=0.07). Those not participating in athletics were less knowledgeable than those participating in sports (20.1%). Males not participating in sports answered incorrectly 23.4% of the time. There was no statistical significance comparing females in relation to sports participation. Responses to the four situational questions analyzed identified answers to be unsafe on the behavior questions 87.1 % of the time (p=0.001). In fact, the actual age of the participants negatively correlated with the behavior answers (r=-0.4, p=0.001).

CONCLUSIONS: High school 9th and 10th-graders are knowledgeable about concussion. Those participating in sports teams are more knowledgeable, especially males. There is no knowledge differences between females who participate or do not participate in sports. Situation based questions indicate an unacceptable level of safety, suggesting poor behaviors in return-to-play (RTP) and concussion reporting decisions, which was worse in older individuals. The RoCKAS information may be helpful to identify behavior deficits that can inform cohort-specific concussion educational programs designed to enhance the safety of youth athletes.

3449 Board #270 May 29 1:30 PM - 3:00 PM

Fear Of Re-injury Correlates With Concussion Symptoms And Reaction Time Among Adolescents With Concussion

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(No relevant relationships reported)

Background: Athletes appear to be at an increased risk of musculoskeletal injury following return to play after concussion. Underlying causes are likely multi-factorial but not well established. Fear of re-injury has been widely studied in musculoskeletal injuries, but its effect on concussion recovery is unknown.

Purpose: To examine the association of fear of re-injury with physical and self-reported measures after concussion. We hypothesized that greater fear of re-injury would be correlated with a higher symptom severity, worse sleep quality, and worse physical test performance.

Methods: Athletes (n=19; 15.01±1.8 years of age; 42% female; 74.1±3.3 days post-injury) were tested within 14 days of concussion, and underwent assessments of self-reported and physical examination measures. Self-reported measures included the Tampa Scale of Kinesiophobia (TSK)- assessing fear of re-injury, Post-Concussion Symptom Inventory (PCSI), and Pittsburgh Sleep Quality Index (PSQI). Physical examination measures included clinical reaction time, near point of convergence, single and dual-task tandem gait, and Balance Error Scoring System (BESS). We examined correlations between TSK scores and each outcome measure using Pearson correlation coefficients, adjusting for age, sex, and time from injury using linear regression models.

Results: Higher TSK scores were significantly correlated with higher symptom severity (PCSI) scores (r=0.69, p<0.01) and slower reaction times (r=0.53; p=0.02). TSK scores were not significantly correlated with single-task tandem gait (r=0.23; p=0.34), dual-task tandem gait (r=0.29; p=0.23), PSQI (r=0.43; p<0.08), NPC (r=0.03; p=0.91), or BESS (r=0.23; p=0.35) scores. After adjusting for the effect of age, sex, and time from injury to examination, higher TSK scores were significantly associated with slower clinical reaction time performance (β=2.8; 95% CI=0.94, 4.62; p=0.006), greater symptom severity (β=3.64; 95% CI=2.07, 5.21; p<0.001), and worse sleep quality (β=0.37; 95% CI=0.05, 0.68; p=0.03).

Conclusions: In accordance with our hypothesis, higher TSK scores were correlated with higher symptom severity and slower reaction times. This suggests that assessing an athlete’s fear of re-injury may be useful following concussion and throughout recovery.

3450 Board #271 May 29 1:30 PM - 3:00 PM

Neurofilament Light Not Associated With Concussion History Or Recency In Special Operations Forces Combat Soldiers

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(No relevant relationships reported)

Special Operations Forces (SOF) combat soldiers sustain high rates of blunt and blunt neurotrauma. Most are mild traumatic brain injuries (i.e., concussion). Repetitive concussions may develop long-term neurological sequelae. Detecting the effects of cumulative exposure to concussion may be helpful to recognize and intervene therapeutically before chronic symptoms begin emerging. Neurofilament light chain (NFL) is an abundantly expressed cytoskeletal component of large caliber myelinated subcortical axons. Peripheral increases may indicate ongoing axonal disruption or chronic repetitive white matter injury within the brain.

PURPOSE: To determine the effects of concussion history, lifetime incidence, and recency on NFL concentrations in SOF combat soldiers. METHODS: 185 SOF combat soldiers (age=33.0±3.5 yrs) participated in our cross-sectional study and self-reported concussion history (90 no, 95 yes), lifetime incidence (0, 1, 2, 3), and recency (<1 month, <1 year, >1 year). Fasted blood samples were obtained from an antecubital vein at a standardized time for all subjects. Serum was separated and stored until analysis. Serum NFL levels were quantified using sandwich enzyme immunoassay kits according to manufacturer instruction. Medians and interquartile ranges (IQRs) were reported because NFL concentrations were not normally distributed. A weighted least squares analysis compared NFL concentrations between those with and without concussion history. Kruskal-Wallis tests compared NFL concentrations across lifetime incidence and recency. RESULTS: We did not observe differences in NFL concentrations (z=1.80, p=0.07) between those with (median=449.7 pg/mL, IQR=192.1) and without (median=447.4 pg/mL, IQR=292.2) concussion history. There was no effect of concussion lifetime incidence (X=3)=3.87, p=0.28) or recency (X=2)=0.86, p=0.63) on serum NFL concentrations. CONCLUSION: We did not observe differences in serum NFL concentration in SOF combat soldiers based on concussion history, lifetime incidence, and recency. Our SOF combat soldiers were otherwise healthy and asymptomatic. Despite this, our findings suggest SOF combat soldiers demonstrated higher NFL concentrations than those reported for civilian severe brain injury and neurodegenerative disease patients. Funded by USASOC

3451 Board #272 May 29 1:30 PM - 3:00 PM

Parent Beliefs Regarding Chronic Traumatic Encephalopathy Associated With Sport-related Conussion


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(No relevant relationships reported)

PURPOSE: To determine CTE beliefs of youth athletes’ parents, and examine the association of sex and prior concussion history with those views.

METHODS: This was a cross-sectional survey study of parents (n = 467; males = 185, females = 282; history of concussion = 52) of youth contact sport athletes (i.e., football, soccer, ice hockey, lacrosse). The survey included items on demographics, diagnosed concussion history, and a standardized concussion knowledge assessment with two exploratory items about CTE beliefs. Parents were asked if CTE was a complication of multiple concussions and premature return-to-play. The 15-minute
survey was administered on-site after practices/events. The association between CTE beliefs, sex (male/female), and concussion history (yes/no) were assessed using chi-square analyses with significance set at \( p \leq 0.05 \).

**RESULTS:** A majority 70.7% (n=319/451) of parents indicated CTE was a complication of multiple concussions; 67.1% (n=294/438) identified CTE was a complication of returning to play prematurely. A greater proportion of male parents (77.4%, n=137/177; \( \chi^2 = 7.32, p = 0.007, V = -0.13 \)) compared to female parents (66.3%, n=181/273; \( \chi^2 = 6.38, p = 0.01, V = -0.12 \)) had greater CTE beliefs. In our relatively young sample, SS at the time of testing was associated with worse outcomes. Continued longitudinal analyses may explain age related changes on these outcomes.

### Table 1: Backwards Elimination Regression Coefficients

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<td>CDOT Total Score</td>
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<td>CDOT</td>
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**CONCLUSIONS:** Parents commonly recognized CTE as a complication of multiple concussions and premature return to play, which shows they are aware of this neurodegenerative condition. Additionally, a greater proportion of male parents endorsed CTE beliefs compared to females. This finding could be a byproduct of the media’s attention towards CTE cases in male athletes specifically. Future research should consider how beliefs about CTE may influence sport participation within a family unit.

Current literature on sport-related concussion (SRC) reporting behaviors and reasons for non-disclosure is dominated by older athletic populations. Youth athletes participating in contact sports are at risk for SRC; however, little is known about SRC disclosure patterns and reasons for non-disclosure in this group. **PURPOSE:** To examine SRC reporting behaviors and reasons for non-disclosure in youth contact sport athletes.

**METHODS:** Youth athletes (n = 442; 66.5% male, 33.5% female) aged 8-14 years participating in football (22.4%), ice hockey (26.5%), lacrosse (24.9%), and soccer (26.2%) completed a 15-minute survey composed of demographics, diagnosed and non-disclosed SRC history, and reasons why they did not report a suspected SRC. The survey was adapted for elementary school readability and researchers were present to clarify any athlete questions. Descriptive statistics expressed frequencies of self-reported diagnosed SRC, suspected SRC non-disclosure, and reasons for non-disclosure.

**RESULTS:** A total of 44 (10%) youth contact sport athletes recalled a diagnosed SRC; 68.1% (n = 30) of those recalled 1, 20.5% (n = 9) recalled 2, and 13.6% (n = 6) recalled 3 diagnosed SRC. Youth athletes also indicated they thought they had a SRC but still played in a practice (n = 55, 13.0%) or game (n = 51, 12.0%), respectively. While, 50 (11.8%) athletes reported they thought they sustained a SRC and did not report it to anyone. The most common reasons for non-disclosure selected by youth athletes included: I did not want to lose playing time (n = 33, 66.0%), I did not want to miss a game (n = 10, 56.0%); at the time I did not think it was a concussion (n = 26, 52%), I did not want to let my team down (n = 23, 46%).

**CONCLUSIONS:** Epidemiological evidence of SRC in this setting is lacking; however, these novel results identified 10% of youth athletes self-reported a previous SRC. Significantly, 13% of athletes indicated they remained in play with a suspected SRC and 12% of athletes did not report their suspected SRC to anyone. Youth athletes’ reasons for non-disclosure were similar to those reported in high school and college athletes. Recent research suggests negative consequences of continued play with SRC, especially in acute stages. Future educational initiatives should emphasize these risks, and focus on reasons why athletes withhold reporting.
Concussive injury and depression affect millions of individuals each year and are connected through common overlapping symptoms. PURPOSE: Aim 1 was to establish an association between post-concussion depression-related symptoms and post-concussion symptoms, balance performance, vestibular function, and executive function. Aim 2 was to further establish the relationship between concussion history and post-concussion depression-related symptoms, concussion symptoms, and mood disturbance. METHODS: 164 concussed individuals (mean age=14.52±3.51 years, 50.63% male, mean time from injury=18.24±13.60) were included in this analysis. Depression-related symptoms were quantified using the Beck Depression Inventory (BDI-II) and post-concussion symptoms using the Rivermead Post-Concussion Symptoms Questionnaire (RPQ). Clinical post-concussion assessments utilized were the modified Balance Error Scoring System (mBESS), Vestibular/Ocular-Motor Screening (VOMS), and, for adolescent patients, the Behavior Rating Inventory of Executive Function (BRIEF). Mood disturbance was quantified using the Profile of Mood States (POMS). mBESS, VOMS, RPQ, and BRIEF were measured against BDI-II scores using Pearson Correlation and Linear Regression analyses. BDI-II, POMS, and RPQ scores were analyzed based on concussion history using Wilcoxon Rank-Sum Tests. RESULTS: As depression-related symptoms increased, post-concussion symptoms (p=0.001, r=0.68) and VOMS scores measuring changes in headache and dizziness (p=0.001, r=0.34; p<0.01, r=0.20 respectively) significantly increased. There was no significant correlation between depression-related symptoms and balance performance (p=0.093, r=0.13). In adolescents, as depression-related symptoms increased parent reported executive function decreased (p=0.001, r=0.46). Those who reported a concussion history reported significantly more depression-related symptoms (p=0.004, concussion symptoms (p=0.004), and mood disturbance (p=0.002). CONCLUSION: This study adds to the current literature surrounding the relationship between concussion and depression by identifying a relationship between depression-related symptoms, post-concussion symptoms, and post-concussion clinical assessments.

Because post-concussion symptoms are often not clearly visible, speech-accompanying gestures may help clinicians to gain additional information about the patient’s history and symptoms during medical consultation. PURPOSE: We hypothesized that athletes with SRC and who suffered from persisting symptoms would display more gestures during concussion assessment protocols when compared to non-concussed athletes because of the athletes’ previous motor-sensory experiences made during the concussive event. METHODS: Three matched groups of 40 (active) athletes were investigated in the context of concussion assessment (hand protocols): 14 symptomatic and 14 asymptomatic athletes with a SRC, and 12 non-concussed athletes. Certified raters using a standard analysis system for nonverbal behavior analyzed videotaped hand movements and gestures during a standardized concussion assessment protocol. RESULTS: Symptomatic athletes spent significantly more time with in space hand movements, i.e., movements that act in the body-external free space without touching anything and specifically, motion quality presentation gestures than non-concussed athletes. CONCLUSIONS: Increased in space movements, which are functionally gestures, and specifically, motion quality presentation gestures in symptomatic athletes indicate that the more motor-sensory motor experience of the head trauma is reflected in more gestural expressions. Thus, hand movements and gestures differentiate athletes who suffer from post-concussion symptoms from non-concussed athletes indicating the athletes’ motor-sensory experiences of the event and its aftereffects. The present study highlights the fact that gestures can be employed as behavioral markers of symptoms after sport-related concussions.

Athletes with previous diagnosis of a psychiatric condition, such as depression or anxiety, have been shown to experience a larger overall concussion symptom score compared to those without a previous psychiatric treatment. Anxiety rates in college students is high (42%) with student-athletes only slightly lower (37%) compared to the general the population (18%). PURPOSE: The purpose of this study was to compare concussion-related anxiety symptoms and validated anxiety disorder screeners to see if baseline concussion symptoms could be used as a screening tool for follow-up mental health assessments. METHODS: 254 club level collegiate student-athletes (18.2±1.6yrs, 150 female, 164 male) completed the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) including the 22-item Post-Concussion Symptom Scale (PCSS), the Patient Reported Outcome Measurement Information System (PROMIS-29), and the Depression Anxiety Stress Scales (DASS-21). DSM-5 Anxiety symptoms were compared to the PCSS symptoms and an anxiety-related concussion symptom score was calculated. These along with the anxiety sub-scales for both the DASS-21 and PROMIS-29 were used for analysis. RESULTS: Participants were divided into 4 anxiety level groups based on norms from the DASS-21 (normal=36; mild=76; moderate=87; severe=28). There was a significant correlation (p<0.001) between Anxiety Cluster PCSS symptom score and DASS-21 anxiety subscale (r=-0.41) and PROMIS-29 Anxiety Sub-score (r=-0.44). The DASS-21 and PROMIS-29 were also significantly correlated (r=-0.64, p<0.001). There were significant group differences across the 4 DASS-21 anxiety levels for Anxiety Symptom Cluster (F(4, 226)=9.27, p<0.001) and the PROMIS-29 Anxiety subscale (F(4,223)=31.01, p<0.001). CONCLUSIONS: The significance from this data shows that the proposed symptom clusters that potentially pertain to anxiety symptoms are meaningfully related to higher scores on the DASS-21 and the PROMIS-29 anxiety related questions. Participants that demonstrated a higher overall concussion-related anxiety symptom score were more likely to exhibit more severe levels of anxiety suggesting that this cluster score could potentially screen individuals at risk for anxiety disorders thus providing a pathway to refer and provide resources and support. Biological, metabolic, and environmental factors can influence mental health; however, self-perceived health may be influenced by multiple factors. Thus, the PURPOSE of the present study was to explore associations among objective measures of health, self-perceived health, and habitual physical activity in overweight, older adults. METHODS: In 35 (27 F/8 M) overweight (body mass index, BMI; 27 kg/m²), older adults (>58 years) we assessed blood lipids (point-of-care analyzer); body composition (bioelectrical impedance); habitual physical activity (7-day accelerometer); cardiorespiratory fitness (VO₂max); and self-perceived health (36-item short form survey, SF-36). The SF-36 includes questions that assess eight health concepts including perceptions of physical function and general health. Scores for each concept can range from 0% (poor) to 100% (excellent). Associations were assessed utilizing partial correlations (controlling for age and sex). Significance was set to p<0.05. RESULTS: Average values for these subjects included: age: 64±5y; SF-36 (general health): 63±14%; SF-36 (physical function): 77±16%; BMI: 35±5 kg/m²; body fat percentage: 44±7.0%; VO₂max: 16±3 mL/kg/min; moderate-to-vigorous physical activity (MVPA): 74±23 min/day, LDL cholesterol: 105±27 mg/dL, HDL cholesterol: 49±11 mg/dL, triglycerides: 113±40 mg/dL, and glucose: 100±15 mg/dL. Self-perceived physical function was
Firefighters have substantial levels of fitness and a high prevalence of overweight and obesity. Understanding exercise status and barriers to exercise may be important factors regarding body composition. PURPOSE: The purpose of this study was to examine the influence of exercise status and barriers to exercise on percent body fat (%BF) in career firefighters.

METHODS: Fifty-eight male career firefighters [age: 31.3±7.0 years, standard deviation (SD); body mass index (BMI): kg·m−2: 23.5±5.7%] volunteered for this investigation. Participants self-reported exercise status using the International Physical Activity Questionnaire (IPAQ). AER (minutes·day−1) was calculated. The physical activity was stratified into sedentary (<100 minutes·day−1), moderate (100-599 minutes·day−1), and vigorous (>600 minutes·day−1). The BMI was calculated as weight in kilograms divided by height in meters squared. DMF was calculated as the sum of body fat mass. Self-reported perceived barriers to exercise were calculated on a Likert-type scale (1-7) using 16 barriers: too busy, not enough time, irregular work hours, family obligations, interferes with sleep, not interested in exercise, no time to do exercise, cost, no exercise facilities, health problems, too weak, musculoskeletal problems, pain, too afraid, prior injury, “lack of time” (OR = 0.11) was the significant predictor of LTPA level. Whereas, “fear of injury” (OR = 0.11) and “lack of energy” (OR = 0.18) were the significant factors associated with LTPA among those with BMI >30.

CONCLUSIONS: The present study provides relevant data on predictors to LTPA for older adults. Promotion and intervention strategies should consider the exposed barriers of older adults in order to reduce their obstacles to PA.

