A large and consistent body of evidence supports a relationship between aerobic fitness and cognitive function. Alternatively, it is well known that stress and adverse life events impact brain structure and function, and may produce enduring alterations in cognition and behavior. It remains unclear, however, whether fitness moderates the relationship between stress and cognitive function. The majority of studies examining the relationship between fitness and cognitive function have relied on behavioral performance measures, while the influence of fitness on select temporal aspects of information processing remains less well known. Given the considerable variation in age-related cognitive decline, it may be important to investigate the relationship of fitness with discrete information processing stages, which may aid in future intervention development. PURPOSE: The purpose of this study was to examine the relationship between aerobic fitness and different stages of information processing in older adults using the P3 and lateralized readiness potentials (ERP’s). A secondary aim was to determine whether fitness moderates the relationship between stressful life experiences and stimulus evaluation (P3) or motor preparation (LRP) processes.

METHODS: 48 older adults (aged 40-70 yrs) completed an aerobic training for less than two years and ran on average at least 16km per week completed an aerobic fitness test following a cognitive assessment with the recording of ERPs using electroencephalography. P3 and LRP components were elicited by a modified oddball task and were used to index stimulus evaluation and motor-preparatory cognitive processes. Measures of life stress were collected using the Holmes-Rahe and Cohen perceived stress scales. RESULTS: Reaction time measures and P3 difference waves support previous research indicating differences in stimulus evaluation speed between high-fit and low-fit older adults, ps < .05. Higher perceived stress was also associated with a reduction in P3 amplitude and a delay in P3 latency, ps < .05. Importantly, RSA reactivity to the sad film following exercise was similar in individuals with MDD to typical responses among nondepressed control subjects, p > .05. CONCLUSION: These findings suggest that exercise may serve as a protective factor preceding exposure to stress in individuals at risk for MDD. Future trials investigating the antidepressant effect of exercise should aim to establish predictive biomarkers of exercise treatment response.

RESULTS: Individuals with MDD demonstrated more robust RSA withdrawal during the sad film following exercise relative to the control condition, p < .05. Importantly, RSA reactivity to the sad film following exercise was similar in individuals with MDD to typical responses among nondepressed control subjects, p > .05.

CONCLUSION: These findings suggest that exercise may serve as a protective factor preceding exposure to stress in individuals at risk for MDD. Future trials investigating the antidepressant effect of exercise should aim to establish predictive biomarkers of exercise treatment response.

Peak positive tibial acceleration (PTA) immediately following foot strike during running is greater in runners with a history of tibial stress fracture. PTA does not increase over the course of a 20min run at lactate threshold pace (i.e., moderate effort) in highly trained runners. However, injury incidence in novice runners is higher, which may suggest that novice runners do not have the control strategy to prevent PTA from increasing over a prolonged run. PURPOSE: To assess the effects of a prolonged submaximal run on PTA in novice runners. METHODS: Male (n = 2) and female (n = 8) novice runners (24.5±5yrs; 1.69±0.12m; 70.7±15.6kg; 24.5±3.8kg/m^2) who had been training for less than two years and ran on average at least 16km per week completed a 30min treadmill run at a self-selected speed equivalent to a rate of perceived exertion using the Borg scale between 10-13. A 3D accelerometer (480Hz, PCB Piezotronics, USA) used to measure PTA immediately following foot strike was attached to the distal anteromedial aspect of the right tibia along its longitudinal axis. Sagittal plane foot contact angle and ankle angle were also computed using 3D motion capture data (240Hz, Qualisys, Sweden). Data from five consecutive steps were collected after four (start), 15 (middle) and 30 min (end) of the prolonged run. A one-way repeated measures ANOVA was used to assess the main effect of time on PTA (p ≤ 0.05). Post-hoc paired t-tests were used to compare mean differences among time points. Cohen’s d effect sizes were used to assess effect magnitudes. RESULTS: PTA was not different among time points (p = 0.87). PTA was unchanged between time points during the prolonged run (start: 3.58±1.43g; middle: 3.67±1.09g; end: 3.60±1.47g). Both foot underlying mechanisms have yet to be explored. Preliminary evidence suggests that respiratory sinus arrhythmia (RSA) responses elicited during a sad mood induction, as opposed to a more traditional laboratory stressor, predict symptomatic improvement in currently depressed individuals. PURPOSE: To determine the effect of a single bout of moderate-intensity aerobic exercise on affective and neurocardiac responses to a sad film induction. METHODS: Using a within-subjects design, 40 young adults (20.1 ± 1.8 yrs) with (or high symptoms of depression; n=20) and without MDD (n=20) completed a 30-min session of exercise or a sedentary control condition in counterbalanced order on two separate days. After a 15-min recovery period, neurocardiac function was assessed during a 3-min sad film induction. Pre-ejection period (PEP) and RSA measures were derived using impedance cardiography and served as proxies of sympathetic and parasympathetic activity, respectively. Affective valence and perceived activation were also assessed at 5-min intervals throughout each session. RESULTS: Individuals with MDD demonstrated more robust RSA withdrawal during the sad film following exercise relative to the control condition, p < .05. Importantly, RSA reactivity to the sad film following exercise was similar in individuals with MDD to typical responses among nondepressed control subjects, p > .05. CONCLUSION: These findings suggest that exercise may serve as a protective factor preceding exposure to stress in individuals at risk for MDD. Future trials investigating the antidepressant effect of exercise should aim to establish predictive biomarkers of exercise treatment response.

A large and consistent body of evidence supports a relationship between aerobic fitness and cognitive function. Alternatively, it is well known that stress and adverse life events impact brain structure and function, and may produce enduring alterations in cognition and behavior. It remains unclear, however, whether fitness moderates the relationship between stress and cognitive function. The majority of studies examining the relationship between fitness and cognitive function have relied on behavioral performance measures, while the influence of fitness on select temporal aspects of information processing remains less well known. Given the considerable variation in age-related cognitive decline, it may be important to investigate the relationship of fitness with discrete information processing stages, which may aid in future intervention development. PURPOSE: The purpose of this study was to examine the relationship between aerobic fitness and different stages of information processing in older adults using the P3 and lateralized readiness potentials (LRP) event-related potentials.

METHODS: Male (n = 2) and female (n = 8) novice runners (24.5±5yrs; 1.69±0.12m; 70.7±15.6kg; 24.5±3.8kg/m^2) who had been training for less than two years and ran on average at least 16km per week completed a 30min treadmill run at a self-selected speed equivalent to a rate of perceived exertion using the Borg scale between 10-13. A 3D accelerometer (480Hz, PCB Piezotronics, USA) used to measure PTA immediately following foot strike was attached to the distal anteromedial aspect of the right tibia along its longitudinal axis. Sagittal plane foot contact angle and ankle angle were also computed using 3D motion capture data (240Hz, Qualisys, Sweden). Data from five consecutive steps were collected after four (start), 15 (middle) and 30 min (end) of the prolonged run. A one-way repeated measures ANOVA was used to assess the main effect of time on PTA (p ≤ 0.05). Post-hoc paired t-tests were used to compare mean differences among time points. Cohen’s d effect sizes were used to assess effect magnitudes. RESULTS: PTA was not different among time points (p = 0.87). PTA was unchanged between time points during the prolonged run (start: 3.58±1.43g; middle: 3.67±1.09g; end: 3.60±1.47g). Both foot underlying mechanisms have yet to be explored. Preliminary evidence suggests that respiratory sinus arrhythmia (RSA) responses elicited during a sad mood induction, as opposed to a more traditional laboratory stressor, predict symptomatic improvement in currently depressed individuals. PURPOSE: To determine the effect of a single bout of moderate-intensity aerobic exercise on affective and neurocardiac responses to a sad film induction. METHODS: Using a within-subjects design, 40 young adults (20.1 ± 1.8 yrs) with (or high symptoms of depression; n=20) and without MDD (n=20) completed a 30-min session of exercise or a sedentary control condition in counterbalanced order on two separate days. After a 15-min recovery period, neurocardiac function was assessed during a 3-min sad film induction. Pre-ejection period (PEP) and RSA measures were derived using impedance cardiography and served as proxies of sympathetic and parasympathetic activity, respectively. Affective valence and perceived activation were also assessed at 5-min intervals throughout each session. RESULTS: Individuals with MDD demonstrated more robust RSA withdrawal during the sad film following exercise relative to the control condition, p < .05. Importantly, RSA reactivity to the sad film following exercise was similar in individuals with MDD to typical responses among nondepressed control subjects, p > .05. CONCLUSION: These findings suggest that exercise may serve as a protective factor preceding exposure to stress in individuals at risk for MDD. Future trials investigating the antidepressant effect of exercise should aim to establish predictive biomarkers of exercise treatment response.
Fatigue during running decreases the body’s ability to attenuate shock during impact, which may increase overuse injury risk. Muscles may assist in the attenuation of shock, and fatigue may induce redistribution in energy absorption during a single leg landing from the ankle to hip, but it is unknown whether there is a change in how joints function to dissipate energy after a high-intensity run. PURPOSE: To determine the effect of a high-intensity run on lower extremity energy distribution during running. METHODS: Ten experienced female runners, running 30+ minutes at least three times per week participated in this study. Optical motion capture was used to assess overground running mechanics at preferred running speed prior to completing a high-intensity run. A high-intensity training run was then performed at 80% of estimated VO2 max for 30 minutes, or until participants were unable to continue. Running mechanics were assessed again within 20 minutes of completing the run at the same preferred speed observed prior to the training run. Joint powers for the dominant leg hip, knee, and ankle were calculated, and net joint work and total joint work from initial contact to the end of weight acceptance were calculated and normalized to body mass. Repeated measures ANCOVA were used to assess time x joint interactions for net joint work and total joint work, with rating of perceived exertion at the end of the run included as a covariate. Statistical significance was set a priori at p < 0.05. RESULTS: There were no time x joint interaction effects from pre to post run in either net joint work (Hip: 0.087 vs. -0.095 J/kg; Knee: -0.384 vs. -0.366 J/kg; Ankle: -0.362 vs. -0.346 J/kg; p = 0.198) or total joint work (Hip: 0.175 vs. 0.160 J/kg; Knee: 0.452 vs. 0.446; Ankle: 0.365 vs. 0.348; p = 0.282). There were also no main effects of time for both net and joint work (p = 0.849 and 0.075). CONCLUSIONS: No changes were observed in mechanical energy dissipation by the lower extremity joints after a 30-minute high-intensity run, indicating that lower extremity muscle function while running at a self-selected speed may not be affected by general fatigue. Self-selected running may not be intense enough to elicit changes, so further research should be performed to determine the effect of running at higher intensity on muscle function.

**Table 1:** Variables of interest at minute one and minute 30 between runners with previous ITBS and controls (CON) (mean (standard deviation)); d is effect size (ES).

<table>
<thead>
<tr>
<th>Time</th>
<th>Group</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>ITBS</td>
<td>CON</td>
</tr>
<tr>
<td>Peak hip adduction (degrees)</td>
<td>13.6(3.0)</td>
<td>13.5(2.4)</td>
</tr>
<tr>
<td>30</td>
<td>14.3(3.7)</td>
<td>13.5(3.4)</td>
</tr>
<tr>
<td>Hip adduction excursion (degrees)</td>
<td>2.7(2.0)</td>
<td>3.5(1.9)</td>
</tr>
<tr>
<td>30</td>
<td>3.8(3.1)</td>
<td>4.5(1.3)</td>
</tr>
<tr>
<td>Pre-heelstrike gluteus medius activation (%MVIC)</td>
<td>80.4(19.7)</td>
<td>62.0(28.4)</td>
</tr>
<tr>
<td>30</td>
<td>93.9(36.9)</td>
<td>63.7(25.2)</td>
</tr>
<tr>
<td>Weight acceptance gluteus medius activation (%MVIC)</td>
<td>96.5(13.3)</td>
<td>74.6(25.6)</td>
</tr>
<tr>
<td>30</td>
<td>96.4(7.7)</td>
<td>72.2(26.4)</td>
</tr>
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</table>

CONCLUSION: Runners with previous ITBS had weak hip abductors but similar peak hip adduction angles to controls. The ITBS group activated their hip abductors more to achieve the same hip adduction angle as controls.

**Background:** Compression garments are believed to provide performance benefits to runners. It has been shown that wearing these garments leads to reduced muscle vibrations during running and jumping. However, little research has investigated performance benefits that result from a reduction in muscle vibration. It has been proposed that the reduced muscle vibrations may lead to increased performance through a reduction in energy expenditure. PURPOSE: Investigate the effect of compression tights on muscle vibration and change in energy expenditure during an endurance run. METHODS: Twenty healthy experienced male runners participated. Participants ran at 80% VO2 max speed, previously estimated from an incremental treadmill procedure. Vibration data was collected using a passive marker motion capture system. The peak amplitude of muscle vibrations (axial direction) was calculated 150ms after foot strike for the quadriceps, hamstrings, gastrocnemius, and tibialis anterior muscles. A run was then performed on a treadmill at the same speed for 30 minutes or until voluntary exhaustion. Participants' heart rate (HR) was recorded in 5-min increments during the run and energy expenditure (EE) was estimated using the model: EE (kcal/min) = [3.56 - 0.0136(weight)] × [0.809 + (0.230 × HR)]. Energy expenditure during the run was calculated with compression tights significantly reduced muscle vibration during running but had no effect on energy expenditure during an endurance run. Future work should investigate other performance variables that may be affected by wearing compression tights to better understand possible performance benefits.

**Background:** Running through fatigue has been found to place an excessive amount of stress to lower extremities that may increase the risk of overuse injuries. Cushioned insoles are suggested to help attenuate shock and reduce impact forces caused by running. PURPOSE: To investigate the effect of implementing cushioned insoles on subjects before and after a fatigue protocol run to determine whether the insoles significantly lessened impacts. METHODS: Four male college students (age = 22.8 ± 4yr; weight = 80.2 ± 5kg; height = 187.3 ± 3cm) participated in the study. The participants were randomly assigned to either the control (C) or treatment (T) group. Each participant ran on a treadmill with each group randomized to either condition. During the control condition, participants wore conventional running shoes. During the treatment condition, participants wore cushioned insoles. The running protocol consisted of a 30-minute treadmill run at estimated VO2 max for 30 minutes or until voluntary exhaustion. Heart rate (HR) and energy expenditure (EE) were recorded every 5 minutes during the run. The protocol was repeated on two separate days, one with running shorts and one with high compression tights.

**Conclusion:** Our data suggest that PTA does not change over the course of a submaximal prolonged run in novice runners. This finding is similar to unchanged PTA during a 20-min moderately intense run in trained runners. These findings appear to indicate that, independent of running experience, PTA is unaffected by prolonged running. Changes in lower extremity motion and stiffness over prolonged runs of different lengths and intensities may alter active shock attenuation mechanisms and have different impacts on PTA on novice runners.
were tested three times over a period of three weeks. During the first visit, lactate threshold speed (LTS) was assessed via blood samples (7.8±0.5mmp). During the second and third visits participants were randomly assigned to undergo incremental treadmill tests with and without insoles. The incremental runs included two rounds of seven 30-second bouts at stages -20% below to +40% above the LTS, with a 20 minute run at LTS in between the two trials. A triaxial accelerometer that was placed at each subject’s dominant tibial plateaus recorded acceleration before and after the 20m run. Tibial acceleration (TA), stride length and frequency were calculated through Matlab.

**Results:** A two way repeated ANOVA (2 fatigue states by 2 insoles conditions) showed that there was a main effect of state (p<0.003) and a main effect of insole condition (p<0.001), as well as an interaction (p=0.044). Post hoc analysis revealed that TA was significantly lower during the non-fatigue control run with insoles when compared to the other conditions. Over the course of both pre- and post-fatigue incremental tests, stride length and frequency did not change. **Conclusion:** The findings indicate that insoles are an effective way to reduce tibial acceleration during running, but to a greater extent in the absence of fatigue (22% vs. 13%).

### Lower-body Positive Pressure Treadmill

#### Influence Of Step Rate Control On The Metabolic Demands Of Running In A Lower-body Positive Pressure Treadmill

Brendan J. Rickert. Sacred Heart University, Fairfield, CT. (Sponsor: Peter Ronai, FACSM)

*Email:* rickertb@sacredheart.edu

(No relationships reported)

Lower-body positive pressure treadmills (LBPP-TM) artificially reduce body weight (BW) allowing individuals to run with reduced load and metabolic demand. Previous reports document that temperospatial mechanics are significantly altered as BW levels are reduced. Specifically, step length (SL) is longer and step rate (SR) is reduced. If a runner modifies SR in the LBPP-TM they can maintain normative temperospatial mechanics, however, the influence on metabolic demand is unknown. **Purpose:** To investigate the relationship between the degree of unloading and oxygen consumption (VO2) when SR is maintained. **METHODS:** Eighteen competitive runners (8M: 20.3 ± 1.8 yrs; 59.9 ± 7.8 kg) were randomized into two groups and completed a 30-min continuous run at 65% VO2 peak. Each continuous run started with a 10-min familiarization segment at 100% BW before four 5-min segments at 100%, 90, 80, and 70% BW. In a counter-balanced design, SR was controlled in one trial as runners matched a digital metronome (DM) set to their SR recorded during the familiarization run. VO2 was collected over the last two-minutes of each segment. Hi-speed video (210 Hz) was recorded for each trial and SR subsequently determined. All dependent variables were compared using repeated-measures ANOVAs with Bonferroni post hoc testing (SPSS Statistics 23).

**RESULTS:** There was a significant main effect of BW level (F(2,4,41.8)=8.13, p<0.001) and DM (F(1.17)=45.1, p<0.001) on VO2. SR was significantly reduced at 90, 80, and 70% BW as compared to the 100% BW condition (p<0.05) when runners could self-select their cadence. There was a significant main effect of BW level (F(1.32.9)=105.6, p<0.001) and DM (F(1.17)=6.6, p<0.05) on VO2. **CONCLUSION:** At all BW levels, runners were able to successfully match their SR with a DM set to their normal SR at 100% BW (178±1.9 steps/min). While running with a self-selected SR at 70% BW, runners displayed both a significantly lower SR (168.5±9.9 steps/min) and lower VO2 as compared to when they were forced to match their SR to a DM. As BW level is reduced, VO2 is significantly reduced whether SR is self-selected or matched to DM (F(1,17)=6.6, p<0.05) on VO2.

**CONCLUSIONS:** There was a significant main effect of BW level (F(1.3,22.9)=105.6, p<0.01) on SR. SR was significantly reduced at 90, 80, and 70% BW (F(1,17)=45.1, p<0.05) on VO2. Despite similar PP in SIT20s [16.4 ± 2.5 vs. 14.6 ± 2.6 mmol/L (P = 0.032), 1.46 ± 0.6 vs. 1.19 ± 0.7 (P = 0.021), and 102 ± 9 vs. 73 ± 7 Kcal (P = 0.000), respectively] and TA was significantly lower during the non-fatigue control run with insoles when compared to the other conditions. Over the course of both pre- and post-fatigue incremental tests, stride length and frequency did not change. **Conclusion:** The findings indicate that insoles are an effective way to reduce tibial acceleration during running, but to a greater extent in the absence of fatigue (22% vs. 13%).

### Sprint Interval Training (SIT) protocols

Sprint Interval Training (SIT) is characterized by supramaximal “all-out” efforts of 10-30s, and promotes cardiometabolic and musculoskeletal adaptations. Given that peak power output, a key stimulus for aerobic adaptations, can be achieved during the first seconds of a sprint, it is possible that a very short SIT protocol (i.e., 5 s) can lead to similar adaptations compared to longer efforts. **PURPOSE:** To compare the physiological and mechanical responses of two different SIT protocols ([SIT with 20s efforts (SIT20s) vs. SIT with 5s efforts (SIT5s)]. **METHODS:** Eight males (VO2, max= 45.9 ± 3.7 mL/kg/min; age=25.3 ± 3.6 yr) participated. VO2 was measured during a 10-min warm-up, then the LBPP-TM and two separate trials consisting of a 30-min continuous run at 65% VO2peak were conducted. In the first visit, lactate testing to examine peak levels of oxygen consumption (VO2peak), heart rate (HR), respiratory exchange ratio (RER), energy expenditure (EE), post-exercise lactate (LA), peak power (PP), mean power (MP), rate of fatigue (RF), total work (TW), and OMI(-cycle) scale RPE (Omi(-cycle) RPE). **RESULTS:** Mean VO2, HR, and total EE were higher in SIT5s [37.6±1.45 vs. 26.89±1.21 mL/kg/min (P=0.000), 156±11 vs. 141±14 BPM (P=0.021), and 102±9 vs. 73±7 Kcal (P=0.000), respectively]. LA and RER were higher in SIT20s [16.4±2.5 vs. 14.6±2.6 mmol/L (P=0.032), 1.46±0.6 vs. 1.19±0.7 (P=0.000), respectively]. MP and TW were higher in SIT5s [735.5±72.8 vs. 595.6±57.4 W (P=0.001), and 56.6±5.6 vs. 47.3±4.4 kcal (P=0.02), respectively]. No significant differences were found between protocols in PP [91.4±60.5 vs. 90.1±88.5 W (P=0.937), for SIT5s and SIT20s, respectively]. RF was higher in SIT20s than in SIT5s [54.7±5.9 vs. 39.4±9% (P=0.001)]. Omi(-cycle) RPE at 10 min recovery was lower in SIT5s [3.5±1.7 vs. 4.75±1.5 (P=0.038)]. **CONCLUSIONS:** Despite similar PP between protocols, the short SIT protocol (5s efforts) elicited greater cardiorespiratory responses, higher mechanical strain, and a lower fatigue and glycolytic activation when compared to the standard SIT protocol.

### Training Status Affects The Physiological Response To A Single Bout Of High Intensity Functional Training

Yuri Frito, FACSM, Michael Giardina, Danielle Brown, Brandi Price. Kennesaw State University, Kennesaw, GA. (No relationships reported)

Although the cardiometabolic effects of high intensity training are well established, little evidence surrounds physiological changes occurring as a result of a high intensity functional training (HIIFT) session. Even though previous studies have linked experience with performance, endurance performance alone does not imply greater skill. **PURPOSE:** To examine the physiological response of a HIIFT workout among individuals with different competitive levels. **METHODS:** Sixty-six participants (30.8±7.3 y; 172.4±13.6 kg) with at least six-months of HIIFT experience and different levels of ability and skill were tested. Ability and skill level was determined by the benchmark workout “Fran” [Novice (Nov), N=26; Intermediate (Int), N= 22; Advance (Adv), N= 18]. All participants underwent aerobic capacity testing to examine peak levels of oxygen consumption (VO2peak), heart rate (HRpeak), respiratory exchange ratio (Rpeak), and blood lactate (Lpeak). A week later, the same variables were measured (VO2, HR, R, Lt) during a 15-min HIIFT based workout. **RESULTS:** Analysis of variance revealed significant group differences in VO2peak (Adv=50.1±5.4 Int=46.1±4.9, Nov=43.8±6.6 mL/kg/min; p=0.001) and Lpeak (Adv=12.6±2.5 Int=11.5±3.3 Nov=9.9±3.2 mmol/L; p=0.010). Similarly, during the HIIFT workout, advance athletes had the highest VO2 of the three groups (Adv=39.7±3.1 Int=37.4±4.1 Nov=35.0±5.6 mL/kg/min; p=0.006). However, intermediate athletes had the highest L1 concentration during the HIIFT workout (Adv=9.2±1.6 Int=11.2±1.5 Nov=9.6±2.7 mmol/L; p=0.008). When we compared performance of the HIIFT workout, Advance athletes performed significantly better.
than the Intermediate and Novice athletes (304±25, 258±26, 212±29 repetitions, respectively; p<0.001). Regression analysis revealed experience was the greatest predictor of performance in this 15-min HIIT workout (r²=0.658, p<0.001).

CONCLUSIONS: These data support the notion that individuals with different training levels respond differently to a specific HIIT workout. Further studies should continue to explore these differences among athletes with different training levels.

3502 Board #3  June 3 9:00 AM - 11:00 AM
Effects Of High-intensity Functional Circuit Training On Motor Function And Exercise Motivation: A Randomized-controlled Trial
Jan Wilke, Stefanie Kaiser, Daniel Niederer, Tobias Engeroff, Lutz Vogt, Winfried Banzer, FACSM. Goethe University Frankfurt, Frankfurt am Main, Germany. Email: wilke@sport.uni-frankfurt.de

(NO relationships reported)

PURPOSE: Only a small share of the world population meets current physical activity guidelines, which recommend regular engagement in endurance, strength, and neuromotor exercise. As lack of time has been reported to constitute a major cause of inactivity, multidimensional methods with short training duration might be a promising alternative to classical, volume-oriented approaches. This randomized controlled trial aimed to examine the effects of a high-intensity functional circuit (HIFCT) training program on motor function and motivation to exercise in healthy, untrained adults.

METHODS: 25 inactive participants (26±5 yrs, 9/7) were randomly allocated to two groups. The intervention group (HIFCT, n=15) 3×wk performed functional exercises incorporating complex whole-body movements (e.g. Squats, Step-Ups, Burpees) in a circuit format. The 15 min workouts were composed of repetitive 20s all-out bouts with 10s breaks. In the comparison group (moderate aerobic exercise, MAE) the participants walked 3×wk for 50 min at moderate intensity (progressively increased from 50 to 60% of the individual heart rate reserve). Motor outcomes, measured prior to and after the six-week intervention, were cycling capacity (maximum work load), dynamic maximum strength (leg and shoulder press), postural control (force plate), and jump capacity (reactive strength index, counter-movement jump, single leg hop for distance). Motivation to exercise was assessed using the self-concordance index.

RESULTS: HIFCT increased maximum leg strength (difference of relative median pre-post changes between groups: 6%), shoulder strength (8.4%), and cycling workload (6.5%; p<0.05). No differences were found for postural control and jump capacity (p>0.05). Although not statistically significant, there was a tendency for increased self-confidence according to HIFCT (p=0.051). Systematic group differences were detected with the Mann-Whitney-U-test (p<0.05).

CONCLUSION: Despite considerably shorter training duration, HIFCT enhances motor function in healthy untrained adults more effectively than MAE. It might moreover be better suited to motivate inactive people to engage in regular activity. Further research should thus investigate long-term adherence to the program and its effectiveness in other settings.

3503 Board #4  June 3 9:00 AM - 11:00 AM
Strength and Power Acute Responses to Suspension Training
Cristina Corti1, Giuseppe F. Giancotti1, Carlo Varalda2, Francesca Di Cecio1, Gabriele Risi1, Francesco Di Siena1, Giuseppe Di Micco3, Andrea Fusco1, Laura Capranica1, 1University of Cassino e Lazio Meridionale, Cassino, Italy. 2Italian Weightlifting Federation FIPE, Rome, Italy. 3University of Rome Foro Italico, Rome, Italy. (Sponsor: Carl Foster, FACSM) Email: c.cortis@unicas.it

(NO relationships reported)

Suspension Training (ST) is a form of resistance training aiming at improving strength, endurance, coordination, flexibility, power, and core stability. Although ST is thought to elicit higher muscle activations than traditional exercises, only limited information is available on its acute effects on strength and power performances. PURPOSE: To evaluate strength and power acute responses after group ST in relation to gender.

METHODS: 32 college students (16 M, 16 F; Age: 25±3.8yrs; height: 165.8±11.2cm; Body Mass: 70.4±11.2Kg; BMI: 23.5±2.4kg/m²). To induce a large increase in the finite anaerobic capacity but could not show any effect on the incidence of plateau at VO2max. It is thus concluded that the plate is not simply a product of anaerobic energy provision but a more complex psychological component.

3505 Board #6  June 3 9:00 AM - 11:00 AM
Sex Specific Cardiovascular And Metabolic Responses To High-intensity Exercise On An Elliptical Cross-trainer
Tony P. Nunez, Terence A. Moriarty, Kurt A. Escobar, Len Kravitz, Ann L. Gibson, FACSM. University of New Mexico, Albuquerque, NM. (Sponsor: Ann L. Gibson, FACSM) Email: tnuze212@unm.edu

(NO relationships reported)

High-intensity interval exercise (HIIT) has been shown to elicit greater cardiovascular and metabolic responses compared to moderate continuous aerobic exercise. However, the acute responses to HIIT between males and females using a novel elliptical cross-trainer have not been reported. PURPOSE: To investigate the cardiovascular and metabolic responses of 3 HIIT protocols using a novel device. METHODS: Six males (M) (81.5±8.1kg; 1.79±0.1m) and six females (F) (59.6±6.7kg; 1.64±0.1m) between 19-28 years of age volunteered. Following written consent, each participant performed three different HIIT protocols in a randomized order: 10 bouts of 30/30 sec, 30/60 sec, and 30/90 sec work-to-rest ratios for a total duration of 10, 15, and 20 min, respectively. Protocol order was determined by a random number generator at the time of each training session. For each HIIT protocol, the VO2max and heart rate were collected continuously and monitored during each exercise protocol. Blood lactate (BLa), energy expenditure (EE) rating of perceived exertion (RPE), and watts (W) were also collected during the exercise.
protocols. Separate 2 (sex) X 3 (protocol) repeated measures ANOVA techniques (SPSS v22; p < 0.05) with post hoc analysis were applied to examine differences.

**RESULTS**

There was no sex difference of protocol. However, a significant effect of sex, although not found for BLA and VO2, was observed for RPE (M = 17.2 ± 2.0; F = 14.6 ± 1.5; p = 0.034). W = 165 ± 33W, F = 137 ± 24W; F = 7.519, p = 0.021), HR (M = 168 ± 16bmp, F = 181 ± 58bmp; F = 14.218, p = 0.002) and EE (M = 11.2 ± 1.4 kcal/min, F = 9.0 ± 1.5 kcal/min; F = 11.639, p = 0.004); peak W was also differed by sex (M = 674.5 ± 147W, F = 420 ± 61W; F = 7.519, p = 0.002). There were no sex by protocol effects.

**CONCLUSION**

Our 1:1, 1:2, and 1:3 work-to-rest HIIT bouts, which held work constant at 30 sec, did not elicit a change in cardiovascular or metabolic responses. However, there were sex specific differences for 4 variables; this is most likely explained by physiological and training differences between the men and women in this study. Future studies and exercise programs should consider sex differences during HIIT training when developing exercise protocols.

**3509 Board #1 June 3 9:00 AM - 11:00 AM**

**Mechanomyographic Responses to Blood Flow Restricted, Fatiguing Isometric Muscle Actions**

Jakob J. Rosengarten, Jared W. Coburn, FACSM, Lee E. Brown, FACSM, Andrew J. Galpin, Cal State Fullerton, Fullerton, CA. (Sponsor: Jared W Coburn, FACSM) Email: jakobjc@googglemail.com (No relationships reported)

Blood flow restriction (BFR) during low intensity resistance exercise (LIRE) has been shown to increase activation of lower body musculature. It is unclear if this is due to increases in motor unit recruitment (MU) or firing rate. Mechanomyography (MMG) has been used to investigate motor unit recruitment (MMG amplitude) and motor unit firing rate (MMG frequency).

**PURPOSE**

To use MMG to investigate the neuromuscular effects of BFR in the lower body during LIRE.

**METHODS**

Ten males (age = 27.1 ± 3.1; height = 177.6 ± 6.2 cm; mass = 86.9 ± 13.0 kg) performed 3 knee extensor maximal voluntary isometric contractions (MVIC) with the right limb. Occlusion (OCC) was then applied to the right thigh using a KAATSU master unit while two sets (1 set = 30 ± 7.96 repetitions; set = 13.7 ± 11.29 repetitions) of repeated 5-second isometric knee extensions at 30% of peak torque were performed. Each set was performed to fatigue, defined as the inability to reach 30% of MVIC torque, with 2-seconds rest between repetitions. The same procedure was repeated during a second visit without occlusion (NONOCC), while matching the number of repetitions per set to the first visit. An accelerometer was used to collect MMG data from the vastus lateralis during the MVICs and both sets. Prior to data analysis, repetitions were normalized as percentages (25%, 50%, 75% and 100%) of total repetitions completed, and MMG data were normalized to the values from MVIC testing.