Over half of college students possess ≥1 metabolic syndrome (MetS) risk factors, with each subsequent risk factor increasing lifetime cardiovascular disease risk. As opposed to taking a reactive response to established disease, early behavioral intervention may be effective in preventing MetS risk advancement. While correlates of MetS in the general adult population have been described, ideal targets for sex-specific primary prevention strategies in college students are unknown. PURPOSE: To identify the sex-specific prevalence of MetS risk factors and their correlates in a college-aged population. METHODS: First-year students aged 18-20 yo n =390; 67.4% female; 70% white) were screened for traditional MetS risk factors using IDF/AHA/NHLBI harmonized criteria. Potential correlates of MetS risk included inflammatory markers, relative adiposity, anxiety, depression, stress, diet, physical activity, alcohol consumption, smoking, and sleep. Principal component analysis was used to construct sex-specific continuous MetS risk scores, with waist circumference, systolic blood pressure, HDL-C, and fasting glucose, insulin, and triglycerides as factors in the final model. Two principal components with an eigenvalue ≥1 created the continuous MetS risk score, explaining 51.2% and 54.2% of the variance in risk in females and males, respectively. Multivariate linear regression assessed the relationships between potential correlates and MetS risk score. RESULTS: One or more MetS risk factors were present in 66.9% of males and 59.3% of females, with 3.1% and 2.3% having defined MetS, respectively. In females, % kcal from sugar (β=−0.25, p<.001), stress (β=0.19, p<.003), and relative adiposity (β=−0.45, p<.001) were positively associated with MetS risk, whereas moderate to vigorous physical activity (β=−0.12, p=.028) and anxiety (β=−0.15, p=.017) were negatively associated with MetS risk. In contrast, correlates in males included race (β=−0.24, p<.002; coded as non-white=0, white=1), C-reactive protein (β=−0.36, p<.001), and relative adiposity (β=−.53, p<.001), with % kcal from saturated fat approaching significance (β=−0.23, p=.064). CONCLUSION: The sex-specific prevalence of MetS risk factors and correlates suggest that a one-size-fits-all approach to prevention may not be effective in this population.

Bodybuilders are well known by their addiction to the perfect physique, requiring not only a strong body, but also a strong mind. This potential psychological, motivational, emotional and dedication in bodybuilding has significant impact in athletes’ lives, supporting self-control, confidence, individual’s social realization and mood. Moreover, their motivation and self-control are important skills for a competition. On the other hand, most part of the population doesn’t have this strong motivation, struggling a bit more with nutrition and training programs. In nutritional studies, the “triangle” defined by trigger, behavior and reward really influence how people stick to a diet plan and their actions facing a goal related to losing or gaining weight. PURPOSE: The aim of this research is to study how the strong mind, dedication of bodybuilders, associated with intrinsic and extrinsic motivation, affect their success in bodybuilding, associated with intrinsic and extrinsic motivation, affect their success in bodybuilding. Furthermore, we also want to understand the relevance of behavior and locus of control differences between these two groups. METHODS: The current study was designed to compare two groups (n=18); bodybuilders (n=10) and overweight women (n=8). The data were collected by significantly (>p< 0.05) correlated with indices of body composition and blood lipids [body fat percentage (r=−0.39), visceral fat area (r=−0.42), and LDL cholesterol (r=−0.51)], but not with HDL. Self-perceived general health was significantly correlated with LDL/HDL (r=−0.40), but not with indices of body composition or physical activity level. CONCLUSIONS: These preliminary data suggest that perception of general health and physical function are more closely related to indices of body composition and blood lipids than habitual physical activity level.

Firefighters have substantial levels of fitness and a high prevalence of overweight and obesity. Understanding exercise status and barriers to exercise may be important factors regarding body composition. PURPOSE: The purpose of this study was to examine the influence of exercise status and barriers to exercise on percent body fat (%BF) in career firefighters.

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CONCLUSIONS: The present study provides relevant data on predictors to LTPA for older adults. Promotion and intervention strategies should consider the exposed barriers of older adults in order to reduce their obstacles to PA.
MONDAY, MAY 25, 2020

**MEDICINE & SCIENCE IN SPORTS & EXERCISE**

**3462 Board #283 May 29 1:30 PM - 3:00 PM**

**Diabetes Prevention Program: An Investigation Of Lifestyle Coaches’ Habits And Motivations**

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(No relevant relationships reported)

The Diabetes Prevention Program (DPP) was created after a 27-center randomized clinical trial was conducted to determine if lifestyle intervention alone, or combined with pharmacological therapy could prevent or delay the onset of Type 2 Diabetes (T2DM). Lifestyle intervention decreased the incidence of T2DM by 58% compared with a 31% reduced incidence in the pharmacological group. A key component of the DPP are lifestyle coaches (LC). LC deliver curriculum intended to initiate and promote lifestyle change to individuals at risk for T2DM. Little is known about the behaviors of the LC.

**PURPOSE:** The purpose of this study was to investigate the habits and motivations of LC to elucidate their motivations for coaching.

**METHODS:** A sixteen item electronic survey was emailed to LC. Data was analyzed using descriptive and qualitative analyses, as well as chi-square tests. RESULTS: Sixty-three participants (60 female, 3 male) (Age range = 18-75+) responded to the survey. Descriptive analyses indicated that the majority of responding coaches worked in healthcare fields (59.65%) and achieved ≥ 150 minutes of physical activity (PA) per week (68.42%). Qualitative analyses indicated two types of motivation for coaching: internal (N=19) and external motivation (N=36). External motivation further included two sub-themes external-others (N=11) and external-self (N=25). Additional chi-square analyses revealed that those with bachelor and master’s degrees, and working full time in healthcare occupations reported significantly less incidence of diabetes (p<0.05) and higher instances of achieving 150 minutes or more PA per week (p<0.05). CONCLUSION: These results suggest that lifestyle coaches are employed mainly in healthcare fields and are motivated to coach by external factors. The results indicate coaches may serve as appropriate role models in the adoption of PA behaviors and could help with training, delivery, and recruitment efforts for future coaches. Supported by Health Promotion Council (HPC) Grant.

**3463 Board #284 May 29 1:30 PM - 3:00 PM**

**Obesity In Adolescence: Does Motor Competence Or Physical Activity Matter?**

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(No relevant relationships reported)

Physical activity (PA) and motor competence are closely related to each other since motor competence is mainly, although not entirely, determined by PA patterns (i.e., Light PA [LPA], Moderate PA [MPA], and Vigorous PA [VPA]) in adolescence (Stodden et al, 2009). How the development of the motor competence may be influenced by PA patterns and how the interaction of these two variables may be correlated with obesity in adolescent years are understudied. PURPOSE: The main purpose of this study was to investigate the relationship among PA patterns including LPA, MPA, and VPA, motor competence, and obesity (body composition, waist circumference) in adolescents. The second purpose was to test the gender differences among the study variables.

**METHODS:** Participants were 307 students (M = 12.5 ± 0.9; boys = 142, girls = 165) randomly recruited from four middle schools in the US. Students’ PA patterns were assessed using Actical monitors for 5 consecutive school days. Students’ ball skill competence including volleyball, soccer, and ultimate Frisbee (PE Metrics®; NASPE, 2010) were assessed in PE classes. Body mass index (BMI) and waist circumference were used to represent indices of obesity in this study.

**RESULTS:** Both LPA and VPA were significantly correlated with BMI and waist circumference (p < .05). All three ball skills were significantly associated with both MPA and VPA (r ranges from .21 to .33). Regression analyses indicated that only VPA and soccer skill emerged as significant predictors of BMI (β = -.16; β = -.24, p < .05) and waist circumference (β = -.15; β = -.15, p < .05), respectively. Structural equation modeling suggested a mediating role of motor competence in the relationship between PA patterns and obesity. After controlling for all the covariates, MANCOVA indicated boys had higher levels of VPA than girls (p < .001), but no significant differences were found for overall motor competence and MPA. Girls had higher waist circumference and LPA than boys. CONCLUSION: The findings indicate that engaging in at least vigorous PA may lead to higher and more accurate ball skill competence among adolescents. The potential “physical activity divide” may occur especially among girls between low-skilled adolescents and their skilled counterparts, which suggests a potential trajectory of obesity in adolescent years.

**3464 Board #285 May 29 1:30 PM - 3:00 PM**

**Accelerometer-measured Sedentary Patterns Are Related To Poorer Inhibitory Control In Obese-middle-aged Adults**

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(No relevant relationships reported)

Self-reported sedentary behaviors have been negatively related to executive functions (EFs) in older adults. However, the relationship of objectively measured sedentary time (ST) to EFs in adults with overweight and obesity is poorly understood.

**PURPOSE:** To assess the relationship between accelerometer-measured ST and inhibitory control in middle-aged adults with overweight and obesity. METHODS: Pre-intervention data from 87 subjects (69 [67%] females, M = 35.0 ± 5.9 y, BMI = 22.2 ± 5.4 kg/m²) participating in the Permanente Montana Area for Total Health randomized controlled trial were analyzed. ST and physical activity were measured over 7 days with a wrist-worn gWGT3x-BT accelerometer. Valid wear time was defined as ≥ 4 days, ≥ 10 hrs/day. Daily ST (min/d), frequency, and time spent in sedentary bouts lasting ≥ 5, 10, 20, and 30 consecutive min were estimated using a < 100 counts per minute (CPM) cut point. Moderate-to-vigorous physical activity (MVPA) was defined using an NHANES cut point. Inhibitory control was expressed as accuracy (AC), reaction time (RT), and inverse efficiency (IE = AC/RT) on incongruent trials of a modified Eriksen flanker task; performance on congruent trials indexed controlled processes. Multiple hierarchical regression models controlling for age, sex, intelligence, % fat mass, MVPA and ST (for sedentary bouts) were used to assess relationships between ST, sedentary bouts, inhibitory control, and controlled processes. RESULTS: Frequency (β ≤ -0.22, n ≥ 2.11, Ps ≤ 0.04, F(6,86) ≤ 3.25, Ps ≤ 0.007) and time (β ≤ -0.22, n ≥ 2.01, Ps ≤ 0.047, F(6,86) ≤ 3.17, Ps ≤ 0.008) spent in sedentary bouts lasting ≥ 20 and 3 min were associated with lower AC during incongruent trials. While ST and time spent in sedentary bouts ≥ 20 min were related to faster RTs during congruent trials (β ≤ -0.23, n ≥ 2.08, Ps ≤ 0.04, F(6,86) ≤ 3.04, Ps ≤ 0.01), greater ST was related to lower IE on congruent and incongruent trials (β ≤ -0.43, n ≥ 2.33, Ps ≤ 0.023, F(7,86) ≤ 2.76, Ps ≤ 0.01). CONCLUSION: In adults with overweight and obesity, more prolonged ST was related to lower inhibitory control and less efficient controlled processes as indicated by more impulsive responding. Our results reveal a novel relationship between sedentary patterns and an aspect of EFs that has been implicated in the maintenance of obesogenic behaviors.

**3465 Board #286 May 29 1:30 PM - 3:00 PM**

**The Role Of BMI On Cognition Following Acute Physical Activity In Preadolescent Children**

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(No relevant relationships reported)

PURPOSE: There is an increasing prevalence of physical inactivity during childhood, concurrent with a rise in obesity rates (as measured by Body Mass Index, BMI), which is associated with a variety of health problems. However, the extent to which increased BMI influences acute physical activity (PA) benefits on cognition in childhood remains unknown. The aim of this study was to examine the relationship of BMI and acute PA on performance of a modified flanker task, which modulates inhibitory control. METHODS: A sample of 116 children pooled from four prior studies (ages 8-11; 51 females), demographic measures including sex, % IQ, socioeconomic status, and aerobic fitness were considered along with BMI. Children participated in a counterbalanced, randomized crossover study, whereby they completed two different interventions; 20 minutes of restful reading or treadmill walking (60-70% heart rate max). Following each intervention, children performed a modified flanker task to assess inhibitory control. Results concluded that the influence of demographic variables, fitness, and BMI on inhibitory control following each intervention. Subsequent hierarchical regression analyses were performed with

**3466 Board #287 May 29 1:30 PM - 3:00 PM**

**The Role of PA on Brain Connectivity in Childhood**

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(No relevant relationships reported)
significant demographic factors in the first step, aerobic fitness in the second step when significant, and BMI in the final step. RESULTS: Analyses indicated that children exhibited improved task performance (p's ≤ 0.001) following the walking intervention, as well as decreased interference (p = 0.04), indicating greater benefits following acute PA for the task condition requiring greater inhibitory control. Regression analyses were conducted to examine the influence of BMI on task performance following each intervention. Results revealed that increased BMI was related to decreased performance following acute PA (p = 0.001), an effect not seen following restful reading (p's > 0.11). CONCLUSIONS: These findings indicate that the beneficial effects following an acute bout of PA on cognition are generalized across conditions of a flanker task, but are selectively greater for the task conditions requiring greater inhibitory control. However, the effects may be blunted in children with higher BMI. These results suggest that indices of inhibition are influenced by PA and adiposity in children.

Board #287
May 29 1:30 PM - 3:00 PM
An Investigation Of Exercise Motivation In Normal Weight And Obese Humans And Rodents
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PURPOSE: The leading causes of morbidity and mortality stem not from predetermined factors, but from maladaptive health behaviors that people have the ability to change. One primary example is physical inactivity, which is the fourth leading risk factor for global mortality and is a direct contributor to the global epidemic of obesity. Both the behavioral and neural mechanisms underlying sedentary behavior in healthy and obese populations are unknown, and constitute a major gap in our understanding of health behaviors. Understanding the mechanisms that regulate the motivation for exercise would allow us to devise treatments to target sedentary behaviors in both healthy and obese populations. As a precursor for these studies, the purpose here was to delineate levels of exercise motivation in both humans and a preclinical mouse model of obesity.

METHODS: Self-reported measurements of exercise motivation in humans (n=727) was collected via Amazon Mechanical Turk. Voluntary wheel running data was collected in both wild type mice and mice with a targeted deletion of the basic helix-loop-helix (bHLH) gene Nhlh2 (N2KO), which serve as a preclinical model of obesity. Wheel running wheel data was collected continuously for a period of 21 days as well as after a 72-hour period of wheel deprivation (rebound running response, Basso & Morrell, 2015).

RESULTS: Here, we demonstrate that compared to normal weight controls, exercise motivation is significantly impaired in obese individuals, with normal weight controls reporting higher intrinsically regulated motivations to exercise, and obese individuals reporting lower levels. Further, we demonstrate that free running in rodents is highly motivating and that running motivation is significantly impaired in the N2KO mice.

CONCLUSIONS: Impairments in exercise motivation may be a driver of obese outcomes, which are demonstrated here in both human and preclinical models of obesity. Previous work from our lab has demonstrated that regions of the motivational circuitry including the medial prefrontal cortex regulate the motivation for voluntary wheel running in rodents. We are currently investigating in both wild type and N2KO mice the hypothesis that neural activity in the PFC, modulated by dopamine, regulates the motivation for exercise.

Board #288
May 29 1:30 PM - 3:00 PM
Sleep Parameters During A 12-month Behavioral Weight Loss Intervention With Varying Doses Of Physical Activity: The Heart Health Study
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Obesity is associated with poor sleep. Weight loss following caloric restriction has been shown to improve sleep, but whether physical activity (PA) alongside caloric restriction can augment these improvements is unclear. PURPOSE: To examine whether self-reported sleep parameters improve as a result of a behavioral weight loss intervention that included varying doses of moderate-vigorous PA compared to a diet-only condition. Methods: 383 adults with overweight or obesity (age=46.2±7.7 years; BMI=32.1±3.8 kg/m²) participated in a 12-month behavioral weight loss intervention and were randomly assigned to one of three conditions: diet alone (DIET, n=127), diet plus a moderate dose of MVPA (DIET+MODPA; n=129), diet plus a high dose of PA (DIET+HIGHPA; n=127). All intervention conditions were prescribed a diet that reduced caloric intake to 1200-1800 kcal/day and received behavioral counseling targeting weight loss. DIET+MODPA and DIET+HIGHPA conditions were prescribed home-based MVPA that progressed to 150 and 250 min/wk, respectively. Weight and sleep measures were collected at 0, 6, and 12 months. Sleep measures included the Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleepiness Scale (ESS). Results: Weight (LS mean [95% CI]) significantly decreased over time (0 months: 90.3 [89.0, 91.7] kg; 6 months: 81.7 [80.4, 83.0] kg; 12 months: 81.2 [79.8, 82.6] kg) (p=0.001), with no difference between groups (Group: p=0.29; Group X Time: p=0.50). PSQI scores (LS mean [95% CI]) were reduced (i.e., improved) (0 months: 3.0 [2.8, 3.2]; 6 months: 2.8 [2.5, 3.0]; 12 months: 2.8 [2.5, 3.0]) (p=0.08), with no difference in the pattern of change by group (Group X Time: p=0.59). ESS scores did not change over time (p=0.98) in any group. Weight change (adjusting for intervention group) was associated with PSQI change at 6 months (P<0.01) and 12 months (P<0.001), but not ESS change at either time point (P>0.41). Conclusion: Improvements in sleep quality were primarily associated with weight change in this behavioral weight loss intervention. Physical activity did not result in any additive improvements in sleep quality. In adults with overweight or obesity, enhancing long-term weight loss may be an important target for improving sleep quality.Support: National Institutes of Health (R01HL103646).

Board #289
May 29 1:30 PM - 3:00 PM
Analysis Of Physical Activity-Related Smartphone Apps For Behavior Change Potential
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PURPOSE: To evaluate top-ranked free health and fitness apps in the US iOS app store for behavior change potential and to determine the relationship between this evaluation and consumer perceptions of quality, such as app store ranking and consumer ratings. METHODS: The top 100 “free” health and fitness apps in the US iOS app store were screened for inclusion. Apps were excluded if the descriptions did not address any aspects of PA or fitness; required an external device, purchase/subscription after a trial period, or a health club membership or specific health insurance. Apps were also excluded if their descriptions was not written in English. Two investigators downloaded and evaluated the remaining apps that met the inclusion criteria using the App Behavior Change Scale (ABACUS). Apps were scored on 21 strategies within 4 categories (knowledge/information, goals/planning, feedback/monitoring, and actions), and prevalence in the sample was calculated. Pearson correlations were estimated for the relationship between ABACUS total scores and relative app ranking, as well as consumer rating. Significance was set at p < 0.05. RESULTS: 23 apps met the inclusion criteria. 100% offered some form of personalization; 96% incorporated self-monitoring and/or rehearsal; and 70% included options for goal-setting. Only 13% recommended restructuring of the environment, and 4% provided advice on distraction or avoidance. There were no significant correlations between ABACUS score and store ranking (r²=–0.15, p = 0.49) or consumer rating (r²=–0.26, p = 0.91). CONCLUSIONS: Free apps may have the potential to support PA behavior change, especially in the areas of planning and self-monitoring. There is no correlation between the total number of evidence-based behavior change strategies and app popularity, however, so it may be beneficial for wellness professionals to counsel patients and clients on app choice.
Multiple studies from our research group examining American adults have conclusively identified smartphone use as a sedentary behavior (SB). However, the same work has repeatedly found no relationship between smartphone use and physical activity (PA). Typically, SB is negatively related to PA. This may not be true, smartphone use can displace PA (e.g., watching videos, social media) and also promote PA (e.g., fitness apps, mHealth). Thus, different smartphone behavioral patterns should be considered in relationship to PA. Researchers have recently identified problematic smartphone use as a behavioral pattern motivated by the recurrent craving to use a smartphone. It is an addiction-like behavior leading individuals to use their smartphone compulsively in inappropriate situations such as during classroom lectures, while driving a car, or perhaps in environments intended for PA or planned exercise. Therefore, while total use is not associated with PA, problematic smartphone use may interfere with PA.

PURPOSE: To assess the relationship between total and problematic smartphone use to PA in a sample of American college students.

METHODS: A sample of American college students (N = 471, 21.1 ± 2.8 years old) completed validated surveys assessing total daily smartphone use, PA, and problematic smartphone use (assessed via the Mobile Phone Problem Use 10-item scale). Pearson’s correlation coefficients were then performed.

RESULTS: As in previous studies, there was a significant, positive relationship between total daily smartphone use and PA (r = 0.31, p < 0.001) and no relationship with PA (r = 0.05, p = 0.32). However, while problematic smartphone use was similarly significantly and positively related to PA, it was also significantly and negatively related to PA (r = -0.18, p < 0.01).

CONCLUSION: While prior research and the current study has found no relationship between total smartphone use and PA, this is the first study to assess the relationship between problematic smartphone use and PA. Results suggest that, unlike total daily smartphone use, problematic smartphone use may occur at the expense of PA behavior.
Screen-time (e.g., television, phone, tablet use) has been linked to increased depression in both child and parent total screen use (Model 4).

**PURPOSE:** To examine screen-based media device (smartphone, tablet, television, video games, computer) use in children and parents from a rural population in relation to sedentary behavior and physical activity.

**METHODS:** Parents (N = 7, 33.57 ± 3.95 years old) completed validated questionnaires assessing average daily total screen use (smartphone, tablet, television, video games, computer), portable screen-based device use (smartphone, tablet), sedentary behavior, and physical activity for both themselves and their children (N = 7, 7.00 ± 1.15 years old). Four standard regression models were used to assess the relationship between criterion variables and the following predictor variables: child age, sex, child average daily sedentary time, child physical activity time. Criterion variables included (a) child portable screen-based device use (Model 1), (b) child total screen use (Model 2), (c) parent portable screen-based device use (Model 3), and (d) parent total screen use (Model 4).

**RESULTS:** Child sedentary time was significantly (β = 0.92, t = 4.65, p < 0.04) and positively associated with parent screen-based device use, respectively. Child age, sex, and physical activity were not significantly (p > 0.05) related to either parent or child portable or total device use.

**CONCLUSION:** Contrary to findings in young children from suburban populations, the current results from this limited sample suggest child sedentary behavior was not found to be related to portable screen-based device use in rural children. Furthermore, the data confirms previous findings that parental screen-based device use was predictive of sitting in their children.

**Screen-time** (e.g., television, phone, tablet use) has been linked to increased depression and sedentary behaviour. A better understanding of associations between screen-time and depression is critical due to increased levels of screen-time and sedentary behaviour. **Purpose:** As part of a large nationally-representative observational study, the cross-sectional study reported here examined associations between self-reported screen-time and depressive symptoms among 396 adolescents (13.43 ± 0.87y; 115 female) in primary and secondary level schools in the Republic of Ireland. **Methods:** Participants completed the Quick Inventory of Depressive Symptomatology and reported the number of days during the prior seven days that spent watching television, on a computer, and on a tablet or smartphone, and, on average, the number of hours spent on these devices on each reported day. One-way ANOVA examined potential sex-related differences in screen-time and depressive symptoms. Linear regression quantified crude and adjusted associations between total weekly hours of screen-time and depressive symptoms. Age, sex, waist circumference, functional disabilities, MVPA, and school status (i.e., whether the school is in a government identified economically disadvantaged location) were included covariates. **Results:** Mean±SD hours of screen-time per week and depressive symptoms (SDS) were 17.33±18.53 and 5.47±4.27, respectively. Males (18±2.77) reported more screen-time than females (15.19±17.77; p = 0.084). Depressive symptoms did not differ by sex (p = 0.99). Total weekly hours of screen-time was significantly, positively associated with depressive symptoms (β = 0.10, p = 0.05). After adjustment for age, sex, waist circumference, functional disabilities, MVPA, and school status, screen-time was significantly, positively associated with depressive symptoms (β = 0.14, p = 0.006). MVPA was the only statistically significant covariate in the model (β = 0.11, p = 0.04). **Conclusions:** Screen-time was significantly associated with greater depressive symptoms in Irish adolescents. Lower levels of screen-time and sedentary behaviour should be encouraged to reduce depressive symptoms among adolescents.

**Hypohydration is common among athletes and can be the result of a failure to maintain hydration between exercise bouts.** The negative impact of hypohydration on aerobic performance is well characterized. However, little is known about the effect of hypohydration on anaerobic performance particularly when the hypohydration is the result of insufficient water intake prior to the onset of exercise, not water loss due to body temperature regulation. **Purpose:** The purpose of this study was to examine the effect of hypohydration on anaerobic performance following voluntary water intake reduction. **Methods:** Fifteen healthy adults (8 women, 7 men) completed two exercise sessions, euhydric (EUD) and hypohydrated (HYP). Subjects were asked to voluntarily limit water intake during the 24-hours prior to the hypohydration trial. Sessions consisted of baseline anthropometric and blood lactate measurement followed by a 30-second Wingate test and 3 maximum vertical jump trials. The vertical jump trials were completed approximately 1 minute after finishing the 30-second Wingate test and used to measure anaerobic performance in an anachronistically challenged state. Additional blood lactate measurements were taken immediately and at 5, 10, and 15-min post Wingate test. **Results:** The hypohydration protocol resulted in a significant 1.5% reduction in body mass (EUD 69.1 ± 17.2kg, HYP 68.1 ± 16.6kg, p = 0.039). The 30-second Wingate peak power (EUD 971 ± 302W, HYP 960 ± 316W, p = 0.578) was not different between conditions, nor was maximum vertical jump height (EUD 26.4 ± 4.5cm, HYP 26.6 ± 3.6cm, p = 0.779). Blood lactate (p = 0.001) was elevated immediately following the 30-second Wingate test and remained elevated throughout the remainder of the trial. There were no differences in blood lactate between conditions. **Conclusions:** Acute anaerobic power and exercise performance are not negatively affected by mild voluntary hypohydration during and following a single 30-second Wingate test.
Effect of Cold Water Intake During a Short Exercise in Heat on Cognitive Function


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(Please note that relationships reported)

PURPOSE: This study evaluated the effect of cold water intakes before and during exercise in heat on the cognitive function in healthy young men. METHODS: Ten men (23.6 ± 4.4 yrs, 176.2 ± 5.8 cm, 72.1 ± 14.6 kg) who participated in vigorous exercises at least twice a week and maximal oxygen capacity estimated by Rockport’s 1-mile test was over 32.7 ml/kg/min were recruited. They underwent three testing sessions with different conditions in separate days: cold water (CW, 4 °C), neutral temperature water (AW, 36 °C), and no water conditions (NW). Testing order was randomly assigned and balanced. In each session, they were asked to ingest a prescribed amount of tap water (10 ml/body weight) at rest (1/3 of the total amount) and during exercise (2/3 of the total amount). After resting, they ran on a treadmill for 20 min in a hot environment (39.2 ± 2.1 °C, 41.7 ± 9.4 % relative humidity) at their predicted 75% of maximal heart rate. At 6, 12, and 18 min of exercise of CW and AW, they drank water. Cognitive test was performed 3 times; at rest, immediately after exercise, and after 20 min of recovery, by using Stroop color-word test (SCWT). During resting and exercise, their temperature, heart rate (HR), ratings of perceived exertion (RPE), naked body weight changes, and water intakes were measured. RESULTS: The average ear temperature during exercise was 37.2 ± 0.6 °C, 37.5 ± 0.6 °C, and 37.2 ± 0.5 °C, and mean skin temperature was 34.8 ± 2.3 °C, 35.3 ± 1.6 °C, and 34.9 ± 1.2 °C at CW, AW, and NW, respectively (p < 0.05). Average HR and RPE was 148.3 ± 14.1 bpm and 149.9 ± 12.7 bpm and 133.7 ± 10.3 bpm, 0.07 and 12.7 ± 1.14 at 4 °C, AW, and NW, respectively (p > 0.05). They drank a total of 813 ± 133 ml at CW and 812 ± 132 ml at AW. They lost weight by sweating 493 ± 145, 507 ± 257, and 390 ± 139 ml at CW, AW, and NW, respectively (p > 0.05). They drank a total of 813 ± 133 ml at CW and 812 ± 132 ml at AW. They lost weight by sweating 493 ± 145, 507 ± 257, and 390 ± 139 ml at CW, AW, and NW, respectively (p > 0.05). The reliability of cognitive test was 0.999. The cognitive score was 23 ± 5.6, 24 ± 3.15, and 22 ± 0.11 in CW, 24 ± 2.13, 28 ± 11.04, and 25 ± 1.97 in AW, and 17.5 ± 3.8, 22 ± 10.6, and 21 ± 7.9 in NW, at resting, immediately after exercise, and after recovery, respectively (p < 0.05). CONCLUSIONS: No advantage of cold water intake before and during a short bout of exercise in heat was evident for the cognitive function. The mode, intensity, and duration of exercise may be responsible for the outcomes.
Reduced circulating concentrations of the endogenous peptide apelin is implicated in multiple negative health outcomes. As an increasingly valuable modulator of chronic health, further research should explore additional roles apelin may have in physiological responses to exercise in the heat and its relationship to physiological responses to exercise in the heat.

**CONCLUSIONS:** To examine whether predicted heat balance parameters explain variance in core temperature (T_core) and heart rate (HR) responses to exercise in the heat following 24 h of fluid restriction. **METHODS:** 8 participants (4 males and 4 females; age: 21 ± 3 y, body mass: 70 ± 13 kg, VO_2peak: 48 ± 5 ml·kg⁻¹·min⁻¹) completed a 30 min bout of treadmill running and walking in the heat (32°C, 55% relative humidity) under two conditions: 1) 24 h of fluid restriction (DEH) and 2) euhydration (EUH). Participants exercised at 11W/kg for 15 min, followed by 7W/kg for 15 min, which were derived via indirect calorimetry. Total sweat losses were assessed through rectal thermometry and HR was measured at the end of each intensity. Metabolic heat production (M-W), dry heat loss (DHL), and evaporative requirement (E_vap) were calculated for both exercise intensities. Pearson correlation coefficients were utilized to examine the relationship between M-W, DHL, E_vap, and T_core, change in T_core (ΔT_core), HR, and change in HR (ΔHR) under DEH and EUH. Linear regressions were performed to assess all significant correlations. Statistical significance was set at p ≤ 0.05.

**RESULTS: M-W and DHL were not correlated with T_core, ΔT_core, HR, or change in HR under DEH or EUH.** However, perceptual strain (thirst, exertion) may be increased, requiring a greater effort to produce similar performance.

**Sex Differences In Response To Passive Dehydration Via 24-h Fluid Restriction**

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(No relevant relationships reported)

Whole-body heat loss has been extensively examined during exercise in hot environments. Interestingly, the relationship between predicted heat balance parameters and thermoregulatory strain have been limited to individuals in an euhydrated state. As dehydration has been shown to exacerbate thermoregulatory strain, it is imperative to examine whether dehydration modulates heat exchange during exercise in the heat and its relationship to physiological responses to exercise in the heat.

**CONCLUSIONS:** To examine whether predicted heat balance parameters explain variance in core temperature (T_core) and heart rate (HR) responses to exercise in the heat following 24 h of fluid restriction. **METHODS:** 8 participants (4 males and 4 females; age: 21 ± 3 y, body mass: 70 ± 13 kg, VO_2peak: 48 ± 5 ml·kg⁻¹·min⁻¹) completed a 30 min bout of treadmill running and walking in the heat (32°C, 55% relative humidity) under two conditions: 1) 24 h of fluid restriction (DEH) and 2) euhydration (EUH). Participants exercised at 11W/kg for 15 min, followed by 7W/kg for 15 min, which were derived via indirect calorimetry. Total sweat losses were assessed through rectal thermometry and HR was measured at the end of each intensity. Metabolic heat production (M-W), dry heat loss (DHL), and evaporative requirement (E_vap) were calculated for both exercise intensities. Pearson correlation coefficients were utilized to examine the relationship between M-W, DHL, E_vap, and T_core, change in T_core (ΔT_core), HR, and change in HR (ΔHR) under DEH and EUH. Linear regressions were performed to assess all significant correlations. Statistical significance was set at p ≤ 0.05.

**RESULTS: M-W and DHL were not correlated with T_core, ΔT_core, HR, or change in HR under DEH or EUH. However, perceptual strain (thirst, exertion) may be increased, requiring a greater effort to produce similar performance.**
Workplace safety organizations recommend that workers predicted to incur heavy sweat loss should consume a ‘sport drink’ during work. These sugar-sweetened beverages (SSB) often include fructose, which can lead to acute kidney injury (AKI), especially when combined with hypohydration. PURPOSE: Investigate the effect of SSB on renal stress in response to simulated industrial work in the heat, while maintaining euhydration.

METHODS: Twenty male participants (24 ± 2 years, 179 ± 6 cm, 24.7 ± 9.0% body fat) completed two randomized, matched trials of simulated industrial work (2 hr-long; total 2.5 min work and 15 min rest bouts) in the heat (30°C, 55% RH). Equal amounts of SSB or placebo were provided during rest and within-2 hr of completing work. Urine specific gravity (USG), heart rate (HR), and rectal temperature (T_r) were monitored throughout trials. Serum [Na⁺], hemoglobin, and hematocrit levels were measured at baseline, pre- and post-work, and 16- hr post-work. Urinary kidney injury molecule-1 (uKIM-1) and urinary neutrophil gelatinase-associated lipocalin (uNGAL) were measured pre- and post-work, 3-hr and 16-hr post-work.

RESULTS: uKIM-1 was elevated post-work and 16-hr post-work compared to baseline (p≤.028). There was no significant trial difference in hemoglobin (p=.612). There was no trial difference in hemoglobin (p=.637). uKIM-1 was elevated post-work and 16-hr post-work compared to baseline (p=.028) and 3-hr post-work (p=.009), but showed no trial difference (p=.126). uNGAL 3-hr post-work was significantly lower than baseline (p=.011), but showed no trial difference (p=.992). There was no significant trial difference in total urine volume (p=.277) or APV (p=.098). CONCLUSION: These findings indicate that beverage type did not affect renal stress biomarkers following simulated industrial work in the heat when euhydration was maintained.

Hydration position stands outline suggested volume considerations but remain somewhat ambiguous regarding frequency parameters. PURPOSE: To determine the effects of micro-dosing or bolus-dosing plain water (MW, BW, respectively) or a carbohydrate-electrolyte solution (MCE, BCE, respectively) on fluid retention and carbohydrate oxidation during exercise in the heat. METHODS: In a repeated measures cross-over design, males (n=8, 80.3 ±11.8 kg, VO_2 peak 53.0±5.0 ml kg⁻¹ min⁻¹) completed four 2-hour trials (treadmill, 1.3 m·s⁻¹ at a 5° grade) in a heat chamber (33°C and 30% RH) with a 1.5 kg pack. Fluids were delivered to equal 100% of a pre-determined hourly fluid loss familiarization trial. Micro-dosed fluids were provided at 22 doses (49±13 ml dose⁻¹), while bolus-dosed fluids were provided at 1 dose (1075±274 ml dose⁻¹). CE trials delivered 67±17 g CHO hr⁻¹ and 939±239 mg Na⁺ hr⁻¹. Nude body weight, urine volume, and urine specific gravity (USG) were recorded during and 1-hour post exercise. Steady state expired air samples were collected to evaluate rates of carbohydrate oxidation. A two-way ANOVA with repeated measures was used to determine differences. Statistical significance was established at p<0.05.

RESULTS: Total body weight loss was similar across all four trials (-0.60±0.25, -0.53±1.7, -0.67±0.34, and -0.50±0.27 kg, for the BCE, MCE, BW, and MW trials, respectively, p>0.05). Cumulative urine output was similar across all four trials (728±478, 779±491, 818±507, 718±446 ml, for the BCE, MCE, BW, and MW trials, respectively, p>0.05). USG was additionally similar across all trials at 0, 60, 120, and 180 minutes (n=7, 1.008±0.006, 1.008±0.007, 1.007±0.007, 1.008±0.006, p>0.05). Carbohydrate oxidation was significantly higher in the CE trials when compared to the W trials (1.5±0.3 and 0.8±0.2 g min⁻¹, p<0.05) but was not different between dosing styles of the same composition (1.6±0.3 and 1.5±0.3 g min⁻¹ for BCE and MCE, 0.9±0.2 and 0.8±0.3 g min⁻¹ for BW and MW, p>0.05). CONCLUSION: These data demonstrate minimal differences in overall fluid retention and substrate oxidation during exercise in the heat across varied fluid composition and delivery intervals. Supported by the United States Forest Service (USFS), National Technology and Development Program.
estimate the heat load sensation and efficacy of cooling methods using self-reports, and by measuring parameters of hydration status of Olympic-level 470 sailors and windsurfers, during a training camp in the summer of 2019 in Japan.

Methods: Seven females (4 windsurfers, 3 sailors 470) and 4 males (470 sailors), age 21.17 ± 1.4, used cooling vests, plates, and collars before and in-between training races. Weather conditions were measured using Kastril 5500. Athletes scored their heat load sensation on a scale of 1 – “comfortable” to 5 – “ unbearably hot” after each practice. Following the use of different cooling accessories, the athletes were asked to rate cooling method efficiency between 1 – “not efficient” to 5 – “very efficient”. Hydration status, was assessed by urine specific gravity (USG) prior to each training, body weight change and fluid intake measure during training sessions.