**RESULTS**

For MMG frequency, a significant 3-way interaction between set (2), condition (2) and percent repetitions (4) (p = 0.046) was found. Follow-up tests revealed no interaction or main effects for set (p > 0.05), and no interactions for set 2. When collapsed across percent repetitions, MMG frequency was lower for OCC (0.837 ± 0.045) than for NONOCC (0.116 ± 0.099) during set 2 (p = 0.046). For MMG amplitude, there was a significant condition by set interaction (p = 0.024). MMG amplitude was higher for the OCC condition (0.754 ± 0.187) than for the NONOCC condition during set 2 (0.481 ± 0.163; p = 0.001). MMG amplitude during set 1 (0.599 ± 0.179) was lower than set 2 (0.754 ± 0.187; p = 0.042) for OCC.

**CONCLUSION**

OCC exhibited lower levels of MMG frequency and higher values for MMG amplitude. This suggests that higher MU recruitment, rather than firing rate, was responsible for increased muscle activation during BFR.
Muscle oxygen uptake (VO₂) is comprised of perfusive and diffusive oxygen transport. Few techniques demonstrate the ability to measure both components of VO₂ simultaneously within the same volume of tissue. It has previously been shown that quadriceps microvascular blood flow during cycling exercise establishes a plateau at approximately 60% peak work rate (WR₆₀), while muscle deoxy-[Hb+Mb] and total-[Hb+Mb] have been shown to plateau at 80%-90% WR₆₀. PURPOSE: The purpose of this study was to simultaneously measure perfusive and diffusive oxygen transport in the same volume of tissue during incremental forearm exercise. We hypothesized that any plateau in muscle blood flow index (BFI) would occur at the same work rate as plateaus in deoxy-[Hb+Mb] and total-[Hb+Mb]. METHODS: 17 subjects (age: 22.6 ± 3.1) completed an incremental handgrip exercise test to task failure. Muscle oxygenation and BFI of the flexor digitorum superficialis was measured continuously using near-infrared and diffuse correlation spectroscopy (DCS), respectively. The incremental test consisted of 2 min of baseline followed by 3 min at 1W and then a 1W increment every 2 min until task failure. During the last 10s of each stage subjects stopped exercise to obtain motion artifact-free DCS measurements. Deoxy-[Hb+Mb] and total-[Hb+Mb] were averaged over the last 10s of exercise and BFI was averaged during the subsequent 10s of rest for each stage. RESULTS: Deoxy-[Hb+Mb] and total-[Hb+Mb] plateaued in nearly all subjects (n=16; r=.15). There was no difference between deoxy-[Hb+Mb] and total-[Hb+Mb] in the work rate at which these plateaus occurred (59 ± 2.14 W and 67.9 ± 15.8% WR₆₀, respectively). The plateaus in deoxy-[Hb+Mb] and total-[Hb+Mb] were significantly correlated (r=0.70, p<0.01). A plateau in BFI was observed in 7 subjects (53.1 ± 9.3% WR₆₀), which was significantly lower than the plateaus in total-[Hb+Mb] and deoxy-[Hb+Mb] (both p=0.05) but was significantly correlated with the plateau in deoxy-[Hb+Mb] (p=0.78, p<0.05). 3 subjects showed a break up in BFI near end exercise; the remaining responses were approximately linear. CONCLUSIONS: In contrast to our hypothesis, BFI did not consistently exhibit a plateau and, when present, it occurred sooner in the incremental protocol than did the plateaus in deoxy-[Hb+Mb] and total-[Hb+Mb].
**CONCLUSIONS:** Fatigue is a major limiting factor for application of ES in sports injury and rehabilitation. Muscles with different fiber type composition respond differently to stimulation frequencies and fatigue development. These differences should be considered when developing treatment plans. Supported by NSF EFRI 1332329.

**METHODS:** Our deterministic model predicts the forces and force capacities of 120 motor units, and the whole muscle, for the full range of excitations. We estimated: relative force, excitation threshold, initial firing rate, maximum firing rate and excitation adaptation of each MU. During sustained, constant force contractions, we calculated the required excitation level to meet the force demand, and monitored the instantaneous levels of each variable listed above, to determine force and force capacity changes in each active MU and the whole muscle over 0.1 s intervals. The model provided very good estimates of endurance times for intensities ranging from 15% to 90% MVC, compared to published values.

**RESULTS:** The model predicted endurance times of 509.0 and 14.4 s at 20% and 80% MVC, respectively, at which time all MUs were recruited for both intensities. The 20% MVC condition resulted in larger relative decreases in strength (i.e. ‘fatigue’) for all 120 MUs. At the endurance time for the 20% condition, fatigue was 6.4%, 81.8%, 7.4% and 54.3% for the lowest MU (#1), middle MU (#60), and highest threshold MU (#120) and average MU, respectively. In contrast, at the endurance time for the 80% condition, fatigue was 0.2%, 2.3%, 3.8% and 4.3% for MUs 1, 60, and 120, and average MU, respectively. Excitation adaptations resulted in decreases in firing rates for all motor units, relative to initial maximum rested values.

**CONCLUSION:** The 20% MVC endurance trials resulted in the eventual recruitment of all MUs and >10-fold greater average fatigue for the MU population compared to the 80% MVC condition. Therefore, low intensity contractions, sustained to volitional fatigue, may provide more challenge to the motor unit population, and a more profound overall stimulus for muscle hypertrophy, compared to high intensity contractions.

**RESULTS:**

For the 80% condition, EI was calculated as the percent of acceleration at the end of each stimulation stage relative to the peak acceleration. Oxygen saturation was measured using near-infrared spectroscopy. RESULTS: Acceleration correlated with torque during twitch electrical stimulation of the vastus lateralis(mean R² = 0.96±0.04; p < 0.05). Measures of EI reproducibility were CV = 2.49±3.67% for the 2Hz stage, CV= 7.36±8.11% for the 4Hz stage, and CV = 4.30±3.09% for the 6Hz stage. EI was significantly higher in the gastrocnemius at the 4Hz (EI = 96.1±2.9%) and 6Hz (EI = 95.5±2.03%) stages compared to the forearm (4Hz: EI = 87.1±9.3%; 6Hz: EI = 68.3±17.6%) in healthy controls (p<0.01). Muscle oxygen saturation was not reduced during stimulation of the forearm (72.6±9.8% at 2Hz, 73.2±11.6% at 4Hz, and 71.0±12.5% at 6Hz) compared to baseline (74.3±15.1%; p>0.1). Participants with MS had significantly lower gastrocnemius muscle endurance at the 2Hz (EI = 53.6±10.2%), 4Hz (EI= 57.2±6.1%), and 6Hz (EI= 20.5±6.7%) stages compared to healthy controls (p<0.01). CONCLUSION: Muscle endurance as measured by twitch electrical stimulation and aMMG has the potential to evaluate endurance in various muscles and clinical populations.

**G-17 Thematic Poster - Vascular Function**

**Chair:** Bryan Taylor. University of Leeds, Leeds, United Kingdom.

- **3517 Board #7 June 3 9:00 AM - 11:00 AM**
  **Muscle Specific Endurance of the Lower Back Erectors using Electrical Twitch Mechanography**
  Kevin K. McCully, FACSM1, Caio Morales1, Sahil V. Patel1, Max Green2, T. Bradley Willingham1. 1University of Georgia, Athens, GA, 2UGA-AU Medical Partnership, Athens, GA. Email: mccully@uga.edu

**Reported Relationships:** K.K. McCully: Intellectual Property; Infrared Rs, Inc. Consulting Fee; Novartis, Ownership Interest (Stocks, Bonds); Infrared Rs, Inc. Employee of an ACCME Defined Commercial Interest; Infrared Rs, Inc.

**RESULTS:**

Lower back pain is a common symptom that may be associated with skeletal muscle dysfunction. PURPOSE: This study evaluated the endurance of the lower back muscles in healthy participants using accelerometer-based Mechanomyography (aMMG). METHODS: Surface electrodes and a tri-axial aMMG device were placed on the belly of the erector spinae muscles along the T11-L1 vertebrae. Current levels that evoked visible and tolerable twitch contractions were used. The muscles were stimulated for 3 minutes each at 2, 4, and 6 Hz. An endurance index (EI) was calculated as the maintenance of acceleration at the end of each stage of stimulation relative to the peak acceleration. Subjects (N=7) were tested on two separate days to assess reproducibility. Muscle oxygenation (HbO₂) was measured with near infrared spectroscopy (NIRS) during stimulation and during a maximal isometric back extension to induce complete ischemia for signal calibration (N=5). EI was measured in the wrist flexor and vastus lateralis muscles for comparison. RESULTS: EI for the erector spinae muscles were 70.3 ± 13.4%, 32.6 ± 8.4%, and 19.2 ± 6.2 % for 2, 4, and 6 Hz, respectively. The coefficients of variation were 9.8%, 13.9%, and 20.3% for 2, 4, and 6 Hz, respectively. EI values for the erector spinae were significantly lower than EI values for the arm and the leg (all comparisons, p <0.05). HbO₂ values for the erector spinae were 86.4 ± 10.9% at rest, and 77.2 ± 15.5%, 84.3 ± 14.1%, and 84.1 ± 18.9% for 2, 4, and 6 Hz, respectively. CONCLUSION: EI is a reproducible method of assessing muscle endurance of the lower back erector muscles that is not related to low oxygen levels. The erector spinae muscles have lower muscle endurance relative to limb muscles.

**3518 Board #1 June 3 9:00 AM - 11:00 AM**

- **Peripheral Vascular Pulsatility in Heart Failure Patients with Continuous Flow Centrifuge and Axial Left Ventricular Assist Devices: The Effect of Pump Speed.**
  Jay R. Hydren, Andrew C. Kithas, Soung Hun Park, Omar Weyer-Pinzon, Craig H. Selzman, William H. Perry, Camila A.S. Vargas, Stavros G. Drakos, Russell S. Richardson. University of Utah, Salt Lake City, UT.

**RESULTS:**

Current continuous flow left ventricular assist devices (LVAD) decrease peripheral vascular pulsatility, which may contribute to side effects such as bleeding, thrombotic events and orthostatic intolerance. PURPOSE: To investigate the impact of manipulating LVAD pump speed, documented as revolutions per minute (RPM), on peripheral (brachial artery) pulsatility index (PI) in 20 heart failure patients implanted with a HeartWare (HVAD, n = 10) or HeartMate III (HMII, n = 10) LVAD. METHODS: Doppler ultrasound blood velocity in the brachial artery was recorded at baseline and 3 minutes after altering RPM, at three different RPM settings above and below baseline (60 RPM increments for HVAD and 200 for HMII). Brachial PI was calculated for each cardiac cycle by dividing the difference between minimum and maximum blood velocity (HV ADVmin) (HV AD) and HMIIPI (HMII). Relationships were evaluated using multilevel linear modeling with random intercepts and data are reported as mean±SE. RESULTS: Baseline RPMs were 2590±44 (HVAD) and 9220±75 (HMII). Brachial PI changed significantly across the range of LVAD RPM speeds tested (HVAD: 360; HMII: 1200), from 2.3±0.6 to 4.1±0.9 with the HVAD and from 1.8±0.6 to 3.6±1.0 with the HMII, with no differences in brachial PI between
Moving from a supine to a standing position typically reduces plasma volume (PV) and while this increases the concentration of some molecules in the blood, the effect on plasma nitrate [NO₃⁻] and nitrite [NO₂⁻] has not been reported. **PURPOSE:** To determine the change (Δ) in PV, [NO₃⁻] and [NO₂⁻] while lying supine, sitting, standing, and following short-duration exercise. **METHODS:** Fourteen participants (9 male, age 27 ± 4 yr, body mass 71 ± 11 kg) completed two trials. The first was conducted with no dietary intervention (control; CON) and the second was preceded by ingestion of 3 ± 70 mM NO₃⁻, and beetroot juice the day before and 2 ± 70 mM two hours before the trial (BR, total of ~31 mM NO₃⁻). Both trials comprised 30 min lying supine followed by 2 min of standing, 2 min of sitting, and then 5 min of cycling at 60% of age-predicted maximal heart rate. Repeated blood samples were collected to allow measurements of haemoglobin and haematocrit in whole blood and plasma [NO₂⁻] and [NO₃⁻] by chemiluminescence. The ΔPV was calculated using the Dill and Costill formula. **RESULTS:** Following the supine phase, PV increased from baseline in both trials (CON Δ = 2.1 ± 3.5%, BR Δ = 3.7 ± 2.0%, P < 0.01) and then decreased upon standing (CON Δ = –5.2 ± 3.8%, P = 0.01; BR Δ = 4.0 ± 3.5%, P = 0.02), sitting (CON Δ = –10.1 ± 3.7%, BR Δ = 4.4 ± 3.6%, P < 0.001), and following exercise (CON Δ = –19.1 ± 5%, BR Δ = –15.5 ± 3.4%, P < 0.001). Plasma [NO₃⁻] levels at baseline were 120 ± 49 mM and 357 ± 129 mM in CON and BR, respectively. Plasma [NO₂⁻] decreased from baseline after lying supine in both trials (CON 77 ± 30 mM; BR 231 ± 92 mM, both P < 0.05) before increasing during standing (CON 109 ± 42 mM; BR 297 ± 105 mM, both P < 0.05) and sitting (CON 131 ± 43 mM; BR 385 ± 125 mM, both P < 0.001). Plasma [NO₂⁻] remained elevated following exercise in the CON trial (125 ± 61 mM, P < 0.05) but was not different to the 30 min supine value in the BR trial. There were no statistical differences in [NO₂⁻] between measurement points in either condition (all P ≥ 0.05). **CONCLUSIONS:** Plasma [NO₂⁻] changes in the opposite direction to PV during changes in posture, both in the presence and absence of prior dietary NO₃⁻ supplementation. Given that [NO₂⁻] offers the best approximation of nitric oxide bioavailability, researchers must be cognizant of these outcomes when designing and interpreting dietary NO₃⁻ research.

**3520**

**Board #3**  
June 3 9:00 AM - 11:00 AM  
Effects of Prolonged Aerobic Exercise on Flow Mediated Dilation Responses to Prolonged Sitting in Healthy Men  
Robert M. Duguid, Craig W. Berry, Kevin D. Ballard. Miami University, Oxford, OH. (Sponsor: Helane Alessio, FACSM)  
Email: duguidrm@miamioh.edu  
(No relationships reported)

Prolonged sitting is common in modern society and has recently been shown to impair vascular endothelial function (VEF) in healthy men. Conversely, a single bout of aerobic exercise improves VEF. **PURPOSE:** The objective of this study was to examine the acute effects of a single bout of aerobic exercise on VEF responses to prolonged sitting. **METHODS:** Eleven healthy men [21.2 ± 0.6 y; BMI = 24.7 ± 1.0 kg/m²; maximal oxygen consumption (VO₂max) = 49.5 ± 5.1 mL/min (mean ± SE)] participated in two randomized 3 hours sitting trials preceded by a single bout of continuous treadmill exercise (45 min at 65.6 ± 1.2% VO₂max) (range = 60.9–72.6%). Resting femoral artery diameter and FMD responses (2.7 ± 0.6% and 2.6 ± 0.5% for EX and REST, respectively) did not differ between trials at Pre. No time or trial effects were detected for resting arterial diameter (P≥0.28). Compared with Pre, participants’ FMD responses decreased at 1, 2, and 3 hours of prolonged sitting (P<0.05) when preceded by REST, whereas FMD responses were unaffected when prolonged sitting was preceded by EX (P>0.33). In the REST trial, resting shear rate decreased at 3 hours (P<0.05) relative to Pre. Resting shear rate was unaffected in the EX trial (P=0.09). **CONCLUSION:** These preliminary findings suggest that a single bout of aerobic exercise prevents the decline in FMD induced by 3 hours of prolonged sitting in healthy men. Future studies should examine differences due to sex, age, disease status, and exercise modality on VEF responses to prolonged sitting.

Supported by College of Education, Health, and Society Seed Grant.
protocol consisted of eccentric contractions of the TA in one leg, while the contralateral leg served as control. At baseline, and 48h after eccentric exercise, participants were positioned in a 3T magnet, and BOLD images were acquired in TA muscle during i) brief maximal contractions (MVC), and ii) cuff occlusion (5 min, 260mmHg) to monitor the hyperemic responses. The time-to-peak (TTP, s) of the hyperemic response was used as an index of microvascular reactivity. Data were analyzed using mixed model, three-way (Leg, Group, Session (0h, 48h)) repeated measures ANOVA. RESULTS: The ANOVA revealed no significant interactions for accessing TTP following brief MVCs and cuff occlusion (P > 0.001), with no main or interaction effects of group. Specifically, 48h after eccentric exercise, TTP (MVC) was prolonged in all groups compared with baseline (BR: 8.6±1.0 vs.10.9±1.0 s; AO: 8.4±1.0 vs.10.1±1.0 s; PLA: 9.0±0.9 vs.11.0±0.8 s), with no changes in control leg. Similarly, 48h after eccentric exercise, TTP (cuff) was prolonged in all groups compared with baseline (BR: 45.5±4.7 vs.68.6±7.7 s; AO: 54.5±5.7 vs.68.6±7.5 s; PLA: 42.1±6.4 vs.68.1±7.1 s), with no changes in control leg. CONCLUSION: Ingestion of BR and AO do not preserve microvascular reactivity after eccentric exercise, indicating that elevated oxidative stress and lower NO bioavailability do not contribute to altered microvascular function after eccentric exercise. Supported by Danish Ministry of Culture grant.

Bikram (hot) yoga is a style of hatha yoga practiced at 40.5° C with 40-60% relative humidity. We have previously documented improvements in endothelium-dependent vasodilation with a Bikram yoga intervention in middle-aged adults. Presently, it is not known whether the effect of hot yoga on endothelial function might be attributed to the yoga postures or the heated environment. PURPOSE: The purpose of this investigation was to determine the effects of Bikram yoga performed in standard heated conditions and in a thermoneutral environment on endothelium-dependent vasodilation. METHODS: Fifty-two sedentary but apparently healthy adults aged 40-60 years were randomly assigned to one of three groups: Bikram yoga practiced at 40.5°C (n=19); Bikram yoga practiced at 23°C (n=15); or sedentary time-control (n=19). The 12-week yoga intervention consisted of 3 weekly 90-minute Bikram yoga classes. The time control group was instructed to maintain current lifestyle patterns for the study duration. Body composition was determined via dual energy x-ray absorptiometry (DXA). Endothelium-dependent vasodilation was measured noninvasively using brachial artery flow-mediated dilation (FMD) after 5 minutes of blood flow occlusion. RESULTS: Age, anthropometric variables, lipid, glucose, and triglyceride concentrations, and brachial artery FMD were not different among the three groups at baseline. Body fat percentage declined (p<0.01) and LDL-cholesterol concentration tended to decline (p=0.09) only in the hot (40.5°C) yoga group. Brachial artery FMD increased (P=0.05) in both yoga groups. There were no significant changes in any outcome variables in the time control group. CONCLUSIONS: Bikram yoga practiced at hot/humid and thermoneutral conditions produced similar improvements in endothelium-dependent vasodilation in healthy, middle-aged adults. However, the addition of the heat/humidity led to further improvements in body composition. This study was funded by Pure Action, Inc. Austin, TX, USA.

Purpose of this study was to examine the wave reflection responses to PEMI in adults with PRET2D and T2D.

RESULTS: Aortic hemodynamics were obtained using pulse wave analysis at rest and during PEMI following isometric handgrip at 30% of maximal voluntary contraction in adults (age, 59 ± 7.6 and 3.3 y) with PRET2D (n= 12) and T2D (n= 12). RESULTS: Vascular parameters were similar at rest. Aortic systolic BP (PRET2D Δ42 ± 13 mmHg vs. T2D Δ31 ± 10 mmHg, P < 0.001 for both), pulse pressure (PRET2D Δ68.1 ± 7.1 s), with no changes in control leg.

CONCLUSION: Ingestion of BR and AO do not preserve microvascular reactivity after eccentric exercise, indicating that elevated oxidative stress and lower NO bioavailability do not contribute to altered microvascular function after eccentric exercise. Supported by Danish Ministry of Culture grant.

HISTORY: A 20-year-old male community college football defensive end developed left shoulder paresisesthesia during a game. He was tackled an opponent and his head was forced into a left lateral rotation. After this, he developed immediate paresisesthesia in the left upper trapezius and upper deltoid. He was evaluated on the side line by medical staff and removed from the remainder of the game. Symptoms resolved within the next two days, and he returned to competition. Two weeks later, he again had his head forced into a left lateral rotation during a tackle. Paresthesia immediately returned in the left upper trapezius and upper deltoid. However, this time pain was increased and had onset of a burning sensation. After sideline evaluation, he was removed from competition. Following the game, he continued to have severe burning pain. He was sent to a local emergency department and ultimately released home. Paresthesia resolved over the next five days, but he was not cleared to return to competition.

PHYSICAL EXAMINATION: There was no deformity to the neck or upper extremity. No cervical or left shoulder tenderness to palpation. His range of motion in the left glenohumeral joint was full. Strength was full throughout the entire left upper extremity. Sensation to light touch was diminished in the left upper trapezius and upper deltoid, but normal throughout the remainder of the upper extremity. Deep tendon reflexes were 2+ in bilateral biceps, brachioradialis, and triceps. Spurling’s test was positive on the left.


TREATMENT AND OUTCOMES: 1. Orthopaedic spine referral determined to treat with non-operative management 2. Physical therapy for cervical strengthening, flexibility, and traction. Currently being withheld from competition with undetermined return to play date.

MEDICINE & SPORTS EXERCISE®

G-18 Clinical Case Slide - Cervical Spine

HISTORY: A 52-year-old male was referred to Physical Therapy (PT) by his primary care physician for progressive quadriparesis related to suspected peripheral neuropathy (PN). The patient was healthy and active until two years prior when
he began experiencing weakness and paresthesia in both hands. This progressed to his right lower extremity, then all four extremities, and by the time of the PT evaluation, the patient was no longer able to stand. He also endorsed several episodes of bladder incontinence, constipation, and painful muscle spasms. He was scheduled for imaging of the spine and a follow-up with his physician in two months. Review of the medical record revealed that the patient was evaluated by a physical therapist nine months prior. His presentation then was consistent with the working diagnosis of PN (see table).

PHYSICAL EXAMINATION: The patient presented in a wheelchair, though was unable to propel or stand without assistance due to significantly worsening weakness. Neurologic exam revealed several upper motor neuron signs including hypertonia and hyperreflexia. This presentation was no longer consistent with the working diagnosis of PN (see table).


TESTS AND RESULTS:
Cervical Thoracic spine MRI: 12.4 cm intradural intramedullary mass from C5 to T5, likely related to multiple tumoral cystic areas, with syrinx from T3 to T4

FINAL DIAGNOSIS: Intradural intramedullary ependymoma extending from C5 to T5 with associated syrinx

TREATMENT AND OUTCOMES: Based on the examination and presence of multiple red flags, the physical therapist referred the patient to the Emergency Department for further evaluation.

3532 June 3 10:00 AM - 10:20 AM
Neck Injury
Özlem G. Ulger1, Ayun Demirel1, Mehmet Yorubulut2.
1Hacettepe University, Ankara, Turkey. 2Acibadem Hospital, Ankara, Turkey.
Email: ozlemulger@yahoo.com
(No relationships reported)

HISTORY: A 34-year-old woman has severe neck and radiating pain to left arm applied to our clinic. Two years ago she had strain and she used myorelaxative drugs and felt better. When she performing heavy weights in bench press position at the gym, she felt pain suddenly both neck and left arm.

PHYSICAL EXAMINATION: Paravertebral and shoulder muscle spasm were palpated. Cervical compression and distraction tests were positive. Verteobasilar artery test, Adson and Roos test were negative. There was no limitation in range of motion. There was strength (20%) and sensorial deficit (hypoesthesia in C3-C4-C5 dermatomes).

DIFFERENTIAL DIAGNOSIS:
Cervical disc herniation
Peripheral nerve entrapment

TEST AND RESULTS:
Cervical Joint T1 and T2 MRI:
− Left posterolateral foraminal extrude herniation (C5-C6 level, herniation volume decreased from 4.5 mm to 3.1 mm, interspace disc height increased from 3.6 mm to 3.9 mm. Regression was seen in this level)
− Right posterolateral protrusion (C4-C5 level, there was no change in herniation thickness and disc height)

FINAL WORKING DIAGNOSIS:
Cervical disc herniation

TREATMENT AND OUTCOMES:
15 sessions of Physiotherapy programme which included Non-invasive Spinal Decompression, manual therapy applied.
− Physiotherapist guided spinal stabilization exercise applied (4 months follow-up)
− After therapy strength and sensorial problems resolved.

3533 June 3 10:20 AM - 10:40 AM
Sternoclavicular Injury - Rugby Union (15-players-a-side)
1Rugby Research and Injury Prevention Group, Inc, Hospital for Special Surgery, New York, NY. 2Missouri Orthopaedic Institute & Thompson Laboratory for Preventive Group, Inc, Hospital for Special Surgery, New York, NY. 3Baylor Orthopaedic Institute & Thompson Laboratory for Regenerative Orthopaedics, Columbia, MO. 4State University of New York Medical Center (Downstate), Brooklyn, NY. 5Lake Erie College of Osteopathic Medicine, Bradenton, FL. 6Hospital for Special Surgery, New York, NY. (Sponsors: Robert C. Cantu, FACSM)
Email: dvlortlopezjr@gmail.com
(No relationships reported)

HISTORY: A 19-year-old men’s college rugby-15s winger collapsed during match play. The player had no impact with another player, dizziness and no loss of consciousness. A medical history revealed the player had sustained a right clavicular injury in a previous match 25 days prior to this incident. Where he complained of right shoulder pain, after impacting the ground with a multi-player tackle. The player had presented to an Urgent Care facility after that injury and provisionally diagnosed with shoulder sprain -vs- pectoralis strain, placed in arm-sling and sent home on oral analgesics. Right shoulder radiographs at Urgent Care visit were read as normal. PHYSICAL EXAM: Exam in ED revealed slurred speech, and complaints of localized pain and tenderness on right medial clavicle. Right sternoclavicular joint pain on palpation. Limited upper extremity range of motion secondary to pain, no facial drop, decreased left sided upper and lower extremity sensation, reflexes and strength. Symmetrical radial pulses with brisk capillary refills. DIFFERENTIAL DIAGNOSIS:

FINAL WORKING DIAGNOSIS: Missed posterior sternoclavicular joint dislocation with brachiocephalic artery compromise leading to hemiparesis TREATMENT AND OUTCOMES:
1. Surgical Emergency. Often missed on radiograph. 2. Open repair of...
brachiocephalic artery, right clavicular reduction/SCJ capsulorrhaphy with hamstring tendon allograft. 3. Patient recovered with left sided hemiparesis. No return to sport. Sponsor: NOCSAE.org

G-19 Clinical Case Slide - Medical Issues II
Saturday, June 3, 2017, 9:00 AM - 10:40 AM
Room: 402

3534 Chair: Holly J. Benjamin, FACSM. University of Chicago, Chicago, IL. (No relationships reported)

3535 Discussant: Sourav Poddar. University of Colorado Health Sciences Center, Denver, CO. (No relationships reported)

3536 Discussant: Natalie Voskanian. UCSD Sports Medicine, San Diego, CA. (No relationships reported)

3537 June 3 9:00 AM - 9:20 AM
Primary Amenorrhea and High Triad Risk: The Reluctant Runner
Andrea Kussman, Aurelia Nativ, FACSM. University of California Los Angeles, Santa Monica, CA. (Sponsor: Aurelia Nativ, FACSM)
Email: akussman@mednet.ucla.edu (No relationships reported)

History:
A 19 year-old collegiate runner presented to her pre-participation exam with primary amenorrhea and a high female athlete triad risk score placing her in the “no clearance” range for participation. She denied intentionally restricting her caloric intake, purging behaviors, or psychiatric disorders.

Physical Exam:

Differential Diagnosis:
Hypothalamic hypoestrogenic primary amenorrhea
Physiologic delay of puberty
Gonadal dysgenesis
Androgen insensitivity syndrome
Mullerian agenesis
PCOS
Isolated GnRH deficiency

Results:
-Total T3 61*
-Free T4 6.0
-LH 0.9*
-FSH 4.0*
-Estradiol <12*
-DHEA 1830
-TSH 0.57
-CMP normal
-Vitamin D 42
-Total testosterone 12
-Urine pregnancy test negative

DXA Z scores: total body 0.7, total hip 0.3, femoral 0.8, spine 0.3

*indicates abnormal

Final working diagnosis:
Female athlete triad with primary amenorrhea due to hypothalamic hypoestrogenism.

Treatment and Outcomes:
The athlete was provisionally cleared. Although very reluctant, with the support of her coach, she signed a contract which required her to meet at regular intervals with the team dietitian, physician, and psychologist, and included weekly weigh-ins. Goal and minimum weights were established, with lower weekly mileage permitted at lower body weight. She established care with a psychologist but did not engage during sessions and discontinued. Labs from the spring: estradiol <12, FSH 3.8, LH 0.9, BUN 23, AST 49, low T3, and normal prolactin, TSH, T4, and 17-alpha-OH progesterone. Transdermal hormonal treatment was considered to maintain BMD, but the patient refused. She sustained bilateral tibial stress reactions in May, 2016. She blamed her training to 30mi/week. Free T3 was 53.6 and total T3 was 59 suggesting ongoing low energy state. She remains provisionally cleared.

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

3538 June 3 9:20 AM - 9:40 AM
Proximal Muscle Weakness in 10-year-old Female Gymnast
Peter Waller, David Lessman, Philip Skiba. Advocate Lutheran General Hospital, Park Ridge, IL.
Email: pwaller189@gmail.com (No relationships reported)

History:
A 10-year-old gymnast initially presented with three weeks of right hamstring pain, and was started on a home exercise program. After 4 weeks without improvement, the patient was started on a program of formal physical therapy. After ten weeks of therapy, the patient began to develop core muscle weakness and right anterior hip pain, and reported an inability to walk more than a mile without limping. She went on to develop similar pain with stair climbing, as well as activities of daily living. Shortly thereafter, the patient began to complain of quadriceps weakness and thoracic back pain.

Physical Examination:

Differential Diagnosis:
1. Juvenile Dermatomyositis
2. Polymyositis
3. Viral myositis
4. Lupus Erythematosus

Tests and Results:
Labs: CPK: 524 H, AST: 75 H, ALT: 32 H, ESR: 18 wnl, Aldolase 11 H, CRP <0.3 wnl, LDH Total 317 H
X-Ray: 3V of bilateral hips-No acute fractures, subluxation, or dislocations.
MRL Pelvis: Diffuse intramuscular edema, predominantly involving gluteal muscles.
Consistent with myositis.

Final Working Diagnosis:
Juvenile Dermatomyositis

Treatment and Outcomes:
1. Patient admitted to outside hospital, and patient started on daily prednisone, weekly methylprednisolone, and hydroxychloroquine.
2. Patient started on IV methylprednisolone weekly, and monthly IVIG infusion by rheumatology
3. Evaluation at NIH Myositis Clinic. Recommended increasing IVIG dosing and pulse doses of IV steroid with every IVIG infusion.

3539 June 3 9:40 AM - 10:00 AM
Not All Headaches Are Concussion Related
Jennifer Oberstar. University of Minnesota, Minneapolis, MN. (Sponsor: Steven Stovitz, FACSM)
Email: ober0442@umn.edu (No relationships reported)

HISTORY: A 13-year-old soccer player was struck in the back of the head by a soccer ball. She was diagnosed with a concussion without loss of consciousness. Concussion symptoms improved over ten days, but mild headache and fatigue persisted. Her ImPACT scores were at or above baseline. She completed her soccer season. One month later, she began cross country and reported exertional headaches with running. The certified athletic trainer reduced her training to the point of exercise biking. Upon evaluation at the clinic for shortness of breath and abdominal pain, the patient was treated for exercise-induced asthma and constipation. She was started on an albuterol inhaler, polyethylene glycol, and ranitadine. At a three month follow-up, the patient was started on a home exercise program. After 4 weeks without improvement, she was referred back to the clinic due to continued exertional headaches. The patient believed that the patient was having concussion symptoms again due to the patient’s irritability, dizziness, nausea, and return of headaches upon pushing herself at a recent nordic ski meet. She was unable to get out of bed and appeared depressed.