Results: During the 8 training days the average weather conditions were: heat index 26.3°C ± 3.7; humidity 84% ± 3.7%; and temperature 27.7°C ± 3.5°C. Average sea training duration was 221 min ± 66 for sailing and 177 min ± 71 for windsurfing. Although the heat index did not change, the heat load sensation rating was affected by wind speed – rated as 2.5 when the wind speed was above 8 knots and 4 with lower wind speed (P < 0.002). Using cooling vests before and between races was rated as efficient (4). Cooling plates (inserted under the life vests) and a cooling collar were somewhat less efficient (3.5 and 3.1 respectively). Athletes were well hydrated before training (average USG 1.009 ± 0.007), and maintained good hydration during training (average fluid consumption of 2.1 L ± 0.9 and average weight loss of 0.05 Kg ± 0.55).

Conclusions: High humidity with a moderate heat index was measured at the area of the Tokyo Olympic Sailing Arena during July 2019. The athletes reported high heat load sensation during training and found different methods efficient. Higher wind speed decreased the heat load sensation, probably due to the acceleration of sweat evaporation. High awareness and prior training in a hot environment like Israel may contribute to improved drinking behavior and hydration status.

3489 Board #310 May 29 2:30 PM - 4:00 PM
Sweat Rate Variability Between Training Sessions
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(NO RELATED RELATIONSHIPS REPORTED)

Practitioners regularly develop hydration plans for athletes based on measured sweat rate. Often times, this is a single measure utilized over various training sessions without consideration for sweat rate variability.

PURPOSE: The purpose of this study was to investigate sweat rate variation in self-selected training sessions to assess the potential error that might be seen when determining sweat rate.

METHODS: Eleven endurance trained runners (7 competitive and 4 recreational) arrived at the research facility once a week over four weeks. Upon arrival, researchers recorded athlete’s body mass. Athletes then completed a running workout lasting a minimum of 30 minutes exercise time. Pace and distance were left to the individual runner’s preference for the training session. Immediately upon run completion, researchers reassessed the runners’ body mass. Difference in body mass pre- to post-run was reported as sweat rate as no fluid or beverage were ingested during the run. The highest and lowest sweat rate recorded for each individual during the four-week period were used for comparison. Paired sample t-tests were used to compare run duration, run distance, running pace, WBGT, and sweat rate with significance set a priori at P < 0.05.

RESULTS: There were no differences in run duration (41.3 ± 11.1 min; p = 0.68), run distance (8.13 ± 2.85 km; p = 0.84), run pace (5.11 ± 0.78 min/km; p = 0.03), or WBGT (21.9 ± 1.4°C; p = 0.41) between trials. Participants highest sweat rate recorded during the four-week period was significantly higher 1.08 ± 0.39 L/hr compared to the lowest of 0.89 ± 0.32 L/hr (p = 0.003).

CONCLUSIONS: Assessing sweat rate is a useful tool for aiding in the determination of fluid intake during exercise however, a single point assessment may not accurately capture an individual’s typical rate. Caution needs to be taken when relying on a single assessment or extrapolating to longer training sessions even in similar conditions.

3490 Board #311 May 29 2:30 PM - 4:00 PM
Elite Female Rugby Sevens Tournament Match-Play - Core Temperature Changes
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(NO RELATED RELATIONSHIPS REPORTED)

PURPOSE: Characterise player core temperature (Tc) across a World Rugby Women’s Sevens Series (WRWSS) tournament day and determine the efficacy of commonly employed cold water immersion (CWI) protocols.

METHODS: Tc was measured in twelve elite female rugby sevens athletes across 3 games (O1-3) from day 1 of the Sydney WRWSS tournament. Exertional heat illnesses symptoms, perceptual scales, CWI details, playing minutes, external load data (measured by Global Positioning Systems) and wet blub globe temperature (range: 18.5–20.1°C) were also collected. Linear mixed models and magnitude-based inferences were used to assess differences in Tc between periods (O1-3 and warm-ups (WU)).

RESULTS: Average Tc was very likely lower (O1-2 > O3) and JES: ±90°C CL. ±0.33; ±0.10 were lower than GI (P < 0.05). JES was lower than GI (0.33 ± 0.44°C) and playing minutes were lower than GI (30 ± 5). CWI decreased Tc by 1.7 ± 0.3°C before WU and 1.9 ± 0.3°C at end of game.

CONCLUSIONS: Elite female WRWSS athletes experienced high Tc during WU (Te peak 37–39°C) and matches (Te peak 37.9–39.8°C), a magnitude known to reduce intermittent high-intensity physiological performance (2°C). The CWI protocol resulted in players ≥ 6 min match-play with a ~1°C raised Tc compared to Te at WU onset.

3491 Board #312 May 29 2:30 PM - 4:00 PM
Patch Application Timing And Adherence Duration Effects On Local Sweating Rate And Sweat Electrolyte Concentrations
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Reported Relationships: K.A. Barnes: Salary; PepsiCo, Inc. Ownership/interest/stock; PepsiCo, Inc. Other (please describe); This study was funded by the Gatorade Sports Science Institute, a division of PepsiCo, Inc. The views herein are those of the authors and do not necessarily reflect the position or policy of PepsiCo.

Sweat testing is often conducted to assist with electrolyte replacement plans for athletes. However, the effect of patch application timing and on-skin duration on local sweating rate (LSR) and sweat electrolyte concentrations is unclear.

Purpose: To determine the effect of patch application timing and on-skin duration on LSR and local sweating rate (LSR) and sweat electrolyte concentrations is unclear.

Methods: Thirty-nine recreationally trained (VO2 max: 47.1±7.8 mL/kg/min) athletes (27 M, 12 F; 75±12.4 kg) cycled at ~80% HRmax in the heat (32°C, 39% rh). Prior to (PRE) and 15 min into exercise (EX), two sweat patches were applied to the left and right mid-back, respectively. The patches were removed after a skin adherence duration of 30 (SHORT) or 70 (LONG) min. LSR was measured from sweat mass over patch surface area (11.9 cm2) and duration. Sweat was centrifuged and analyzed for [Na+], [K+] and [Cl-] by ion chromatography. A two-way repeated measures ANOVA was used to determine the effect of patch application timing (PRE vs. EX), duration (SHORT vs. LONG), and interaction effects on each variable, followed by Tukey post-hoc where main effects were found. Significance was set at p < 0.05.

Results: There was an interaction effect with EX LONG and EX SHORT vs. PRE SHORT for [Na+] (56.8±21.6, 58.5±22.3 > 50.7±20.1 > 39.4±18.3 mmol/L, p=0.001). There was no significant differences for [K+] and [Cl-] between EX LONG, EX SHORT, PRE LONG, and PRE SHORT (3.8±0.6, 4.0±0.7, 3.0±0.6, 3.5±0.6 mmol/L, p=0.07). Conclusion: The on-skin duration did not affect sweat [Na+] and [Cl-] when patches were applied during exercise. However, applying patches prior to exercise resulted in lower sweat [Na+] and [Cl-], especially when removed after a short duration. This was likely due to lower LSR during the ramp up to steady state sweating. Therefore, practitioners should take patch application timing into account when interpreting sweat electrolyte results. Local sweat [Na+] and [Cl-] measured from patches applied prior to exercise may not be representative of concentrations during the full bout of exercise. However, more research is needed to determine the impact of patch timing in the context of whole body sweat [Na+] and [Cl-] estimations.

3492 Board #313 May 29 2:30 PM - 4:00 PM
Cross-validation Of Whole Body Sweat Sodium Prediction Equations
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Reported Relationships: L.B. Baker: Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc.

We have previously published regression equations to estimate whole body (WB) sweat sodium concentration ([Na+]WB) from regional (REG) measures; however, a cross-validation is needed to corroborate the applicability of these prediction equations.
between studies. PURPOSE: To determine the validity of published regression equations (Baker et al. 2018) in predicting WB sweat [Na] from REG measures when applied to a new data set. Physiological strain index (PSI) was calculated as previously described. Paired sample t-tests or repeated measures analyses of variance, with Bonferroni post-hoc testing were used to identify significant differences (p<0.05).

RESULTS: There was no significant difference in Tg before trials (p=0.84), however, maximum Tc achieved was greater in EQ (39.3 ± 0.7°C) compared to NEQ (39.0 ± 0.7°C; p<0.016).

Regardless of time point, HR (p<0.001) and PSI (p=0.004) were significantly greater in EQ compared to NEQ. Tg was significantly elevated in EQ compared to NEQ throughout trials (p<0.001). Perceptually, EQ increased RPE (p=0.003) and TS (p=0.012) compared to NEQ throughout trials. Urine specific gravity (USG) following trials was not significantly different between trials (p=0.151).

CONCLUSION: Trial differences in Tg, HR and perceptual measures suggest a greater impact in thermoregulation while wearing men’s lacrosse to ensure athlete safety.

Climate change is increasing the number of hot days to which outdoor workers are exposed, thereby increasing their risk of heat illness. Currently, continuous monitoring of core temperature (Tc) is expensive, invasive, and impractical. The BioModule is a non-invasive physiological monitor that uses heart rate to provide an estimation of Tc, but its accuracy is unknown. PURPOSE: To test the association between measured gastrointestinal temperature (Tg) and estimated core temperature (Tc) from the BioModule device during outdoor work in a hot environment. METHODS: Twenty groundskeepers (18 men; mean±SD age = 38.8±8 years, body mass index = 31.5±7.5 kg/m²) swallowed an ingestible temperature sensor and strapped on a BioModule before work. Tg was collected every 15 minutes during the workday; Tc was determined by a 1-min average from the same time of day. Data collection occurred in Alabama during July and August (31.4±3.1 °C WBGT). Relationship between Tg and Tc was quantified using the repeated measures correlation coefficient (r). Agreement (bias±1.96 SD) between Tg and Tc was evaluated using the Bland-Altman method for repeated observations. RESULTS: There was a moderate, positive relationship between Tg and Tc (r=0.56, p<0.001). Agreement analysis indicated that Tc was overestimated (0.28±0.58 °C). The error between Tg and Tc was larger at lower temperatures, as indicated by a strong negative trend (Pearson’s r=−0.73). CONCLUSION: The BioModule provides an estimation of Tc that may be helpful as a guide during outdoor work in hot environments but should not be used for safety considerations or measurement of Tc. Funded by the Deep South Center for Occupational Safety and Health, a National Institute for Occupational Safety and Health and Education Research Center.

Sweat electrolytes: influence of environment, sex and exercise intensity

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Sweat electrolytes: Influence Of Environment, Sex And Exercise Intensity

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Reported Relationships: M. Millard-Stafford; Consulting Fee; The Coca-Cola Company. Industry contracted research; Study was funded by The Coca-Cola Company.

Sweat electrolytes: influence of environment, sex and exercise intensity

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Sweat rate and electrolyte loss are highly variable among individuals; but sources of intra-individual variability due to test conditions remain to be quantified. PURPOSE: To determine the impact of exercise intensity and environment on sweat electrolyte losses in men and women. METHODS: Twenty adult male and female subjects completed two sessions during summer months: 3 x 20 min intermittent cycling beginning at low intensity (50/75 Watts) with 25 W increases in work rate under hot-humid (35°C, 60%RH) or hot-dry (35°C, 20%RH) conditions. Whole body sweat rate, regional sweat [Na+] and [K+] were obtained at each work rate. Sweat was collected by transparent plastic patches secured to the skin. Electrolytes were measured using Horiba LAQ/AuTrin Ion meters. RESULTS: Sweat rate and [Na+] was significantly higher (p<0.001) due to increased RH in the heat and incremental changes in exercise intensity. Compared to low exercise intensity, sweat electrolyte losses were increased in men and women.

Sweat rate and [Na+] increased by 149% (112%)

reported relationships

ACSM May 26 – May 30, 2020 San Francisco, California
sweat rate increases of 0.4 l/min (67%) and 0.6 l/min (100%) compared to low exercise intensity. However, [Na+] difference due to greater %RH of environment (60% vs. 20%RH) was only 7.7 mmol (14%) higher for all bouts combined. Sweat [K+] was not different (p=0.4) based on environment, but significantly higher (p<0.03) under low intensity exercise compared to higher work rates (6.9±1.9 vs. 6.0±1.4 mmol). When work rate was matched (75W) under humid conditions, no differences between men and women were observed in sweat rate (0.8±0.3 vs. 0.49±2.17 ±2.5 %RH), with both groups achieving similar post-GXT (p≥0.08).

values (untrained: 37.8±0.2; trained: 37.7±0.2ºC; p=0.37). BLA at recovery (trained: 56±6 mL·kg⁻¹·min⁻¹) was 56±6 mL·kg⁻¹·min⁻¹) ingested 2 capsules of CurraNZ™ (210 mg anthocyanin per day) or a visually matched placebo (microcrystalline cellulose) for 7d prior to a 1h treadmill run (65% VO₂max) in hot ambient conditions (34ºC / 40% RH). PBMC were isolated from EDTA plasma samples that were collected post (1h after (1-Post) and 4h after (4-Post) exercise. Inflammatory capacity was calculated as the ratio between phosphorylated and total NF-κB content in cell lysates. Apoptotic drive was calculated as the ratio between BAX and BCL-2 in cell lysates. Caspase 9 was measured to provide additional confirmation. Western blot data were analyzed with two-way (Condition x Time) RM-ANOVA with Duncan post-hoc tests. The p-NF-κB:NF-κB ratio was reduced following 7d NZBC supplementation (-46%, p<0.03). Post hoc analysis indicated p-NF-κB:NF-κB content at 4-Post had fallen below values at Post (-24%, p<0.02) and 1-Post (-60%, p<0.04). The BAX:BCL-2 ratio was increased following 7d NZBC supplementation (+106%, p<0.01). Post hoc analysis indicated the BAX:BCL-2 ratio increased from Pre to Post exercise (+119%, p<0.01) in NZBC and remained elevated (+77%, p<0.04) both Pre and Post and 4-Post (+59%, p<0.04). Caspase 9 content also increased following 7d NZBC supplementation (p<0.05). Post hoc analysis indicated elevated Caspase 9 content at PRE in NZBC (+86%, p<0.01), with differences between conditions being resolved by 4-Post exercise (p<0.94). Conclusions: Study data suggest 7d NZBC supplementation may increase inflammatory capacity and increase apoptotic drive in PBMC. This might call nascent leukocytes into circulation to ensure maintenance of the putative inflammatory response that accompanies exertional heat stress. However, the exact physiological relevance of these changes remains to be determined.

Utility of a verification trial to confirm maximal oxygen intake (VO₂max) in the heat is unclear and initial studies are needed to explore recovery duration between the initial graded exercise test (GXT) and the verification trial to ensure verification trial fidelity. PURPOSE: To compare the recovery kinetics of gastrointestinal temperature (Tgi) and blood lactate (BLA) after a GXT in the heat between trained and untrained cyclists. METHODS: Trained (n=10; age: 22.6±2.2 y; body fat: 15.4±5.8% and untrained (n=11; age: 23.4±2.9 y; body fat: 21.5±8.5%) male cyclists volunteered. Tgi, BLA (finger prick), expired gases, and power output (watts; W) were continuously measured during the GXT in a heated chamber (39ºC, 31%RH). After the GXT, subjects exited the chamber and rested in a temperate room (22ºC, 40%RH) until Tgi returned to pre-GXT values (defined as “recovery”) at which point BLA was re-assessed. Separate independent t-tests assessed differences in Tgi, BLA, and recovery duration between groups. Separate by 2 (training status [trained vs. untrained]) pre-GXT, post-GXT, recovery) repeated measures ANOVAs evaluated changes in Tgi and BLA with Tukey post hoc tests (alpha = 0.05). RESULTS: As expected, the trained cyclists GXT was longer (7093 ±19/61098 ±c; p<0.02) and achieved greater peak power output (278±32 vs. 238±32 W; p<0.009) than the untrained cyclists. However, when expressed as a % of peak power output, the untrained cyclists achieved up to 75% of the trained cyclists. CONCLUSION: At matched low intensity exercise, sex differences in sweat sodium and rate were not observed. Intra-individual variability in sweat sodium is influenced more by modest incremental changes (25 W) in exercise intensity than the ambient humidity in hot conditions. Sweat rate increases of 0.4 l/min (67%) and 0.6 l/min (100%) compared to low exercise intensity. However, [Na+] difference due to greater %RH of environment (60% vs. 20%RH) was only 7.7 mmol (14%) higher for all bouts combined. Sweat [K+] was not different (p=0.4) based on environment, but significantly higher (p<0.03) under low intensity exercise compared to higher work rates (6.9±1.9 vs. 6.0±1.4 mmol). When work rate was matched (75W) under humid conditions, no differences between men and women were observed in sweat rate (0.8±0.3 vs. 0.49±2.17 ±2.5 %RH), with both groups achieving similar post-GXT (p≥0.08).

Supported by a grant from The Coca-Cola Company.
and resting VO₂, RPE, and HR values were collected then subjects rested in a heated chamber (39°C, 31% relative humidity) for 20 min before completing the GXT. Post-GXT, subjects exited the chamber and rested in a thermoneutral room (22°C, 40%RH) until Tgi returned to baseline. Subjects re-entered chamber and repeated pre-GXT procedures prior to VRF. For VRF, subjects warmed-up cyclically at 60% maximal wattage (Wmax) from GXT and then cycled at 110% Wmax until exhaustion. VO₂, HR, and RPE values from the last complete min were used for comparison. A 2 × 2 (T vs. UT)×(GXT vs. VRF) mixed-factor ANOVA with Bonferroni post hoc tests and an alpha of 0.05 was used for analysis. RESULTS: VO₂: trained cyclists VO₂max was greater than untrained (56.4±8.6 vs. 40.1±5.9 mL·kg⁻¹·min⁻¹; p<0.001). VO₂ during GXT was greater than VO₂ for both groups (p=0.013, np²=0.29). HR: subjects had significantly higher HR during GXT vs. VRF (T:188±178 bpm; UT:189±181 bpm; p<0.001, np²=0.74) and HR was not significantly different between groups (p=0.777). RPE: There was a significant trial×training interaction (p=0.04, np²=0.21), and a with hot water immersion and sauna suits on VO₂max, running economy, and lactate threshold. METHODS: Participants (see table for physical characteristics) were randomized into three standardized 3wk exercise training groups: 1) exercise training alone - control (N=10), 2) exercise training with immediate post-exercise hot water immersion (N=10), and exercise training with immediate post-exercise sauna suit (N=10). At baseline and post-program participants completed a running economy protocol and maximal exercise testing protocol to measure VO₂max and lactate threshold. The running economy protocol consisted of three consecutive 5-minute stages: stage 1 = 4.6 mph, stage 2 = 5.0 mph, and stage 3 = 5.4 mph. RESULTS: After 3wk, mean VO₂max and lactate threshold changes in the sauna suit and hot water immersion groups were significantly greater (p<0.05) when compared to the control group (see table). The hot water immersion group showed significant within-group improvements (p<0.05) in economy between baseline and 3wk for all three stages (see table), although there were no between group differences (p>0.05). CONCLUSION: Both post-exercise passive heating strategies were equally effective at increasing VO₂max and lactate threshold values. Additionally, despite the absence of between-group statistical significance, preliminary evidence suggest post-exercise hot water immersion may be a more effective strategy at improving running economy relative to sauna use after exercise.

### Table

<table>
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<td>VO₂ max</td>
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<td>61.1±9.2</td>
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<tr>
<td>VO₂ max</td>
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<td>64.7±10.2</td>
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<tr>
<td>Lactate threshold (mmol/L)</td>
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<td>4.8±0.4</td>
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Note: All values are mean±SD. *p-value is significantly different than baseline, p<0.05. **p-value is significantly different from controls group, p<0.05.

### Graph

- Exercise has been found to promote the release of brain-derived neurotrophic factor (BDNF). Literature suggests that BDNF is upregulated in the periphery post aerobic exercise. There is evidence that shows BDNF plays a role in temperature regulation, though further work is warranted.

### Conclusions

The study investigated the diurnal effects of exercise in the late morning and evening on endurance exercise capacity and thermoregulatory responses during a time-to-exhaustion test in the heat. METHODS: Ten male participants cycled at 70% peak oxygen uptake until exhaustion in the heat (30°C, 30% relative humidity). Participants commenced exercise in the late morning at 10:00 h (AM) or evening at 21:00 h (PM). Upon cessation of exercise, participants completed a 30 min post-exercise recovery. RESULTS: Time to exhaustion was 281±13 min (mean±SD) longer in PM (49.1±16.3 min) than AM (38.7±14.6 min; p<0.001). Rectal temperature before and during exercise were higher in PM than AM (both p<0.01) in accordance with the diurnal variation of core temperature (Tc). The rates of rise in rectal temperature (AM:0.030±0.012°C/min; PM:0.021±0.008°C/min), mean skin temperature (AM:0.095±0.042°C/min; PM:0.068±0.028°C/min), thermal sensation and rating of perceived exertion during exercise were slower in PM than AM (all p<0.05). Rectal temperature at the point of exhaustion was not different by time-of-day (AM 38.3±0.4°C; PM 38.6±0.5°C). Dry and evaporative heat losses and an increase in skin blood flow were greater in PM than AM (all p<0.05). During 30-min post-exercise recovery, the rates of fall in rectal temperature (AM 0.013±0.004°C/min; PM 0.019±0.010°C/min) and skin blood flow were faster and thermal sensation was lower in PM than AM (all p<0.05). Heart rate during exercise and recovery were not different between trials. CONCLUSION: This study indicates that endurance exercise capacity is greater and heat-loss responses to control Tc during exercise in the heat are more effective in the late evening than morning. Moreover, perceived fatigue during exercise and thermal perception during and following exercise are lower in the late evening than morning.

### Effect of Heat On Serum and Plasma Brain-derived Neurotropic Factor During Aerobic Exercise

Tori D. Hargett, Ryan T. Wiet, Elliot Arroyo, Emily C. Tagesen, Ellen L. Glickman, FACSMD, Adam R. Jajtner. Kent State University, Kent, OH. (Sponsor: Ellen L. Glickman, FACSMD)

### Conclusions

The purpose of this study was to examine temperature related effects on BDNF during aerobic exercise in different environmental conditions along with differences between serum and plasma BDNF. Six recreationally active college aged men (26±0.523) completed a 360-min VO₂max test (84.8±5.7 mL·kg⁻¹·min⁻¹) and performed experimental trials in 35°C at 45% humidity (HT/MH) and 22°C at 45% humidity (MT/MH). During each trial, participants cycled for 60-minutes at 60% of VO₂max, rested for 15-minutes, cycled until exhaustion at 90% VO₂max, then recovered for 60-minutes. Blood was obtained before exercise (PRE), after 60 minutes of cycling (60), after the TTE (90), and after recovery (REC). Serum and plasma BDNF were assessed via ELISA, while data was analyzed using a mixed model regression, with significance defined as α<0.05. Results: There was no significant condition by time interaction (F = 0.602, p = 0.618) nor main effect of condition (F = 1.792, p = 0.189) or time (F = 1.949, p = 0.139) for serum BDNF concentrations. There was also no significant condition by time interaction (F = 0.272, p = 0.845) nor main effect of condition (F = 0.415, p = 0.523) or time (F = 1.070, p = 0.373) for plasma BDNF concentrations. Conclusions: This study suggests high temperature does not have an effect on the BDNF response in serum or plasma concentrations. These results may be due to the upregulation of BDNF concentrations due to aerobic exercise, though further work is warranted.

This study was partially funded by the Kent State University Research Council.

### References

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(No relevant relationships reported)
Repetitive hot head-out water immersion increases peripheral vascular function and non-immersion cerebral artery blood velocity. However, it is not known if an acute bout of hot head-out water immersion (HOWI) improves cerebrovascular function (i.e., cerebrovascular reactivity (CVR)). PURPOSE: We tested the hypothesis that CVR is greater during and following hot (HOT) vs. thermoneutral (TN) HOWI. METHODS: Twelve healthy participants (age: 22 ± 2 yrs, 6 females) completed two randomized trials which consisted of 30 min of HOT (39°C) or TN (35°C) HOWI. Beat-to-beat blood pressure (MAP), middle cerebral artery blood velocity (MCAv), and the partial pressure of end-tidal CO2 (PETCO2) were recorded continuously. After 5 min of seated baseline, participants breathed hypercapnic gas (3.5%, and 7% CO2 for 3 min each) in a stepwise fashion. CVR testing was completed pre, 30 min into HOWI (HOT vs. TN), and immediately post-HOWI. CVR was calculated as the slope of the linear regression line by plotting MCAv versus PETCO2. RESULTS: MAP (HOT: 84±6 vs. TN: 83±9 mmHg; P<0.05), MCAv (HOT: 66±10 vs. TN: 66±14 cm/s; P=0.40), PETCO2 (HOT: 43±2 vs. TN: 43±3 mmHg; P=0.41) and CVR (HOT: 1.66±0.3 vs. TN: 1.82±0.5 cm/s/mmHg; P=0.16) were not different between HOT and TN at baseline. MAP was different between HOT and TN during (HOT: 80±9 vs. TN: 89±11 mmHg; P=0.01) and post (HOT: 84±9 vs. TN: 95±9 mmHg; P<0.01). MCAv was not different between HOT and TN during (HOT: 64±12 vs. TN: 71±13 cm/s; P=0.48) and post (HOT: 67±13 vs. TN: 70±15 cm/s; P=0.79). PETCO2 was not different between HOT and TN during (HOT: 44±3 vs. TN: 45±3 mmHg; P=0.69) or post (HOT: 43±3 vs. TN: 43±3 mmHg; P=0.74). CVR was not different between HOT and TN during (HOT: 1.62±0.4 vs. TN: 2.01±0.61 cm/s/mmHg; P=0.22) and during post (HOT: 1.51±0.69 vs. TN: 1.77±0.64 cm/s/mmHg; P=0.43). CONCLUSION: These preliminary data indicate that cerebrovascular reactivity is not improved during an acute bout of hot water immersion compared to thermoneutral water immersion. Further investigations should examine if repetitive hot water immersion improves cerebrovascular reactivity. Supported by Office of Naval Research Award N00014-17-1-2665.
was not different between HOT and TN during (HOT: 2.9±0.9 vs. TN: 1.0±0.8°C; P=0.74) or post (HOT: ±1.2±0.5 vs. TN: -2.0±0.7°C; P=0.74). CONCLUSION: These data indicate an acute bout of hot water immersion attenuates cerebral blood velocity vs. thermoneutral water immersion. This response is likely due to the differences in arterial blood pressure and/or arterial cardiac output between conditions. However, cerebral autoregulation during and following hot water immersion is not different compared to thermoneutral water immersion in healthy participants.

Supported by Office of Naval Research Award N00014-17-2-6665

3509 Board #330
May 29 2:30 PM - 4:00 PM
Do The National Institute Of Occupational Safety And Health Recommendations Prevent Hyperthermia And Dehydration?
Nate E. Bartman1, Jonathan R. Larson1, Zachary J. Schlader, FACSM2, Blair D. Johnson, FACSM1, David Hostler, FACSM1, Riana R. Pryor1. 1University at Buffalo, SUNY, Buffalo, NY. 2Indiana University, Bloomington, IN.

The National Institute of Occupational Safety and Health (NIOSH) recommendations for work in the heat suggest a consuming 237 mL of water every 15-20 min and rest intervals are not necessary for work if conditions are not extreme. The efficacy of these recommendations to prevent against hyperthermia (rise in core temperature) and dehydration (percent body mass loss) has not been tested. PURPOSE: To test the effectiveness of the NIOSH guidelines to prevent body temperature from exceeding 38.0°C and dehydration greater than 2% of body mass. METHODS: Seven men walked for 2 hours at 6.4 kph in the highest thermal stress NIOSH allows before recommending work-to-rest ratios (34°C, 30% relative humidity). Participants drank 237 mL of water every 20 minutes while rectal temperature (Trec) monitored. Body mass and urine specific gravity (USG) were measured before and after exertion. Trec was extrapolated out to four- and eight-hour workdays based on the rate of Trec rise in the last hour of exertion. Percent dehydration was extrapolated out to four- and eight-hour workdays based on body mass lost and planned hydration during exertion. RESULTS: Trec rose from baseline (36.8±0.3°C) to the completion of exertion (38.1±0.6°C, p<0.001), with two subjects reaching the 38°C threshold. Four- and eight-hour predicted percent dehydration (USG: 1.013±0.005) and dehydrated 0.03±0.48% during the work protocol, with no differences between HOT and TN during (HOT: 2.9±9.0 vs. TN: 1.0±8.8°C; P=0.74) or post (HOT: -1.2±12.8 vs. TN: -2.0±19.7°C; P=0.74). CONCLUSIONS: Because IM metabolic and thermal effects are sufficiently large to have a measurable impact on research, we conclude that the IM represents an uncontrolled, unmeasured factor in the experimental design of human studies. Resting experimental protocols will incur a larger percent error than protocols involving exercise and elevated core temperatures. Therefore, researchers should acknowledge the IM as a study limitation and control these factors which strongly affect IM metabolism such as exercise, antibiotics, diet, and prebiotics.

3510 Board #331
May 29 2:30 PM - 4:00 PM
Human Intestinal Microbiota Heat Production Is An Unmeasured Quantity In Thermal And Metabolic Studies
Lawrence E. Armstrong, FACSM1, Douglas J. Casa, FACSM1, Luke N. Belval2. 1University of Connecticut, Storrs, CT. 2Institute for Exercise and Environmental Medicine, Dallas, TX. Email: lawrence.armstrong@uconn.edu

The human intestinal microbiota (IM) contains a diverse array of micro-organisms from more than 1,000 species that inhabit the surface and contents of the gastrointestinal tract. The number of bacterial cells (10^10 - 10^12) is approximately the number of cells in the entire human body. Most investigators ignore the potential contributions of this biomass to human metabolic and physiological processes. PURPOSE: To examine influences of the IM on research measurements of metabolism and calculations of heat balance. METHODS: This prospective study combined data from 9 IM, 4 small animal, and 6 human peer-reviewed publications. Our analyses compared IM versus human metabolism and heat production. RESULTS: We calculated the rate of IM heat production in the human colon to be 32 kcal/h for fecal bacteria (based on 46 g dry weight of colonic fecal bacteria and a median Lactobacillus acid metabolites heat production of 800mW/kg dry weight during anaerobic fermentation). This calculated rate of IM heat production is considerable, when compared to both the resting metabolic rate (RMR) of men (42% of 76.2 kcal/h) and women (36% of 56.2 kcal/h) and 24-h energy expenditure (RMR + energy expenditure during activities) of men (23% of 140 kcal/h) and women (34% of 94 kcal/h). The heat production of bacteria residing within the intestinal mucosa is unknown and adds to that of fecal bacteria. Diet contents (e.g., resistant starch) are primary determinants of IM heat production. Considering Acceptable Macronutrient Distribution Ranges published by the National Academy of Sciences, USA, the fermentation of plant material generates 69.3 - 264.6 Kcal/24h during metabolism of a 2200 kcal/24h diet. CONCLUSIONS: Because IM metabolic and thermal effects are sufficiently large to have a measurable impact on research, we conclude that the IM represents an uncontrolled, unmeasured factor in the experimental design of human studies. Resting experimental protocols will incur a larger percent error than protocols involving exercise and elevated core temperatures. Therefore, researchers should acknowledge the IM as a study limitation and control these factors which strongly affect IM metabolism such as exercise, antibiotics, diet, and prebiotics.

3511 Board #332
May 29 2:30 PM - 4:00 PM
Wearable Technologies For Real-time Monitoring Of Body Core Temperature Under Heat Stress Conditions
Ken Tokizawa1, Toru Shimuta1, Hirofumi Tsuchimoto2. 1National Institute of Occupational Safety and Health, Japan, Kawasaki, Japan. 2Murata Manufacturing Co., Osaka, Japan. Email: tokizawa@sbp.t-com.ne.jp

Athletes and workers are at risk of heat illness whenever they work for a prolonged duration in outdoor extreme temperatures due to their metabolic demands. Safe limits under heat stress conditions are currently determined using predictive models for ambient temperature and exercise intensity. Wearable technology is now being adopted, but a system that accurately measures core temperature using wearable devices has yet to be reported. PURPOSE: To develop a new wearable patch-type sensor system that predicts core temperature based on heat-flux data from the chest. METHODS: We performed experiments that compared our predicted temperatures (Trec using a revised algorithm from the dual-heat-flux method, with the actual temperatures in both nasal (Tn) and rectal (Trec) sites during exercise in three heat conditions. Thirty-two volunteers walked for 60 min at 4-5 km/h at 30°C, 35°C, or 40°C. Trec was monitored using a smartphone application receiving wirelessly transmitted data from the patch-type sensors (65 ± 45 x 8 mm) on the chest. RESULTS: In the 40°C condition, Tn rec and Trec increased from 37.2 ± 0.2°C, 36.9 ± 0.2°C, and 37.3 ± 0.2°C to 38.2 ± 0.3°C, 37.9 ± 0.3°C, and 38.0 ± 0.2°C (mean ± standard deviation), respectively, during exercise. The difference between Tn and Trec was -0.10 ± 0.15°C and that between Trec and Tn was 0.02 ± 0.19°C, using data sampled at 5-min intervals during exercise. In the 35°C condition, Tn rec and Trec increased to 37.9 ± 0.3°C, 37.8 ± 0.3°C, and 37.9 ± 0.2°C after exercise. In this case, the difference between Tn and Trec was 0.06 ± 0.17°C and that between Trec and Tn was 0.04 ± 0.14°C. In the 30°C condition, the differences were -0.13 ± 0.24°C (Tn - Trec) and 0.06 ± 0.25°C (Trec - Tn). Body mass, fat percentage, and sex did not affect the Trec algorithm, but skin temperature changes during exercise yielded errors. CONCLUSIONS: The error ranges for our system are slightly superior to those in previous studies involving noninvasive core temperature measurements. Our system uses simple wearable devices and can provide real-time, subject-specific, and accurate body core temperature estimates under heat stress conditions. In combination with other physiological and environmental parameters, this early warning system will reduce the risk of heat illness.

3512 Board #333
May 29 2:30 PM - 4:00 PM
Abstract Withdrawn

3513 Board #334
May 29 2:30 PM - 4:00 PM
Effects Of Polyester Wicking Versus Cotton Fabric T-shirt On Sweat Rate In Obese Males
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The effects of different t-shirt fabrics on thermoregulation during exercise remain to be elucidated. PURPOSE: This crossover study investigated the effects of cotton (C) versus polyester (P) t-shirts on sweat rate and skin temperature at the torso (chest, back) and peripheral (forehead, forearm) regions of physically active, obese males. METHODS: Seven participants (21.7 ± 1.7 yr; 35.7 ± 6.7 kg·m⁻²) completed 4 visits (separated by 48 hrs); visit 1 was to complete the informed consent, ACSM health questionnaire, PAR-Q, and body composition assessment using air displacement plethysmography. Visit 2 was a VO₂max test (30-sec averaging for expired gas analysis), followed by two treadmill walking sessions (30 min at 30 - 39% VO₂max in either C or P-shirt (randomized, counterbalanced sequence)) on the third and fourth visits. Exercise was performed in a hot and dry (27°C, ± 2°C ± 2°C) relative humidity) environment. Sweat rate was determined as 0.1 cm/hr body weight (pre- minus post-exercise body weight) using a digital scale. Skin temperature was measured during exercise using a skin thermometer. Torso skin temperature (Tt) was the sum of 0.5Tsktorso + 0.5Trarm. Peripheral site skin temperatures were analyzed separately. A dependent t-test was used to compare sweat rates. Separate two-way ANOVAs were performed to investigate fabric type, time, and their interactions on skin temperature by body region. RESULTS: On average, participants VO₂max and body fat were 36.8 ± 8.7 mL·kg⁻¹·min⁻¹ and 34.7 ± 4.3%, respectively. There was no difference between C and P conditions in sweat rates (Δ body weight = -35.1 ± 11 kg; -37.0 ± 20 kg).
respectively, \( p = .754 \). A significant interaction effect was detected between \( T_{\text{spine}} \) and fabric \((p = .022)\) with \( C > P \). Interaction effects of skin temperature in the peripheral regions (forearm, \( p = .195 \); forehead, \( p = .037 \)) were nonsignificant.