Nine months post-concussion, neurosurgery was consulted for work-up of exertional headaches. She was later evaluated by psychiatry for anxiety.


DIFFERENTIAL DIAGNOSIS:
1. Post-concussion syndrome
2. Exertional headaches
3. Thyroid disease

TEST AND RESULTS:
T3 TOTAL: 106
T4 TOTAL: 4.6
THYROID STIMULATING HORMONE: 52.57
MRI/MA/DRV:
- Conspicuous enlargement of the adenohypophysis, concern for possible pituitary hyperplasia
- No vascular abnormalities detected

FINAL/WORKING DIAGNOSIS:
1. Hashimoto’s autoimmune thyroiditis with secondary pituitary enlargement
2. Depression and Anxiety

TREATMENT AND OUTCOMES:
1. Evaluated by pediatric neurosurgery, endocrinology, neurology, psychiatry.
2. Started on levothyroxine 50mg po daily for 3 months.
3. Three years later, the patient is enrolled in several AP courses and joined the robotics team.

3540  June 3 10:00 AM - 10:20 AM
Heat Illness- Running
José J. Correa, Anita M. Rivero-Brown, FACSMM, William F. Micheos, FACSMM. University of Puerto Rico School of Medicine, San Juan, Puerto Rico.
Email: jicorrea@coqui.net
(No relationships reported)

HISTORY: A 14 year-old highly competitive runner presented to our sports medicine clinics one week after collapsing during his first 10 km race in a hot and humid climate. His goal was to achieve a time similar to adult elite runners. He felt dizzy but did not want to slow down. At 8 km he was seen disoriented and stumbling and soon after collapsed. He was taken unconscious to a local ER, where IV hydration was given. After ~25 min he regained consciousness but was disoriented and irrational. He did not remember having collapsed or transport to the ER. After ~two hours he was alert and felt better, and was discharged. Upon arrival to his home he showered with cold water. He reported a mild sore throat the day before and leg pain after the race.

TEST AND RESULTS:
1. Syncope associated to dehydration
2. Syncope associated to hypoglycemia
3. Rhabdomyolysis
4. Syncope associated to exertional heat stroke

DIFFERENTIAL DIAGNOSIS:
1. Syncope associated to dehydration
2. Syncope associated to hypoglycemia
3. Rhabdomyolysis
4. Syncope associated to exertional heat stroke

PHYSICAL EXAMINATION:
Normal vital signs (BP: 116/68; HR: 68 bpm), alert, cold water. He reported a mild sore throat the day before and leg pain after the race.

3554  June 3 8:00 AM - 9:30 AM
Photographic Method for Measuring Body Composition by Level of Physical Activity Level in Adults
Email: akinsey@uab.edu
(No relationships reported)

Our laboratory has previously shown that photographic methods can be used to accurately measure body composition in adults. Given the limitations of the body mass index (BMI) for assessing obesity status across different levels of physical activity (PA), we wanted to test our method to see if there were any differences in the prediction of body fatness by level of PA in a diverse sample of women and men.

PURPOSE: To examine the performance of a photographic method to estimate body composition amongst adults that differ in PA status.

METHODS: Our sample consisted of 723 black and white adults (women: n= 309, age, 39.4 ±14.4 years, height 163.2 ± 6.1 cm, weight 74.5 ± 19.5 kg, BMI 27.9 ± 7.0 kg/m2; men: n= 414, age, 40.4 ±14.6 years, height 175.8 ± 6.9 cm, weight 84.7 ± 18.0 kg, BMI 27.4 ± 5.5 kg/m2). Self-reported PA level was classified as low, moderate or high. Body fat percentage was measured with dual energy x-ray absorptiometry (%BFDXA) and predicted with digital photographic methods (%BFPHOTO). The photographic method measures pixel volume and body shape to predict body volume. The regression model to predict %BFPHOTO included age, sex, race, BMI, body volume and body shape. Pearson correlations between %BFDXA and %BFPHOTO were calculated for each level of PA.

RESULTS:
There was a strong positive correlation between %BF_DXA and %BF_PHOTO for all levels of physical activity in black women (low, r = 0.89, p < 0.0001; moderate: r = 0.91, p < 0.0001; high: r = 0.86, p < 0.0001) and white women (low, r = 0.83, p = 0.0001; moderate: r = 0.82, p = 0.0001; high: r = 0.71, p = 0.0001). Similarly,
strong positive correlations between %BF and %BF_r, at all PA levels were observed in black men (low: r = 0.80, p<0.0001; mod: r = 0.84, p<0.0001; high: r = 0.79, p<0.0001) and white men (low: r = 0.85, p<0.0001; moderate: r = 0.80, p<0.0001; high: r = 0.70, p<0.0001).

CONCLUSIONS: The determination of body fat percentage from digital photographs was strongly correlated with DXA measurements in black and white men and women regardless of physical activity status. Photographic methods may be a viable, cost effective alternative for the assessment of body composition.

Supported by NIH Grant R01HL107916, T32DK062710, and P30DK056336

3556 Board #3 June 3 8:00 AM - 9:30 AM
Identifying Politically Motivated Medical Withdrawals From International Competition
Peter A. Harmer, FACSM. Willamette University, Salem, OR.
Email: pharmacist@willamette.edu
(No relationships reported)

The IOC and many international federations (IF) have clear regulations prohibiting participants in sanctioned events from refusing to compete against athletes from other countries for political, cultural or religious reasons. Failure to abide by these regulations can result in significant penalties for the offending athletes and their federations. However, being injured or ill provides plausible deniability for those committed to not competing for political purposes.

PURPOSE: To explore the use of quantitative analysis to uncover patterns of medical withdrawal from competitions that indicate systematic abuses of medical waivers for political purposes.

METHODS: Demographic information (number of participants, event, country) was compiled from the official entry and results lists of the Federation Internationale d’Escrime (FIE) for 1.5 competition seasons 2014-2016 for 3 countries (Iran (IRI), Kuwait (KUW), Saudi Arabia (KSA)) anecdotally reported to be systematically avoiding competition against Israel (ISR) by using medical withdrawals.

RESULTS: Athletes from the three countries had a total of 623 competition exposures during the observation period (IRI: 279 vs. other nations; 4 vs. ISR; KUW: 239 vs. other nations; 6 vs. ISR; KSA: 101 vs. other nations; 3 vs. ISR). For IRI there was 100% (279) participation against non-ISR opponents but 0% (0/4) participation against ISR athletes. KUW had 99% (233/235) participation against non-ISR athletes and 0% (0/6) against ISR. KSA had 100% (98/98) against non-ISR and 0% (0/3) for ISR.

CONCLUSIONS: Although it is not reasonable to determine the legitimacy of requests for medical withdrawal from competition on a case-by-case basis in instances where non-medical motivation may be involved, it is possible to identify systematic abuses of medical exemptions through data analyses. To reaffirm the integrity of sports competition and the independence of medical care, it is incumbent on the IOC and IFs to investigate suspicious cases involving entry and withdrawal data and to hold non-conforming nations accountable.

3557 Board #4 June 3 8:00 AM - 9:30 AM
Application of Environmental Sensors to a Military Combatives Training Environment
Tyler F. Rookee, Katie P. Logsdon, B. Joseph McEntire, Valeta Carol Chancy. U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL.
Email: tyler.f.rookee.civ@mail.mil
(No relationships reported)

Timely and accurate identification is important for effective concussion management and has implications for extended return-to-play/duty timelines. An environmental sensor (ES) for measuring head impact events is one method for timely identification of a potential concussion. Civilian ESs were used in the Modern Army Combatives Program (MACP). Each course has its own instructional requirements with varying levels of direct head impact or inertial loading possibilities, and protective equipment requirements. The training environment, drills and equipment limited the ES evaluated to specific form factors including: (1) adhesive-mounted and (2) headband or skullcap worn.

PURPOSE: Characterize ES performance in MACP.

METHODS: Students were instrumented with multiple ES types during combatives drills to record head impact events. Human factors and environmental issues were recorded. The students were videotaped during the drills to visually identify head and body impact events.

The drills were recorded from multiple views and all videos were time synchronized.

RESULTS: The ESs used were dependent on the drill type and the required protective equipment for the drill. During a Level 1 drill, the video analysis identified 26 to 41 impacts per student with the ES recording 30 to 35 impacts. Peak linear accelerations (PLA) for all students ranged from 4.9 to 162.1 G. One student, required to wear headgear, had a maximum linear acceleration of 67.3 G (compared to 162.1 and 117.5 G for students with no headgear). For the Level 2 drills, video analysis identified between 90 to 271 impacts per student per day with the ES recording 78 to 239 impacts per student per day. PLA ranged from 4.3 to 158 G. For the Level 3 drills, video analysis identified between 10 to 76 impacts per student per day with the ES recording 44 to 191 impacts. PLA ranged from 1.6 G to 220.6 G. Human factors issues identified included sensor mounting, stability, and the need for a properly sized skullcap. For skullcap/headband use, protective headgear was required to keep the cap in place.

CONCLUSION: Both form factors are usable, though not perfect, in the MACP; further development is required. The ES data variance shows that ESs cannot yet be used as a diagnostic standard for likelihood of concussion.

3558 Board #5 June 3 8:00 AM - 9:30 AM
Assessment Of The Relationship Between Body Composition And Bioavailability Of Diclofenac Sodium In Healthy Volunteers
Andrea Naves1, Valden Capistrano Júnior2, Maria Elisabete Amaral de Moraes1. 1IP Research Institute, São Paulo, Brazil. Federal University of Ceará, Ceará, Brazil.
(No relationships reported)

PURPOSE: The objective of this study was to evaluate the relationship between body composition and pharmacokinetics of diclofenac sodium formulation in healthy volunteers.

METHODS: This was a cross-sectional study. Twenty-four healthy subjects (age range: 18-42 years) received 50 mg of diclofenac sodium single oral dose. Hematologic and biochemical analysis and body composition (bioelectrical impedance method) were obtained before and after the administration of the study. The pharmacokinetics was evaluated by high performance liquid chromatography coupled to mass spectrometry. Relationships between pharmacokinetics and body composition were assessed with simple Pearson correlations. Student’s t-test was used for continuous variables and type I error was set at p<0.05.

RESULTS: There were significant inverse correlation between area under the concentration time curve from time 0 to 24h (AUC0-24) and lean mass (r=0.4917, p=0.0147), intracellular water (r=-0.4046, p=0.0312), extracellular water (r=-0.4964, p=0.0136) and basal metabolic rate (r=-0.5033, p=0.0122), between area under the concentration time curve from time 0 to infinity (AUC0inf) and lean mass (r=-0.4908, p=0.0149), intracellular water (r=-0.4401, p=0.0314), extracellular water (r=-0.4964, p=0.0122); between area under the concentration time curve from time 0 to 24h (AUC0-24) and lean mass (r=-0.4917, p=0.0147), intracellular water (r=-0.4406, p=0.0312), extracellular water (r=-0.4964, p=0.0122); between area under the concentration time curve from time 0 to infinity (AUC0inf) and lean mass (r=-0.4908, p=0.0149), intracellular water (r=-0.4401, p=0.0314), extracellular water (r=-0.4964, p=0.0122).
The U.S. Department of Health and Human Services (HHS) expects to issue a second edition of the Physical Activity Guidelines for Americans (PAG) in 2018 to provide updated evidence-based guidance on the types and amounts of physical activity that offer substantial health benefits. PURPOSE: To present the topics, priority questions, and research-related issues being reviewed by the 2018 Physical Activity Guidelines Advisory Committee (PAGAC) and to show how selected topics have evolved since 2008. METHODS: Seventeen nationally recognized experts were asked to review the current evidence regarding physical activity and health and provide a summary of their findings to the federal government to inform the update of the PAG. In July 2016, the PAGAC formed nine subcommittees corresponding to key topic areas to review in this process. The PAGAC has identified key research questions to be addressed through systematic reviews and will evaluate the evidence, ultimately submitting a Scientific Advisory Report to HHS. RESULTS: The subcommittees include: Aging, Brain Health, Cancer, Cardiometabolic Health and Weight Management, Exposure, Individuals with Chronic Conditions, Promotion of Physical Activity, Sedentary Behavior, and Youth. Similar to the 2008 PAGAC, some subcommittees will address specific health outcomes (e.g., What is the relationship between physical activity and cancer incidence?) or populations (e.g., What is the relationship between physical activity indicators and physical activity for children younger than six years old?). Other subcommittees will explore the health impact of differing exposures such as sedentary behavior or higher intensities of physical activity. Across the topic areas the PAGAC has identified several research-related issues that require particular attention (e.g., reconciling self-report and device-measured physical activity data). CONCLUSION: The PAGAC is charged with reviewing the available scientific evidence, considering public comments, and ultimately submitting a comprehensive scientific report to HHS. While clear topics and questions have been established, key research issues will need to be addressed during this process in order to produce a report that best informs public health guidelines.

### Table 1. PAGAC Subcommittees and Priority Areas

<table>
<thead>
<tr>
<th>Subcommittee Topic</th>
<th>Subcommittee Lead</th>
<th>Priority Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aging</td>
<td>Loretta DiPietro, PhD, MPH, FACSM</td>
<td>PA and risk of injury due to fall</td>
</tr>
<tr>
<td>Brain Health</td>
<td>Kirk Erickson, PhD</td>
<td>PA and brain function (cognition)</td>
</tr>
<tr>
<td>Cancer – Primary Prevention</td>
<td>Anne McTiernan, MD, PhD, FACSM</td>
<td>PA and cancer incidence</td>
</tr>
<tr>
<td>Cardiometabolic Health and Weight Management</td>
<td>John Jakicic, PhD</td>
<td>PA and weight gain prevention</td>
</tr>
<tr>
<td>Exposure</td>
<td>William Kraus, MD, FACSM</td>
<td>PA and all-cause and CVD mortality</td>
</tr>
<tr>
<td>Individuals with Chronic Conditions</td>
<td>David Buchner, MD, MPH, FACSM</td>
<td>PA and all-cause mortality in cancer survivors</td>
</tr>
<tr>
<td>Promotion of Physical Activity</td>
<td>Abby King, PhD</td>
<td>Effective PA interventions</td>
</tr>
<tr>
<td>Sedentary Behavior</td>
<td>Peter Katzenmary, PhD</td>
<td>Sedentary behavior and all-cause mortality</td>
</tr>
<tr>
<td>Youth</td>
<td>Russell Pate, PhD, FACSM</td>
<td>PA and health outcomes in youth under age 6</td>
</tr>
</tbody>
</table>

3561 Board #8 June 3 8:00 AM - 9:30 AM Updating The Physical Activity Guidelines For Americans: Priority Topics And Research-Related Issues

Emily Bhutiani1, Katrina Piercy2, Sarah Prowitt3, Richard Troiano1, Alison Vaux-Bjerke1. \(^1\)National Cancer Institute, Bethesda, MD. \(^2\)Office of Disease Prevention and Health Promotion, Rockville, MD. (Sponsor: Janet Fulton, FACSM) (No relationships reported)

The 2018 Physical Activity Guidelines Advisory Committee (PAGAC) will provide independent recommendations based on current scientific evidence to aid the federal government in the development of the second edition of the Physical Activity Guidelines for Americans (PAG). PURPOSE: To describe the analytic frameworks and systematic literature reviews used by the PAGAC to evaluate the science and develop evidence-based conclusions and recommendations for its Advisory Committee Scientific Report (Report). METHODS: The U.S. Department of Health and Human Services (HHS) contracted a systematic literature review to evaluate and synthesize published, peer-reviewed physical activity literature. The approach is designed to maximize transparency, minimize bias, and ensure systematic reviews are relevant, timely, and high quality. The PAGAC’s first task was to develop and prioritize research questions. The highest priority questions were those with potential for the greatest public health impact (Table 1). Each question will be evaluated using de novo systematic reviews, high-quality existing systematic reviews, meta-analyses, and reports, or a combination of approaches. RESULTS: The output from the literature review is an evidence portfolio summarizing the findings for each question. The Committee will grade each question as strong, moderate, limited, or grade not assignable. During a series of public meetings, subcommittees will review and deliberate on their conclusions, implications, and research recommendations in order to come to consensus. Analytic frameworks and search strategies for initial questions and information discussed during the first three public meetings will be presented. CONCLUSIONS: HHS will use the Report, along with agency and public comments, to develop the second edition of the PAG. This edition will provide updated science-based advice on how physical activity can help promote health and reduce the risk of chronic disease.
Promotion Of Nutrition Care By Australian Fitness Businesses: A Website Analysis

Katelyn Barnes, Lauren Ball, Ben Desbrow, Monzies Health Institute Queensland & Griffith University, Southport, Australia.
(Sponsor: Professor Louise Burke, FACSM)
Email: k.barnes@griffith.edu.au

(Purpose) Fitness professionals are well placed to simultaneously facilitate improvements in physical activity and dietary behaviours. However, concerns regarding the competence of fitness professionals to provide nutrition care have been raised. More than 85% of fitness professionals provide nutrition care beyond the recommended scope of practice. It is currently unclear if the provision of nutrition care beyond scope of practice is intentional, or if it arises as a consequence of discussions around lifestyle modification. The aim of this study was to investigate the intention of fitness professionals to provide nutrition care, by comparing the advertised nutrition content of fitness business websites and social media pages with a national scope of practice document for fitness professionals. Fitness businesses were targeted because advertisement of a service indicates that it would be provided, and advertisements may influence public expectations of fitness professional services. Methods Inductive content analysis of websites and social media sites was undertaken for 36 registered fitness businesses in Queensland, Australia. This review included 8 franchise fitness businesses with more than 400 sites each across Australia and was conducted from August to October, 2014. Advertisements were considered within scope if they referred to national nutrition guidelines or dietetic services, at risk of being beyond scope if they advertised services that were not clearly within the parameters of national nutrition guidelines, or beyond scope if they referred to nutrition care outside of the national nutrition guidelines. Results Of the businesses individually, 15% of the advertisements were within scope, 34% were at risk, and 51% were beyond scope. These included advertisements for diet planning and nutrition counselling, as well as food or nutrition claims, and recipe provision. Conclusions Many fitness businesses advertised nutrition care, provided by their staff members, which extended beyond the recommended scope of practice for fitness professionals. Strategies that support fitness professionals to provide nutrition care of value to clients, without extending beyond their scope of practice, are warranted.

Globalizing the ACSM Certified Personal Trainer Job Task Analysis: The Case Study of China

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No relationships reported

China relies on foreign vendors such as the American College of Sports Medicine (ACSM) certifications and related workshops to educate its exercise specialists. Purpose: Examine the relevancy of the current ACSM Job Task Analysis (JTA) for the Certified Personal Trainer (CPT) certification in China. Methods: Seventeen Chinese (including six females) and six Taiwanese (including two females) fitness professionals (age: 34.95±5.10 years) attended an ACSM CPT workshop in Shanghai, China in 2016. At the end of the workshop, U.S. presenters verbally read each JTA in English to the participants, and these were simultaneously translated verbally into Mandarin. The JTAs consist of knowledge and skills (N=191) covering four domains (D): Initial Client Consultation & Assessment (D1; N=58), Exercise Programming & Implementation (D2; N=53), Exercise Leadership & Client Education (D3; N=27), and Legal, Professional, Business & Marketing (D4; N=53). The participants were asked, "How relevant is the JTA in China?" on a scale of 1 to 3 (1: excellent, 2: somewhat relevant; 3: poor). Results: Response rate was 87%. 67% of the participants reported that the JTAs’ relevancy was excellent and 21% somewhat relevant. When individual JTAs were combined to represent their specific domain collectively, the frequency of a poor rating was 12% for D1, 5% for D2, 10% for D3, and 34% for D4. The JTAs that 48 JTAs were significantly (p<0.05) higher than the hypothesized score of 1. D4 and D1 contained the majority of these higher scores, 64% and 30% respectively (v. D2 and D3, around 10%). Specifically, the initial client consultation and interview for health appraisals, medical clearance, seeking client feedback for exercise enjoyment, dietary guidelines, liability, safety policies, professional attire, business models and plan, marketing materials and networking, copywriting, and client confidentiality were significantly different. Conclusions: This is the first time that the ACSM CPT JTAs are investigated abroad showing an impact on their relevance for a foreign country. The desire to create a set of international JTAs outside of the U.S. should be recommended by certified and culturally sensitive ACSM professionals. The new international JTAs should also be specific to the culture for the concerned region of the world.

Free Communication/Poster - Chronic Disease and Nutrition

Purposes: To determine the influence of lower limb ischemic preconditioning on glucose regulation in overweight and obese adults. Methods: Following initial screening, 10 men and women (age: 45 ± 4 years; body mass index: 30.4 ± 1.2 kg/m² (mean ± SE)) visited the laboratory on 2 separate and randomly ordered occasions, separated by a minimum of 14 days. Automated pressure cuffs were inflated/deflated on alternate legs to either 20 mmHg (control condition) or 200 mmHg (ischemic preconditioning), in five-minute intervals, for a total of 40 minutes (20 minutes per leg). 15 minutes post-treatment, subjects ingested 75g of glucose dissolved in 300 ml of water; circulating glucose and insulin concentrations were measured over 180 minutes. Results: Area under the glucose response curve was lower (P<0.026) after ischemic preconditioning compared with control (17,840 ± 521 vs. 17,095 ± 393). This favorable attenuation of the glucose response curve could not be attributed to a modified circulating insulin response (area under the insulin curve: 8356 ± 1807 vs. 7641 ± 1353; P=0.33). Conclusions: These preliminary data suggest that ischemic preconditioning may improve oral glucose tolerance in overweight and obese adults.

Effects of a Sedentary vs. Active Lifestyle on Blood Glucose Uptake

Joohec Im, Abby Bogner, Kaitlyn Brandt, Hector Raya, Ciara Stanley, William (Turi) Braun, FACSM. Shippensburg University, Shippensburg, PA. (Sponsor: William A. Braun, FACSM)
Email: joohecim@yahoo.com

No relationships reported

It is well known that obesity, led by sedentary lifestyle, increases the risk of developing cardiovascular and metabolic disorders. However, whether leading a sedentary lifestyle alone would independently increase the risk of developing these diseases is less clear. Purpose: To examine the effects of sedentary (SED) vs. active (ACT) lifestyles on blood glucose (BG) uptake at rest and post exercise to identify possible predisposition for metabolic and cardiovascular diseases in young adults. Methods: Seven SED (age 21.0 ± 0.6 years; height 164.8 ± 6.2 cm; weight 57.9 ± 8.5 kg; % body fat 16.7 ± 5.6%) and thirteen ACT (age 20.3 ± 1.0 years; height 173.3 ± 9.5 cm; weight 66.8 ± 7.6 kg; % body fat 13.0 ± 6.2%) individuals participated in the study. After obtaining baseline anthropometric measures, BG was monitored at 15 minute intervals under two separate conditions; resting (R) and after exercise (E). During E, subjects cycled for 30 minutes at 60% of their estimated VO2max. Before, during, and after E, subjects’ heart rate (HR), blood pressure (BP), and rate of perceived exertion (RPE) were measured. Each condition was separated by a minimum of 24 hours. A 2 x 2 ANOVA was performed to make comparisons between groups (SED vs. ACT) and conditions (R vs. E). Results: For the baseline measure, significantly higher resting HR was seen in SED when compared to ACT (SED 95.3 ± 13.9 vs ACT 79.9 ± 14.5 bpm, p<0.05). Furthermore, a trend of higher BG was shown in SED throughout the hour post exercise when compared to ACT. However, these differences were not significant (p>0.05). Interestingly, this trend of higher BG was shown during the E condition but not during the R condition. Conclusion: Sedentary lifestyle in young adults may lead to early alterations in cardiovascular function. Although the difference in glucose uptake between SED and ACT groups was less clear, adapting an active lifestyle should still be considered to promote an individual’s health and well-being.
The aging population has been increasing globally and raising significant concern. Research points out that the prevalence of malnutrition in community-dwelling elderly was 35% - 40%, and the risk of malnutrition of elderly living alone was 11.1 times more than non-solitary elderly. Malnutrition led to poor health, frailty, disability and death as well as other serious problems, which further reducing elderly’s quality of life and at the same time increasing healthcare costs.

**PURPOSE:** This study aimed to investigate muscle strength and self-care ability of elderly living alone with malnutrition status.

**METHODS:** A total of 229 elderly individuals age 65 and above (aged 78.93 ± 7.65 years) were recruited and divided into nutrition group (MNA ≥ 12, N = 126) and control group (MNA < 12, N = 103) based on their nutritional status by mini nutritional assessment short form (MNA:SF). Muscle strength and self-care ability were measured, including maximum grip force was measured by electronic grip equipment, activities of daily living (ADL) and instrumental activities of daily living (IADL).

**RESULTS:** The results showed 45% elderly living alone had malnutrition. Comparing to the nutrition group, the maximum grip strength, activities of daily living and instrumental activities of daily living for elderly living alone with malnutrition were decreased by 11% (t0.025 = 4.401, p < 0.000), 9% (t0.025 = 4.947, p < 0.000) and 23% (t0.025 = 5.822, p < 0.000), respectively.

**CONCLUSIONS:** Malnutrition may reduce muscle strength and self-care ability of elderly living alone, thus it is imperative to pay attention to their food intake and conduct periodical nutritional assessment in order to early intervene malnutrition. To establish of regular exercise habits, appropriate muscle strength training, increase muscle strength and activity function.

**RESULTS:**

A total of 229 elderly individuals age 65 and above (aged 78.93 ± 7.65 years) were recruited and divided into nutrition group (MNA ≥ 12, N = 126) and control group (MNA < 12, N = 103) based on their nutritional status by mini nutritional assessment short form (MNA-SF). Muscle strength and self-care ability were measured, including maximum grip force was measured by electronic grip equipment, activities of daily living (ADL) and instrumental activities of daily living (IADL).

**PURPOSE:** To examine the association between nutritional risk, physical function and PA in older adults.

**METHODS:** One hundred four participants (age= 71.0 yrs±7.7; BMI=33.1±7.9) completed questionnaires related to nutritional risk (SCREEN Nutritional Risk Questionnaire) for older adults, physical function (Physical Function Questionnaire, PFQ), and physical activity (PA, CHAMPS physical activity questionnaire). Additional physical function measures included: 1) timed up and go (TUG), which involved rising from a chair, walking three meters, returning to the chair and sitting down, 2) usual gait speed (UGS) over a six-meter distance, and 3) 6-minute walk (6MW). Spearman correlation coefficients were used to examine the association between nutritional risk and the different measures of physical function and PA.

**RESULTS:** In this population of community dwelling older adults, 34.4% were considered to be at risk of under nutrition. There was a significant association (p<0.05) between nutritional risk and PFQ (r=-.291), TUG (r=-.247 and UGS (r=-.263). There were also significant associations between PFQ and TUG (r=-.508), PFQ and UGS (r=-.630), and PFQ and 6MW (r=.524). There was not a significant association between nutritional risk and PA (p>0.05). There was a significant association (p<0.05) between nutritional risk and 6MW (r=.535) and PFQ and 6MW (r=.535).

**CONCLUSIONS:** These results suggest that risk of under nutrition is prevalent in older adults living in the community. In addition, risk of undernutrition is related to objective and subjective measures of physical function. Given the association between nutritional risk and mobility, community based exercise and PA programs for older adults designed to improve mobility and physical function should include screening for nutritional risk with appropriate follow-up.

**Purpose:** To establish of regular exercise habits, appropriate muscle strength training, increase muscle strength and activity function.

**Methods:** Accelerometry measured sedentary time was 99.8%, 93.7% and 84% for the SED, SED+2m and SED+5m conditions, respectively. SED+5m significantly decreased plasma glucose levels during the protocol compared to the SED condition as evidenced by a reduction in 120-min post-prandial glucose (PGP)-area under the curve (AUC) (15.9±8.8 mg/dL/min vs 22.5±13.1 mg/dL/min for SED+5m and SED respectively, p=0.031), and 180-min PPG AUC (13.2±7.8 mg/dL/min vs 20.8±13.9 mg/dL/min for SED+5m and SED respectively, p=0.006). SED+2m 60-min PPG AUC and 120-min PPG AUC values were 14.2±11.1 mg/dL/min and 13.2±7.8 mg/dL/min, respectively, but were not found to be significantly different from either the SED or SED+5m conditions.

**Conclusions:** Our findings show that 5 minutes of moderate intensity walking every 30 minutes (SED+5m) significantly decreased plasma glucose levels during the protocol compared to the SED condition as evidenced by a reduction in 120-min post-prandial glucose (PGP)-area under the curve (AUC) (15.9±8.8 mg/dL/min vs 22.5±13.1 mg/dL/min for SED+5m and SED respectively, p=0.031), and 180-min PPG AUC (13.2±7.8 mg/dL/min vs 20.8±13.9 mg/dL/min for SED+5m and SED respectively, p=0.006). SED+2m 60-min PPG AUC and 120-min PPG AUC values were 14.2±11.1 mg/dL/min and 13.2±7.8 mg/dL/min, respectively, but were not found to be significantly different from either the SED or SED+5m conditions.
CONCLUSIONS: In accordance with previous findings in adults and adolescents, one common factor is unlikely to define cardio-metabolic health in pre-adolescent children. Each of the factors, except waist (which was predominantly explained by AIX), are in agreement with previous findings in adolescents. An additional novel finding was that Hba1c and FBG loaded on to different factors, supporting previous work suggesting that FBG indicates short-term glycemic control whereas Hba1c reflects chronic glycemic control. Lastly, overweight-obese pre-adolescent children were found to have worse scores for the adiposity, blood pressure and vascular factors.

Daily heart rate (HR) is usually higher among HIV+ compared with HIV- adults, a possible aspect of chronotropic incompetence (CI) in this population. Low cardiorespiratory fitness (CRF) and metabolic syndrome (MetSyn) are prevalent among HIV+ adults, possibly influencing CI. However, information regarding 24-hr HR as an index of CI, and its association with CRF and MetSyn in this population is nonexistent. PURPOSE: To describe the association between CRF, MetSyn, and daily HR in a group of HIV+ and HIV- adults in Puerto Rico. METHODS: Eighty-Nine adults (59-HIV+ and 30 HIV-) completed measurements of CRF (VO2 peak), 24-hr blood pressure and HR, and metabolic syndrome (fasting glucose and lipid profile, resting BP, waist circumference). T-tests were used to detect differences between groups, and correlation analyses to evaluate associations between variables. RESULTS: The proportion of low CRF based on age and sex, and MetSyn was not different between HIV+ and HIV-participants (56 vs. 40%; and 53 vs. 37%; P=0.2, respectively). However, 24-hr HR, daytime HR, and night-time HR were all significantly higher in HIV+ compared with HIV- participants (73.9±9.4 vs. 67.4±8.4, 81.9±9.9 vs. 69.7±8.6, 70.7±9.4 vs. 62.7±9.0 bpm, respectively, P=0.005 for all). VO2 peak was inversely correlated with daily HR, daytime HR, and nighttime HR in both groups (ρ=-0.40, -0.36, -0.49, P<0.05 for all). Considering CRF classification in each group, all HR measures were significantly lower among those with high CRF vs. low CRF regardless of HIV status (HIV+: 24-hr HR by CRF: low= 81.1±8.2 vs. high= 74.8±9.7 bpm, P=0.009; daytime HR: low= 83.0±8.7 vs. high= 78.0±10.2 bpm, P=0.006; night-time HR: low= 72.8±8.7 vs. high= 68.0±9.8 bpm, P=0.02) (HIV-: 24-hr HR by CRF: low= 72.1±4.4 vs. high= 64.2±9.2 bpm, P=0.009; daytime HR: low= 74.1±4.9 vs. high= 66.8±8.4 bpm, P=0.02; night-time HR: low= 67.8±6.1 vs. high= 59.2±9.1 bpm, P=0.008). No HR differences were observed by MetSyn in the HIV+ group, but HR measures in the HIV- group were lower in those without MetSyn. CONCLUSION: The results suggest that CRF but not MetSyn, influence daily HR in HIV+ participants, with potential impact on CI correction. Intervention studies must be conducted to confirm these results. Supported by: NIH/CTSA KL2 RR024151, NIH/NIMHHD U54MD 007587-03.