**CONCLUSION:** Though the sweat rate was similar across cotton and polyester trials, polyester appears to be effective for temperature regulation, especially in the torso region during low intensity aerobic exercises in young, obese males. Future research should explore the impact of C vs. P fabric on sweat rate and skin temperature during different intensities and modalities of exercise.

**METHODS:** Eight healthy male participants were recruited in the study (age: 25±3yr; height: 171.6±7.4cm; weight: 79.2±14.2kg). Participants performed 4 exercise trials in a cross-over, randomized, designed: standard+fan (S+F), novel+fanning (N+F), standard+vest (S+V), and novel+vest (N+V). Participants exercised for 60 min on a cycle ergometer in a heated, humidity-controlled chamber (29.4±0.4°C and 32.0±2.6%RH; temperature and RH \( p > 0.05 \) for all trials). During the first 30 min, participants exercised in the trial specific shirt with no external wind. In the second 30 min, the fan was used to simulate wind to chest and back. Heart rate (HR), skin temperature (\( T_{sk} \)), and core temperature (\( T_{core} \)) were recorded every 5 min. \( T_{sk} \) was measured by ingestible sensor 4.5 hours before exercise and \( T_{sk} \) was assessed at 5 sites: upper chest, mid-chest, forearm, upper back, and mid-back. The initial 10.1 cm ventilation area that covered mid-chest and mid-back. Rating of perceived exertion (RPE) and feeling (+5 good; -5 bad) were assessed every 5 min. RESULTS: Mean \( T_{sk} \) was lowest in \( N+F \) (31.3±1.2°C) compared to other trials in final 30 min. \( T_{sk} \) of averaged mid-chest and mid-back was lower in the final 30 min (32.1±1.9°C) exercise compared to the first 30 min in \( N+F \) (33.0±1.3°C; \( p > 0.001 \)). However, \( T_{sk} \) of averaged upper chest and back (outside of ventilation area) remained the same in final 30 min as first 30 min (\( \sim 34^\circ \)C). No significant differences were found in \( T_{sk} \) and HR across the trials. N+F had lowest RPE and best overall feeling compared to other trials in the final 30 min.

**CONCLUSIONS:** N+F had greatest impact on upper body heat dissipation, mainly appearing in lower chest \( T_{sk} \), and RPE. In addition, novel ventilation vest successfully decreased the \( T_{sk} \) of mid-chest and back in final 30 min exercise.

**REFERENCES:**

**F-70 Free Communication/Poster - Medical Management and Injury Risk**

**Board #335**

**May 29 2:30 PM - 4:00 PM**

**Upper Body Heat Dissipation Wearing A Novel Synthetic Material Shirt During Exercise In The Heat**

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**Abstract Withdrawn**

**3515**

**Board #336**

**May 29 2:30 PM - 4:00 PM**

**Novel Factors Associated With Adverse Mental Health In Elite Para Athletes In South Africa**

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**No relevant relationships reported**

Para-athletes (PA) may have specific mental health (MH) challenges that, together with the demands of high-level sport performance, could put them at risk for MH disorders. However, research in this population is limited. **PURPOSE:** To investigate factors associated with MH in South African PA. **METHODS:** In this descriptive, cross-sectional study, 124 athletes (93 males; 31 females) with a mean age 26.7 (±9.2) competing in the 2019 National Champs were recruited. Demographic, medical history and sleep-related variables were included in bivariate analyses to assess their association with MH. Between-group differences were analysed using the Mann-Whitney U or T-tests. Variables significantly associated in the bivariate analyses were included in multiple regression analyses for mental health. Mental health was measured with the State/Trait Anxiety Inventory (STAI) and the Kessler Psychological Distress Scale (K-10 Questionnaire). Sleep quality, sleepiness and chronotype were measured with the Pittsburgh Sleep Quality Index (PSQI), the Epworth Sleepiness scale and Morningness-Eveningness Questionnaire (MEQ-SA). **RESULTS:** The model explained 40% of the variance in MH (F=12.04, p<0.001). Compared to athletes with “good” sleep quality, K-10 and STAI scores were significantly higher (indicating poorer MH) in athletes with “poor” sleep quality (U = -2.6, p=0.001; t(116.8) = -4.3, p<0.001).

“Poor” sleep quality (B:0.8; 95%CI 0.4 to 1.3), moderate to severe daytime sleepiness (B:4.2; 95%CI 1.1 to 7.3) and sleepiness (B:3.5; 95%CI 1.1 to 6.5) were most strongly associated with high STAI scores. **CONCLUSIONS:** This study identified novel factors associated with adverse MH in elite PA. As some of these factors are modifiable, further research towards prevention strategies is warranted.

**3517**

**Board #338**

**May 29 2:30 PM - 4:00 PM**

**Investigating The Effect Of Mouth Guard Use On Aerobic Performance In Amateur Boxers.**

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**No relevant relationships reported**

Purpose – To assess if wearing a mouth guard effects maximal aerobic capacity in amateur boxers. Methods – 13 amateur boxers took part in a prospective crossover study to assess maximal aerobic capacity achieved during the 20m Multi Stage Fitness Test (MSFT). Each participant completed the MSFT 7 days apart, under control (no mouth guard – C) and intervention conditions (mouth guard – MG). The order of tests was determined via a coin toss on day 1, and two primary outcomes measures were recorded: (1) the estimated maximum oxygen uptake (VO\(_{2}\max\) – kg/mL/min) and (2) distance run (meters – m). Data on height, weight, and type of mouth guard were recorded. Complete datasets on Rate of Perceived Exertion (RPE) were available for 10 boxers. Results – Mouth guard use was shown to reduce estimated VO\(_{2}\) max and distance run during the 20m MSFT from 56.31 kg/mL/min to 54.12 kg/mL/min and 2572 m to 2380 m respectively, (P<0.05). All 13 participants recorded lower VO\(_{2}\) max scores when wearing a mouth guard. \((Mean = -2.43kg/L/min, Range = 4.2-0.9 kg/L/min). 10 participants submitted data on RPE and reported a 32.3% increase in mean RPE scores when performing the MSFT in mouth guards compared to control conditions, (P<0.05).

Conclusions – Mouth guard use was shown to significantly reduce aerobic performance in amateur boxers and increase the perceived rate of exertion during the 20m MSFT.

**3518**

**Board #339**

**May 29 2:30 PM - 4:00 PM**

**The Relationship Between Flourishing, Pain, And Injury In Collegiate Athletes**

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**No relevant relationships reported**

Flourishing encompasses a holistic representation of physical, psychological, and social health. However, pain and injury can negatively affect health. Currently, there is little research on flourishing within collegiate athletes. **PURPOSE:** To evaluate the relationship of pain and injury with flourishing in NCAA athletes and to compare by division. **METHODS:** NCAA division 1 (D1), 2 (D2), and 3 (D3) athletes were given a questionnaire incorporating the flourishing scale and the Oslo Sports Trauma Research Center Overuse Injury Questionnaire (OSTRC). Athletes were further classified by OSTRC scores into overuse and substantial overuse injuries. Multivariable regressions with logistic transformations and ANCOVAS were performed to investigate the relationship between flourishing and OSTRC pain and flourishing, overuse and substantial overuse injury. Confounders controlled for included age, gender, history of orthopaedic surgery and major injury, hours of sleep, and non-steroidal anti-inflammatory use. Unadjusted and adjusted effect size and 95% confidence intervals (95% CI) were reported. **RESULTS:** 253 athletes (Age: 19.43 (1.18) years; Male: 70; D1: 102, D2: 74, D3: 77; 7-8 hours of sleep: 157 participated. Mean flourishing scores were D1: 48.59 (10.43), D2: 50.08 (5.31), and D3: 48.58 (8.09). The median OSTRC score was 0 (IQR = 0-22). 124 reported an overuse injury and 47 a substantial overuse injury. There was a unadjusted negative relationship between OSTRC total score and flourishing (\( r^2 = 5.2\%\)).
Exertional rhabdomyolysis is a serious clinical condition in which skeletal muscle is rapidly broken down, potentially leading to life-threatening systemic complications. Clinicians often diagnose rhabdomyolysis based on elevations in circulating creatine phosphokinase (CPK) and symptomology. Normal CPK and other biomarker concentrations following intense exercise are unknown. **Purpose:** This study aimed to determine reference concentrations for biomarkers that suggest muscle damage in athletes and examine the time-course of muscle damage biomarker responses after strenuous exertion. **Methods:** 20 collegiate NCAA I football players were enrolled in the study. Serum and urine samples were collected immediately and 24 hours post strenuous practice (0h and 24h, resp). Serum samples were analyzed for biomarkers of muscle damage including a Chem26 metabolite and chemistry panel and myoglobin. Urine samples were analyzed for creatinine and myoglobin concentrations. Participants were also given Physical Symptoms Questionnaires 24 hours post strenuous practice (0h and 24h, resp). Serum samples were analyzed to evaluate the evidence to support the effectiveness of neuromuscular warmup-based interventions for lower extremity injuries (LEIs) in basketball. **RESULTS:** Thirteen studies testing neuromuscular interventions for LEI prevention in basketball athletes were included in this review. They reported significant protective effects for the following LEIs: ankle injuries (significant in 4/9 studies that assessed this outcome); ACL injuries (2/4 studies); a general knee injury outcome (1/5 studies); and overall LEIs (composite; 5/7 studies). Significant results were almost universally directionally favorable. **CONCLUSIONS:** Neuromuscular interventions that require minimal equipment are an appealing injury prevention strategy in youth sports. In soccer, the FIFA 11+ warmup program has been rigorously studied and proven effective when adoption and adherence are strong. Overall, the evidence is supportive of warm up for LEI prevention in basketball. However, most studies are underpowered, intervention components are varied, and adoption and adherence is often low. More work is needed to validate the necessary and sufficient warmup activities, and to maximize adoption and sustained adherence to these strategies over time.
Purpose: To determine how current collegiate athlete pain and injury affect athletic identity and how these relationships differ across NCAA divisions. METHODS: NCAA division 1 (D1), 2 (D2), and 3 (D3) athletes were administered a questionnaire through an encrypted database. The Athletic Identity Questionnaire (AIM) and Oslo Sports Trauma Research Center Overuse Injury Questionnaire (OSTRC) were used within the survey. AIM estimates self-perceived athletic identity while OSTRC measures level of participation, training volume, performance, and pain. Athletes were further classified by OSTRC scores into overuse injuries and substantial overuse injuries. Multivariable and logistic regressions assessed the relationship between Aim, OSTRC scores, and overuse injury. Models were adjusted for age, gender, NCAA division, history of orthopedic surgery, and history of major injury, with unadjusted and adjusted coefficients and Odds Ratios (OR) with 95% confidence intervals (95% CI). RESULTS: 252 athletes (age of 19.4 ± 1.2 years, male: 181, female: 70, D1: 101, D2: 74, D3: 77) participated. Mean AIM scores were D1: 37.98 (7.61), D2: 37.63 (3.03), and D3: 38.86 (6.98). The OSTRC median score was 0 (Q0: 0.22). 127 (50%) athletes had an overuse injury while 47 (19%) had a substantial overuse injury. Adjusted total OSTRC score was -0.67 (95% CI: -2.4, 1.1; p=0.474). Adjusted OR for OSTRC overuse injury was 1.80 (95% CI: 0.97, 1.94; p=0.589) and substantial overuse injury was 0.95 (95% CI: 0.91, 0.99; p<0.036). Similar results were observed between gender and division subgroups. CONCLUSION: After adjusting for confounding variables, it was determined that substantial overuse injuries negatively affected athletic identity, regardless of gender or NCAA division. Sports medicine professionals need to consider the possibility of lost athletic identity when an athlete sustains an injury. Measures should be taken to ensure that athletes continue to have meaningful contribution to sport following pain or injury.

Subjective well-being is related to injury in soccer athletes, but little is known about how these variables change around a single athletic competition. Continued athletic participation combined with negative well-being may lead to tissue overload and subsequent injury. PURPOSE: The purpose of this study was to identify the differences in daily well-being measures before, during, and after the day of each match. METHODS: Thirty female soccer (age: 19.8 ± 1.1 years, height: 1.6 ± 0.05 m, mass: 64.9 ± 6.6 kg) players provided daily measures of readiness, physical fatigue, mental stress, and soreness intensity over the course of a competitive season. Subjective well-being was taken on standard practice days (P), game days (D0), and on days one (D1) two (D2) following games. One-way within subject analysis of variance was used to compare the subjective well-being variables between each time point. Post-hoc analysis was performed with a Bonferroni adjustments. RESULTS: A significant main effect was present for readiness (F=52.96, P<0.001). Post-hoc testing revealed readiness on D1 (68.5 ± 12.4) was significantly more negative than readiness on P (77.9 ± 8.0, P<0.001), D0 (73.8 ± 7.6, P<0.001), and D2 (77.1 ± 8.8, P<0.001). A significant main effect was present for fatigue (F=41.8, P<0.001). Post-hoc testing revealed fatigue on D1 (0.5 ± 1.6) was significantly more negative than fatigue on P (1.7 ± 1.4, P<0.001), D0 (2.3 ± 1.4, P<0.001), and D2 (1.7 ± 1.5, P<0.001). A significant main effect was present for stress (F=3.8, P=0.01) and soreness (F=15.1, P=0.01), but after accounting for multiple comparisons, there was no differences between times. CONCLUSIONS: Self-reported readiness to train and physical fatigue are decreased for a full day following competitive soccer competition. Coaches, strength coaches, and athletic trainers may use this information to tailor training programs to promote recovery and limit injury risk, as previous literature indicates that negative outcomes on subjective scales may be indicative of injury. Future research should incorporate training load assessments into this analysis to understand if these changes are correlated to the frequency, intensity, or volume of soccer training and participation.

Purpose: To investigate activity levels, body composition, and bone mineral content in collegiate eSport players as compared to age-matched controls. METHODS: Twenty-four male collegiate eSport players and non-eSport players between 18-25 years of age underwent body composition and bone mineral content testing using a GE DXA absorptiometry scan. Daily activity (step count) and sleep duration were measured for two weeks using a Fitbit Charge3™ and a questionnaire assessing their physical activities and computer usage was administered. Body mass index (BMI) was calculated on all subjects. RESULTS: The step count in the eSports players was significantly lower than the age matched controls (p<0.004; 6040.2 ± 3028.6 vs 12843.8 ± 5661.1). eSport players exhibited greater body fat percentage (p<0.05), less lean body mass (p<0.003) and less bone mineral content (p=0.03), despite no difference in BMI between the eSport and non-eSport players. CONCLUSION: As compared to non-eSport players, collegiate eSport team players were significantly less active and had a higher body fat percentage with lower lean body mass and bone mineral content. BMI is a common marker of health and obesity, yet this index showed no difference between the two groups. Considering the eSport athletes displayed significantly lower step numbers, which are all correlated with potential health issues, use of the BMI is not capturing this difference and should not be considered an accurate measure of health in competitive eSport players.
F-71 Free Communication/Poster - Function & Cancer

Friday, May 29, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

3528 Board #349 May 29 2:30 PM - 4:00 PM Balance And Functionality In Breast Cancer Survivors: Does Improvement In Balance After Exercise Intervention Improve Functional Test Outcomes? Dean Amatuli, Chad W. Wagoner, Jordan T. Lee, Kirsten A. Nyrop, Hyman B. Muss, Brian C. Jensen, Claudio L. Battaglini, FACSM. UNC-Chapel Hill, Chapel Hill, NC. (Sponsor: Claudio Battaglini, FACSM)

(No relevant relationships reported)


PURPOSE: Postural control is necessary for proper functionality, independence, and quality of life. Breast cancer survivors (BCS) is a population that has displayed challenges in postural control post-treatment (Wampler et al. 2007). This study evaluated changes in balance and functionality following an exercise intervention which included balance training. METHODS: BCS who completed major anti-cancer treatments within the past year participated in an intervention including aerobic, strength and balance exercises, 3 days/week for 16 weeks. Training progressed in intensity and volume and incorporated movements that challenged whole-body balance. Functionality was measured using the 6 Minute Walk Test (6MWT), dynamic balance using Timed Up and Go (TUG), and balance using the NeuroCom Sensory Organization Task (SOT). Dependent samples t-test using pre and post intervention scores were used to evaluate the impact of exercise on functionality and balance. Pearson correlations were used to assess the relationship between physical function and balance outcomes. RESULTS: Thirty-two BCS (54±12 years) participated. 6MWT distance significantly increased (34.7±48.9m, p<.001) & TUG times significantly improved (-.55±1.0s, p = .005) from pre/post intervention. SOT composite balance distance significantly increased (34.7±48.9m, p<.001) & TUG times significantly increased (4.02±4.0s, p = .025). There was a strong correlation between pre-testing scores of TUG & 6MWT (r = -.703, p<.001). CONCLUSION: A 16-week exercise intervention improves physical function evaluated using 6MWT and TUG and balance using SOT composite scores. However, no relationship was observed between improvements in physical function and balance; possibly due to the differences in the dynamic nature of the physical function and static assessment of balance. Future studies should consider the evaluation of balance using dynamic tasks in order to further examine the relationship between physical function and balance in BCS. Funded by Breast Cancer Research Foundation (New York, NY).

3529 Board #350 May 29 2:30 PM - 4:00 PM Effects Of A Lifestyle Intervention On Simulated Activity Of Daily Living Performance In Prostate Cancer Patients Undergoing Androgen Deprivation Therapy Brian C. Focht, FACSM1, Alexander R. Lucas2, Elizabeth Grainger1, Christina Simpson1, Ciaran M. Fairman3, Jessica Bowman1, Victoria R. DeScenza1, Zachary L. Chaplow1, Kathryn Dispennette1, Marcy Haynam1, Xiaochen Zhang1, Steven K. Clinton1. The Ohio State University, Columbus, OH. "Virginia Commonwealth University, Richmond, VA. "Edith Cowan University, Perth, Australia. (No relevant relationships reported)

The adverse effects accompanying androgen deprivation therapy (ADT) compromise prostate cancer (PCa) patients’ ability to complete activities of daily living (ADL) requiring muscular strength and mobility. Although emerging evidence suggests lifestyle interventions combining modification of exercise and dietary intake (EX-D) result in improvements in mobility in PCa patients undergoing ADT, the effects of EX-D interventions upon simulated ADL performance has yet to be delineated. PURPOSE: The purpose of the single-blind, randomized controlled Individualized Diet and Exercise Adherence-Pilot (IDEA-P) trial is to evaluate the preliminary efficacy of a lifestyle EX-D intervention, implementing a group-mediated cognitive behavioral (GMCB) approach, relative to standard of care (SC) among PCa patients undergoing ADT. In the current study, we evaluated the effects of the EX-D intervention on performance of a simulated ADL task at the end of the intensive phase of the intervention. METHODS: A total of 32 PCa patients (M age = 65 years) on ADT were randomly assigned to the EX-D (n = 16) or SC (n = 16) interventions.