In individuals with cardio-metabolic risk factors, meal timing in relation to exercise may be important for optimal metabolic control. The holistic approach of metabolic fingerprinting can provide new insights into metabolic changes due to stimuli such as exercise and meal consumption. PURPOSE: To investigate the effect of prior meal consumption on the serum metabolic fingerprint of exercise. METHODS: Eight overweight sedentary men participated in two trials: high-intensity interval exercise (HIIE) after the consumption of a standardized meal (postprandial exercise, PaEx) and HIIE in the fasted state (postabsorptive exercise, PaEx). Blood samples were collected before and immediately after exercise for targeted metabolic analysis by liquid chromatography-mass spectrometry (HILIC-UPLC-MS/MS). Data for the 45 identified serum metabolites were subjected to univariate and multivariate analysis. RESULTS: A two-way repeated measures ANOVA on peak areas revealed six metabolites with significant trial x time interaction: alanine (PpEx, 11 ± 10 % change from baseline vs PaEx, 39 ± 17 %; p = 0.04), betaine (PpEx, 4 ± 1 % vs PaEx, 1 ± 3 %).

The process of atherosclerosis is increasingly frequently initiating during preadolescence. The early onset of atherosclerosis has been linked to cardiometabolic complications, including obesity, which in turn are associated with deficient lifestyle behaviors. PURPOSE: Assess the associations between body fatness and lifestyle behaviors with cardiometabolic health in prepubescent children aged 8-10 years. METHODS: Three hundred ninety two children aged 8-10 years (195 male, 197 female; 9.5 ± 1.1y) were recruited from three regions across New Zealand. Body composition was evaluated using anthropometric measurements (waist: hip ratio) and bio-electrical impedance analysis (body fat %). Cardio-respiratory fitness was calculated using the 20-meter shuttle run. Physical activity and sedentary behavior was evaluated using the Youth Physical Activity Questionnaire. Nutritional behavior was evaluated using the New Zealand Adolescent food Frequency Questionnaire (processed food, fruit/vegetable consumption, breakfast foods). Quality of sleep was assessed using the Child Sleep Habits Questionnaire (duration, habits, social jet lag). Cardiometabolic health was gauged using pulse wave analysis to assess blood pressures (diastolic, systolic, central systolic) and arterial wave reflections (augmentation pressure), and finger prick procedures to evaluate fasting blood lipids (LDL, HDL, total cholesterol, triglycerides), glucose, and glycylated hemoglobin. RESULTS: The cardiometabolic variables were reduced to 4 factors using principle component analysis: (blood pressure, cholesterol, vascular, carbohydrate-metabolic). Following adjustment for co-founders, body fat % associated with blood pressure and vascular factors. Cardio-respiratory fitness and strength associated with CHO-Met, whereas sedentary associated with cholesterol and vascular factors. Processed foods associated with vascular, whereas fruit/veg associated with cholesterol. Social lag associated only with cholesterol. CONCLUSION: One common factor is unlikely to define cardiometabolic health in prepubescent children, and each of the underlying cardiometabolic health factors is associated with different lifestyle behaviors.
SUNDAY, JUNE 4, 2017

3574 Board #21 June 3 8:00 AM - 9:30 AM Lipid And Glucose Profiles Of Middle-aged Male Runners After 3-week High Fat-Low-carbohydrate Diet Ashton F. Waddell1, Yunsuk Koh2, Alexander J. Heatherley2, Lauren L. Keilen, Hunter S. Waldman3, Amanda Hollingsworth3, Eric K. Heigenhauser1. 1University of North Alabama, Florence, AL. 2Baylor University, Waco, TX. (Sponsor: James Matthew Green, FACSMS) (No relationships reported)

PURPOSE: High-fat very-low carbohydrate diets (HFLC) have become increasingly popular in the endurance community, but there is little data concerning the effects of HFLC on markers of cardiovascular disease risk. The aim of this study was to examine glucose and lipid marker responses following a prolonged HFLC diet.

METHODS: Eight middle-aged (39.5 ± 9.9 y), trained but non-elite (VO2 peak = 48.5 ± 4.5 ml/kg/min) runners (1.77 ± 0.08 m; 81.7 ± 7.0 kg; 19.3 ± 6% body fat) served as participants. Venous blood was drawn from an antecubital vein after an overnight fast with standardization of evening fluid intake on 4 occasions. During the first phase, runners simply consumed their habitual high carbohydrate diet (HC). Blood was collected around 0600 following ~48 h of restriction from any intense exercise. A 50-min run in the heat followed by a 5-km time trial was implemented following blood collection to induce significant heat and exercise stress. A fasted blood sample was acquired the subsequent morning to further delineate the influence of exercise stress. This protocol was repeated after 3 weeks during which time runners continued normal training but consumed <50 g of carbohydrate/day with 70% of daily calories derived from fat. RESULTS: Diet intervention approached (p = 0.07) but did not reach significance for glucose. Triacylglycerol did not differ between treatments (pre-exercise HC = 65 ± 17; HFLC = 67 ± 35 mg/dL) but decreased (p = 0.05) for both treatments 24-h after exercise (HC = 42 ± 16; HFLC = 35 ± 21 mg/dL). There was a main effect for diet on HDL-C (pre-exercise: HC = 48 ± 10 and 50 ± 11; post-exercise: HFLC = 57 ± 13 and 60 ± 13 mg/dL). There was also a main effect (p = 0.02) for diet on LDL-C with HFLC exceeding HC at both collection points by ~20 mg/dL. Total cholesterol was approximately 30 mg/dL higher for HFLC both before and 24-h after exercise (p = 0.05). There was no change in HDL-C in healthy counterparts. As compared to a HC diet, four days of a LCHF diet reduced hyperglycemia and improved some inflammatory markers in people with T2D. The addition of three daily post meal walks did not appear to further improve glycemic or inflammatory status.

Funding from Canadian Institutes of Health Research (MSH-141980) and Medtronic Diabetes.

3575 Board #22 June 3 8:00 AM - 9:30 AM Effects Of A Low-carbohydrate Diet And Walking Exercise On Inflammation In Type 2 Diabetes. Etienne Myette-Cote, Cody Durrer, Helena Neudorf, Jonathan P. Little. University of British Columbia Okanagan, Kelowna, BC, Canada. Email: myettect@ualberta.ca (No relationships reported)

Low-carbohydrate high-fat (LCHF) diets are regaining popularity for improving glucose control in patients with type 2 diabetes (T2D). However, largely based on studies in rodents and findings from cell culture models, concern still remains over the possible pro-inflammatory and cardiovascular risk consequences of consuming a diet high in fat. The well-recognized anti-inflammatory and cardioprotective properties of high fat-very low carbohydrate diets (HFLC) have become increasingly popular in the endurance community, but there is little data concerning the effects of HFLC on markers of cardiovascular disease risk. The aim of this study was to examine glucose and lipid marker responses following a prolonged HFLC diet.

METHODS: Eight middle-aged (39.5 ± 9.9 y), trained but non-elite (VO2 peak = 48.5 ± 4.5 ml/kg/min) runners (1.77 ± 0.08 m; 81.7 ± 7.0 kg; 19.3 ± 6% body fat) served as participants. Venous blood was drawn from an antecubital vein after an overnight fast with standardization of evening fluid intake on 4 occasions. During the first phase, runners simply consumed their habitual high carbohydrate diet (HC). Blood was collected around 0600 following ~48 h of restriction from any intense exercise. A 50-min run in the heat followed by a 5-km time trial was implemented following blood collection to induce significant heat and exercise stress. A fasted blood sample was acquired the subsequent morning to further delineate the influence of exercise stress. This protocol was repeated after 3 weeks during which time runners continued normal training but consumed <50 g of carbohydrate/day with ~70% of daily calories derived from fat. RESULTS: Diet intervention approached (p = 0.07) but did not reach significance for glucose. Triacylglycerol did not differ between treatments (pre-exercise HC = 65 ± 17; HFLC = 67 ± 35 mg/dL) but decreased (p = 0.05) for both treatments 24-h after exercise (HC = 42 ± 16; HFLC = 35 ± 21 mg/dL). There was a main effect for diet on HDL-C (pre-exercise: HC = 48 ± 10 and 50 ± 11; post-exercise: HFLC = 57 ± 13 and 60 ± 13 mg/dL). There was also a main effect (p = 0.02) for diet on LDL-C with HFLC exceeding HC at both collection points by ~20 mg/dL. Total cholesterol was approximately 30 mg/dL higher for HFLC both before and 24-h after exercise (p = 0.05). There was no change in HDL-C in healthy counterparts. As compared to a HC diet, four days of a LCHF diet reduced hyperglycemia and improved some inflammatory markers in people with T2D. The addition of three daily post meal walks did not appear to further improve glycemic or inflammatory status.

Funding from Canadian Institutes of Health Research (MSH-141980) and Medtronic Diabetes.

3576 Board #23 June 3 8:00 AM - 9:30 AM Subjective and Objective Measures of Physical Exertion in Adults With and Without Type 2 Diabetes Deirdre M. Rafferty, Rebecca L. Scalzo, Susanna Carter, Judith G. Regensteiner, Amy G. Hueschmann. University of Colorado, Aurora, CO. (No relationships reported)

PURPOSE: Regular exercise is a cornerstone of type 2 diabetes (T2D) management because it improves cardiovascular outcomes. However, greater perceived effort at low absolute work rates remains a barrier to exercise for people with T2D. In turn, disparities in perceived effort are linked to poor adherence to regular exercise. It remains unknown if the link between T2D status and greater perceived effort is due to lower peak oxygen consumption levels (VO2peak). We hypothesized that exercise effort would be greater in people with T2D at relative work rates below the anaerobic threshold (AT), as compared to healthy counterparts. As T2D impacts VO2peak more profoundly in women than men, we also hypothesized that sex would modify the association between T2D and exercise effort.

METHODS: During assessment of VO2peak we measured objective (heart rate (HR)) and subjective exercise effort (Borg Rating of Perceived Exertion (RPE)) every 1 and 2 minutes, respectively. AT was identified by V-slope method. Group differences in RPE and HR were determined at 15%, 25% and 35% of VO2peak.

RESULTS: We analyzed data from 112 previous adult participants in our laboratory (Table). As compared to nondiabetic participants, we found greater effort (Table) at 25% VO2peak (HR) and at 35% VO2peak (RPE). We found no sex differences in the association between T2D and effort.

Table. Comparisons Of Exercise Effort At Relative Work Rates In Adults With and Without T2D

<table>
<thead>
<tr>
<th></th>
<th>Healthy men and premenopausal women (n = 55)</th>
<th>Men and premenopausal women with T2D (n = 57)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>0.71</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>24.6 (3.5)</td>
<td>27.2 (4.3)</td>
<td>0.13</td>
</tr>
<tr>
<td>VO2peak (ml/kg/min)</td>
<td>24.5 (6.4)</td>
<td>20.7 (4.5)</td>
<td>0.02*</td>
</tr>
<tr>
<td>Peak RER</td>
<td>1.22 (0.08)</td>
<td>1.21 (0.08)</td>
<td>0.16</td>
</tr>
<tr>
<td>RPE at 15% VO2peak</td>
<td>8.1 (1.5)</td>
<td>8.6 (1.7)</td>
<td>0.24</td>
</tr>
<tr>
<td>RPE at 25% VO2peak</td>
<td>9.3 (1.5)</td>
<td>9.3 (2.0)</td>
<td>0.92</td>
</tr>
<tr>
<td>RPE at 35% VO2peak</td>
<td>10.2 (1.5)</td>
<td>10.9 (1.6)</td>
<td>0.69</td>
</tr>
<tr>
<td>HR at 15% VO2peak</td>
<td>89.1 (11.5)</td>
<td>91.5 (9.5)</td>
<td>0.13</td>
</tr>
<tr>
<td>HR at 25% VO2peak</td>
<td>93.2 (9.3)</td>
<td>96.8 (10.0)</td>
<td>0.02*</td>
</tr>
<tr>
<td>HR at 35% VO2peak</td>
<td>101.4 (10.9)</td>
<td>104.2 (10.7)</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Data presented as mean (standard deviation); *p < 0.05; Abbreviations: BMI, Body Mass Index; VO2peak, Peak oxygen utilization; RER, Respiratory Exchange Ratio; RPE, Rating of Perceived Exertion; HR, Heart rate.

CONCLUSION: T2D status conferred greater objective and subjective exercise effort at some but not all relative work rates below AT in T2D compared to nondiabetic adults. Counter to our hypothesis, there were no sex differences in the association between T2D and effort. Contradictions with our prior studies showing higher exercise effort for participants with T2D may be explained by differences in exercise test protocols and the use of relative work rates. Future research should assess if T2D status influences exercise effort during relative work rates of longer duration. Supported by ADA grants 7-02-CR-25, 1-08-CR-52, 1-12-CT-64
RESULTS: Females fasting glucose (92.5±27.3 mg/dl), A1C levels (5.74±0.92%), as well as BMI (32.72±9.060) and males fasting glucose (96.25±27.52 mg/dl), A1C levels (5.77±1.050%), and BMI (32.41±9.302%) were below the blood biomarker levels that define diabetes. However, students showed risk for prediabetes at this young age according to the 2015 ADA prediabetes A1C criteria (5.7-6.4%). The A1C levels across colleges ranged between 5.6% College of Health Affairs (COHA), 5.62 College of Sciences (COS), 5.7% College of Education (COE), 5.71% College of Business and Entrepreneurship (COBE), 5.8% College of Liberal Arts (COLA), 6.0% College of Fine Arts (COFA), and 6.1% College of Engineering and Computer Science (COECS). Females showed a greater prevalence in prediabetic A1C levels at 40.13% with a mean of 5.744, while males exhibited 27.94% at an average of 5.772. The t-test assessment concluded that no statistically significant differences (p<0.05) in fasting glucose levels (p=0.36), A1C levels (p=0.9), and BMI (p=0.81) between genders were found.

CONCLUSIONS: This research targets a young population where early intervention would be most effective. Results indicated that 5 out of the 7 colleges were prediabetic according to the A1C levels. Moreover, the gender comparison in prevalence proposed that females were at a greater risk for prediabetes and diabetes than males. These findings suggest that surveillance and education is recommended for the prevention of chronic metabolic conditions in college-aged students at a Hispanic-serving institution.

Mice fed a high fat diet exhibit signs of neuropathy including mechanical hindpaw hypersensitivity and neuronal inflammation, suggesting high fat diet-induced inflammation may play a role in the development of neuropathy. Omega-3 (n-3) fatty acids have anti-inflammatory properties and may hold therapeutic potential as a preventative treatment for prediabetic and diabetic patients at risk for neuropathy. PURPOSE: Investigate the impact of diet composition on signs of neuropathy. We hypothesized that a diet rich in n-3 fatty acids would attenuate hindpaw hypersensitivity during prolonged feeding of a high fat diet. METHODS: C57BL/6 mice were randomized into four diet groups (n = 12/group) for 32 weeks: 10% low fat-fish oil (LFFO), 41% high fat-fish oil (HFFO), 10% low fat-lard (LFL), or 41% high fat-lard (HFL). Neuropathy was characterized at baseline and every other week thereafter using the von Frey behavioral test for hindpaw mechanical sensitivity.

A glucose tolerance test was performed at end study, and total area under the curve (AUC) was calculated using the trapezoidal method. RESULTS: At end study, body weight was greater in HFL compared to all other groups. Body weight was also greater in HFFO compared to LFFO. Fasting glucose and glucose AUC were higher in HFL compared to LFFO and HFFO. Following the same pattern as body weight, fasting glucose was higher in HFFO compared to LFFO. Although percent paw withdrawal was greater in HFL compared to HFFO and LFFO, there were no significant differences for LF vs. HF for fish oil or lard.

Weight (g) 34.3 ± 0.6 39.5 ± 1.6 a 37.2 ± 1.1 44.3 ± 1.7 abc
Fasting glucose (mg/dl) 129.1 ± 5.6 152.0 ± 7.7 a 148.1 ± 5.2 158.8 ± 8.8
Glucose AUC total (mg·h/120 min) 5368.1 ± 678.9 7282.6 ± 1144.4 7384.3 ± 685.4 9149.6 ± 1013.8
Percent paw withdrawal (%) 22.5 ± 4.5 29.2 ± 6.4 37.5 ± 7.2 54.2 ± 5.7 abc

P < 0.05 vs. LFFO; *P < 0.05 vs. HFFO; and **P < 0.05 vs. LFL

CONCLUSION: A HFL diet induced signs of neuropathy including hindpaw hypersensitivity, whereas a fish oil diet was protective against hindpaw hypersensitivity. Moreover, omega-3 fatty acids may hold therapeutic potential for neuropathy prevention in nondiabetic and diabetic patients. Supported by NIH R21NS090282-01

Osteoporosis and its associated comorbidities remain the pivotal public health concern of the 21st century. One interest in the development of insulin resistance is the degeneration and dysfunction of skeletal muscle mitochondria. PGC-1α1, the principal regulator of mitochondrial biogenesis has been proposed as a possible therapeutic target to alleviate lipid overload-induced mitochondrial dysfunction. Yet current data remain controversial on the efficacy of artificially promoting PGC-1α1 as a therapeutic modality. PURPOSE: The purpose of this study was to investigate the efficacy of genetic overexpression of PGC-1α1 alone and in combination with physical activity as a therapeutic agent during lipid overload. METHODS: wild type (WT, –/–) mice and mice with muscle-specific overexpression of PGC-1α1 (MCK-PGC-1α, –/–) were given Western Diet (WD) at 8 weeks of age and allowed to consume food ad libitum throughout the course of the study. At 12 weeks of age, animals were further divided into sedentary (SED) and physical activity (voluntary wheel running [VWR]) interventions. At ages 7-11, and 15 wks animals underwent glucose tolerance tests (GTT). At 16 wks of age animals were humanely euthanized and tissues collected for analysis. Results were analyzed by 2X2X3 repeated measures ANOVA with an α=0.05. RESULTS: MCK-PGC-1α1 animals were lighter and had less epididymal fat compared to WT (~6% and ~28% respectively). Food efficiency (weight gained:food consumed) was ~17% lower in MCK-PGC-1α1 animals. While there was no difference at 7 wks age, at 11 wks age MCK-PGC-1α1 had ~50% greater GIT integrated area under the curve (IAUC) compared to WT. Yet at 15 wks, VWR had 30% lower IAUC compared to SED, regardless of genotype. MCK-PGC-1α1 +VWR ran ~3X more per day compared to WT-VWR. Correlations for wheel running distance per day v. IAUC, body weight, and epididymal fat were significant and moderately strong (r=0.67-0.71) for WT-VWR, but in MCK-PGC-1α1 there was no correlation between these variables and wheel running distance per day (r=-0.10-0.20). CONCLUSION: These results suggest increasing PGC-1α1 promotes exercise-induced adaptations regardless of exercise volume, but overexpression of PGC-1α1 during lipid overload without physical activity does not mitigate insulin resistance and may in fact exacerbate the condition.

Improvements in glucose tolerance and insulin action with aerobic exercise may be the result of increased glucose utilization and/or more complete oxidation of intramuscular triglycerides. PURPOSE: To investigate the effect of acute aerobic exercise at an intensity that maximizes the rate of fat oxidation (FM) on glucose tolerance, insulin action, and metabolic flexibility (MF) compared to acute aerobic exercise at lactate threshold (LT) resulting in greater carbohydrate (CHO) oxidation. METHODS:
Physical activity is important for blood glucose management in people with Type 2 diabetes (T2D). Little research has explored the relationship between sedentary behaviour and mean glucose and glucose variability in people with T2D using objective and continuous measurements.

**Aims:** To explore the relationship between sedentary bout duration and mean glucose and glucose variability in people with T2D using objective continuous measurement.

**Methods:** 16 participants with T2D managed with diet, Metformin or DPP4 inhibitors were recruited (mean age 46.1±10.9 yr & BMI 29.5±4.7 kg/m²). Participants completed a demographic questionnaire and wore an activPAL accelerometer and FreeStyle Libre continuous glucose monitor for 3-14 days whilst documenting sleep, food, and medication. Average proportion of time spent sitting/lying, during the waking day were calculated. Bouts of wake time sedentary behaviour were identified and defined as a period of at least 30 minutes continuous, uninterrupted sitting/lying during the waking day. Correlation analysis was conducted to investigate the relationships between sedentary bout duration and mean glucose, glucose range and glucose coefficient of variation.

**Results:** On average, participants spent 65% of their day sitting/lying, 76% of sedentary bouts were ≥30minutes and 29% of bouts were ≥60minutes. Mean glucose was negatively (r = -0.08, p < 0.01) associated with sedentary bout duration. Glucose range (r = 0.07, p < 0.01) and glucose coefficient of variation (r = 0.26, p < 0.001) both positively correlated with sedentary bout duration. Participants characterised such as age, gender and BMI appear to influence the relationship between sedentary bout duration and glucose response.

**Conclusions:** Results indicate increased sedentary time leads to improved mean glucose and increased glucose variability.

**Board #30**

**June 3 8:00 AM - 9:30 AM**

**Exercise Prescription in Type 1 Diabetes: Should We Use Percentages of Maximum Heart Rate?**

Othmar Moser1, Alexander Mueller2, Gerhard Tschakert2, Gerd Koehler3, Jimmy B. Lawrence4, Werner Groeschl2, Thomas R. Pieber1, Richard M. Bracken1, Peter Hofmann, FACSFM, Swansea University, Swansea, United Kingdom. 1University of Graz, Graz, Austria. 2Medical University of Graz, Graz, Austria. 3University of Potsdam, Potsdam, Germany. 4University of Potsdam, Germany. (No relationships reported)

**Aims:** To determine the exercise intensity given as percentages of HRmax in T1D patients versus healthy controls (nT1D) related to the degree and direction of the HR performance curve (HRPC).

**Methods:** Eight male T1D patients (25 ± 5 yrs, BMI: 24 ± 2 kg/m², HbA1c: 7 ± 3.6%, duration of diabetes: 15 ± 9 yrs) and eight male nT1D (26 ± 5 yrs, BMI: 23 ± 2 kg/m²) performed an incremental exercise test (IET) until exhaustion (start 40 W; increase 20 W/min). nT1D were matched for age and maximum power output (Pmax), respectively. The first and the second lactate turn points (LTP1, LTP2), as well as the direction and degree of the time course of HRPC (kD), were determined form IET and compared to 50% and 70% of HRmax (kS, Pmax power output (P) and HR at LTP were compared between groups in relation to 50% and 70% of HRmax. Group differences were calculated by an ANOVA with post-hoc testing, p<0.05.

**Results:** No significant differences were found between both groups for HRmax and Pmax (p>0.05). HR at LTP vs. 50%HRmax and 70%HRmax were significantly different for both groups, except for the nT1D group at 70%HRmax. P at 50%HRmax was significantly lower than at LTP, in both groups; at 70%HRmax P was significantly higher only in T1D (p<0.05). Significant differences for P between both groups were only found at 70%HRmax (133 ± 17 W vs. 91 ± 38 W, p<0.05). 50%HRmax was as low as resting conditions (0 W) in 38% of the T1D group and 50% of the nT1D kD was lower in T1D (0.21 ± 0.30 vs. 0.39 ± 0.27) but the difference was not statistically significant (p>0.05).

**Conclusion:** 50%HRmax is clearly too low to induce any training effects even when exercising 150min/week. A lower kD for the acute HR response in T1D patients indicates a reduced β1-receptor sensitivity, which needs to be respected for the calculation of target exercise intensities.

**Board #31**

**June 3 8:00 AM - 9:30 AM**

**Metabolic Changes After Two Different Exercise Programs in Sedentary Type 2 Diabetic Patients.**

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**Purpose:** The prevalence of type 2 diabetes mellitus (T2DM) is increasing worldwide and exercise has been shown to be a key component in the prevention of this disease. However, there is limited information comparing metabolic control in T2DM patients after high intensity interval training (HIIT). The purpose of this study was to compare body composition and metabolic changes following 16 weeks of continuous aerobic training (AT) or HIIT in T2DM patients.
**Methods:** Twenty-four sedentary T2DM patients (age: 46 ± 6 years, body mass index (BMI): 30 ± 5.5 kg/m², glycated hemoglobin (HbA1C) 6.3 ± 0.9%) were included in this study. Maximal heart rate (HRmax) and oxygen consumption (VO2peak) were measured before and after the interventions. Participants were then randomly allocated to AT (3 times/week, 60 minutes, at 70% HRmax) or HIIT (3 times/week, 10 × 1:1 work-to-rest ratio, at ~85% HRmax) on a cycle ergometer. Anthropometrics, blood pressure, and metabolic markers (plasma glucose, HbA1c, total cholesterol, triglycerides and HDL) were obtained before and after the interventions. Data are presented as means ± SD. Statistical analysis included repeated ANOVA with LSD post-hoc analysis.

**Results:** No significant differences were observed between groups at baseline. Following the interventions, both groups decreased BMI (0.9 ± 0.7 kg/m², P < 0.04 vs. 0.03 ± 0.7 kg/m², P > 0.01), waist circumference (-0.4 ± 0.7 vs. 2.3 ± 4.8, P < 0.01 for both) and increased VO2peak (7.65 ± 3.2 vs. 6.51 ± 2.16, P < 0.01 for both). Although glucose significantly decreased in the HIIT group (-28 ± 46 g/m² vs. -2.9 ± 2.6 g/m², P < 0.001 for both) and increased VO2max (7.65 ± 3.2 vs. 6.51 ± 3.6, P < 0.001 for both), no significant differences were observed compared to the no change in the AT group.

**Conclusions:** Metabolic fitness, aerobic fitness and measures of central adiposity were similarly improved in both groups following 16 weeks. Therefore, HIIT is an efficient alternative to continuous aerobic training for diabetic patients who enjoy high intensity training.

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**Table 1. Clinical, anthropometric and metabolic characteristics**

| Age (yr) | BMI (kg/m²) | SBP (mmHg) | DBP (mmHg) | HR (%) | HDL (mg/dL) | VMax2 (%) | RBC (×10⁹/L) | Glucose (mg/dL) | Fasting (mg/dL) | TrKα (fibers/mm) | IENFD (fibers/mm) | IL-1α (pg/mg) | IL-5 (pg/mg) | IL-6 (pg/mg) | IL-13 (pg/mg) |
|----------|-------------|------------|------------|--------|-------------|-----------|-------------|---------------|---------------|----------------|----------------|--------------|--------------|--------------|--------------|--------------|
| BASELINE | 56.8 ± 10.3 | 123.8 ± 14.1 | 71.5 ± 10.3 | 45.4 ± 7.5 | 90.6 ± 9.4 | 314.1 ± 16.0 | 158.6 ± 600 | 112.3 ± 33.4 | 142.2 ± 50.8 | 140.6 ± 40.5 | 39.4 ± 1.2 | 4.8 ± 1.3 | 5.8 ± 0.7 | 4.5 ± 1.0 |
| FINAL    | 48.5 ± 10.3 | 112.9 ± 10.2 | 69.7 ± 7.5 | 43.4 ± 6.1 | 90.6 ± 9.4 | 314.1 ± 16.0 | 158.6 ± 600 | 112.3 ± 33.4 | 142.2 ± 50.8 | 140.6 ± 40.5 | 39.4 ± 1.2 | 4.8 ± 1.3 | 5.8 ± 0.7 | 4.5 ± 1.0 |
| P        | < 0.001     | < 0.001    | < 0.001    | < 0.001  | < 0.001     | < 0.001    | < 0.001     | < 0.001       | < 0.001       | < 0.001       | < 0.001       | < 0.001      | < 0.001      | < 0.001      |

**Association Between Whole-body Vo2peak And Skeletal Muscle Mitochondrial Respiration In Adults At Risk Of Diabetes**

**PURPOSE:** To determine if neuronal inflammation is a potential initiating mechanism for the development of mechanical hypersensitivity and nerve fiber changes (signs of neuropathy) in high fat fed mice. **METHODS:** Male C57Bl/6 mice were randomized to a standard (Std, 15% kcal from fat) or high fat diet (HF, 54% kcal from fat) for 2, 4, or 8 weeks (n = 11-12 per group). Lumbar dorsal root ganglia were harvested and immunofluorescent immunolabeled (IL-1α, IL-1β, IL-2, IL-6, IL-10, IL-17, MCP-1, IFN-γ, TNF-α, MIP-1α, GM-CSF, RANTES) were quantified using a Multiplate ELISA and normalized to total protein. Neuronal inflammation was characterized by the von Frey test for mechanical sensitivity at wk 0 and every other week thereafter. Hindpaw-plant skin was harvested at end study and used to quantify intradermal nerve fiber density (iNFD) and pain-sensing (TrKα) nerve fibers via immunohistochemistry. **RESULTS:** After 8 wks, HF had greater bodyweight (33.1 ± 10.2 vs. 26.7 ± 9.5 g, P < 0.001), fasting glucose (160.3 ± 94 vs. 138.5 ± 34 mg/dL, P < 0.04) and insulin (3.58 ± 0.4 vs. 0.82 ± 0.14 μg/L, P < 0.001) compared to Std. IL-1α and IL-1β were higher in HF compared to Std after 2 wks and 4 wks, respectively (IL-1α: 4.8 ± 1.1 vs. 0.66 mg/mg, P < 0.05; IL-5: 5.8 ± 0.7 vs. 3.1 ± 0.5 mg/mg, P < 0.05). There were no significant differences in hindpaw sensitivity for Std vs. HF at any time point. **CONCLUSION:** Increased inflammatory mediators preceded and accompanied an increase in a specific population of pain sensing nerve fibers (TrKα) in the hindpaw footprint of high fat fed mice. Diet high in fat may increase neuronal inflammation and initiate nerve fiber changes responsible for painful neuropathy in nondiabetic and diabetic individuals.

Supported by SIU Seed Grants for Transitional and Exploratory Projects
Non-alcoholic steatohepatitis (NASH) is characterized as a dysregulation of hepatic lipid metabolism and a chronic inflammatory state. It is hypothesized the link between lipid dysregulation and inflammation may be due in part to defective hepatic autophagy and reduced mitochondrial capacity to oxidize fatty acids. It remains to be determined, however, if a Western diet on hepatic autophagy and mitochondrial function during aging. PURPOSE: The purpose of this study was to determine the effect of a high-fat-high-fructose diet (HFF) on markers of hepatic autophagy and mitochondrial function in an age-accelerated mouse model. METHODS: Twenty-week old, male and female, SAM8 mice (n=49) were randomly assigned, matching for gender, to either a standard chow (SC) or HFF (45% fat, 24% fructose) diet for 32 weeks. Liver tissue was analyzed for mRNA expression of autophagic (BNIP3, Beclin 1, p62, and Atg7) and mitochondrial (PGC-1α and COX-IV) genes. Differences between gender and dietary groups were identified by a 2 x 2 ANOVA and statistical significance was set at p<0.05. RESULTS: Following 32 weeks of feeding, male mice fed the HFF diet were significantly heavier than male mice in the SC group (31.6 g vs 26.5 g, p<0.001), however, no difference was observed between diet groups for female mice. The HFF diet resulted in higher autophagic activity as observed by Beclin 1 (+36%; p<0.001) and BNIP3 (+40%; P=0.003) expression. Despite the higher autophagic activity, p62 was higher (+31%; p=0.001) in the HFF compared to the SC group, suggesting impaired autophagic flux. In addition, mitochondrial COX-IV expression was elevated (+45%; P<0.001) in the HFF group compared to the SC group suggesting increased β-oxidation. Overall, the expression of all autophagic and mitochondrial markers was higher in male compared to female mice; however, both sexes responded similarly to the HFF diet. CONCLUSION: Despite the higher expression of autophagic and mitochondrial genes, elevated expression of p62 suggests an impaired autophagic flux in age-accelerated mice following a Western diet.

Non-alcoholic steatohepatitis (NASH), defined as excess hepatic lipid and chronic inflammation, provides an environment prone for the development of hepatic fibrosis. Recent evidence suggests that the antifibrotic protein BAMBI (BMP-Activin membrane bound inhibitor) is downregulated in the presence of inflammation, and may provide anti-fibrotic effects; however, the effects of ω-3 fatty acids on hepatic fibrosis are not well-established. PURPOSE: To determine the effect of fish-oils on the hepatic fibrosis signaling cascade, following 32-weeks of high-fat feeding in a LPS-induced model of NASH. METHODS: Male C57BL/6 mice were randomly assigned to two diets for 32 weeks (n=9/group): low-fat lard based (LFL, 10% kcal fat), low-fat fish-oil based (LFFO, 10% kcal fat), high-fat lard based (HFL, 41% kcal fat), or high-fat fish-oil based (HFFO, 41% kcal fat). Following 8 x LPS stimulation, liver mRNA expression of CD14, TLR4, MyD88, BAMBI, and TGF-β1 was quantitated using quantitative RT-PCR. Differences between diets were identified using a one-way ANOVA with statistical significance set at p<0.05. RESULTS: Following LPS stimulation, CD14 was increased 2.5 fold (p=0.020) in HFFO compared to HFL. Despite the increase in CD14, TLR4 showed no difference between groups. In contrast, MyD88 was 2.8 fold greater (+p<0.001) in HFFO compared to HFFO. In comparison to untreated tissue, BAMBI was 1.7 fold (p=0.017) higher in the HFFO LPS-stimulated tissue, which best explained the 1-fold (p=0.004) lower expression of TGF-β1 in HFFO when compared to HFL post-LPS stimulation. CONCLUSION: Despite the increase in extracellular LPS signaling receptor CD14, the consumption of fish-oils produced a protective intracellular response as observed by an increase in BAMBI and decrease in TGF-β1. These results suggest that a diet high in ω-3 fatty acids may protect against the development of hepatic fibrosis.
is the main source of circulating Asprosin - a newly identified protein hormone encoded by PBN1. It triggers hepatic glucose release into the bloodstream in order to maintain hemal energy standards between meals and is suggested to serve as target battling obesity and T2D. In obese male individuals plasma Asprosin levels were found to be increased twofold and in male Ob/Ob-mice, the Fbn1 mRNA expression was also elevated in skeletal muscle compared to non-obese animals (Romero et al. Cell 2016).

PURPOSE: To estimate the basal Asprosin secretion in obese women and (ii) to analyze the changes in Asprosin response after an acute bout of high intensity exercise in obese versus non-obese subjects. METHODS: 12 highly obese women (age 47.1±14.2; BMI 47.3±12.7) and 6 men (age 53.7±7.5; BMI 46.3±12.0) were matched to age and sex adjusted controls (age 46.1±13.6; BMI 21.6±6.2; age 52.3±5.0; BMI 23.8±1.5) and their resting serum Asprosin levels were analyzed using the human Asprosin ELISA kit from Wuhan ELAB Science, PR China. To evaluate Asprosin response to an exhaustive bout of exercise 14 obese individuals (10 women and 4 men) underwent an adapted treadmill protocol at individually adjusted speeds between 2 and 4.9 km/h constantly with increasing slopes, finishing >85% of their age-dependent maximal HR. Normal weight recreational athletes, 8 females (age 26.4±5.4; La max 9.0±1.8; HR max 193.0±12.3) serving meals and is suggested to serve as target battling obesity and T2D. In obese male individuals plasma Asprosin levels were found to be increased twofold and in male Ob/Ob-mice, the Fbn1 mRNA expression was also elevated in skeletal muscle compared to non-obese animals (Romero et al. Cell 2016).

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REFERENCES:
of 10 weeks of two isocaloric training programs; moderate-intensity endurance (END) (70%) of maximal running capacity (MRC) or high intensity interval training (HIIT) (50-90% of MRC), in a mouse model of diet-induced obesity.

**METHODS:** Ten week-old male C57BL/6 mice were fed a high fat diet (HFD) (45% kcal from fat) *ab libitum*, and simultaneously underwent END or HIIT (3x40min sessions/week). Untrained HFD and chow-fed mice acted as controls. After 10 weeks mice were euthanased and *quadriceps* muscle was extracted for analysis.

**RESULTS:** END and HIIT, each with HFD, showed similar prevention in body weight (BW) gain (p<.05) (HFD=45±2g; END=37±2g; HIIT=36±2g), preserved fat-free mass (5°FFM) (HFD=58±3; END=72±6; HIIT=72±7), and improved insulin sensitivity (blood glucose AUC) during an insulin tolerance test (0.65 IU/kg BW) (HFD=411±54; END=350±57; HIIT=320±66 A.U.). HFD induced decreases in grip strength (N) were prevented by END and HIIT similarly (HF D=1.42±0.06; END=1.53±0.10; HIIT=1.51±0.17; p<.05). Aerobic performance (treadmill progressive test) was higher in END and HIIT groups compared to untrained HFD, with END being superior to HIIT (2.8±0.5 and 2.6±0.3 fold-change respectively; p<.05). Fasting hyperglycaemia and hyperinsulinaemia found in HFD untrained mice (each p<.05 vs controls) were each partially prevented by END. The higher collagen deposition found in HFD untrained mice, was not prevented by END nor HIIT. However, decreased collagen (-45% of controls; p<.05) and increased collagen-II (-2-fold controls; p<.05) seen in HFD untrained mice was prevented by both END and HIIT. Only END increased skeletal muscle adiponectin mRNA (14-fold; p<.05) compared to HFD untrained. Furthermore, END but not HIIT prevented the HFD downregulation in mRNA level of PGC1a, and upregulation of UCP2 (1.5-fold; p<.05).

**CONCLUSIONS:** Whilst further research is needed to clarify the differential impact of END and HIIT in muscle function this data favour END training rather than HIIT in having muscle specific and metabolic advantages during high fat feeding.

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**Dimensions in a Model of Doxorubicin-Induced Cardiomyopathy**

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(No relationships reported)

Doxorubicin (DOX), a powerful anthracycline antibiotic commonly used to treat many different forms of cancer, is associated with the production of reactive oxygen species that cause oxidative damage resulting in cardiac dysfunction. Kefir is a naturally fermented milk product containing antioxidants, probiotic bacteria and yeast. The antioxidants contained in kefir interact with several types of reactive oxidative species, some of which act to manage oxidative stress. While recent studies suggest that consumption of kefir may have anti-tumor and antimicrobial properties, none have explored its potential for protecting against DOX-induced cardiac dysfunction.

**PURPOSE:** To explore the effects of dietary kefir on DOX-induced cardiotoxicity in rats.

**METHODS:** Singly housed, 10 week old, male Sprague Dawley rats were placed on 1 of 2 isocaloric diets: milk control diet (CON n=24) or kefir diet (KEF, n=23) with equivalent macronutrient profiles. After 8 weeks of dietary intervention, all animals were given either a bolus injection (15 mg/kg) of DOX (CON-DOX, n=12; KEF-DOX, n=11) or saline (CON-SAL, n=12; KEF-SAL, n=12). Cardiac geometry and cardiac function were evaluated using echocardiography 5 days post injection, and data were analyzed using a 2 X 2 ANOVA.

**RESULTS:** Significant effects were observed for left ventricular dimension at systole (diastole p=0.01, drug p=0.002), left ventricular dimension at diastole (diastole p=0.01 and drug p<0.0001), peak mitral flow velocity (diastole p=0.02 and drug p<0.001), septal wall thickness at diastole (drug p=0.0013), ejection time (drug p=0.0039), left ventricular mass (drug p=0.0085), relative wall thickness (drug p=0.0002), and filling time (drug p=0.0006). **CONCLUSION:** Incorporation of kefir into the diet altered DOX-induced changes in rat cardiac function and morphology. We speculate that kefir may be an alternative strategy in mitigating the deleterious cardiac side effects of anthracycline chemotherapy.

**Board #43 June 3 8:00 AM - 9:30 AM**

**Interfacing Continuous Glucose and Activity Measurement to Compare Glycemia after Exercise or Breaks from Sitting**

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(No relationships reported)

**Abstracts were prepared by the authors and printed as submitted.**
Physical activity (PA) is an important component in the prevention and management of type 2 diabetes and chronic kidney disease (CKD). Determining current patterns and predictors of PA is essential to implement programs that encourage behavior change for patients with these diseases. PURPOSE: To describe self-reported PA and self-efficacy among adults with type 2 diabetes and CKD and determine predictors of overall PA patterns. METHODS: 76 overweight/obese participants (age: 66±8 y; body mass index [BMI]: 33.0±5.3 kg/m²; sex: 60% male; ethnicity: 91% non-Hispanic white; race: 80% white) with type 2 diabetes and CKD, participating in a technology-delivered lifestyle intervention, completed two well-validated surveys at baseline: International Physical Activity Questionnaire-Short Version and Self-Efficacy for Exercise (SEE) Scale. Biomarkers (hemoglobin A1c, glomerular filtration rate, C-reactive protein) were collected via blood draw. Multiple linear regression was performed to predict total metabolic equivalent (MET)-minutes/week of PA based on biomarkers, BMI, and SEE. Preliminary analyses were conducted to ensure no violation of the assumptions of the regression model. Statistical analyses were conducted using IBM SPSS Statistics (version 22.0). RESULTS: Participants self-reported completing median [interquartile range, IQR] MET-minutes/week walking intensity, 160(780) MET-minutes/week moderate intensity, 0(960) MET-minutes/week vigorous intensity, and 1431(2938) total MET-minutes/week. 40.8% of participants met the PA guidelines of 150 minutes/week (median [IQR]: 107[346] min/week). Average SEE scores were 55±22 (range 2 to 90). SEE was the only statistically significant predictor of total MET-minutes/week (β=0.364, p<0.004). CONCLUSION: Self-efficacy for exercise was a strong predictor of PA in patients with type 2 diabetes and CKD. Social cognitive theory-based programs that build self-efficacy and incorporate PA should be developed to promote risk reduction of these chronic diseases. Given the tendency to self-report higher levels of PA, future studies should include more objective measures of PA to explore these relationships.

Supported by NIH Grant R01 DK100492 (PI Ma Sevick)
was no effect of lactic acid on temperature or observational score. CONCLUSION: These findings suggest that elevated lactic acid levels in sepsis patients may attenuate immune cell activation. This information may improve our understanding of immunosuppression in the late phase of sepsis and could reveal new molecular targets for treatment, for which there are currently none. Supported by NIH grants: 1R01AI101153 and 2R01AI059638

3603 Board #50 June 3 9:30 AM - 11:00 AM
The Effect of Creatine Supplementation on Upper Body Strength and Immune Function in Men
Joan M. Eckerson, FACSFM, Lisa A. Riesberg, Kyle Serreyen, Jennifer Yee, Geri A. Moore, Dimitrios Katsevialis, Eric Bredahl, Kristen Drescher, David Fukuda, Laura Kurata, Brittany Morgan, 1Creighton University, Omaha, NE. 2University of Central Florida, Orlando, FL.

Purposedescribed

RESULTS:
Compared to chemotherapy alone, exercise plus chemotherapy

METHODS:
We performed simple network analyses (i.e., correlations matrices) based on CD14 and CD16 expression. Flow cytometry was performed and non-classical monocytes were determined by age (<50 [YNG, n=7, 38.7±6.0 yrs] or ≥50 [OLD, n=12, 61.7±6.9 yrs]). Blood was extracted in five EDTA tubes and one serum separation tube to obtain lymphocytes and serum. Immunomodulatory effects of CR were determined using RT-PCR to analyze the mRNA expression of pro-inflammatory cytokine tumor necrosis factor-α (TNF-α), while a cytokine assay was used to measure the amount of cytokine present in the sera. Data were analyzed using 2 x 2 (group x time) repeated measures ANOVA and statistical significance for all tests was p < 0.05.RESULTS: There were no significant interactions or treatment effects for BW or 1 RM BP, however, there was a significant main effect for time with both groups demonstrating an increase in BW (PL = 0.13 kg; CR = 0.46 kg) and 1 RM BP (PL = 1.76 kg; CR = 2.06 kg). There was a significant interaction for serum creatinine, and a significant treatment effect for TNF-α mRNA levels. Post-hoc tests revealed that the CR group demonstrated a significant increase in serum creatinine levels, and significantly lower TNF-α mRNA levels after the 5 d loading phase compared to PL. CONCLUSIONS: The changes in BW and serum creatinine observed in the CR group following a 5 d loading phase are consistent with previous research. However, this is one of the first studies using human subjects to show that CR significantly reduced TNF-α mRNA expression, which suggests that it may have an anti-inflammatory effect. Future studies are warranted to further define CR as an immunomodulator and should focus on determining the expression of other pro-inflammatory mediators and markers. Acknowledgments: Supported by LB692 and MusclePharm® (CR supplement).

3604 Board #51 June 3 9:30 AM - 11:00 AM
Exercise During Chemotherapy May Reduce Pain By Strengthening Co-regulatory Couplings In The CytoReceptor Network
Ian R. Kleckner1, Calvin Cole1, Charles Heckler1, Steven Rousey2, Saver Kasbahi3, Jessica Miller4, Pavan S. Reddy3, Sheili Kesler1, Karen Mustian1. 1University of Rochester Medical Center, Rochester, NY. 2Metro Minnesota NCOCP, Saint Louis Park, MN. 3Southeast Clinical Oncology Research Consortium NCOCP, Winston-Salem, NC. 4Wichita NCOCP, Wichita, KS. 5MD Anderson Cancer Center, Houston, TX. Email: ian_kleckner@urmc.rochester.edu

Purposedescribed

RESULTS:
Compared to chemotherapy alone, exercise plus chemotherapy strengthened the normal co-regulatory couplings between changes in concentrations of several pro- and anti-inflammatory cytokines - specifically, between IL-6 and all other cytokines (p < 0.05) and between IL-10 and all other cytokines (p < 0.05). Among exercise plus chemotherapy, decreased concordance between concordant cytokines was associated with strengthened co-regulatory coupling between changes in concentrations of IL-6 and IL-10 (r = −0.18, p = 0.047).

CONCLUSIONS: Exercise strengthened the regulation of the inflammatory cytokine network via strengthened co-regulatory couplings between concentrations of pro- and anti-inflammatory cytokines. The strength of co-regulatory coupling between IL-6 and IL-10 may reflect the beneficial effects of exercise. Other cytokines (e.g., IL-2 and IL-10) are known to contribute to the physical conditioning effects of exercise. Our novel methods to analyze cytokine data may complement traditional analytic approaches in the investigation of immune-mediated phenomena beyond this study.

The oral-respiratory mucosal immunity is important to prevent upper respiratory tract infection after exercise for athletes. Lysozyme and lactoferrin, as salivary antimicrobial proteins, play an important role in first-line defense against invading microbes. The responses of saliva flow rate and composition during exercise are influenced by the sympathetic nervous system. Additionally, the sympathetic nervous system is affected by the menstrual cycle. However, the changes in salivary antimicrobial proteins following exercise at different phases of the menstrual cycle remains unclear. PURPOSE: To examine the influence of the menstrual cycle on salivary antimicrobial proteins level at rest and in response to acute bout of endurance exercise. METHODS: Eight healthy recreationally active females completed a cycling exercise at 70% V(•)O2peak for 45 minutes at two time points of the menstrual cycle: during the mid-follicular phase (day 8±2) and the mid-luteal phase (day 21±2). All participants have a regular menstrual cycle and have never taken oral contraceptives. Timed unstimulated saliva samples were obtained before, immediately after, and 1 hour after exercise and analyzed for salivary antimicrobial proteins. The concentrations of lysozyme and lactoferrin were measured using enzyme immunosassays. RESULTS: The menstrual cycle modified the resting levels of lysozyme (follicular: 23435.0 ± 4144.2 U/mL vs. luteal: 21229.0 ± 314.0 U/mL, p<0.05). The menstrual cycle did not significantly modify the levels of lactoferrin at rest (follicular: 4896.6 ± 1850.0 ng/mL vs. luteal: 5300.0 ± 2488.2 ng/mL, NS). Lysozyme concentration increased after exercise (p<0.01) and lactoferrin concentration was increased immediately after exercise (p<0.01) and 60 minutes after exercise (p<0.05) but unaffected by the menstrual phase. Saliva flow rate was slightly reduced after exercise but not significantly altered by the menstrual cycle. CONCLUSION: The pattern of salivary antimicrobial protein secretion in response to endurance exercise was not influenced by the menstrual cycle. These findings indicate that the regular menstrual cycle may not need to be considered when assessing oral-respiratory mucosal immune responses to acute endurance exercise.

C-C chemokine receptor 2 (CCR2) plays an important inflammatory role following ST segment elevation myocardial infarction (STEMI) by regulating the chemotaxis of monocytes to damaged tissue. Circulating non-clonal monocytes are responsible for debris clearance following STEMI and are positively correlated with age in healthy individuals, as well as increased plaque area in cardiovascular disease (CVD) patients. While post-STEMI non-clonal composition within the monocyte population has been defined in CVD patients, age related differences in monocyte phenotypic characteristics and response to stress hormones remains unclear. Specifically, epinephrine (EPI) and cortisol (CORT), which are elevated during acute stress, have been shown to both affect immune cell function and positively correlate to infarct size. PURPOSE: To determine the in-vitro effects of CORT and EPI on non-clonal monocyte CCR2 expression differences in response to Stress Hormones
Anson Blanks, Charles S. Schwartz, Lauren N. Pedersen, Leo F. Buckley, Edmund O. Accvedo, FACSFM, Antonio Abbate, R. Lee Franco. Virginia Commonwealth University, Richmond, VA. Email: blankams2@vcu.edu

Purposedescribed

RESULTS:
Post-STEMI Age-related Non-clonal Monocyte CCR2 Expression Differences In Response To Stress Hormones

C-C chemokine receptor 2 (CCR2) plays an important inflammatory role following ST segment elevation myocardial infarction (STEMI) by regulating the chemotaxis of monocytes to damaged tissue. Circulating non-clonal monocytes are responsible for debris clearance following STEMI and are positively correlated with age in healthy individuals, as well as increased plaque area in cardiovascular disease (CVD) patients. While post-STEMI non-clonal composition within the monocyte population has been defined in CVD patients, age related differences in monocyte phenotypic characteristics and response to stress hormones remains unclear. Specifically, epinephrine (EPI) and cortisol (CORT), which are elevated during acute stress, have been shown to both affect immune cell function and positively correlate to infarct size. PURPOSE: To determine the in-vitro effects of CORT and EPI on non-clonal monocyte CCR2 expression in young and old patients post-STEMI. METHODS: Blood was collected from 19 volunteers 72 hours post-STEMI. Samples were grouped by age (<50 [YNG, n=7, 38.7±6.0 yrs] or ≥50 [OLD, n=12, 61.7±6.9 yrs]). Blood was diluted to 1 x 10e4 cells/mL and cultured with EPI (10-5 M) or CORT (10-5 M). Cultures were stained against CD14, CD16, and CCR2. Flow cytometry was performed and non-clonal monocytes were determined based on CD14 and CD16 expression. RESULTS: Unstimulated CCR2 expression

Abstracts were prepared by the authors and printed as submitted.
Adipose tissue (AT) immunometabolic health predicts systemic health. Exercise improves metabolic function and insulin sensitivity and is thought to improve AT metabolism by reducing AT inflammation. Fibroblast growth factor 21 (FGF21) is a pleotropic hormone-like protein that has been shown to have beneficial effects by improving glucose and lipid metabolism and may have beneficial effects on AT immunometabolic function. However, it is unknown whether exercise-induced AT adaptations are mediated through FGF21. PURPOSE: To determine the role of FGF21 in exercise-induced adaptations in white (W) and brown (B) AT. METHODS: Male FGF21 knockout (KO) and wild type (WT) mice were fed normal chow and either exercise trained via voluntary wheel running (EX) or kept sedentary (SED) for 8 weeks. Visceral (i.e., epididymal), subcutaneous (inguinal region) WAT, and interscapular BAT were harvested. Animals were divided into four treatment groups: CON, PL, PPB, and PL + PPB, which were used to supplement with an aqueous proprietary polyphenol blend (PPB) at 28 days prior to an acute bout of exercise.RESULTS: FGF21KO mice had greater systemic IR (CON: 307.3 ± 142.6 pg/ml; PPB: 302.0 ± 154.2 pg/ml; PL: 502.0 ± 154.2 pg/ml) and reduced BAT insulin sensitivity (CON: 1.1 ± 0.2; PPB: 0.9 ± 0.2; PL: 0.9 ± 0.2). FGF21KO mice had reduced VAT content (CON: 3.0 ± 0.5; PPB: 1.2 ± 0.4; PL: 0.8 ± 0.2). Plasma MCP-1 and TNFα were significantly higher in FGF21KO compared to WT (CON: 1.3 ± 0.2; PPB: 1.9 ± 0.3; PL: 1.7 ± 0.3). Expression of COX III and IV genes (e.g., MCP-1, TNFα, CD11c, P22phox) were significantly upregulated in FGF21KO compared to WT (CON: 1.0 ± 0.1; PPB: 1.9 ± 0.2; PL: 1.8 ± 0.2). Phospho-Akt and GLUT4 proteins were significantly upregulated in FGF21KO compared to WT (CON: 0.7 ± 0.1; PPB: 1.3 ± 0.2; PL: 1.2 ± 0.1).CONCLUSIONS: Exercise induced hormonal responses. Supported by NIH Grant R34HL121402.

Exercise induces an inflammatory immune response, which is evidenced by the release of numerous cytokines. Specifically, interleukin-6 (IL-6) is of unique relevance, as exercise-induced release is mediated primarily by contracting skeletal muscle. Accordingly, elevations in IL-6 have been observed following various exercise modes, including resistance training. However, there is limited data comparing the IL-6 response between high-repetition (HR) and low-repetition (LR) resistance training programs. PURPOSE: To examine the effect of an acute bout of resistance training on changes in circulating IL-6 levels and to compare the response between volume-equated HR and LR training sessions. METHODS: Sixteen males (Age: 23.3 ± 3.5yrs, Body Mass: 84.4 ± 12.3kg, Body Fat Percentage: 11.7 ± 4.7%) with at least two yrs. of resistance training experience were counterbalanced by relative strength and assigned to one of two groups (high-repetition HR or low-repetition LR), which performed one resistance training session of back squat and bench press: HR (n=8): 4 sets of 12 repetitions at 60% of one-repetition maximum (1RM) or LR (n=8): 8 sets of 6 repetitions at 75% of 1RM. 10ml blood was obtained from the antecubital vein 30min prior to and immediately following the resistance training session. Samples were centrifuged and plasma was stored at -80°C until further analysis. IL-6 concentrations were analyzed in duplicate, via a commercially available enzyme linked immunosorbsent assay. A 2x2 repeated measures ANOVA with a Tukey post-hoc was used to determine changes in IL-6 response. Significance was set at p≤0.05. RESULTS: A significant time effect was detected for IL-6 response in both groups: HR (0.71 ± 0.19 to 1.39 ± 0.50 pg/ml; p=0.001; +95.77%) and LR (0.53 ± 0.10 to 1.27 ± 0.10 pg/ml; p=0.001; +139.62%). However, no group differences (p=0.46) were observed. CONCLUSION: An acute resistance training bout incorporating multi-joint exercises effectively elicits a circulating IL-6 response. Further, in a trained population, this phenomenon appears to occur in a volume-dependent manner as the magnitude of IL-6 increase did not vary with repetition range.
Slopes from the motor unit action potential size (MUAPsize) vs. recruitment threshold (RT) relationships provides a non-invasive measurement of MU sizes. As such, the slopes (APslope) may be able to quantify age-related MU atrophy. PURPOSE: To determine if APslope differed between young and old individuals. METHODS: Twenty two young (YG, age = 22.5±2.7 yrs) and ten aged (OG, 61.0±2.0 yrs) subjects completed the investigation. Surface electromyography signals were recorded from the first dorsal interosseous muscle during a steady force task set at 50% MVC. The signals were decomposed to yield MUAPsize and RTs for each MU. The APslope was calculated via the MUAPsize vs. RT relationships for MUs recruited between 10 and 50% MVC for each subject. Few MUs with RTs < 10% MVC were probed during the course of the investigation and, thus, these MUs were excluded from the slope calculation. FDI cross-sectional area (CSA) and echo intensity (EI) were quantified using ultrasonography. Possible differences in APslope, CSA and EI between groups were examined with independent samples t-tests. RESULTS: OG demonstrated significantly reduced APslope (OG: 0.033 ± 0.010; YG: 0.048 ± 0.020; p = 0.048) and greater EI (OG: 41.3 ± 7.0 Å2; YG: 50.6 ± 7.5 Å2; p = 0.002), however, CSA was similar between YG and OG (OG: 2.22 ± 0.47 cm2; YG: 2.09 ± 0.31 cm2; p = 0.438). CONCLUSION: The APslope suggested non-uniform differences in MUAPsize in relation to RT, likely due to reduced sizes of higher threshold MUs. Higher threshold MUs have been suggested to contain a greater proportion of type II muscle fibers, which demonstrate greater age induced atrophy than type I fibers commonly associated with lower threshold MUs. As such, the difference in APslope suggested atrophy of higher threshold MUs in OG. In addition, OG’s elevated EI indicates greater infiltration of adipose and connective tissue into the muscle. Greater EI in combination with similar CSA may indicate a reduced contractile tissue volume in the muscle, supporting the speculation that the APslope differences were due to MU atrophy.

Evidence suggests that ankle proprioceptive ability is significantly correlated with soccer performance level. It has not been determined if ankle proprioception is associated with specific soccer skills in youth recreational soccer players. PURPOSE: to investigate the relationship between ankle proprioception and soccer skills in youth recreational players. METHODS: twenty-seven youth recreational soccer player (mean 14.8 years old, range 13-17), without ankle injury during the past 3 months, participated in this study. Their passing, shooting and dribbling skills were assessed by using the reliable and valid Soccer Skill Tests (Russell et al. 2010). Ankle proprioception was measured by using the active movement extend discrimination apparatus (AMEDA) in standing. RESULTS: Ankle proprioceptive discrimination accuracy scores were significantly positively correlated with passing, shooting and dribbling accuracy scores (r=0.52, r=0.71, and r=0.53; respectively; all p<0.01). Further, participants who had history of ankle injury beyond 3 months performed significantly worse in both ankle proprioception and shooting accuracy tests than those who did not (F[1,50]=3.03, and F[1,57]=2.02, respectively). CONCLUSION: Findings here highlight the importance of ankle proprioception for soccer skills in youth recreational soccer players. Future research is needed to determine if there is a causal relationship between poor ankle proprioception and injury history, because this is crucial for talent identification, ankle injury prevention and rehabilitation in youth soccer players.

Judo is an intermittent sport associated with explosive movements reliant on static and dynamic grip strength. Analysis of force-time curves has been implemented in many judo related analyses; however, the effects of judo training in novice practitioners as an intervention is absent. PURPOSE: To examine the effects of a 10-week introductory judo class on a reactive gripping task. METHODS: Sixteen healthy men (age: 22.6±3.4y; height: 172.5±6.4cm; body mass: 78.8±13.2kg), 8 in an introductory judo class and 8 age-matched controls, were recruited. All participants performed 3, 5 maximal voluntary isometric contractions with their right hand on a handgrip dynamometer before and after the 10-week intervention. The handgrip dynamometer was connected to a data acquisition system and the force-time curve was constructed from the raw voltage data and analyzed with computer software. The variables measured were: peak force (PF), average force (AVGF), rate of force development (RFD), time to PF (TPP), force at peak RFD (F@RFD), 1s impulse (AUC1) and 2s impulse (AUC2). A 2×2 [group (judo vs. control) x time (pre vs. post)] repeated measures ANOVA was used to assess all force-time curve parameters. RESULTS: No differences were observed between groups within any variable (Table 1). However, there was a statistically significant main effect for time (post > pre) in AUC2 (F[1,25]=5.75, p = 0.02). CONCLUSIONS: A 10-week introductory judo class did not have an effect on handgrip performance during a reactive gripping task. Future studies should examine longer training interventions or the force-time characteristics during gripping between novice and experienced judokas.

Table 1: Force-time curve characteristics during a reactionary gripping task before (Pre) and after (Post) the 10-week intervention

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF (mN)</td>
<td>1.707 ± 0.240</td>
<td>1.697 ± 0.220</td>
</tr>
<tr>
<td>TPP (s)</td>
<td>2.539 ± 0.985</td>
<td>2.346 ± 0.772</td>
</tr>
<tr>
<td>AVGF (mV)</td>
<td>1.498 ± 0.215</td>
<td>1.483 ± 0.218</td>
</tr>
<tr>
<td>AUC1 (mV·s)</td>
<td>1.412 ± 0.206</td>
<td>1.378 ± 0.188</td>
</tr>
<tr>
<td>AUC2 (mV·s)</td>
<td>2.987 ± 0.472</td>
<td>2.965 ± 0.415</td>
</tr>
<tr>
<td>RFD (mV/s)</td>
<td>6.600 ± 1.260</td>
<td>6.971 ± 1.613</td>
</tr>
<tr>
<td>F@RFD (mV)</td>
<td>1.196 ± 0.167</td>
<td>1.241 ± 0.150</td>
</tr>
</tbody>
</table>

*Statistically significant from Pre (p<0.05). PF = Peak force; TPP = Time to peak force; AVGP = Average force; AUC1 = 1s impulse; AUC2 = 2s impulse; RFD = Rate of force development; F@RFD = Force at maximal rate of force development. Data presented as Mean±SD.

Advancing age is often accompanied by declines in muscle function and walking performance, which likely involve changes in the discharge characteristics of motor units in key leg muscles. PURPOSE: To determine the associations between the discharge characteristics of motor units in leg muscles during steady contractions and performance on functional tests of walking endurance, chair rise time, and maximal walking speed of older adults. METHODS: twenty healthy older adults (8 men, 72 ± 4 yrs) were recruited to participate in up to 4 experimental visits spanning ~10 wks. Motor unit characteristics were assessed by decomposing surface EMGs detected with a grid of 4x8 electrodes placed over the medial gastrocnemius (MG), lateral soleus (LS), and tibialis anterior (TA) muscles during 30 s isometric contractions with the plantarflexors (PF) or dorsiflexors (DF). The target torque was 10% or 20% of maximum. Time to walk 400 m (205 ± 43 s), time to rise and sit as quickly as possible from a chair five times (8 ± 2 s), and maximal walking speed over 10 m (2.3 m/s) were recorded. RESULTS: A statistically significant main effect for age was found for all variables, with older adults displaying lower maximum force, lower average force, higher rate of force development, longer time to peak force, and longer time to rise and sit. CONCLUSIONS: This study confirms that advancing age is associated with declines in muscle function and walking performance. Advancing age is associated with declines in muscle function and walking performance, which likely involve changes in the discharge characteristics of motor units in key leg muscles.