Assessments of simulated ADL performance, measured using a lift and carry task, were obtained at baseline and 2 month follow-up assessments. RESULTS: A total of 32 PCa patients (M age = 65 years) on ADT were randomly assigned to the EX-D (n = 16) or SC (n = 16) interventions. Assessments of simulated ADL performance, measured using a lift and carry task, were obtained at baseline and 2 month follow-up assessments. RESULTS: Results of intention to treat ANCOVA analysis of residualized change scores yielded a significant Treatment main effect for (p<.001) demonstrating that the EX-D intervention resulted in superior improvements in lift and carry performance (d = 1.01) relative to the SC intervention at 2 months. CONCLUSIONS: Findings from the IDEA-P trial suggest that the intensive phase of the EX-D intervention, implementing a GMCB approach designed to promote adoption and adherence to lifestyle behavior change, resulted in superior changes in a simulated ADL performance task relative to SC. These results underscore the utility of lifestyle interventions providing change in both exercise and dietary behavior for preserving mobility and functional health among PCa patients undergoing ADT.

3530 Board #351 May 29 2:30 PM - 4:00 PM Effects Of High Intensity Interval Training On Patient-reported Outcomes And Physical Function During Anthracycline Chemotherapy Kyuwan Lee1, Ellice Wang1, Christina Dieli-Conwright, FACSM. U of Southern California, Los Angeles, CA. ’City of Hope National Medical Center, Duarte, CA. (Sponsor: Christina Dieli-Conwright, FACSM)

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(No relevant relationships reported)

PURPOSE: Breast cancer patients treated with anthracycline chemotherapy experience negative anthracycline-related side effects, including poor quality of life and impaired physical function. However, it is unclear whether high intensity interval training (HIIT) improves quality of life and physical function in breast cancer patients undergoing anthracycline-based chemotherapy. METHODS: Thirty breast cancer patients were recruited prior to initiating anthracycline-based chemotherapy and randomized into the HIIT group (n=15) or control (CON) group (n=15). The HIIT group attended the HIIT session for 3 days per week for 8 weeks. The CON group was asked to maintain their current level of physical activity and offered the same HIIT intervention after the 8-week study period. Patient-reported outcomes were assessed by the Functional Assessment of Cancer Therapy-Breast Cancer (FACT-B), Multidimensional Fatigue Inventory with 20 questions (MFI-20), and the 15-item Five-Facet Mindfulness Questionnaire (FFMQ-15). Physical function was assessed using the timed up and go (TUG), 30-second sit-to-stand (30STS), Margaria-Kalamen stair climb test, and 6-minute walk test (6MWT). Repeated measures ANCOVA and paired t-tests performed to assess changes in the outcome measures. RESULTS: Thirty breast cancer patients completed the 8-week study with 82.3% adherence to the intervention among the HIIT group. Post-intervention, significant improvements were found for the functional Margaria-Kalamen Power Test (-3.39%; P=0.013) and 6MWT (+11.6%; P=0.008) in the HIIT group compared to baseline and to the CON group. No changes in patient-reported outcomes, TUG, and 30STS were found following the 8-week study period in both groups (P>0.05). CONCLUSIONS: HIIT may be an effective strategy to improve physical function and possibly maintain quality of life in breast cancer patients undergoing the anthracycline-based chemotherapy.

3531 Board #352 May 29 2:30 PM - 4:00 PM Effects Of Exercise On Disability Process Outcomes In Prostate Cancer Patients Undergoing Androgen Deprivation Therapy: An Updated Systematic Review Zachary L. Chaplow, Jessica Bowman, Victoria R. DeScenza, Kathryn Dispennette, Marcy Haynam, Stephanie Hoh, Xiaochen Zhang, Brian C. Focht, FACSM. The Ohio State University, Columbus, OH. (Sponsor: Brian C. Focht, FACSM)

(No relevant relationships reported)

Although androgen-deprivation therapy (ADT) is a foundation of treatment for prostate cancer (PCa) patients, adverse effects of ADT may accelerate functional decline. Whereas exercise improves muscular strength and functional performance in PCa patients, evidence of the benefits of exercise for alternative disablement process outcomes remain equivocal. PURPOSE: To update the findings of our previous systematic review of the effects of exercise on disablement process outcomes in PCa patients undergoing ADT. The purpose of this study is to determine the extent to which exercise interventions produce meaningful improvements in the specific impairment domain outcome of body composition (BC) in PCa patients on ADT. METHODS: A comprehensive literature search was conducted of all relevant published studies.
from December 2013–present. Data were extracted on BC outcomes from 8 published exercise intervention studies involving 307 PCa patients on ADT. The magnitude of pre- to post-intervention change was examined. To isolate the effects of exercise, studies combining other interventions were excluded. Weighted, bias-corrected Cohen’s d effect sizes were calculated for change in each outcome and averaged across included studies. RESULTS: Results revealed that exercise yielded small average improvements in lean body mass (d = -0.09), appendicular lean mass (d = -0.08), trunk fat mass (d = -0.03) and visceral fat mass (d = -0.11). All other measures of whole-body and regional BC showed negligible average effects of exercise.

CONCLUSIONS: The findings of this updated systematic review suggest that while exercise attenuates the established adverse effects of ADT on BC, the magnitude of exercise-induced improvements in BC outcomes is small and inconsistent across studies. These findings have important implications for delineating the effect of exercise on disability and prostate cancer outcomes and underscores the potential of complementing exercise with targeted nutritional approaches in the supportive care of PCa patients on ADT.

3532 Board #353 May 29 2:30 PM - 4:00 PM
Dynapenic Obesity: Strength, Body Composition, And Physical Function In Women Diagnosed With Breast Cancer
Lindsey L. Hanson1, Diane K. Ehlers2, Gregory Russell1, Edward Levine3, Marissa M. Howard-McNatt2, Shannon L. Mihalko1.
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(No relevant relationships reported)

Background: Breast cancer survivors (BCS) report more limitations performing activities requiring strength compared to women without a cancer history. Combined with obesity, BCS with dynapenia (poor muscle strength) may have greater risk of physical function (PF) difficulties; however, the prevalence and impact of dynapenic obesity (DO) in BCS remains unknown. Purpose: This study aimed to: 1) prospectively determine the prevalence of DO; 2) evaluate associations among DO, clinical factors, and resistance training (RT); and 3) determine if DO predicts PF in BCS from diagnosis to 2-year follow-up. Methods: DO was operationalized as waist circumference (WC) ≥88 cm and poor grip strength, measured via dynamometry prospectively determine the prevalence of DO; 2) evaluate associations among DO, dynapenic obesity (DO) in BCS remains unknown.

PURPOSE: Androgen deprivation therapy (ADT) has detrimental side effects, but changes between localized and advanced prostate cancer are unclear. The purpose is to determine body composition, physical function, and quality of life (QoL) differences across progressive stages of men with PCa on ADT. METHODS: Men with localized (PC, n=45, age 67±6.4y) or metastatic castration-resistant prostate cancer (mPC, n=21, age 72±8.3y) and non-cancer controls (CON, n=37, age 69±6.1y) completed total body DXA scans (% fat, lean and fat mass), physical function testing (6m walk, chair stands, timed up and go (TUG), stair climb), and QoL questionnaires (FACT-P).

RESULTS: Percent fat differed between all groups, along with greater fat mass in mPC vs. CON. Both stair climb and TUG were slower in mPC compared to both CON and PC, whereas chair stands and 6m walk were only slower in mPC vs. CON. There were trends for lower QoL scores in mPC vs. PC for FACT-P, Social Well-Being, and Trial Outcome Index vs. CON. Total length of ADT was similar between mPC and PC (mPC: 30±34 months, PC: 37±38 months, p=0.536). CONCLUSIONS: Body composition and physical function appear to deteriorate in advanced prostate cancer. As the length of ADT is similar between groups, this suggests that the additional forms of ADT for mPC appear to be influencing these changes. However, increases in body fat and reduced functional capacity with ADT do not translate into lower QoL for mPC. Exercise interventions targeting these outcomes are warranted to minimize the side effects of anti-cancer therapy.

Head and neck cancer (HNC) accounts for 3-5% of cancer cases in the United States. A known complication of oncological treatments for HNC is trismus, defined as limited mouth opening of less than 35mm. Trismus occurs in 6-86% of survivors. There is no standardized treatment for trismus, however, commonly used conservative interventions include manual therapy (MT), active exercises and assistive stretching devices. These interventions have shown promise as means to improve jaw mobility and alleviate symptoms. Without early detection and intervention, trismus is often chronic and progressive in nature. PURPOSE: To determine the feasibility of study processes, including recruitment rate, completion rate, adherence to protocol, and to establish processes for the dynamic splint mouthpiece fitting and intervention protocol.

A single subject design was used in this pilot feasibility study. Participants underwent a treatment protocol involving MT, exercises, and use of a dynamic splint at home for eight weeks. Multiple maximal interincisal opening (MIO) measures were performed at baseline testing, before and after each treatment session, and at the end of the intervention period. Researchers documented participant adherence to supervised sessions and dynamic splint use, and subjective responses to treatment after each session. RESULTS: 70% of participants had an improvement in their MIO after eight weeks, with an average increase of 3.0mm (range: -2.0 to 7.5mm). 90% of participants had 100% adherence to supervised sessions and 70% adherence to home use of the dynamic splint. Two participants were unable to be fitted with a dynamic splint mouthpiece due to insufficient mouth opening and, therefore, used the flat plate of the device. Two participants required special adaptation of the mouthpiece, one due to dental pain and the other due to being edentulous. Treatment protocols required tailoring to facilitate comfort and adherence. CONCLUSION: Home use of a dynamic splint with MT shows promise as an intervention to address trismus in HNC survivors. The need for adaptations to the mouthpiece and treatment protocol should be anticipated, and a longer intervention period is recommended to optimize outcomes. Supported by: Faculty of Rehabilitation Medicine.

Table 1. Between group differences in body composition, functional tasks, and quality of life questionnaires in men with various stages of prostate cancer

<table>
<thead>
<tr>
<th>Body Composition</th>
<th>CON (n=37)</th>
<th>PCA (n=42)</th>
<th>mPC (n=21)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Fat</td>
<td>26.1 (5.6)</td>
<td>29.9 (8.9)*</td>
<td>34.5 (5.6)*</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total Fat Mass (kg)</td>
<td>22.2 (7.8)</td>
<td>27.9 (12.1)</td>
<td>32.2 (17.7)</td>
<td>0.003</td>
</tr>
<tr>
<td>Functional Tasks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stair Climb (sec)</td>
<td>4.7 (1.0)</td>
<td>4.8 (1.0)</td>
<td>6.1 (2.4)*</td>
<td>0.006</td>
</tr>
<tr>
<td>TUG (sec)</td>
<td>6.1 (1.3)</td>
<td>6.0 (1.5)</td>
<td>10.4 (8.0)*</td>
<td>0.011</td>
</tr>
<tr>
<td>Chair Stands (sec)</td>
<td>9.3 (2.2)</td>
<td>10.6 (3.1)</td>
<td>12.8 (4.6)*</td>
<td>0.007</td>
</tr>
<tr>
<td>6m Walk (sec)</td>
<td>3.9 (0.7)</td>
<td>3.9 (0.4)</td>
<td>4.7 (1.5)*</td>
<td>0.018</td>
</tr>
<tr>
<td>Quality of Life</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FACT-P</td>
<td>138.6 (13.3)</td>
<td>121.8 (20.7)</td>
<td>120.0 (18.5)</td>
<td>0.050</td>
</tr>
<tr>
<td>Social Well-Being</td>
<td>27.0 (5.1)</td>
<td>21.8 (4.4)*</td>
<td>22.9 (3.4)</td>
<td>0.006</td>
</tr>
<tr>
<td>Trial Outcome Index</td>
<td>91.3 (6.9)</td>
<td>80.2 (14.8)</td>
<td>77.8 (12.7)</td>
<td>0.044</td>
</tr>
</tbody>
</table>

Data reported are mean (standard deviation).
While individualized exercise training improves physical and psychosocial health, paired exercise training may result in similar improvements at a reduced patient-to-staff ratio. **PURPOSE:** To compare the effect of paired vs. individualized exercise training on physical and psychosocial health in cancer patients. **METHODS:** Twenty-five female cancer patients (mean±SD: 62±8 years) were assigned to exercise in pairs (n=13) or individually (n=12). They completed 36, 90-min sessions consisting of cardiovascular, resistance, balance and flexibility training according to standardized guidelines. Cardiorespiratory fitness (VO_{peak}), muscular strength (1-repetition max), endurance (chair squat test), balance (single leg stance), and flexibility (sit-and-reach) were measured pre- and post-exercise. Psychosocial health was assessed pre-, mid- and post-intervention (Functional Assessment of Cancer Therapy-General (FACT-G), Insomnia Index, Brief Fatigue Index, Patient Health Questionnaire-9). Two-way ANOVAs (Factors: Group, Time) were used to identify main effects or interactions; differences were detected with post-hoc tests. Significance was set at p<0.05. **RESULTS:** Improvements in physical fitness were similar between paired (P) and singly (S) trained patients. VO_{peak} significantly increased from 26.6±9.2 to 31.0±7.2 ml•kg^{-1}•min^{-1} (S) and 26.0±6.3 to 29.7±7.2 ml•kg^{-1}•min^{-1} (P). Upper and lower body strength increased by 20.0% (S) and 19.6% (P); 15.9% (S) and 20.8% (P), respectively. Paired patients exhibited larger improvements in lower body endurance (S: 24.0% vs. P: 52.3%), flexibility (S: 5.3% vs. P: 11.0%), and balance (S: 17.8% vs. P: 36.8%). A significant main effect (Time) was detected in the functional dimension (FACT-G) but not in social (p=0.200), emotional (p=0.054), or physical well-being (p=0.075). Time (main effect) was not significant for insomnia for either group (p=0.0778), but paired patients had significant improvements in sleep from pre- to mid-intervention (9.8±6.9 vs. 7.2±6.3). **CONCLUSION:** The social aspect associated with paired exercise sessions may have increased motivation, resulting in enhanced improvements in fitness and mental well-being in the paired group. These data suggest that exercising in pairs is a promising approach to cancer rehabilitation.

**3537**

**Board #357**  May 29 2:30 PM - 4:00 PM

**Role Of Joint Loosening Yoga In Management Of Aromatase-Inhibitor-Induced Arthralgia In Breast Cancer Survivors**

Leigh Leibell1, Kashinath Metri2, Rajendra Prasad2, Greg Mears1. 1Columbia University Medical Center, New York, NY. 2S-Vyasa University, Bangalore, India.  

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(No relevant relationships reported)

Aromatase inhibitor hormonal therapy causes joint pain in up to half of women, and to 20% become non-compliant with the 5-10 year treatment schedule due to pain and discomfort. Non-compliance affects patient prognosis and survival. This pilot study investigated the efficacy of joint loosening yoga in improving aromatase inhibitor-induced joint pain and evaluated the feasibility of delivering the intervention on Facebook.  

**METHODS:** Breast cancer patients undergoing treatment with aromatase inhibitors with self-reported arthralgia were recruited via an IRB-approved announcement posted in two closed breast cancer support groups on Facebook to participate in a yoga study delivered on Facebook. Participants completed BPI, DASH, PRAI and WOMAC questionnaires online before and after the study. Intervention consisted of 12 joint loosening exercises performed in a chair, once daily for 12 minutes, Monday-Friday for 4 weeks. Asynchronous video demonstrations were available in a secure Facebook group and viewing confirmed by typing “done” (time-stamped) in comments.

**RESULTS:** 200 women responded. 38 met the inclusion criteria/consent, 26 completed the online consent, interventions and pre/post questionnaires. Participants were based in US, Canada and UK. Paired simple t tests showed significant (P < 0.05) improvement in all the pain measures and quality of life parameters after yoga intervention compared to baseline.

**CONCLUSIONS:** This study provides the first evidence that it is feasible to teach joint loosening yoga to patients on Facebook and that the intervention significantly improves aromatase inhibitor-induced arthralgia. Teaching yoga via social media may provide better access to this therapeutic modality to patients at all points in the cancer care continuum globally.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre Mean</th>
<th>Post Mean</th>
<th>% Change</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPI_PSS</td>
<td>4.26±1.79</td>
<td>2.3±1.45</td>
<td>-46.00%</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>BPI_PIS</td>
<td>3.9±2.32</td>
<td>1.8±1.00</td>
<td>-53.58%</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>DASH</td>
<td>30.5±15.20</td>
<td>13.7±14.86</td>
<td>-55.07%</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>PRAI</td>
<td>2.69±1.55</td>
<td>1.36±1.13</td>
<td>-49.34%</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>WOMAC 1</td>
<td>6.76±3.67</td>
<td>3.24±2.02</td>
<td>-52.07%</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>WOMAC 2</td>
<td>4.04±1.76</td>
<td>2.4±1.15</td>
<td>-40.59%</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>WOMAC 3</td>
<td>22.64±13.11</td>
<td>13±8.83</td>
<td>-42.57%</td>
<td>P&lt;0.05</td>
</tr>
</tbody>
</table>

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**3538**

**Board #358**  May 29 2:30 PM - 4:00 PM

**The Impact Of Sports Science-based Prehabilitation On Spontaneous Physical Activity After Major Abdominal Cancer Surgery**

Savannah V. Wooten, J. Stuart Wolf, John B. Bartholomeow, FACSM, Diana Mendoza, Philip R. Stanforth, FACSM, Dixie Stanforth, FACSM, Ladia M. Hernandez, Cathy T. Nguyen, Joseph R. Carneglia, Hirofumi Tanaka, FACSM, R. Y. Declan Fleming. The University of Texas at Austin, Austin, TX.  