Evidence suggests that ankle proprioceptive ability is significantly correlated with soccer performance level. It has not been determined if ankle proprioception is associated with specific soccer skills in youth recreational soccer players. PURPOSE: to investigate the relationship between ankle proprioception and soccer skills in youth recreational players. METHODS: twenty-seven youth recreational soccer player (mean 14.8 years old, range 13-17), without ankle injury during the past 3 months, participated in this study. Their passing, shooting and dribbling skills were assessed by using the reliable and valid Soccer Skill Tests (Russell et al. 2010). Ankle proprioception was measured by using the active movement extend discrimination apparatus (AMEDA) in standing. RESULTS: Ankle proprioceptive discrimination accuracy scores were significantly positively correlated with passing, shooting and dribbling accuracy scores (r=0.52, r=0.71, and r=0.53; respectively; all p<0.01). Further, participants who had history of ankle injury beyond 3 months performed significantly worse in both ankle proprioception and shooting accuracy tests than those who did not (F[1,50]=3.03, and F[1,57]=2.02, respectively). CONCLUSION: Findings here highlight the importance of ankle proprioception for soccer skills in youth recreational soccer players. Future research is needed to determine if there is a causal relationship between poor ankle proprioception and injury history, because this is crucial for talent identification, ankle injury prevention and rehabilitation in youth soccer players.
**ABSTRACT.** Relative, percent change differences between homologous vastus lateralis muscles across different resting muscular lengths have not previously been reported following the completion of unilateral fatigue in aerobic exercise. **PURPOSE:** The purpose of the present study was to compare contralateral cross-over adaptations following unilateral fatigue exercise, between different aerobically trained populations, across resting postural positions (RPPs) that incorporated different hip and knee joint angles.

**METHODS:** Twenty healthy, college-aged men (mean ± SD; age = 22 ± 3.5 years and 22 ± 2.8 years; height = 181 ± 7.5 cm and 180 ± 5.9 cm; body mass = 85.2 ± 10.5 kg; BMI = 26.6 ± 3 kg/m² and 26.2 ± 2.2 kg/m²; dominant thigh skinfold thickness = 15.1 ± 4.6 mm and 14.55 ± 5.3 mm; non-dominant thigh skinfold thickness = 15.5 ± 3.5 mm and 15.2 ± 3.8 mm; and VO₂ peak = 25.1 ± 4.3 ml/kg/min and 44.7 ± 3.7 ml/kg/min, for the 10 novice and 10 advanced trained participants, respectively) exercised on an upright cycle ergometer, using only their dominate limb, for 30 minutes at 60% of their VO₂ peak. Resting surface electromyographic (sEMG) and mechanomyographic (MMG) signals were measured prior to and following exercise. **RESULTS:** The results indicated that the relative, percent change difference of the normalized MMG amplitude values were 7.6% and 4%; 9.1% and 7.5%; 5.7% and 3.9%; and 3.7% and 2%; while the results for the relative, percent change difference of the normalized MMG mean frequency values were 4.7% and 5.7%; 8.4% and 7.4%; 4.2% and 3.2%; and 2.7% and 3.7% for the upright sitting position with legs extended 180° [1]; upright sitting position with legs bent 90° [2]; lying supine position with legs extended 180° [3]; and lying supine with legs bent 90° [4], respectively, for the novice and advanced groups, respectively. **CONCLUSION:** Our results suggest that muscles are capable of possessing MMG activity post-exercise, despite a lack of sEMG signals. Additionally, our results suggest that there may be multiple neural and mechanical mechanisms concurrently contributing to the contralateral cross-over adaptations observed across the post-exercise recovery time course.

### 3614 Board #61 June 3 9:30 AM - 11:00 AM Reliability of the V-Wave during Maximal Voluntary Plantar Flexion Exercise

**Alwyn T. Quarshie,** Robert E. Hight III, Christopher D. Black.

**University of Oklahoma, Oklahoma City, OK.** (Sponsor: Pat O’Connor, FACSM)

(No relationships reported)

An emerging technique to quantify supra-spinal contributions to neuromuscular function is the V-wave. However, little data exist regarding its day-to-day reliability in comparison to traditional measures such as MVC and motor unit recruitment assessed via twitch interpolation. **PURPOSE:** To determine the reliability of the V-wave in comparison to MVC, evoked twitches, and motor unit recruitment across 4 testing visits. **METHODS:** Eleven men and women were tested on 4 separate occasions over 4 weeks. Participants were instructed to perform a sustained maximal voluntary contraction (MVC) followed by twitch interpolation. **RESULTS:** V-wave amplitudes were determined from the peak-to-peak amplitudes of the EMG response to a single stimulus. An ascending increments of 5 mA until evoked M-wave amplitude peaked. Participants then performed 3, 3-second maximal voluntary isometric contractions. During each contraction, a supramaximal stimulus (150% M-max) was applied 2.5 seconds into the contraction with control twitches occurring 2 and 4 seconds following relaxation. V-wave amplitudes were determined from the peak-to-peak amplitudes of the EMG signal following the stimulation of MVC. Mean and maximum V-wave amplitudes (Vₐ and V₉₀) were calculated to determine test-retest reliability and repeated-measures ANOVAs were used to evaluate the means between the 4 testing visits. **RESULTS:** No differences were observed between visits for motor unit recruitment (83 ± 19; 89 ± 14; 95 ± 9; and 95 ± 9% [p = 0.06]; twitch force 117 ± 33; 109 ± 29; 112 ± 28; and 108 ± 23 N [p = 0.61]), or the V₉₀-to-M ratio 0.42 ± 0.23, 0.50 ± 0.28, 0.49 ± 0.21, and 0.48 ± 0.22 (p = 0.0001). MVC increased across the test days (p = 0.0001), but did not differ (p = 0.68) between days 3 (707 ± 220 N) and 4 (695 ± 188). Motor unit recruitment (0.77 ± 0.91), twitch force (0.86 ± 0.91), MVC (0.95 ± 0.97), and the V₉₀-to-M ratio (0.79 ± 0.84) exhibited adequate test-retest reliability that tended to improve over time. **CONCLUSIONS:** Our findings indicate the magnitude of V-wave remains stable over multiple testing days despite measured changes in motor unit recruitment and force. Indicating changes in spinal excitability and/or antagonist co-activation rather than altered supra-spinal input may underlie the changes in force and motor unit recruitment.

### 3615 Board #62 June 3 9:30 AM - 11:00 AM Unilateral Fatiguing Exercise And Its Effect On Relative, Percent Change Differences Between Vastus Lateralis Muscles

**Nathan Wages¹,** Travis Beck¹, Xin Ye², Joshua Carr¹, Hayden Tharp¹.

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(No relationships reported)

**ABSTRACT.** Data acquired from 70 trials were decomposed into the discharge times of single motor units, yielding data for 5,146 motor units: 1,086 from MG, 1,582 from LS, and 2,477 from TA. The mean coefficient of variation for interspike interval (ISI) during the 20% LS task (0.47 ± 0.02) and mean ISI during the 10% LS task (150 ± 27 ms) explained 38% of the variance in chair rise time (p = 0.001). Mean ISI during the 20% MG task (145 ± 25 ms) explained 18% of the variance for 10 m walking time (p = 0.0001). **CONCLUSION:** Significant amounts of the variance in tests of physical function for older adults were explained by the discharge characteristics of motor units in leg muscles during steady isometric contractions and the strength of the plantarflexors. However, the predictor variables differed across the three tests of physical function.

### 3616 Board #63 June 3 9:30 AM - 11:00 AM Is There A Cessation Of Motor Unit Remodeling As A Compensatory Strategy To Age-related Motor Unit Loss?

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(No relationships reported)

Despite the compensatory process of collateral reinnervation to counteract human age-related muscle fiber denervation, a substantial loss of functioning motor units (MUs) occurs which seems to be accelerated after the 7-8th decades of life. However, it is not known whether there is a limitation or cessation of this process in very old age because to date MU remodelling has not been explored in those above ~85 years of age. **PURPOSE:** To explore in an accessory elbow extensor muscle electrophysiological factors including, motor unit number estimations (MUNE) and measures of compensatory MU remodeling in men in their 9th and 10th decades of life. **METHODS:** A maximal compound muscle action potential (CMAP) was recorded from the anconeus in 8 healthy men aged to 82-91 years. Decomposition-enhanced spike-triggered averaging was used to collect surface and intramuscular electromyography (EMG) from the anconeus during a series of submaximal (30% and 50% of the maximal root mean squared (RMS) EMG of the anconeus) voluntary isometric elbow extensor contractions. In addition, motor unit potential (MUP) analysis was performed to provide a detailed assessment of neuromuscular status. **RESULTS:** Results were compared with a young cohort (~25y of age) published previously using the same procedures. Participants in the current study had CMAPs of ~3 mV, surface motor unit potentials (S-MUPs) of ~168 and ~232 μV at 30 and 50 RMS, resulting in a MUNE of ~23 and ~16 at these two intensities. The CMAPs and S-MUPs were ~5.5 μV, but similar S-MUPs of ~155 and ~240 μV at 30% and 50% RMS compared with the old. These values indicate a significant loss of muscle mass, but due to no difference in S-MUPs the old do not show signs of collateral reinnervation. **CONCLUSION:** Thus, compensatory remodeling may no longer be a viable process to counteract age-related loss of MUs in the very old, although this could be muscle or activity dependent. Supported by NSERC.
Comparisons Between Voluntary Muscle Activation And Evoked V-wave Responses As A Function Of Torque

Robert E. Hight, Alwyn T. Quarshie, Christopher D. Black. University of Oklahoma, Norman, OK. (Sponsor: Patrick O’Connor, FACS/M)

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(No relationships reported)

The interpolated twitch technique is used to assess motor unit recruitment during voluntary actions. The V-wave is a complementary measure indicating supra-spinal contributions to force. No study has examined the relationship of these measures as a function of increasing force production. PURPOSE: To compare the magnitude of IT assessed motor unit recruitment to V-wave amplitude during contractions of increasing force. METHODS: Thirteen men and women volunteered to participate in this study. Transcutaneous electrical stimulation was applied over the tibial nerve while surface EMG was recorded from the soleus muscle. Single 1 ms pulses were delivered every 5 to 10 seconds in ascending increments of 5 mA until the M-wave amplitude plateaued. Participants then performed 3, 3-segment maximal voluntary contractions. During each contraction, a supramaximal stimulus (150% M-max) was applied 2.5 seconds into the contraction with control twists occurring 2 and 4 seconds following relaxation. Lastly, 3 randomized series of submaximal contractions (20%, 40%, 60%, and 80% of MVC) were performed under the same stimulation conditions. All values were performed under the same stimulation conditions. Values for % recruitment and the V-to-M ratio were averaged across the 3 efforts at each force level. Repeated measures ANOVAs were conducted to examine changes in recruitment and the V-to-M ratio as a function of force. RESULTS: Recruitment increased as force increased (p < 0.01) from 6 ± 14% to 51 ± 18% to 82 ± 13% to 94 ± 11% to 95 ± 8% at 20%, 40%, 60%, 80%, and 100% of MVC, respectively. All values differed from each other (p < 0.05) except for values from 80% and 100% of MVC (p = .75). Similarly, the V-to-M ratio also increased (p < .01) as force was increased—with values increasing from 5 ± 3% to 13 ± 8% to 23 ± 7% to 38 ± 18% to 48 ± 20% at 20%, 40%, 60%, 80%, and 100% of MVC, respectively. Unlike recruitment all values for the V-to-M ratio differed from each other (p < 0.05). The increase in recruitment as a function of force was modeled with a polynomial equation (R² = 0.99) while a linear model better fit the relative change in recruitment (R² = 0.97). CONCLUSION: As the demand for force production increases, supra-spinal output increases in a linear manner while recruitment plateaus around 80% of MVC. As recruitment plateaus, the increased supra-spinal input likely increases rate coding to augment force production.

Exploring Bilateral Handgrasp Forces Control During Inter-limb Coordination Task After Hemiparetic Stroke: A Preliminary Study

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(No relationships reported)

Interhemisphere cooperation plays an important role in daily living because the most functional performance of daily activities require the participation of bilateral hands simultaneously. However, the influence of stroke-related impairment on bilateral handgrip forces control between hands was still unclear. Therefore, it is necessary to develop a quantitative method to directly evaluate the coordination performances of two hands in stroke patients. PURPOSE: The purpose of this preliminary study was to investigate interhemisphere cooperation by analyzing inter-limb force control and coordination during inter-limb coordination tasks. METHODS: Seven stroke participants (Brunnstrom motor recovery stage II recovery or beyond, mean age =57.07±7.8y/o) were recruited and asked to execute maximal voluntary contraction (MVC) tests and inter-limb coordination tasks with reciprocal grasping, holding, and releasing of a dynamometer of two hands at two target force levels (20% and 40%) of MVC of paretic hand. The force outputs of the participant’s hands were recorded and the alternating time of cross point (from non-paretic to paretic hand and paretic to non-paretic) in force generation was calculated and identified for the evaluation of bimanual coordination in both hands. Differences in non-paretic and paretic grip force and changes in hand-grip performance at two targeted force levels were determined using pre and post sample t-test using a two-way ANOVA. RESULTS: The results demonstrated that the alternating time in non-paretic to paretic hand was longer than in paretic to non-paretic hand condition at 20% (F(1,31) = 15.6% vs. 23.7t=12.0%, p = .006) and 40% (52.8t=19.4% vs. 26.0t=14.6%, p = .004) inter-limb coordination tasks. No significant changes in the force modulation timing between the non-paretic and paretic hand at different force levels were found (F=608, p=.443). CONCLUSION: This is the first study to directly evaluate the capacity and quality of inter-limb coordination via the grip force between two hands and demonstrate the non-hemiparetic brain controlling non-paretic hand has greater coordination control ability than hemiparetic brain during bilateral force modulation for stroke patients, which may provide useful information on developing effective exercise interventions in stroke rehabilitation.

An Examination of Patellar Tendon Reflex Pre-Motor Conduction Velocity across the Adult Lifespan

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(No relationships reported)

It is known that aging is accompanied by a loss in muscle mass and motor units. However, the direct cause for the loss of motor units has not been identified. One possible mechanism could be related to changes in the sensory input motor neurons receive. Therefore, it is important to determine if sensorimotor function that are sensitive to changes with aging receive. Therefore, it is important to determine if sensorimotor function that are sensitive to changes with aging receive. It is important to find objective measures to quantify sensory function that are sensitive to changes with aging. PURPOSE: To determine if the conduction velocity of a patellar tendon reflex is sensitive to aging. METHODS: One hundred and one volunteers participated in this study. Tendon taps were delivered to the patellar tendon of each subject while surface electromyographic (EMG) signals were recorded from the rectus femoris. The pre-motor reflex latency was calculated as the time from the onset of the hammer-strike to the onset of EMG activity. This latency (s) was adjusted for femur length (m) to instead provide a pre-motor conduction velocity (CV, m/s). The subjects were then grouped and averaged into intervals based on age as follows: 18 - 29 yrs. (n = 50), 30 - 39 (n = 10), 40 - 49 (n = 6), 50 - 59 (n =
16), 60 - 69 (n = 13) and > 70 (n = 6). Linear regression was applied across the mean age and pre-motor CV from each interval. RESULTS: Pre-motor CV was negatively related to age (r = -0.799, p = 0.026). The resulting regression equation was y = -0.1111x + 24.216. The group averaged data as well as the line of best fit are shown in the figure below. CONCLUSION: Our findings show that the conduction velocity of a patellar tendon reflex is significantly related to age. Therefore, this variable may be useful in future studies that wish to track changes in sensory function across age.

**CONCLUSION:**

Conclusions:

1. Bilateral Arthrogenic Muscle Inhibition in the Soleus muscles: the soleus (F(1,34)=5.219, P=0.029). The Hmax:Mmax ratio in the AAS group (0.56±0.04) was significantly lower than in the healthy control group (0.68±0.04). No significant main effects were found in the tibialis longus (F(1,34)=1.255, P=0.27). CONCLUSION: AMI in the soleus muscle was present bilaterally in patients with AAS, which provides insight into neurophysiological mechanisms responsible for bilateral muscle dysfunction following the unilateral acute injury.

Supported by Texas State University College of Education

**REFERENCES**

- Hoffman reflex (H-reflex) was used to quantify AMI. H-reflex tests of the soleus, tibialis longus, and tibialis anterior were performed bilaterally in the prone position. Maximum peak-to-peak amplitudes of H-reflexes (H-max) and motor waves (M-max) were recorded. Since H-max significantly varies between individuals, it was normalized to M-max to obtain a H/max:Mmax ratio for each muscle. Separate two-way ANOVAs with repeated measures were performed to compare groups (AAS, control) and limbs (injured, uninjured) for each of the muscles. The alpha level was set at <0.05. RESULTS: There were no significant group-by-limb interactions for all muscles: the soleus (F(1,34)=1.763, P=0.19), tibialis longus (F(1,34)=1.194, P=0.28) and tibialis anterior (F(1,34)=0.887, P=0.35). However, there was a significant group main effect for the soleus (F(1,34)=5.219, P=0.029). The Hmax:Mmax ratio in the AAS group (0.56±0.04) was significantly lower than in the healthy control group (0.68±0.04). No significant main effects were found in the tibialis longus (F(1,34)=1.255, P=0.27). CONCLUSION: AMI in the soleus muscle was present bilaterally in patients with AAS, which provides insight into neurophysiological mechanisms responsible for bilateral muscle dysfunction following the unilateral acute injury.

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- Hoffman reflex (H-reflex) was used to quantify AMI. H-reflex tests of the soleus, tibialis longus, and tibialis anterior were performed bilaterally in the prone position. Maximum peak-to-peak amplitudes of H-reflexes (H-max) and motor waves (M-max) were recorded. Since H-max significantly varies between individuals, it was normalized to M-max to obtain a H/max:Mmax ratio for each muscle. Separate two-way ANOVAs with repeated measures were performed to compare groups (AAS, control) and limbs (injured, uninjured) for each of the muscles. The alpha level was set at <0.05. RESULTS: There were no significant group-by-limb interactions for all muscles: the soleus (F(1,34)=1.763, P=0.19), tibialis longus (F(1,34)=1.194, P=0.28) and tibialis anterior (F(1,34)=0.887, P=0.35). However, there was a significant group main effect for the soleus (F(1,34)=5.219, P=0.029). The Hmax:Mmax ratio in the AAS group (0.56±0.04) was significantly lower than in the healthy control group (0.68±0.04). No significant main effects were found in the tibialis longus (F(1,34)=1.255, P=0.27). CONCLUSION: AMI in the soleus muscle was present bilaterally in patients with AAS, which provides insight into neurophysiological mechanisms responsible for bilateral muscle dysfunction following the unilateral acute injury.

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Supported by Texas State University College of Education
VL. EMG signals were decomposed to extract action potentials and firing events of single MUs. Only MUs with >90% accuracy were used for analysis. Recruitment thresholds (REC Thresh) and mean firing rates (MFR) were calculated for each MU. MFR was calculated as the average value of the MFR trajectory during steady force. Subjects gave a muscle biopsy of the VL. Type 1 %MHC area was determined by SDS-PAGE. Linear regressions were performed for the 50% MVC, whereas inverse exponential regressions were performed on the 70% and 90% MVC to determine the slopes and y-intercepts for the MFR vs REC Thresh relationships. Predicted firing rates at target force were calculated from the regression equations for each subject for MUs with a REC threshold of 5-45% MVC in 5% increments. To examine changes in MU firing rates in relation to REC Thresh, predicted firing rates from the 70% and 90% MVC were normalized to the predicted firing rate value for the 50% MVC. For each REC Thresh, linear regressions were performed on the normalized firing rate values vs contraction intensity. Pearson’s product moment correlations were calculated comparing the slopes and type 1 %MHC area. Alpha was set at 0.05.

RESULTS: Pearson’s product moment correlations were significant among type 1 %MHC area and the slopes of the change in predicted firing rates vs contraction intensity for MUs with a REC Thresh of 35, 40, and 45% MVC (P > 0.05, R = -0.754 to -0.669). CAUTIONS: Individuals with lower percentages of type 1 MHC were more likely to have increased MU firing rates with increments in targeted forces for MUs with REC Thresses of 35 - 45% MVC. This may indicate that MU firing rate and recruitment patterns differ as a function of MHC area.
Conclusions: The sensorimotor increased activation associated with neuromuscular training is similar to motor recovery after injury and after long-duration (weeks) motor skill training. The increased sensorimotor cortex activation indicates the cortical representation may be functionally increased for knee motor control after the focused intervention. Future work with expanded sample sizes will map whole brain connectivity and other brain region activation changes associated with neuromuscular training.

3629 Board #76 June 3 9:30 AM - 11:00 AM Exploring Relations Between Gross Motor Skills, Attention, and Inhibition in Adolescents
Jonathan Rivard, Julie Bouchard, Annie Gagné, Linda Paquette, Jacinthe Dion, Tommy Chevrrette. UQAC, Chicoutimi, QC, Canada.
Email: jonathan.e.rivard@gmail.com

PURPOSE: Scientific literature addressing the association between Gross Motor Skills (GMS), attention, and inhibition is scarce. Studying these relations helps better understand the interactions and their behavioral repercussions. The aim of this study is to search for relations between gross motor skills, attention, and inhibition.

METHODS: GMS of adolescents (n=220, range=13–17; mean 15.0 ±1.4 yrs) were assessed using protocols from UQAC-UQAM research team. Measures included: Arm and Leg Limb Speed, Agility, Coordination, Balance and Simple Reaction Time. Attention and inhibition assessments were collected using a Continuous Performance Test (CPT) protocol. Reaction times, number of errors, types of errors and derived measures from the CPT were used. Statistical analysis includes Spearman correlation test and Kruskal Wallis ANOVA. Both parents and adolescents gave their written consents.

RESULTS: Reaction Time was in relation with all agility measurements (Circle Run: r = -.19, p < .01), Shuttle Run: r = .17, p = .01; Slalom Run: r = .17, p < .01), but also with Limb Speed measures (r = -.21, p < .01). Variability of Reaction Time was correlated with Agility (Circle Run test: r = .16, p < .05), (Slalom Run test: r = .15, p < .05), Limb Speed (r = -.24, p < .01) and Balance (r = -.15, p < .05). Girls showed more correlations between GMS and neuropsychological measures.

CONCLUSIONS: Some neuropsychological measures obtained with CPT protocol were related to Limb Speed, Agility, Balance and Reaction Time in adolescents. This conclusion suggests that motor and psychomotor development program may play a role in helping adolescents to better perform in attention and inhibition ability. The relations between functions were affected by gender. Future research is needed to better understand the role of motor and psychomotor development program on psychological measurements.

3630 Board #77 June 3 9:30 AM - 11:00 AM Gaze Stability of Visually Trained and Non-Visually Trained Athletes During a Sport-Like Postural Task
Brian Szekely1, Megan Mormile1, Peter Chrysosofridis1, Katelyn Grimes1, Brian Mizeski2, Barry Munkasy2, Nicholas Murray2. 1Georgia Southern University, Statesboro, GA. 2University of Memphis, Memphis, TN.

(Sponsor: Tinker D. Murray, FACSM)
Email: dm1441@txstate.edu

No relationships reported

During object tracking, reflexive eye movements away from the target object or directional errors occur in order to capture visual field information. The ‘off target’ visual data aid the brain in determining the velocity, location, and orientation of the objects in motion. However, an excessive amount of movement is classified as pro-saccade errors and can disrupt gaze stability. Little is known about how these errors differentiate between athletes who participate in object tracking sports versus those that do not in object tracking sports. PURPOSE: The aim of this study was to compare gaze stability of athletes who train and perform in visually (VT) and non-visually (NVT) rich environments during a sport-like postural anti-saccade task, the Wii Fit Soccer Heading Game (WFS). METHODS: 12 NCAA Division I VT (age, 24.8 ± 1.2 yrs) and 12 matched (NVT) athletes (18.08 ± 0.51 years of age) wore a monocular eye tracker (240 Hz) while participating in two WFS trials of approximately 60 s. Athletes were instructed to maintain their gaze on the center of the screen during play. Motion capture was synced during the postural task to determine instantaneous gaze coordinates. Multivariate ANOVAs assessed gaze by direction (horizontal and vertical) for excursion and peak velocity, while an independent t-test assessed pro-saccade errors. RESULTS: A significant group difference in horizontal peak gaze (p<.05). Follow up assessments indicated greater gaze excursions (VT = 871.4 ± 446.23 pixels; NVT = 554.79 ± 220.54 pixels; p = 0.038) and vertical peak velocities (VT = 1660.25 ± 860.78 pixels/s; NVT = 711.01 ± 551.45 pixels/s; p = 0.004). No significant differences were observed in the horizontal direction. There were no significant differences in pro-saccade errors between the groups (p = 0.96; VT SE = 2.64; NVT SE = 1.63). CONCLUSION: These results suggest that VT athletes’ gaze movement more and had greater velocity in the vertical direction when compared to NVT. This could indicate that VT use a vertical scanning visual strategy to locate and determine velocity of the object during a sport-like anti-saccade postural task. This could suggest that VT use different motor control strategies to maintain gaze stability during anti-saccade task than NVT.

3631 Board #78 June 3 9:30 AM - 11:00 AM The Effect of Different Cognitive Tasks on Motor Output in Young Adults
Amanda Morris, David Gallacher, Anita Christie. University of Oregon, Eugene, OR. (Sponsor: David Gabriel, FACSM)
Email: amorris8@uoregon.edu

No relationships reported

Performance of a cognitive task can alter performance on a simultaneous motor task. The underlying mechanisms leading to these changes are unknown. PURPOSE: To determine the effects of a simple and complex cognitive task on motor cortex excitability and inhibition. METHODS: Transcranial magnetic stimulation of the motor cortex was performed on 11 participants (21.2 ± 0.9 years; 6 females) to measure motor evoked potentials (MEP), an assessment of cortical excitability, and cortical silent periods (CSP), an assessment of cortical inhibition, from the first dorsal interosseous muscle. MEP and CSP were obtained during: (1) baseline with no cognitive task, (2) a simple cognitive task, and (3) a complex cognitive task. The simple cognitive task consisted of counting from 1 to 10 and the complex task consisted of counting down from a large number by smaller numbers (e.g. count backward from 97 by 6). RESULTS: MEP amplitude was similarly increased during the simple (1.38 ± 1.23 mV) and complex tasks (1.34 ± 1.1 mV), compared to baseline (0.68 ± 0.38 mV) (p = 0.01). CSP duration was 114.65 ± 58.64 ms at baseline and did not change significantly with either the simple (117.07 ± 53.27 ms) or complex (113.93 ± 50.71 ms) task (p < 0.93). There was no significant difference in accuracy (p = 0.89) or time to complete (p = 0.95) the complex task at any time point. CONCLUSION: These results indicate that there was no effect of cognitive task on cortical inhibition. Further, the act of talking, rather than the act of thinking, is likely responsible for the increase in cortical excitability.

3632 Board #79 June 3 9:30 AM - 11:00 AM Quadriceps Torque During High- and Low-frequency Neuromuscular Electrical Stimulation
Dillon M. Magee1, Joni A. Mettler2, Barbara M. Doucet2. 1Texas State University, San Marcos, TX. 2Louisiana State University Health Sciences Center, New Orleans, LA. (Sponsor: Tinker D. Murray, FACSM)
Email: dm1441@txstate.edu

No relationships reported

Neuromuscular electrical stimulation (NMES) is often used to artificially generate muscle contraction; however, the stimulation parameters that optimally modulate torque output during prolonged stimulation protocols are not well-established. PURPOSE: To compare torque output between low-frequency and high-frequency NMES protocols with increasing stimulation intensity throughout the protocol to achieve a constant submaximal torque output. METHODS: Ten healthy individuals (age, 24.8 ± 1.2 yrs) participated in the study. This study employed a quasi-experimental crossover design in which each subject received a low-frequency (20 Hz) and a high-frequency (60 Hz) NMES intervention on different days. Repetitive, intermittent stimulation of 10 seconds on and 15 seconds off was applied for 60 min over the quadriceps muscles. Stimulation intensity was increased every 5 min throughout the course of the intervention to achieve a target torque of 15% maximal voluntary contraction (MVC). Mean torque and peak torque were measured for each contraction. Force-time integral (FTI) was also measured for each contraction and the sum of all contractions was compared between protocols. Frequency was compared using paired t-tests. RESULTS: The 20 Hz protocol compared to the 60 Hz protocol produced a larger overall mean torque (11.2 ± 0.5% MVC vs. 8.0 ± 0.6% MVC, p < 0.01) and FTI sum (38,030.0 ± 1724.9 Nm∙s vs. 32,128.0 ± 1668.0 Nm∙s, p = 0.01). There was no difference between frequencies for peak torque (1.40 ± 0.6% MVC vs. 12.3 ± 0.7% MVC) or stimulation intensity required to achieve 15% MVC during the first 5 mins (80.2 ± 3.8 mA vs. 120.7 ± 8.0% mA) or during the last 5 mins of the NMES protocol (74.7 ± 5.0 mA vs. 120.8 ± 10.6% mA, p < 0.05) for 20 Hz and 60 Hz, respectively. CONCLUSION: Torque maintenance was greater during a low-frequency NMES protocol when stimulation intensity was increased to achieve a constant submaximal torque output. When the goal is to optimize torque output during functional electrical stimulation, low frequency stimulation may be preferred.

3633 Board #80 June 3 9:30 AM - 11:00 AM Identification of Latent Variables Underlying Manual Dexterity In Middle-aged and Old Adults Landon D. Hamilton1, Ewan Thomas2, Roger M. Enoaka1. 1University of Colorado Boulder, Boulder, CO. 2Università degli Studi di Palermo, Palermo, Italy. Email: lhaha3107@colorado.edu (No relationships reported)

As a biomarker of neurologic health and function, manual dexterity quantifies the ability to coordinate and manipulate objects in a timely manner. The NIH Toolbox measure of manual dexterity is the Rolyan 9-hole pegboard test with the Lafayette 25-hole grooved pegboard test provided as a supplement.

PURPOSE: To identify latent variables associated with pegboard times in middle-aged and old adults. We hypothesized that pegboard times would be slower for old adults and that latent variables would differ for the two groups.

METHODS: Middle-aged (MA, 40-60 yrs; n=25) and old adults (OA, 65-89 yrs; n=28) performed the 9-hole pegboard test (9HPT) and the grooved pegboard test (GPT), as well as tests of maximal grip strength, tactile discrimination, force steadiness, and the NIH Toolbox cognition battery. Latent variables were identified using Independent Component Analysis from significant Spearman’s rank correlation coefficients between pegboard times and secondary measures.

RESULTS: MA adults (51±7 yrs) performed significantly faster than OA (72±5 yrs) on both the 9HPT (18.3 ±s vs 20.3 ±s, p=0.01) and GPT (60.9 ±s vs 78.1 ±s, p=0.01). MA adults also had superior tactile discrimination (95.1 ±11 vs 72.2 ±20, p=0.01). The latent variables influencing manual dexterity differed for the two tests and age groups: (1) 9HPT - MA times were negatively correlated (r = -0.84) with the first Independent Component (IC), which explained 37.8% of the covariance and included the 10% double-action pinch force error as the second largest contributor (r = -0.45; scaled r = -0.54); OA times were positively correlated (r = 0.40) with the first IC, which explained 24.4% of the covariance and included wrist extension strength as the second largest contributor (r = 0.52; scaled r = 0.88); (2) GPT - MA times were positively correlated (r = 0.71) with the first IC, which explained 44.7% of the covariance and included index finger abduction strength as the second largest contributor (r = -0.42; scaled r = -0.59); OA times were negatively correlated (r = -0.49) with the first IC, which explained 73.6% of the covariance and included age as the second largest contributor (r = -0.44; scaled r = -0.49).

CONCLUSIONS: 9HPT times were explained by accuracy to reach a force target and strength for MA and OA respectively, whereas GPT times were explained by strength and age.

3634 Board #81 June 3 9:30 AM - 11:00 AM Effect Of Knee Joint Angle On Force Accuracy And Neuromuscular Activation During Force Tracking Task. Aya TOMITA, Hiroki AKIMA, Nagoya University, Nagoya, Japan. (Sponsor: Katsumi ASANO, FACSM) Email: to-mi-ta@nagoya-u.jp (No relationships reported)

Force steadiness and neuromuscular activities during isometric knee extension have been investigated in a condition of only one joint angle, e.g. 90°. Muscle length may modify force steadiness by change in neuromuscular activation patterns of working muscles; however, it has not been well understood. In terms of the quadriceps femoris muscle (QF), muscle activation differs dependent upon knee joint angle (i.e. muscle length), and its magnitude of difference is muscle dependent during knee extension force exertion. Therefore, there is a possibility that knee joint angle affects to the force accuracy (FA) and neuromuscular activation during force tracking task. PURPOSE: The purpose of this study was to examine FA and neuromuscular activity of QF during isometric knee extension force tracking task for 3 knee joint angles.

METHODS: Thirteen healthy men and women (23 ± 4 years) performed force tracking task during isometric knee extension to match a given constant force signal on a computer monitor. Each task was lasted 30 seconds. The force level of the task was 6% of maximal voluntary contraction (MVC). The tasks were performed in 70°, 110° and 150° of knee joint angle (180° = full knee extension). During the tasks, surface electromyogram (EMG) was recorded from 4 QF muscles. We calculated FA as follows: (produced force / target force) / target force×100. The root mean square (RMS) of EMG signals of each muscle was calculated in the middle of 10 seconds during 30 seconds task. The RMS of the individual muscles was normalized by that of the MVC.

RESULTS: There was significant difference in FA between knee joint angles. FA at a knee joint angle of 70° was significantly greater than that at knee joint angle of 110° and 150° (p = 0.026 and 0.028). RMS of vastus intermedius (VI) was smaller at 70° than 110° (p = 0.005). On the other hands, RMS of vastus lateralis, vastus medialis, and rectus femoris did not differ between knee joint angles (p > 0.05).

CONCLUSIONS: The FA of the QF was worse at a flexed knee joint position than other extended knee joint positions. Furthermore, neuromuscular activation pattern of VI was different depend on knee joint angles, whilst that of other muscles was similar. That result suggests that force control strategy may be modified by neuromuscular activation of VI with respect to knee joint angle (i.e. muscle length).

3635 Board #82 June 3 8:00 AM - 9:30 AM Locomotor Training with Adjuvant Testosterone Promotes Activity-Mediated Neuromuscular Plasticity in Spinal Cord Injured Rats Joshua F. Yarrow. VIT Medical Center, Gainesville, FL. Email: jfyarow@ufl.edu (No relationships reported)

Testosterone (T) treatment preserves motor neuron survival and dendritic morphology after spinal cord injury (SCI), but produces only minimal neuromuscular recovery in the absence of locomotor activity. PURPOSE: To determine whether a multimodal strategy involving T treatment with partial body weight supported quadruped treadmill (TM) training produces neuromuscular benefit in a rodent severe contusion SCI model. METHODS: 16-week old male Sprague-Dawley rats (n = 8–11/group) received: 1) SHAM surgery (T laminectomy), 2) severe (250 kdyne) contusion SCI, 3) SCI-T (7.0 mg/kg, i.m.), or 4) SCI-T+TM. Manually assisted TM training was initiated one-week post-SCI and consisted of two 20 min bouts/day, performed 5 days/week. RESULTS: After surgery, all SCI animals exhibited a near-complete absence of hindlimb locomotor function (BBB score < 1 (scale 0–21); p < 0.01 vs SHAM). SCI and SCI-T regained minimal voluntary locomotor activity with BBB scores progressing to 4 ± 1 and 6 ± 1, respectively, over the 8 week intervention. At sacrifice, SCI animals exhibited 42% lower soleus mass (p ≤ 0.001) and altered in vitro force mechanics, characterized by 35% lower maximal tetanic force (p ≤ 0.001), 8% faster time to peak tension (TPT, p ≤ 0.001), and 50% faster half-relaxation time (half RT, p < 0.01 vs SHAM); effects that were not prevented by T treatment-alone. BBB hindlimb locomotor scores were higher in SCI-T+TM vs SCI and SCI-T groups from weeks 2–8 (p < 0.01 at all time points), reaching a value of 10 ± 1 by week 8. At sacrifice, 7 of 8 SCI-T+TM animals exhibited unassisted/voluntary weight supported stepping (BBB score ≥ 9), in comparison with 0 of 11 SCI animals and 2 of 10 SCI-T animals (p < 0.001). In addition, T+TM ameliorated muscle atrophy and preserved muscle mechanical properties, exemplified by 33–40% higher soleus mass (p < 0.001), 35% higher maximal tetanic force (p < 0.001 vs SCI-only), 9–11% slower TPT (p < 0.001), and 130% slower half RT (p < 0.001) vs SCI and SCI-T groups. CONCLUSION: TM training with adjuvant T accelerated hindlimb locomotor recovery after severe contusion SCI and mitigated the loss of soleus muscle mass and muscle function, suggesting that this combinatory strategy promotes activity-mediated neuromuscular plasticity. Supported by PVA Research Fellowship #2939 to Fan Ye.

G-30 Free Communication/Poster - Neuromuscular Physiology

Saturday, June 3, 2017, 7:30 AM - 11:00 AM Room: Hall B

3636 Board #83 June 3 8:00 AM - 9:30 AM Relationship Between Body Composition And The Autonomic Nervous System Behavior At Rest Henry H. León-Arizá1, Daniel A. Botero-Rosas2, Alejandra I. Silva-Uribé1, Gabriela Sánchez-Tangredi1, Victoria I. Morales-González1, Aura C. Zea-Robles2, La Sabana University, Chía, Colombia. 2Santo Tomas University, Bogotá, Colombia. Email: henrylearn@clinicaunisabana.edu.co (No relationships reported)

In recent years, the assessment of body composition (BC) has been reframed by the hormonal effect that skeletal muscle and adipose tissue have in the body, including the autonomic nervous system (ANS). PURPOSE: To determine the relationship between the BC and ANS response in a population of individuals with different levels of physical activity. METHODS: 63 individuals (31 men 19.9 ± 2.4 years and 19.6 ± 3.2 women 2.0 years) were evaluated on their body composition (bioimpedance and anthropometry) and the ANS activity at rest through the Heart Rate Variability. RESULTS: In men a direct proportional relationship between the percentage of muscle mass (evaluated for both methods) and indicators of parasympathetic activity was found: The Root Mean Square Successive Differences RMSSD (r=0.49, p<0.05), the deviation of the scattergram plot in the “short” direction SDI (r=0.40, p<0.05), and Vagal Cardiac index VCI (r=0.46, p<0.01), while body fat was associated with sympathetic tone as the ratio Low Frequencies as the ratio Low Frequencies/High Frequencies (r=0.36, p=0.05) and sympathetic cardiac index SCI (r=0.36, p<0.05), the SCI was inversely proportional to muscle mass too (r=0.41 p<0.05). In women only heart rate was directly related to adipose tissue (r=0.35, p=0.05) and inversely with muscle mass (r= 0.42, p<0.05). CONCLUSIONS: The muscle mass has an influence on the ANS by increasing parasympathetic activity and reducing sympathetic tone. The study results suggest that there are some hormones produced by the muscles (myokines) like the Fibroblast Growth Factor 21 or the Brain Derivate neurotrophic Factor that produce

Abstracts were prepared by the authors and printed as submitted.
this effect. For the other hand, some adipokines like the Tumoral Necrosis Factor alpha and the leptin contribute to have greater sympathetic and lower parasympathetic activity.

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<th>Relationship Between The Body Composition and the results of Heart Rate Variability in Men</th>
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<td>Fat Percentage</td>
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<td>Muscle Percentage</td>
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**PURPOSE:** To investigate the neuromuscular adaptations in quadriceps muscles after short-term resistance training with and without blood flow restriction (BFR).

**METHODS:** Twelve males (age = 27.4 ± 6.3 years; height = 171 ± 7 cm; weight = 79.8 ± 13.2 kg) volunteered to participate in this study. Subjects had their legs randomly assigned to two training conditions that differed in contraction intensity. One leg was trained with blood flow restriction (BFR) at an intensity of 20% of their one repetition maximum (1RM) for a total of four sets (30, 15, 15, 15 repetitions) and the contralateral leg was trained without BFR (non-BFR) at an intensity of 70% 1RM for two sets of 11 repetitions. Subjects performed unilateral knee extensions and extended each leg with their assigned training protocol for 2 weeks, 3 times/week. Pre and post 1RM tests were performed for each leg on a dynamic constant external resistance machine and an isokinetic exercise machine was used to determine maximal voluntary contraction (MVC) and isokinetic exercises at two speeds of 60°/s and 180°/s. Additionally, heart rate (HR) and rating of perceived exertion (RPE) were recorded after the completion of each set.

**RESULTS:** No condition*time interaction or condition main effect for 1RM strength test was detected, but there was a significant time main effect for 1RM strength from pre to post values (p=0.01). There were no significant condition*time, condition*day, and day*time interactions and condition (HR was higher for non-BFR and RPE for BFR), day, and time main effects for HR and RPE values (set 3 and 4 for BFR vs. set 1 and 2 for non-BFR) (p>0.05). There were no significant condition*time interaction, condition main effect, or time main effect for MVC and isometric strength at 180°/s and 60°/s (p>0.05).

**CONCLUSION:** The findings indicate that both training conditions resulted in similar dynamic strength gains suggesting that low-intensity BFR training is as effective as high-intensity training in neuromuscular adaptation following short-term resistance training. The results also suggest that non-BFR condition placed a greater demand on the cardiovascular system, but subjects experienced higher perceived exertion during BFR.

**Table 01 - Correlation between muscle strength and resting vagal CAM**

<table>
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<tr>
<th>variables</th>
<th>r-MSSD</th>
<th>r-MSSD</th>
<th>Aabs</th>
<th>SD1</th>
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<th>SD1</th>
<th>SD1cap</th>
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<tbody>
<tr>
<td>PT(N-M)</td>
<td>r = -0.09 (p = 0.36)</td>
<td>r = -0.45 (p = 0.05)*</td>
<td>-0.41 (p = 0.05)</td>
<td>0.51 (p = 0.03)*</td>
<td>0.51 (p = 0.03)*</td>
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<tr>
<td>PT (%)</td>
<td>r = 0.32 (p = 0.12)</td>
<td>r = 0.51 (p = 0.03)*</td>
<td>-0.41 (p = 0.05)</td>
<td>0.51 (p = 0.03)*</td>
<td>0.51 (p = 0.03)*</td>
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PT: peak torque; (N-M): newton-meters; %: relative; sup: supine; ort: orthostatic; Aabs: absolute variation; *: Spearman correlation test (p<0.05).

**Conclusion:** We found significant positive correlation between relative MS with resting vagal CAM on supine position and significant positive correlation between absolute and relative MS with vagal responsiveness (withdrawn) after active orthostatic stress. Our results demonstrate that the higher the MS the higher is the tonic (resting supine) and phasic (withdrawn on standing up) vagal modulation.
motivation climate is beneficial to the improvement of PEL. PURPOSE: To investigate the impact of differences in sport events (individual event and group event) and three types of needs (competence, autonomy and relatedness) on motivation and further to explore the causes for the lack of motivation. METHODS: The present study combines experiment and questionnaire. With 65 male students randomly selected from a high school in Dalian as subjects (age: M =16.1, SD =3.4; height: M=176.4cm, SD=9.2; weight: M=69.7kg, SD=7.5), an 8-week experiment was conducted. All the subjects were divided into two groups: 31 of which were allocated to a roller-skating class, the others to a basketball class. In order to control the variable of task motivation climate, the same teacher completed the tasks of teaching in both classes. Before the experiment, a pretest was conducted based on the Sport Situational Motivation Scale and a post-test was carried out based on the Post-Experimental Intrinsic Motivation Inventory when the experiment was completed. RESULT: The task motivation climate helped students to improve the intrinsic motivation in PEL (P <0.05). The satisfaction of competence needs is more important in the environment of autonomous learning (Motivation: F(1, 63) = 5.147, P < 0.05; F(2, 62) = 5.03, P < 0.05; Interests: F = 7.808, P < 0.01; Efforts: F = 12.090, P < 0.01). The needs of autonomy, relatedness and competence are the intermediary variables which influenced the motivation level, interests and efforts in PEL. Relatedness is an important factor to account for the effects on motivation and efforts in PEL (R = 0.995, P < 0.001). CONCLUSION: In physical education teaching, creating task motivation climate is conducive to improve the students’ intrinsic motivation in PEL. The factor of sport events has no significant effect on motivation in PEL. The satisfaction of competence needs is more important in the autonomous learning environment and the group event is helpful to improve the students’ relatedness.

3641 Board #88 June 3 8:00 AM - 9:30 AM Perceived Impact Of Restorative Flow Movement Patterns On NCAA Division II Football Athletes Justin R. Geijer, Connie A. Mettille. Winona State University, Winona, MN. Email: jgeijer@winona.edu (No relationships reported)

The Restorative Flow Movement Patterns are a combination of yoga principles, functional movements, and various other training principles. The traditional yoga movements are essentially modified to improve function, recovery, mobility, and stability. The goal of the Restorative Flow Movement Pattern sessions was to improve recovery, prevent injury, and improve symmetry, which is acquired through improved mobility, stability and function. Prior research has indicated a significant decrease in games missed due to injury after implementation of the Restorative Flow Movement Patterns injury prevention program.

PURPOSE: The purpose of this investigation was to determine the perceived effectiveness of the injury prevention program implemented for an NCAA Division II football program, as measured by a qualitative, online survey of the student-athletes. METHODS: A newly developed injury prevention program (Restorative Flow Movement Patterns) was implemented prior to the 2014 football season. Athletes participated in a modified yoga flow, which combined functional movement patterns with yoga movements, twice a week for the duration of the pre-season, regular season, and spring season. Online survey data was collected after the 2015 football season. Likert scales were used for all questions on the survey. Means and standard deviations were calculated for all question responses.

RESULTS: Thirty-six student-athletes responded to the survey. Participants self-reported decreased muscular soreness after games and workout sessions (1-10 scale, 5.47±2.48), improvements in flexibility (1-10 scale, 6.53±2.24) and overall well-being (1-10 scale, 5.94±1.91) as a result of the injury prevention program. Of the 36 respondents, 14 (39%) claimed the program was a useful addition to their training regimen, and 12 (33%) reported that the program improved their physical health and recovery, and another 12 (33%) reported that the program actually improved their physical health and recovery.

CONCLUSIONS: NCAA Division II football student-athletes perceive that the combination of functional movements and yoga movements can be useful in improving flexibility, decreasing muscular soreness, and improving overall well-being.

3642 Board #89 June 3 8:00 AM - 9:30 AM Is Vo2max Related To Rating Of Perceived Capacity (RPC) And What Is Vo2max At Onset Of Training? Christina Gjestvang, Line Annette Hagen Haakstad, Trine Stensrud. Norwegian School of Sports Sciences, Oslo, Norway. Email: christina.gjestvang@nhi.no (No relationships reported)

ABSTRACT

Objective: To examine how maximal oxygen uptake (VO2max) is related to rating of perceived capacity (RPC) and evaluate VO2max at onset of training in healthy untrained adults.

Method: In this methodological comparison study, 125 newly registered members, equally males and females, at 25 fitness centers answered an electronic questionnaire including the RPC scale and performed measurements of VO2max. Eligible criteria was <4 weeks of fitness center membership, ≥18 years, and not pregnant. The RPC is a one-page scale based on metabolic equivalents task (MET), where the individual choose the most strenuous activity that can be sustained for at least 30 minutes, rated from 1 to 20. RPC was administered before measurement of VO2max (using a stepwise modified Balke protocol) until exhaustion (200 m) at the laboratory. The strength of agreement between the two methods was analyzed by Bland-Altman plot, as well as Pearson correlation coefficient to enable comparison of these results with other studies. VO2max at onset of training is presented as means with standard deviations (SD).

Results: Agreement as seen in Bland-Altman plot demonstrated a tendency of overestimation, meaning that the participants ranked their own aerobic capacity estimated from the RPC scale objectively measured values of VO2max. The mean differences between the two methods were ± 6.2 (± 1.6) METs, with 95% confidence limits of agreement varying from 4.57 to 2.60 and ± 5.35 to ± 2.72 METs, in men (n = 62) and women (n = 63), respectively. The Pearson correlation coefficient were moderate, with r=0.426 (p<0.01). VO2max was mean (± SD); 37.7 (± 7.2) ml·min⁻¹·kg⁻¹, with 40.5 (± 7.2) for men and 35.0 (± 6.0) ml·min⁻¹·kg⁻¹ for women.

Conclusions: The RPC scale may be useful in large scale studies of healthy untrained individuals, but may overestimate VO2max individually.

Key words: Rating of perceived capacity, RPC scale, VO2max, METs

3643 Board #90 June 3 8:00 AM - 9:30 AM Can Rate Of Perceived Exertion Be Used To Estimate Muscle Activation? Daniela Schäfer Olsdø,1 Per-Ludvik Kjendlie1,2, Jan Cabri3, Bjørn Harald Olsdø1,3.1 Polar Electro Oy, Kompele, Finland, 2Norwegian School of Sport Sciences, Oslo, Norway. 3Finnish School of Sports Science, Tampere, Finland. (No relationships reported)

Rate of perceived exertion (RPE) has been shown to be highly correlated with heart rate based training load calculations. However, there is limited information whether RPE can also be used to estimate muscle activation during exercise.

PURPOSE: Therefore, we aimed to assess the relationship between integrated electromyography (iEMG) and RPE in breaststroke swimming.

METHODS: Nine elite breaststroke swimmers (4 male and 5 female, 24 ± 7 years, BMI 23 ± 2 kg/m²) swam 25 m breaststroke at 60% (Borg RPE scale 11), 80% (Borg RPE scale 15) and 100% of maximal effort simulating the 200, 100 and 50 m breaststroke events paces. iEMG was measured from upper body muscles (UBM) including m. triceps brachii, m. biceps brachii, m. trapezius and m. pectoralis major and lower body muscles (LBM) including m. gastrocnemius, m. tibialis anterior, m. biceps femoris and m. rectus femoris. EMG was sampled at 1000 Hz and iEMG was amplitude normalized to the relative maximal voluntary contraction. Relative iEMG was expressed as % of iEMG measured at 100%. The average relative iEMG of UBM, LBM and total measured muscles (TBM), Wilcoxon signed rank tests were used to compare relative iEMG with RPE. Six differences were assessed with Mann-Whitney U tests.

RESULTS: Relative iEMG for breaststroke was [mean ± standard deviation (SD)] 74 ± 14 UBM, 64 ± 13 for LBM and 69 ± 13 TBM for breaststroke at RPE 60% and 89 ± 9 (UBM), 80 ± 8 (LBM) and 85 ± 8 (TBM) for breaststroke at RPE 80%. iEMG from UBM was significantly different from RPE for RPE 60% and RPE 80% (p<0.015 and p<0.038, respectively) while TBM and LBM were similar (p>0.05). M. biceps femoris showed the most similar values compared to RPE (64 ± 15 for RPE 60% and 82 ± 14 for RPE 80%). There were no sex differences in relative iEMG at RPE 60% or RPE 80% (p>0.05).

CONCLUSION: The similar results for relative iEMG and RPE for LBM and TBM suggests that RPE can be used to estimate muscle activation of muscles generating the highest propulsive forces in breaststroke swimming. RPE may therefore also be used to optimize training load calculations from breaststroke sessions with high speeds of short duration (e.g. 50-200 m event paces) where quantifying training load from heart rate has its limitations.

3644 Board #91 June 3 8:00 AM - 9:30 AM Efficacy Of The Repetitions In Reserve-based Rating Of Perceived Exertion For The Bench Press In Experienced And Novice Benchers Joseph P. Carzoli1, Alex Klem1, Brittany Allman1, Michael C. Zourdos2, Jeong-Su Kim, FACSIM1, Lynn B. Panton, FACSIM1, Michael J. Ormsbee1,2,3,4.1 Florida State University, Tallahassee, FL, 2Florida Atlantic University, Boca Raton, FL. Email: jcarzoli2016@fau.edu (No relationships reported)

Autoregulation (AR) is the practice of adjusting training variables in response to athlete feedback. One strategy to implement AR is to utilize the resistance training-
specific rating of perceived exertion (RPE) scale measuring repetitions in reserve (RIR). PURPOSE: The purpose of this study was to examine the efficacy of this method using the bench press exercise. METHODS: Twenty-five college-aged men were assigned to one of two groups based upon training age: experience benchers (EB) (n = 14, 47.2 ± 9.2 yrs of training) and novice benchers (NB) (n = 13, 11.3 ± 1.7 yrs of training). Subjects performed a one-repetition maximum (1RM) followed by single-repetition sets at 60, 75, and 90% of 1RM and finally an 8 repetition set at 70% 1RM. Subjects reported verbalized RPEs following every set. Average concentric velocity (ACV) was recorded via the TENDO Weightlifting Analyzer during the 1RM and all single repetitions sets, along with the first and last repetitions of the 8-repetition set. Pearson product moment correlations were used to assess relationships between RPE and velocity, while two-tailed independent-sample t-tests examined differences in RPE and velocity between EB and NB. RESULTS: ACV at 100% of 1RM in EB was slower (6.1 ± 0.4 vs NB 6.8 ± 0.6 (p = 0.001). EB recorded greater RPE than NB at 100% of 1RM (EB: 9.86 ± 0.14 vs NB: 9.35 ± 0.36 (p = 0.011). No between-group differences existed for average velocity or RPE at any other intensity. Both EB (r = 0.85, p < 0.001) and NB (r = 0.85, p < 0.001) had strong inverse significant correlations between average velocity and RPE at all intensities. CONCLUSION: Our findings suggest that the RIR-based RPE scale may be an efficacious approach for AR of bench press training load and volume in EB and NB; however, EB may record more accurate RPEs at near maximal loads.

3645 Board #92 June 3 8:00 AM - 9:30 AM Perceived Versus Actual Health Related Fitness Among College Students

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Half of all young adults between the ages of 18 and 24 have at least one coronary heart disease risk (CHD) factor significantly increasing their risk for heart disease1. Health-related fitness components are used to measure physical fitness and may facilitate in determining one’s risk for CHD and other hypokinetic diseases. PURPOSE: The purpose of this study was to compare college students’ perceived health-related fitness and their measured health-related fitness. METHODS: Health related fitness assessments for flexibility, body composition, cardiovascular fitness, muscular strength, and muscular endurance were selected from ACSM’s Guidelines for Exercise Testing and Prescription (8th ed). Participants (n = 100; 54 males and 46 females) were asked to complete an electronic questionnaire in which they selected a perceived category for each of the health-related fitness components. Participants then performed the health-related fitness assessments and categorical values were assigned to their fitness test scores. Crosstabs were used to compare actual versus perceived categories of fitness for each assessment and approximate significance was tested using Kendall’s tau-b. RESULTS: There were significant differences (p < 0.05) between self-perceived and measured categories of fitness for all health-related fitness components. The area with the least amount of agreement between perceived and actual fitness was cardiovascular fitness where only 6% of participants accurately identified their fitness test scores. There were modest correlations (r = 0.30) between total repetitions performed and the absolute RIR difference at 70% 1RM. Participants were blinded to the load during the 70% set via an opaque trash bag covering the weight discs. During the 70% set subjects verbally called a 5RPE (i.e. 5RIR), 7RPE (i.e. 3RIR), and 9RPE (i.e. 1RIR) when the subject believed he was at the respective threshold. Pearson correlations were used to assess relationships between total repetitions performed and the absolute RIR difference from the actual RIR when each RPE was verbally called. For example, if a subject completed 15 total repetitions and called a 5RPE after 7 repetitions then the RIR difference would equal 15/(7 + 5RPE).

3644 Board #94 June 3 8:00 AM - 9:30 AM Training and Chronological Age Effect Repetitions in Reserve-based Rating of Perceived Exertion Accuracy

Michael H. Haischer1, Jacob A. Goldsmith1, Daniel M. Cooke1, Ryan K. Byrnes1, Jared H. Perlmutter1, Jose C. Velazquez1, Adam Sayih1, Eric R. Helms1, Chad Dolan1, Michael C. Zourdos1, Florida Atlantic University, Boca Raton, FL. 2University of Houston, Houston, TX. (Sponsor: Michael Whitehurst, FACSM)

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PURPOSE: The purpose of this study was to examine the relationship between training age (TA) and chronological age (CA) on the accuracy of intra-set recorded rating of perceived exertion (RPE) values on the repetitions in reserve (RIR)-based RPE scale. METHODS: Twenty-five college-aged and resistance trained men (Body Mass: 89.85 ± 14.72kg, squat one repetition maximum-1RM: 175.76 ± 34.68kg) performed a 1RM back squat followed by one set of maximum repetitions at 70% of 1RM. Subjects were blinded to the load during the 70% set via an opaque trash bag covering the weight discs. During the 70% set subjects verbally called a 5RPE (i.e. 5RIR), 7RPE (i.e. 3RIR), and 9RPE (i.e. 1RIR) when the subject believed he was at the respective threshold. Pearson correlations were used to assess relationships between total repetitions performed and the absolute RIR difference from the actual RIR when each RPE was verbally called. For example, if a subject completed 15 total repetitions and called a 5RPE after 7 repetitions then the RIR difference would equal 15/(7 + 5RPE).

3646 Board #93 June 3 8:00 AM - 9:30 AM Physiological, Gait, And Perceptual Responses At 5-km Race Pace On Motorized Vs. Non-motorized Treadmills

Emily P. Kennedy, Chandon L. Hines, Hunter S. Waldman, Alex J. Heathely, Gavin W. Hall, Eric K. O’Neal, University of North Alabama, Florence, AL. (Sponsor: Matt Green, FACSM)

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(No relationships reported)

PURPOSE: This study examined physiological, gait, and perceptual differences of running at 5-km race pace on a non-motorized (NMT) versus a traditional motorized treadmill (MT). METHODS: Twenty-five college-aged trained (VO2max = 53.0 ± 8.8 ml/kg/min) and non-trained (VO2max = 53.0 ± 11 ml/kg/min) male runners (n = 11) of varying skill level and age (30 ± 10 y) completed 3, 5-km time trials on a NMT. During a later session, the average finishing time of the trials was used as the goal pace to maintain during a 5 min run on the NMT. Participants also ran at their personal best 5-km race pace within the last 6 months on a MT for 5 min with a 10 min rest period between bouts (counter-balanced crossover design). RESULTS: NMT resulted in a slower pace (10.6 ± 1.5 vs 13.9 ± 2.6 km/h; p < 0.001), shorter stride length (1.27 ± 0.18 m; p < 0.001), and decreased cadence (175 ± 12 vs 181 ± 13 steps/min; p < 0.01). However, VO2 (NMT = 3.4 ± 0.4; MT = 3.4 ± 0.5 L/min), RER (NMT = 0.96 ± 0.04; MT = 0.96 ± 0.04), lactate at 3 min into recovery (NMT = 6.9 ± 3.7; MT = 5.7 ± 3.4 mmol), and heart rate at the end of each trial (NMT = 172 ± 10; MT = 170 ± 10 bpm) did not differ significantly. Likewise, RPE for legs, breathing, and total sensation did not differ significantly. CONCLUSION: Although gait and pace were altered significantly, physiologically and perceptual responses between the MT and NMT were similar. NMT time trial testing can be expected to elicit similar endurance exercise stress when using a “free” running task is desired, but interpretation of results need to be made with the consideration that performance is expected to decline by ~25% or more likely due to excess resistance from the NMT belt.

3647 Board #95 June 3 8:00 AM - 9:30 AM Total Repetitions Per Set Effects Repetitions in Reserve-based Rating of Perceived Exertion Accuracy

Jared H. Perlmutter, Jacob A. Goldsmith1, Daniel M. Cooke1, Ryan K. Byrnes1, Michael H. Haischer1, Jose C. Velazquez1, Adam Sayih1, Eric R. Helms1, Chad Dolan1, Michael C. Zourdos1, Florida Atlantic University, Boca Raton, FL. 2University of Houston, Houston, TX. (Sponsor: Michael Whitehurst, FACSM)

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(No relationships reported)

The resistance training-specific rating of perceived exertion (RPE) scale measuring repetitions in reserve (RIR) has been validated to gauge effort per set in resistance exercise. However, it is unknown what descriptive factors of the lifter influence RPE/RIR accuracy. The resistance training-specific rating of perceived exertion (RPE) scale measuring repetitions in reserve (RIR) has been validated to gauge effort per set in resistance exercise. However, it is unknown what descriptive factors of the lifter influence RPE/RIR accuracy. However, exercise testing and prescription (8th ed). Participants (n = 100; 54 males and 46 females) were asked to complete an electronic questionnaire in which they selected a perceived category for each of the health-related fitness components. Participants then performed the health-related fitness assessments and categorical values were assigned to their fitness test scores. Crosstabs were used to compare actual versus perceived categories of fitness for each assessment and approximate significance was tested using Kendall’s tau-b. RESULTS: There were significant differences (p < 0.05) between self-perceived and measured categories of fitness for all health-related fitness components. The area with the least amount of agreement between perceived and actual fitness was cardiovascular fitness where only 6% of participants accurately identified their fitness test scores. There were modest correlations (r = 0.30) between total repetitions performed and the absolute RIR difference at 70% 1RM. Subjects were blinded to the load during the 70% set via an opaque trash bag covering the weight discs. During the 70% set subjects verbally called a 5RPE (i.e. 5RIR), 7RPE (i.e. 3RIR), and 9RPE (i.e. 1RIR) when the subject believed he was at the respective threshold. Pearson correlations were used to assess relationships between total repetitions performed and the absolute RIR difference from the actual RIR when each RPE was verbally called. For example, if a subject completed 15 total repetitions and called a 5RPE after 7 repetitions then the RIR difference would equal 15/(7 + 5RPE).
from the actual RIR when each RPE was verbally called. For example, if a subject completed 15 total repetitions and called a 3RPE after 7 repetitions then the RIR difference would equal 3. RESULTS: Average squat 1RM was 175.76±34.68kg and the mean number of repetitions performed at 70% of 1RM was 16/4. There were moderate and significant correlations between total repetitions performed and the RIR difference at the called 3RPE (r=0.64, p=0.01) and 7RPE (r=0.56, p=0.004), however no relationship between total repetitions and the RIR difference existed at the called 9RPE (r=-0.1, p=0.97). CONCLUSION: Our findings suggest that the greater amount of repetitions performed per set is related to increased difficulty to accurately gauge RIR further from failure. However, total repetitions per set do not seem to effect RIR accuracy when close to failure (i.e. 9RPE).

3649 Board #96 June 3 8:00 AM - 9:30 AM The Role of the Rating of Perceived Exertion Template in Pacing
Jos J. de Koning, FACSM1, Wouter Schallig2, Tim Veneman3, Dionne A. Noordhof2, José A. Rodriguez-Marroyo2, John P. Porcari, FACSM1, Carl Foster, FACSM1. 1Vrije Universiteit, Amsterdam, Netherlands. 2University of León, León, Spain. 3University of Wisconsin - La Crosse, La Crosse, WI. Email: j.j.de.koning@vu.nl
(No relationships reported)

The Rating of Perceived Exertion (RPE) template is thought to regulate pacing and has been shown to be very robust in different circumstances. Purpose: The primary purpose was to investigate whether the RPE template can be manipulated by changing the anticipated race distance during the course of a time trial. The secondary purpose was to study how athletes cope with this manipulation, especially in terms of the RPE template. Method: Trained male cyclists (N=10) performed three cycling time trials: a 10 km (TT10), a 15 km (TT15) and a manipulated 15 km (TTman). During the TTman, subjects started the time trial believing that they were going to perform a 10-km time trial. However, at 7.5 km they were told that it was a 15-km time trial. The Rating of Perceived Exertion (RPE) template is thought to regulate pacing and has been shown to be very robust in different circumstances.