(Sponsor: Hirofumi Tanaka, FACSM)

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(No relevant relationships reported)

Prehabilitation is an emerging alternative strategy that has the potential to speed recovery and may be analogous to athletic preparations for gameplay. For optimal physiological improvement to occur in a limited time period prior to the surgery, cancer patients undergoing prehabilitation interventions must work closer to their maximal physiological capacity (albeit a very low level) in a manner similar to that of competitive athletes. **PURPOSE:** To determine the effect of a 4-week sports science-based prehabilitation program on spontaneous physical activity in cancer patients who undergo major abdominal surgery. **METHODS:** Twenty-two cancer patients (63±11 years) who underwent major abdominal surgery were studied. Fourteen patients participated in a 4-week exercise and nutrition prehabilitation program prior to abdominal surgery. The sport-science based program comprised of an interdisciplinary approach, including blood flow restriction exercise and a daily sports nutrition supplement containing L-citrulline, creatine monohydrate, and whey protein. The remaining 8 patients served as controls. Physical activity of both groups was monitored
In blood cancer, aerobic physical activity may improve fatigue and depression, though its effect on quality of life and physical function is less clear. Assessment of Fit to Thrive (FTT), a community-based individualised, supervised exercise program for people with blood cancer, may assist with future recommendations.

**Purpose:** To assess the effect of the FTT program on physical function and quality of life (QoL) in people with blood cancer.

**Methods:** The 12-week FTT program utilised progressive aerobic and resistance training, supervised by an Accredited Exercise Physiologist, in small groups (n=6), twice weekly, for 8 weeks, with associated psychosocial and peer support. Physical function was assessed via the six minute walk (6MW), functional forward reach (FFR) and 5 times-sit-to-stand (5TSTS) tests. QoL was measured using the 36-item Short Form Survey Instrument (SF-36) and the Functional Assessment of Cancer Therapy General (FACT-G). Minimally important differences (MID) involved a change of 2 points for the SF-36, 3 points for the FACT-G and +50m for 6MW.

**Results:** Participants (n=106) who attended the FTT program between 2014 and 2016 were included. Significant improvements in functional measures were observed for 6MW (+54.7m [95% CI 40.5, 69.0] p<0.001), 5TSTS (+1.9 sec [95% CI -2.5, -1.2] p<0.001) and FFR (+2.7cm [95% CI 1.5, 4.0] p<0.001), with the MID achieved by 56% for the 6MW. The SF-36 physical component summary (PCS) significantly increased (+4.99 [95% CI 3.29, 6.68] p<0.001) immediately following the intervention and 68% (n=72) achieving the MID. The improvement in the SF-36 mental component summary (MCS) also achieved statistical significance (+2.81 [95% CI 0.54, 5.08] p=0.02), with 51% (n=54) achieving the MID. FACT-G scores improved significantly from pre- to post-intervention (+5.30 [95% CI 2.52, 8.47] p<0.001) with 58% (n=62) meeting the MID. MID improvements in PCS and FACT-G were maintained in 77% (n=20/26) and 68% (n=72) achieving the MID. The improvement in the SF-36 mental component summary (MCS) also achieved statistical significance (+2.81 [95% CI 0.54, 5.08] p=0.02), with 51% (n=54) achieving the MID. FACT-G scores improved significantly from pre- to post-intervention (+5.30 [95% CI 2.52, 8.47] p<0.001) with 58% (n=62) meeting the MID. MID improvements in PCS and FACT-G were maintained in 77% (n=20/26) and 68% (n=72) achieving the MID.

**Conclusion:** The FTT program was effective in improving physical function and QoL, with some evidence for long-term effects. An individually-prescribed exercise program supervised by an Accredited Exercise Physiologist should be considered as part of standard care in people with stable blood cancer.
about their usual physical activity, weight history, reproductive history, and past-year dietary intake. Body weight was abstracted from medical records. A sample of breast tissue was collected during surgery. An adipose tissue section was isolated under sterile conditions. Part of the sample was formalin fixed (sectioned at 7 μm thickness for measurement of mean adipocyte size with Image J) and part was flash frozen for RNA isolation. Associations between mean adipocyte size and lifestyle variables were examined by multivariate analysis to determine associations between genes and lifestyle variables. RESULTS: Of 72 women recruited, RNA was isolated from 65 samples. Participants were a mean age of 43 years (range 19-70) and had a mean body mass index of 27.0 kg/m² (SD 5.0). BMI was positively associated with adipocyte size (β = 0.06, p<0.01) and transportation physical activity was negatively associated with adipocyte size (β = -0.25, p<0.002). Six genes, namely SLC27A2, TTC36, WDR57C1L, AASS, ARMCX, GLUT3c, were found to be associated with adipocyte size.

CONCLUSION: Adipose tissue biology is associated with lifestyle exposures in normal breast tissue. Our findings provide directions for future research into the impact of lifestyle on the microenvironment of healthy breast tissue.

3542 Board #363 May 29 2:30 PM - 4:00 PM VASOMOTOR RESPONSE DURING PADDLING GRADATED EXERCISE TEST IN BREAST CANCER SURVIVOR DRAGON BOAT RACERS
Brooklyn E. Herbert, Trent E. Cayot, Riggs J. Klika, FACSM. University of Indianapolis, Indianapolis, IN. (Sponsor: Riggs J Klika, FACSM) (No relevant relationships reported)

Cancer treatment is associated with numerous peripheral pathologies including altered blood flow and vascular dysfunction. A pilot study was conducted to measure the peripheral microvascular oxygenation response during maximal exercise in a group of cancer survivors. PURPOSE: To investigate the differences that paddling side (paddling side, PS; non-paddling side, NPS) and treatment side (treatment side, TREAT; healthy side, HEAL) has on the near-infrared spectroscopy (NIRS) responses during a unilateral paddling graded exercise test in breast cancer survivor dragon boat racers. METHODS: Thirteen breast cancer survivors/racers (56 ± 9 years, 1.65 ± 0.06 m, 76.5 ± 11.0 kg) performed a unilateral, discontinuous graded exercise test (2-minute exercise, 1-minute rest) on a stationary rowing ergometer to volitional fatigue. Tissue oxygenation saturation (StO₂) and total hemoglobin concentration ([THC]) were measured via NIRS from the posterior deltoid muscles during the graded exercise test. StO₂ and [THC] responses were averaged during the last 30 seconds of each exercise stage and normalized to baseline exercise data. Paired t-tests were used to examine if treatment side had an effect on StO₂ responses at maximal intensity. Due to non-normally distributed data, a Wilcoxon Signed Rank Test was used to determine if paddling side had an effect on StO₂ at maximal intensity. Significance was established a priori at p < 0.05.

RESULTS: Paddling side did not significantly affect the StO₂ (PS = 5.2 ± 15.7%, NPS = -13.5 ± 26.8%), [THC] (PS = -0.094 ± 11.2%, NPS = 0.14 ± 0.19, p = 0.425) responses. Treatment side had a significant, moderate (ES = 1.12) effect on the StO₂ response. TREAT = -0.006 ± 16.1%, HEAL = -18.7 ± 17.3%, p = 0.008. Treatment side did not significantly affect the [THC] response (TREAT = 0.13 ± 0.20, HEAL = 0.16 ± 0.19, p = 0.313).

CONCLUSION: Based upon the pilot results, it would suggest that the exercising muscles on the breast cancer treatment side may have a residual impaired ability to use oxygen for energy production during maximal intensity exercise.

3543 Board #364 May 29 2:30 PM - 4:00 PM ROLE OF AEROBIC PHYSICAL TRAINING ON COLON TUMOR METABOLIC REPROGRAMMING
Joao Lucas Penteado Gomes. University of Sao Paulo, Sao Paulo, Brazil. Email: joao.gomes@usp.br (No relevant relationships reported)

PURPOSE: Tumor cells are known for marked growth and proliferation, however adequate energy support is required to sustain the growth and proliferation of cancer cells. Therefore, tumors have a large change in energy metabolism, for example, the glycolysis pathway is overactivated. These phenomena are linked to changes in metabolic genes expression, such as microRNA-33a and its gene target SIRT6. On the other hand, aerobic physical training (APT) is known to increase cellular respiration and metabolic genes expression, such as microRNA-33a and its gene target SIRT6. On the other hand, aerobic physical training (APT) is known to increase cellular respiration and metabolic genes expression, such as microRNA-33a and its gene target SIRT6.

METHODS: We first evaluated if a longer training time prior colon cancer cell inoculation (CT26) contributes to lower tumor progression, we observed that the time of APT is not a major factor since all cancer trained mice have lower tumor progression compared to the sedentary cancer group (SC). Thus, we proceeded to evaluate two groups: 1) group with cancer and 8-weeks training prior to inoculum (TR3, 2) and SC and 3) Wild type (WT). RESULTS: TR3 group presented longer survival (p=0.007), cancer promoted decrease of fat mass (WT-7.3±3.07, SC-1.4±0.8, TR3-5.6±2.8; p<0.01) and increase of liver mass (WT-62.7±9.7, SC-91.7±11.9, TR3-81.5±11.1; p=0.01) in sedentary e trained group compared with WT. SIRT6 (SC-100±21.8, TR3-88.8±27.9) and the microRNA-33a (SC-100±42.9, TR3-78.2±30.6) expression in tumor tissue was not different between the groups. However, we observed differences in HIF-1α expression (SC-100±21.4, TR3-74±13.4; p<0.01), which was decreased due to APT, as well as the GLUT1 (SC-100±32.4, TR3-69±6.3±2.6; p=0.07), PDK (SC-100±20.9, TR3-76.8±2.2; p<0.05), LDH (SC-100±26.2, TR3-65.4±3.7; p<0.03) expression also decreased due to APT. CONCLUSIONS: Our results show that APT decreases tumor progression and increases survival. Also, our results suggest that APT plays an important role in metabolic reprogramming. In conclusion, we showed that APT decreases the glycolytic pathway enzymes gene expression that is related to increased proliferation and malignancy of colon cancer.

3544 Board #365 May 29 2:30 PM - 4:00 PM COMBINED AEROBIC AND STRENGTH EXERCISE MAINTAINS CIRCULATING FGF-21 IN ASIAN BREAST CANCER PATIENTS
Jorming Goh1, Lima Lim2, Brian Kennedy1, Soo Chin Lee2.1 National University of Singapore, Singapore, Singapore. 2National University Cancer Institute, Singapore, Singapore. Email: jorming@nus.edu.sg (No relevant relationships reported)

PURPOSE: Combined aerobic and resistance training improves systemic inflammation and muscle mass in breast cancer survivors (BCS). However, whether combining aerobic exercise modulates systemic metabolic hormones and unknowns. FGF-21 was reported to modulate glucose metabolism in physically active adults, while IL-33, a recently discovered alarmin, is prognostic for breast cancer outcomes. This study aimed to determine the effects of 3 months of combined aerobic and strength exercise on systemic FGF-21, IL-33, and cytokines in Asian breast cancer patients.

METHODS: Patients with early stage (I-II) breast cancer underwent curative breast surgery and were randomized into a combined aerobic and strength exercise group (Age: 55.3 ± 9.2 years; BMI: 26.7 ± 3.8; N= 23) or observation group (Age: 49.3 ± 8.7 years; BMI: 24.7 ± 4.6; N= 20) that spanned 3 months. Antecubital blood was collected at baseline, 3 months and 6 months. Serum concentration of cytokines (IL-10, IL-12, IL-33, IFN-γ, TNF-α) and myokines (FGF-21, FGF-23) were quantified using a customized magnetic bead panel (Milliplex®) and read with a Luminx 200™ instrument. Biomarker data were assessed by a 2-way [group (exercise vs. observation) by time (baseline, 3 months, 6 months)] analysis of variance (ANOVA). Data are reported as means ± SD, with significance set at P<0.05.

RESULTS: A significant main effect of intervention was observed for FGF-21 (P<0.01), with patients in the exercise group presenting with higher FGF-21 at 3 months (73.16 ± 64.05 pg/mL vs. 46.47 ± 25.33 pg/mL) and 6 months (66.67 ± 50.03 pg/mL vs. 41.79 ± 33.81 pg/mL), compared with the observation group. A significant main effect of exercise on IFN-γ (P<0.05) was observed, with lower serum IFN-γ in the exercise group at 3 months (3.85 ± 4.34 pg/mL vs. 5.43 ± 7.28 pg/mL) and 6 months (3.89 ± 4.58 pg/mL vs. 5.32 ± 8.1 pg/mL), compared with controls. No significant differences were observed between groups in other outcome measures.

CONCLUSIONS: A 3-month aerobic and strength exercise program preserves serum FGF-21, possibly associated with better glucose control in breast cancer patients. Lower serum IFN-γ after exercise training may suggest an attenuated pro-inflammatory response, which may be linked to better immune outcomes.

3545 Board #366 May 29 2:30 PM - 4:00 PM ACUTE INFLAMMATORY AND HORMONAL RESPONSE TO STRENGTH TRAINING IN BREAST CANCER SURVIVORS: A PRELIMINARY STUDY
Sandro N. Chaves1, Brenda L. Burtuli Perondi2, Filipe Dinato de Lima1, Martim Bottaro1, Filipe Rodrigues Beltrão2, Claudio L. Battaglini, FACSM3, Ricardo Jacó Oliveira3. 1Universidade de Brasília-UnB, Brasília, Brazil. 2Integrated College IESGO, Formosa, Brazil. 3University of North Carolina, Chapel Hill, NC. (Sponsor: Claudio L. Battaglini, FACSM) Email: sandronobrec@gmail.com (No relevant relationships reported)

There is increasing interest in the use of strength training (ST) exercise in cancer survivors. Aside from the direct beneficial effects on muscle, ST has the potential to chronically attenuate some of the negative alterations commonly seen in the immunological and hormonal physiology of cancer survivors. However, the acute effects of a high intensity ST session on inflammatory and hormonal responses have not been well documented. PURPOSE: To examine the acute hormonal and inflammatory responses of one high intensity traditional ST session in breast cancer survivors (BCS). METHODS: Eight BCS (47±6 years; 67.75±5.90 kg;169.5±28cm)
participated in this study. BCS completed one traditional session of ST consisting of 3 sets of 10-12 repetitions to maximal concentric failure with 120 seconds of rest between sets. The exercises included: 1) leg extension, 2) deadlift, 3) leg press,4) machine bench press, 5) latpull down, and 6) sit ups. Venous blood samples were obtained to assess biomarkers of exercise-induced inflammation (C-reactive protein), and hormonal response (Cortisol, and IGf-1). Measurements were assessed before and immediately after the ST session. Sampled dependent tests were used to compare pre and post blood biomarkers.

RESULTS: No significant changes in C-reactive protein (pre 2.61±2.78, post 2.46±2.99mg/mL, p = 0.056), cortisol (pre 9.53±3.12, post 7.61±1.90µg/dL, p = 0.062), and IGf-1 (pre 150.38±37.913, post 154.88±40.336ng/mL, p = 0.125) were observed after one session of traditional ST.

CONCLUSIONS: Although in healthy people one-timehigh intensity strength training has been associated with increases on different inflammatory and hormonal biomarkers, our results showed that in BCS one session of ST does not appear to significantly increase C-reactive protein, cortisol or IGf-1 concentration levels. These results may be attributed to the lower absolute force production and physiological stress during the ST session in this population. Furthermore, selective estrogen receptor modulators (SERMs), a class of drugs often used to treat certain types of breast cancer, may show anti-oxidative effects. However, in our study we did not observe significant suppression of CRP or Thiol concentrations. In future studies, we will examine the influence of exercise on antioxidants in patients with breast cancer.

PURPOSE: BRCA gene mutation carriers have a 55-60% higher incidence to develop breast cancer than non-mutation carriers, whereas exercise is able to reduce cancer risk in BRCA competent women. Because of growing evidence that BRCA also plays a pivotal role in the regulation of skeletal muscle metabolism and the response to anti-oxidative stress, we examined the influence of regular exercise in human BRCA1 gene mutation carriers on BRCA1 gene/protein expression and inflammatory/oxidative response.

METHODS: 16 BRCA1-mutation carriers without clinical manifestation (13 w, 3 m) were enrolled in this intervention (IG, T0: 61.6±4.5 yrs; T1: 61.8±4.3 yrs). The control group (CG, n=6, 46.3±5.3 yrs) IG received a 6-week long combination of high intensity (interval) strength and endurance training (HIRT/HIT), whereas CG only did low intensity aerobic training. Parameters included: muscle BRCA1 gene and protein expression, inflammatory and oxidative stress (i.e. cytokine and malondialdehyde (MDA)), anti-oxidative capacity (i.e. Thiol status, C-reactive protein (CRP)), peak oxygen capacity (VO2peak) and 1-repetition maximum (1-RM) at six different training machines. Data were analysed by 1-way ANOVA with repeated measures and t-test to determine statistical significance and effect size (ES).

RESULTS: VO2peak (p=0.001) and 1-RM (p=0.001) of IG were increased at T1 compared to T0, whereas CG performance parameters remained unchanged. BRCA1 protein concentration increased in IG from 46.32 ± 18.78 to 64.83 ± 22.53 pg/ml (p=0.001) with small ES as well as anti-oxidative capacity (CRP -p=0.05; Thiol p=0.09) with medium ES, whereas gene expression was unaltered. IG inflammatory and oxidative damage reflected by cytokine and MDA formation, respectively, did not differ between time points. CG physiological and molecular parameters remained unchanged during the intervention.

CONCLUSIONS: Combined HIRT/HIT training increases the performance of BRCA1-mutation carriers with positive influence on BRCA1 protein expression as well as anti-oxidative status without increased inflammatory response and thus might be a prospective prevention method to reduce long-term cancer risk.
correlated with OSU-CLL tumor cell growth (e.g. miR-451a: r=0.606, p<0.001), and 6 miRNAs negatively correlated with OSU-CLL tumor cell growth (e.g. miR-24: r=-0.669, p=0.002).

CONCLUSIONS: Physical fitness in CLL patients appears to beneficially modify T-cells and NK-cells, plasma lipoproteins and exosomal miRNAs. Certain lipoproteins and miRNAs are associated with tumor cell growth and death. Further studies will hope to define the possible beneficial effects of exercise training for CLL patients.

Supported by Internal Duke Funds