3650 Board #97 June 3 8:00 AM - 9:30 AM Perceived Exertion Compared to Physiological Exertion over the course of Two Different Exercise Interventions
Adam C. Lowe1, Neil M. Johannsen1, Conrad P. Earnest, FACSM2, Catrine Tudor-Locke, FACSM3, Melissa Harris4, Timothy S. Church5, Corby K. Martin6. 1Louisiana State University, Baton Rouge, LA. 2Texas A&M University, College Station, TX. 3University of Massachusetts, Amherst, MA. 4Pennington Biomedical Research Center, Baton Rouge, LA. (Sponsor: Catrine Tudor-Locke, FACSM)
(No relationships reported)

PURPOSE: To evaluate the differences in perceived exertion (RPE) and cardiovascular intensity (%HRmax), and to determine the differences in metabolic stress (RER) during two exercise interventions following guidelines for (1) general health and (2) weight loss. METHODS: Sedentary, overweight or obese men and women (N=133, age 47.68, range 21-65 y) were randomly assigned to one of two intervention groups for 24wks. Exercise for general health and weight loss was prescribed at 8 and 20 kcal/kg body weight per week. Exercise was performed at a target HR associated with 65% and 85% of peak ox02 consumption (average HR% = 76.6±8.3%). HR and RPE were recorded every 5min during exercise. Respiratory volumes (VO2, VCO2, and RER) were measured at the start of exercise at BL and periodically during training (weeks 2, 4, 6, 8, 12, 16, 20 and 24) to determine energy expenditure and RER. Data were analyzed using a group by time analysis. RESULTS: RPE (mean±SD, 12.10±0.13 vs. 12.18±0.13, resp, treatment p=0.67, interaction p=0.14) and HR (133.96±1.69 vs. 135.48±1.68, resp, treatment p=0.53, interaction p=0.62) were not different between healthy exercise and weight loss groups. HR plateaued by week 8 for both the healthy exercise and weight loss groups (treatment p=0.53; 134.7±1.9 vs. 136.2±1.9, resp). %HRmax was not different between the healthy exercise and weight loss groups at any time point (treatment p=0.59, interaction p=0.58). RER was significantly different between groups at Week 8 (0.93, 95% CI [0.91, 0.94]; 0.89, 95%CI [0.87, 0.91], resp, p=0.001) and Week 12 (0.93, 95% CI [0.91, 0.93]; 0.89, 95% CI [0.87, 0.91], resp, p=0.0003). CONCLUSIONS: Despite no difference in perceived exertion or cardiovascular intensity, exercise for general health seemed to have a higher RER compared to exercise for weight loss. Physiological adaptations seemed to plateau at a similar time point between groups; however the increased caloric expenditure of weight loss may have induced metabolic adaptations at a faster rate compared to general health. Exercise for weight loss could induce metabolic adaptations without greater perceived or cardiovascular stress.

G-32 Free Communication/Poster - Pulmonary Diseases
Saturday, June 3, 2017, 7:30 AM - 11:00 AM
Room: Hall F

3651 Board #98 June 3 8:00 AM - 9:30 AM Exercise Capacity In Cystic Fibrosis: Changes In C-Reactive Protein Matter
Paula Rodriguez Miguez, Nichole Seigler, Reva Crandall, Dabney Eidson, Kathleen McKay, Caralee Forseen, Ryan Harris, FACSM. Augusta University, Augusta, GA. (Sponsor: Ryan A. Harris, FACSM)
Email: prodriguezmigue@gru.edu
(No relationships reported)

INTRODUCTION: Exercise capacity, assessed by peak oxygen uptake (VO2 peak), has been shown to predict mortality in patients with cystic fibrosis (CF), independent of lung function. Systemic chronic inflammation is a common phenotype in patients with CF characterized by an excessive production of circulating inflammatory mediators. Inflammation contributes to dysfunctional mitochondria, which in turn contributes to exercise intolerance. The link between inflammation and exercise capacity, however, has yet to be investigated in patients with CF. PURPOSE: This study sought to test the hypothesis that 1) C-reactive protein (CRP) is related to exercise capacity and 2) changes in CRP are related to changes in exercise capacity. METHODS: A prospective longitudinal cohort study was completed in 33 patients with CF (18 males and 15 females; age 20±10 yrs) involving a total of 127 visits over a 4 year period (average 4±2 visits per subject). At every visit, anthropometrics, pulmonary function test, exercise capacity, and circulating levels of CRP were evaluated. RESULTS: Overall, a significant inverse relationship was identified between VO2 peak and circulating concentrations of CRP (r=-0.389, p<0.001). Longitudinal changes in VO2 peak were negatively associated with changes in CRP (r=-0.336, p=0.004) and remained significant when both FEV1 (r=-0.345, p=0.004) and BMI (r=-0.281, p=0.018) were considered. In addition, changes in VO2 peak were also significantly associated with changes in CRP (r=-0.248, p=0.043) even after controlling for FEV1 (% predicted), BMI, and sex. Longitudinal changes in VO2 peak (% predicted) were also correlated with changes in CRP (r=-0.248, p=0.043) even after controlling for FEV1 (% predicted) (r=-0.263, p=0.039) or BMI (r=-0.237, p=0.046). CONCLUSION: Circulating CRP is inversely related to exercise capacity in patients with CF. Additionally, for the first time in CF, we have documented that the changes in CRP over time may predict meaningful changes in exercise capacity. These findings support the use of CRP to provide prognostic information into exercise capacity in patients with CF. Supported in part by NIH/NIDDK R21DK100783 and Vertex Pharmaceuticals IIS (RAH).
Asthma and Exercise-Induced Bronchocstriction (EIB) are pulmonary conditions associated with narrowing of the airways, one chronically and the other activated by exercise. Screening in college athletes is valuable, as there is a dearth of evidence and great variability (range 3-42%) among the prevalence rates published. PURPOSE: The purpose of this study was to identify the prevalence of asthma and EIB in college wrestlers. METHODS: Participants were 33 student-athletes (wrestlers). Athletes underwent baseline spirometry following American Thoracic Society (ATS) guidelines, to determine each athlete’s individual baseline FEV1. Each individual’s FEV1 was used to calculate 50-60% of exercise target ventilation (VE) (35*FEV1 * 0.5 and 35*FEV1 * 0.6). After the baseline spirometry was obtained, the athlete performed exercise on a treadmill at 80-90% of their age predicted maximal heart rate or 40-60% of their maximal ventilation for at least 4 minutes. After exercise, the athlete repeated maximum spirometry efforts at 2, 5, 10, 15, and 20 min. A fall in FEV1 >10% from baseline was considered positive for EIB. RESULTS: Thirty-three wrestlers volunteered for the testing. Three (9.09%) had been previously diagnosed with asthma were excluded. Two of the subjects (6.06%) failed to obtain a minimum of 70% of predicted FEV1 at pre-test were also excluded. Of the 28 subjects completing the protocol, 4 (12.1%) failed to obtain 90% of their pre-exercise FEV1 (mean drop 11.6±1.2%) at one of the post-test time points; an indication of EIB. In one subject (6.67%), results were positive for EIB. CONCLUSION: Results of this study are important for raising awareness and potentially improving performance due to unknown pulmonary conditions in college wrestlers.

Exercise-Induced Bronchocstriction (EIB), a transient narrowing of the airways, is activated by vigorous exercise in approximately 10% of the general population. Published articles indicate in college athletic populations, EIB is identified in between 3% and 42% of the tested population. PURPOSE: The purpose of this study was to identify the prevalence of asthma and EIB in college wrestlers. METHODS: Participants were 33 student-athletes (wrestlers). Athletes underwent baseline spirometry following American Thoracic Society (ATS) guidelines, to determine each athlete’s individual baseline FEV1. Each individual’s FEV1 was used to calculate 50-60% of exercise target ventilation (VE) (35*FEV1 * 0.5 and 35*FEV1 * 0.6). After the baseline spirometry was obtained, the athlete performed exercise on a treadmill at 80-90% of their age predicted maximal heart rate or 40-60% of their maximal ventilation for at least 4 minutes. After exercise, the athlete repeated maximum spirometry efforts at 2, 5, 10, 15, and 20 min. A fall in FEV1 >10% from baseline was considered positive for EIB. RESULTS: Thirty-three wrestlers volunteered for the testing. Three (9.09%) had been previously diagnosed with asthma were excluded. Two of the subjects (6.06%) failed to obtain a minimum of 70% of predicted FEV1 at pre-test were also excluded. Of the 28 subjects completing the protocol, 4 (12.1%) failed to obtain 90% of their pre-exercise FEV1 (mean drop 11.6±1.2%) at one of the post-test time points; an indication of EIB. In one subject (6.67%), results were positive for EIB. CONCLUSION: Results of this study are important for raising awareness and potentially improving performance due to unknown pulmonary conditions in college wrestlers.

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Athlete atrophy, weakness and fatigability are characteristic of patients with chronic obstructive pulmonary disease (COPD), which contribute to dyspnea, exercise intolerance and morbidity. Comparisons between upper and lower limb performance suggests intrinsic differences in muscular adaptations between leg and arm muscles, with preserved hip/leg endurance in COPD (Framness et al. M.E.S.E 37:2-9, 2005). We were therefore interested whether loss of muscle oxidative capacity was different between upper and lower limbs in COPD.

METHODS: To compare muscle oxidative capacity in the upper and lower limbs between smokers with or without COPD.

METHODS: 19 COPD patients (GOLD 2/3/4, n=7/6/6; FEV1 <70%; F4/1<8/17; M/F=14/5) and 18 smokers with normal spirometry (CON; M/F=14/4) volunteered. Non-dominant medial forearm and medial gastrocnemius oxidative capacity was assessed from the O2 consumption recovery rate constant (k) following brief muscle contractions using near-infrared spectroscopy with intermittent occlusion. k was estimated from the mean of two repetitions. Differences were determined by 2-way ANOVA (group x limb).

RESULTS: There was a significant main effect of group on muscle oxidative capacity (F=11.7, p<0.01; p<0.001). COPD patients had significantly lower k in both upper and lower limb muscles (upper Brock 4.1±0.8, lower Brock 1.0±0.17, lower Brock 4.1±0.8, lower Brock 1.0±0.17; 1.0±0.17). Compared with CON (1.27±0.49, 1.49±0.67 min^-1), however, there was no effect of limb (F=1.8, p<0.03, p=0.18) and no group x limb interaction.

CONCLUSION: We found that muscle oxidative capacity is lower in COPD controls in both upper and lower limbs. Although, when compared to age- and sex-matched smokers with normal spirometry, k tended to be more reduced in the gastrocnemius (-30%) than the forearms (-20%) of COPD patients, this difference was not significant. Unlike previous findings, these data suggest that muscle mitochondrial function is systemically impaired in COPD patients, and not simply the result of inactivity-induced deconditioning; which is expected to manifest as greater impairments in lower limb than upper limb. The variables contributing to systemic deficiency in muscle oxidative capacity in COPD warrant further study.

Supported by SNSF P300PB_167767; PERF; ATS Foundation/Breathe California of Los Angeles.
report respiratory symptoms during exercise. The prevalence is highest in swimmers and/ or exposure to chlorinated irritants. Athletes with previous diagnosis of asthma and/or respiratory symptoms should be screened with a challenge test so EIB can be detected and prevented.

Patients with cystic fibrosis (CF) have compromised exercise capacity (VO₂ peak) and impaired vascular health. Sildenafil, a phosphodiesterase type 5 inhibitor, has not only been shown to improve vascular health, but also improve maximal exercise capacity in various patient populations. However, it is unknown if improvements in vascular health contribute to improvements in exercise capacity in CF. PURPOSE: To investigate the relationship between the change in vascular health and the change in VO₂ peak following sub-acute treatment with sildenafil in patients with CF. METHODS: 14 patients with CF (age 9-43 y, BMI = 20.7 ± 4.1 kg/m²) participated in this study. At baseline and 4 weeks following sildenafil treatment (20 mg thrice daily;), vascular health was assessed via flow-mediated dilation (FMD) and pulse wave velocity (PWV) to determine endothelial function and arterial stiffness, respectively. In addition, forced expiratory flow in 1 second (FEV1) was assessed via spirometry as an index of disease severity, and VO₂ peak was determined on a cycle ergometer using the Godfrey protocol. Pearson correlations were used to investigate associations between changes (Δ) in VO₂ peak, FMD, and PWV while controlling for potentially confounding variables. RESULTS: VO₂ peak increased from 44.4 ± 8.7 to 46.6 ± 10.0 ml/kg/FFM/min (p = 0.010) after controlling for baseline disease severity (FEV1). FMD increased from 8.3 ± 5.2 to 9.3 ± 3.6 % (p = 0.07). There was a significant relationship between ΔVO₂ peak and FMD (r = 0.636, p = 0.035) when controlling for age, BMI, and baseline FMD. PWV tended to decrease following treatment (5.4 ± 0.9 to 5.3 ± 0.9 m/s, p = 0.07); however, the change was not associated with ΔVO₂ peak and ΔFMD (r = 0.373 or r = 0.063, p = 0.894) when controlling for age and baseline values. CONCLUSIONS: These data suggest that improvements in maximal exercise capacity can, in part, be explained by concomitant increases in FMD following 4 weeks of sildenafil treatment in patients with CF.

The Chronic Obstructive Pulmonary Disease (COPD) is a lung disease with a significant deterioration of the quality of life, functional capacity, and important morbidity. However, exercise can improve fitness and functional capacity, linked with a better quality of life for these patients. PURPOSE: Motion capture devices with a high intensity interval training active video game training has never tried with COPD patients. METHODS: 14 veterans (8 men 69±6 years, 6 women, 74±6 years), with a moderate to severe COPD diagnosis and severe AHR (FEV1/VC% = 38.3±15.2 % and FEV1 = 1.12±0.38 L), with a significant difference between the genders (20.6±18.7 and 20.5±9.0, p = 0.19) performed 4 mini-games (Shape-Up, Ubbi-Jo) adapted for their condition. During the games, the oxygen uptake, ventilation, heart rate and saturation was taken with a portable metabolite analyser (Metamax, Cortex Medical, Germany). Gaming sessions of 10 to 15 minutes were composed of 4 games of about 1.5 min separated with rest. RESULTS: The average and peak minute ventilation, and the METs peak were respectively: Stunt Run game (lifting knees on the spot) 25.3±6.8, 33.5±8.2 L/min, and 4.2±1.5 METs; Arctic Punch (punching targets) 25.1±5.6, 31.9±8.9 L/min, and 3.7±1.2 METs; To the Core (Core twist), 22.2±7.3, 29.2±6.9 L/min, and 3.3±1.1 METs; and Squat to the Moon (sitting to standing from a chair), 27.8±6.7, 36.8±11.1 L/min, and 4.4±1.1 METs. No important desaturation was observed during the training. CONCLUSION: The safety, the pleasure/motivation reported by the participants and, the ability to use it with assistance seems promising and can be a good tool for maintaining physical activity at home for COPD patients. However, further investigation needs to be completed in order to observe the benefits in comparison to a traditional training program and to observe the utilisation at home.

Over the last two decades, more than 3 million veterans have experienced at least one combat deployment to the Middle East. Some veterans present with respiratory complaints that began after deployment and frequently attribute these symptoms to deployment-related airborne hazards exposure (e.g., sand and dust, burn pits), but spirometry is often within normal limits. PURPOSE: To compare cardiopulmonary exercise responses in veterans reporting frequent (High Sx) and infrequent respiratory symptoms (Low Sx) who have normal spirometry. METHODS: 28 veterans were referred to our post-deployment tertiary care clinic for a dyspnea evaluation. 15 veterans (45±11.6 years) reported ≥2 lower respiratory symptoms on a bi-weekly basis over the preceding 6 months (High Sx), and 13 (46±8.5 years) reported ≤1 lower respiratory symptom at least bi-weekly. All veterans underwent complete pulmonary function testing and cardiopulmonary exercise testing (CPX).

RESULTS: Forced vital capacity (High Sx, Low Sx: 99±10.8, 98±12.0 %pred) and forced expiratory volume in 1 second (99±12.5, 97±14.7 %pred) were similar between groups. On CPX, veterans in the High Sx group had lower peak oxygen consumption (VO2) relative to body mass (22.6±7.2, 27.8±6.0 ml/kg/min, p=0.05) though both groups achieved ventilatory threshold at an acceptable level of exercise intensity (62±9.5, 51±7.1 % VO2peak). High Sx veterans had a significantly higher ventilatory equivalent for carbon dioxide (VE/VO2) than low Sx veterans (34±7±11.4, 27.0±3.2, p=0.05), and revealed significantly lower end-tidal carbon dioxide (PetCO2) levels at ventilatory threshold (36±6.7±3, 41±3.2 mmHg, p<0.05).

CONCLUSIONS: Despite similar resting lung function, veterans who reported more frequent lower respiratory symptoms had reduced exercise capacity and poorer gas-exchange in comparison to their less symptomatic counterparts. These findings may suggest an underlying gas exchange pathology that is not yet detectable at rest. Therefore, CPX should be considered when evaluating deployed veterans with respiratory complaints; especially when resting measures of pulmonary function are normal.
**Purpose:** Exercised induced laryngeal obstruction (EILO) is a situation in which an apparently normal larynx instead of opening fully during exercise adducts, and thus represents an obstruction to free airflow. In principle, EILO can be primarily glottic or supraglottic. Surgery has been suggested as treatment for highly motivated patients suffering from severe forms of the latter. We would like to report on complications after surgical treatment for supraglottic EILO.

**Methods:** During 2010-2015, 66 patients underwent laser supraglottoplasty due to a primary severe supraglottic EILO verified using continuous laryngoscopy during exercise. The surgical procedure was performed in general anaesthesia by one of three surgeons. Care was taken to avoid patients with glottic EILO or other upper airway malformations.

**Results:** Of 66 patients operated at mean age 15.8 (range 5-26) years, 43 (65%) were females, three (4.5%) required two surgical procedures, and 63 (95%) met postoperative follow-up exercise laryngoscopy (mean interval 3.8 months). Complications were reported for two patients: (A) Male, 15 years at surgery, diagnosed with postoperative left recurrent laryngeal nerve palsy. Injury caused by intubation or a direct complication from surgery were possible explanations. A mediastinal mass discovered on chest x-ray and a concomitant Epstein-Barr infection, prompted comprehensive work-up; however, with no conclusive findings. At a second follow-up 1.5 year later, the patient had nearly fully recovered and had no problems performing daily activities. (B) Male, 13 years at surgery, diagnosed with postoperative extensive scarring needing a re-operation. Fifteen months after the last surgery, he still had breathing problems during heavy exercise, but reported no problems performing daily activities. Exercise laryngoscopy performed at that time indicated better laryngeal opening when compared to the findings before the first surgery, despite the postoperative scarring.

**Conclusions:** Complications were experienced by 2/66 (3%) highly motivated patients operated with supraglottoplasty for severe supraglottic EILO. At follow-up approximately 1.5 years after last surgery, none had symptoms influencing their daily activities.

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**Board #108 June 3 8:00 AM - 9:30 AM**

**Influence of Respiratory Limitation on Exercise Capacity with Potential Implication of Ventilatory Muscle Fatigue**

Monira I. Alldahia, Liana C. Wooten, Randall E. Keyser, FACSM. George Mason University, Fairfax, VA.

(No relationships reported)

**Introduction:** It is known that respiratory muscles are prone to fatigue in women with systemic lupus erythematosus (SLE) but the extent to which this limits their cardiorespiratory capacity is yet unclear. **Purpose:** This study characterized the ventilatory response during maximal exercise testing in women with SLE, examining the potential contribution of respiratory muscle fatigue to diminished cardiorespiratory fitness. **Methods:** Fifteen women participated in the study (control: n=7, age=36±8 yr, SLE: n=8, age=37±9 yr). Each subject performed a modified Bruce treadmill exercise test to volitional exhaustion. The ventilatory response was characterized by measures of expired minute volume (Ve), tidal volume (Vi), respiratory rate, expiratory time (Te), ventilatory quotients for O2 and CO2, and ventilation-perfusion matching using expired gas analysis and exponential rise CO2 rebreathing methods. **Results:** Women with SLE had lower Vi (1449±83 vs 1795±124 ml; p=0.04) and Ve (61±6.7 vs 71±4.1, Cohen’s ES=0.70) and prolonged Te (42±2.5 vs 32±2.3 ms, p=0.03) compared to the control group. Significant differences of the other cardiorespiratory measures were not observed. The time to exhaustion during the exercise test (13±0.70 vs 17±0.46 min; p=0.02) and peak VO2 (21±1 vs 29±2.9 ml/kg/min p=0.01) were significantly diminished in those with SLE. **Conclusion:** Poor cardiorespiratory endurance has been reported in women with SLE. In the current study, group similarity in ventilatory efficiency and ventilation-perfusion matching eliminate the observation of any impairment of ventilatory drive. Conversely, the decline in Ve and Vi, and an increase in Te, coupled with a decreased time to exhaustion suggest that respiratory muscle fatigue may have contributed to low cardiorespiratory fitness and endurance in these subjects.

NIH/NICHD 1R03HD39775

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**Board #109 June 3 8:00 AM - 9:30 AM**

**Health Related Quality of Life in COPD Patients Completing Aerobic and Resistance Training**

Michael J. Berry, FACSMM, Katherine Shields, Jordan Irwin. Wake Forest University, Winston-Salem, NC.

Email: berry@wfu.edu

(No relationships reported)

Both aerobic and strength training have been found to improve health related quality of life in chronic obstructive pulmonary disease (COPD) patients. However, these findings are not unequivocal, and there has been no direct comparison between the two training methods. **Purpose:** To compare improvements in health related quality of life in a group of COPD patients completing both an aerobic and strength training program. **Methods:** Eleven mildly diseased patients completed a 3 month aerobic training program and, approximately 5 years later, a 3 month strength training program. Differences between 3 month and baseline scores were examined for the 4 domains of the Chronic Respiratory Disease Questionnaire (CRQD) - a disease specific measure (dyspnea, fatigue, emotional function, mastery) and the 2 summary measures (physical (PCS) and mental (MCS)) component scales of a generic survey (SF-36) and the physical function subscale of the SF-36. **Results:** Fatigue scores improved by 0.9 ± 0.3 units (p=0.02) for the aerobic group and 0.8 ± 0.4 units (p=0.07) for the strength training group. These differences were not significantly different from one another. No other domains of the CRQD were found to increase significantly in either group. PCS scores improved by 5.7 ± 2.5 units (p=0.05) in the aerobic training group, but only by 0.7 ± 2.9 units (p=0.82) in the strength training group. MCS scores did not improve significantly for either group. Physical function scores improved by 3.3 ± 1.4 units (p=0.04) in the aerobic training group, but only by 0.5 ± 1.2 units (p=0.70) in the strength training group. **Conclusions:** These results suggest that an aerobic training program may be a better training modality to improve health related quality of life in patients with COPD.
G-33 Free Communication/Poster - Research Methods
Saturday, June 3, 2017, 7:30 AM - 11:00 AM
Room: Hall F

3664 Board #111 June 3 8:00 AM - 9:30 AM Relationship between Body Weight and Youth Fitness Tests with Absolute and Relative Load
Weimo Zhu, FACSM, Hai Yan. University of Illinois at Urbana-Champaign, Urbana, IL.
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A physical fitness test gets its information by test takers performing under a load, e.g., carrying one’s own body while running, lifting a weight, and using a handgrip device. The load of one’s own body weight (BW) varies from person to person and the loads of weights or devices are constant. Therefore, the former can be called a “relative load” and the latter can be called an “absolute load.” The relationship of these loads in regards to test takers’ weight in youth fitness testing have not been carefully examined.

**Purpose:** To examine the role of BW in the youth physical fitness tests with absolute and relative load.

**Method:** A subset of raw data from the 2012 National Youth Fitness Survey were used for the study, in which a total of 1,640 children and youth (M±SD: Age = 9.07±3.70 yr; height = 136.98±22.90 cm; weight = 39.55±20.68 kg; BMI = 19.58±5.04) were tested for two sets of tests with body weight as the load (relative load), consisting of maximal endurance time on a treadmill test, modified pull-up, and plank, and without body weight as the load (absolute load), using handgrip strength and leg extension (combined). After analyzing the data using descriptive statistics by age and sex, the correlations between BW and absolute and relative load tests were computed.

**Results:** Descriptive statistics (M±SD) of the tests and their correlations (r) with BW were summarized below:

<table>
<thead>
<tr>
<th>Test</th>
<th>Endurance Time (sec)</th>
<th>Pull-up (t)</th>
<th>Plank (sec)</th>
<th>Handgrip (kg)</th>
<th>Leg extension (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>663.30±152.44</td>
<td>6.32±6.38</td>
<td>63.86±49.58</td>
<td>45.84±67.21</td>
<td>113.88±65.16</td>
<td></td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>636.83±122.74</td>
<td>5.56±4.15</td>
<td>58.08±40.92</td>
<td>39.32±80.14</td>
<td>104.25±50.67</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>649.52±138.31</td>
<td>4.94±5.55</td>
<td>60.96±45.52</td>
<td>42.57±18.49</td>
<td>109.02±58.47</td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td>-0.49</td>
<td>-12.22</td>
<td>-79.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>-0.47</td>
<td>-21.12</td>
<td>-79.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>-0.47</td>
<td>-01.18</td>
<td>-78.69</td>
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</tr>
</tbody>
</table>

**Conclusion:** BW has a negative correlation with relative load fitness tests and has a positive relationship with absolute load fitness tests. The question then is which load should be used in physical fitness testing, absolute or relative one? While more studies are needed to answer this question, it seems that absolute load is more appropriate for performance-related fitness since the best performance in a sport competition is the key interest while relative load is more appropriate health-related fitness since one’s own health is the main focus.

3665 Board #112 June 3 8:00 AM - 9:30 AM The Importance of Accurate Measurements in Voluntary Wheel Running in Mice
Ayland C. Letsinger1, Jorge Z. Granados2, Heather L. Vellers3, Victor A. Garcia1, Jeremiah D. Velasco1, Nick R. Walker1, Madison Spier1, Isabel Lambertz2, Robin Fuchs-Young1, J. Timothy Lightfoot1, FACSM1. Texas A&M University, College Station, TX. 1Texas A&M Health Science Center, College Station, TX. (Sponsor: J. Timothy Lightfoot, FACSM)
Email: aylandletsinger@gmail.com

**Purpose:** Accuracy of data collection is essential in reducing variability in voluntary wheel running which could potentially hide statistically significant results. When measuring physical activity in rodents, a large portion of each collection period is unobserved and thus, systematic checks to reassure functionality must be a priority. Wheel rotations needed to reach 0.01 km before adjustments to the wheel were significantly higher (p=0.002) than after adjustments (74.7±15.3 vs. 64.5±16.6 rotations, respectively). Before adjustments, rotations had varying correlations with distance (R=0.0080; p=0.027), and speed (R=0.50; p=0.0001). After adjustments, all correlations were lower and insignificant with distance (R²=0.0034; p=0.79), duration (R²=0.0032; p=0.51), and speed (R²=0.0091; p=0.66).

**RESULTS:** Completing ongoing and regular manual checks on the functionality of running wheels will allow for higher accuracy and lower variance in data, especially running speed, which could otherwise hide significant differences between treatment groups.

3666 Board #113 June 3 8:00 AM - 9:30 AM New Analysis Software To Evaluate Performance
Rochus Pokan, FACSM1, Herwig Alleman1, Seiler Philip1, Maria Hausharter1, Christoph Weber2, Stefan Heber3, Serge P. von DuVillard, FACSM1. 1University of Vienna, Vienna, Austria. 2Technical University of Munich, Munich, Germany. 3University of Salzburg, Salzburg, Austria.
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Vienna CPX-tool is newly developed software that evaluates cardiopulmonary exercise test by assessing the transitions (T) between 3 phases of energy supply, i.e., T1 and T2. We integrated 3 calculation methods (angle, regression and error variance). Each allows for estimation of threshold indicators (IND) of blood lactate turn point 1 (LTP1), first ventilatory threshold 1 (VT1), and ventilatory equivalent of oxygen (VE/VCO2), and heart rate turn point (HRTP) for T2. Since each T is based on a common physiological mechanism, we assume that an accurate calculation method would yield a small range of power output (PO) estimates IND within each T.

**Purpose:** The aim of the present study was to compare the 3 methods via the Vienna CPX-tool. METHODS: Sixty-five incremental cardiopulmonary exercise tests were analyzed for PO estimates of LTP1, VT1, lowest turn point of VE/VCO2 and heart rate turn point (HRTP) for T2. Since each T is based on a common physiological mechanism, we assume that an accurate calculation method would yield a small range of power output (PO) estimates IND within each T.

**RESULTS:** The aim of the present study was to compare the 3 methods via the Vienna CPX-tool. METHODS: Sixty-five incremental cardiopulmonary exercise tests were analyzed for PO estimates of LTP1, VT1, lowest turn point of VE/VCO2 and heart rate turn point (HRTP) for T2. Since each T is based on a common physiological mechanism, we assume that an accurate calculation method would yield a small range of power output (PO) estimates IND within each T.

**CONCLUSION:** Using the Vienna CPX-tool. METHODS: Sixty-five incremental cardiopulmonary exercise tests were analyzed for PO estimates of LTP1, VT1, lowest turn point of VE/VCO2 and heart rate turn point (HRTP) for T2. Since each T is based on a common physiological mechanism, we assume that an accurate calculation method would yield a small range of power output (PO) estimates IND within each T.

**PURPOSE:** Substantial evidence demonstrates that built environment features, like density, connectivity, land-use, pedestrian/transit infrastructure, and recreational facilities, can influence physical activity. However, inconsistent findings remain in terms of significance, direction and strength. The purpose of this paper was to determine if the lack of a standardized definition for a neighborhood unit contributes towards these inconsistencies. METHODS: Published literature (PUBMED & SCOPUS) was abstracted to identify studies examining the relation between physical activity and Geographic Information Systems (GIS)-based built environment measures. Data were abstracted to determine the various definitions of neighborhood units used for GIS built environment measures. Each tested association was coded per the presence or absence of a significant finding. Logistic regression was used to estimate the odds of reporting a significant association (p<0.05) between GIS built environment measures and physical activity outcomes, by neighborhood unit definition. Models adjusted for study sample size. RESULTS: Among 165 articles (published articles since Jan 2013), 26.8% used Euclidean buffers of varying radii (400-3000m) to

Abstracts were prepared by the authors and printed as submitted.
define neighborhoods, 28.4% used network buffers, and 44.8% used administrative units of different shapes and sizes (e.g., census tracts). Relative to studies using large administrative units to represent a neighborhood, those using buffers of 400-500m² (OR: 3.2, 95% CI: 1.4, 5.8), and 800-1000m² (OR: 2.9, CI: 1.3, 7.1), had greater odds of reporting a significant association between GIS buffer measurement sizes and physical activity outcomes. Among those using buffers, no significant differences were found between Euclidean vs. network buffers (OR: 1.07, 95% CI: 0.46, 4.29).

CONCLUSIONS: Considering the limitations of using different buffer sizes to characterize the neighborhood environment for physical activity research, future studies should examine differences by physical activity measures (objective vs. subjective) and by built environment constructs.

Supported by NHI R01DK101593

3668 Board #115 June 3 8:00 AM - 9:30 AM Validation Of A Multi-electrode Bioelectrical Impedance Analyzer With A Dual-energy X-ray Absorptiometer

Nathan Meier¹, Yang Bai², Duck-chul Lee, FACSM¹. Iowa State University, Ames, IA. ²University of Vermont, Burlington, VT.

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Reported Relationships: N. Meier: Contracted Research - Including Principle Investigator; Biospace Co, Ltd.

Sarcopenia, the loss of muscle mass, strength, and function due to ageing, is a major health concern for the growing older adult population. One challenge for prevention, diagnosis, and treatment of sarcopenia is the need for a dual-energy X-ray absorptiometry (DXA) analyzer to measure appendicular lean mass (ALM). DXA is the recommended measurement of muscle mass, but is expensive and exposes subjects to radiation. Therefore, inexpensive, safe, and widely available alternative measurements, such as bioelectrical impedance analysis (BIA), need to be identified and validated to be practically utilized in clinical settings. PURPOSE: The purpose of this study is to validate the multi-frequency BIA with 8 tactile electrodes (InBody) and mean absolute percent error (MAPE), measures of prediction accuracy, respectively, after adjusting for age and sex. Mean percent error (MPE) (DXA - BIA) and mean absolute percent error (MAPE), measures of prediction accuracy, were -13% and 13% for FFM, -12% and 13% for ALM, and 16% and 17% for PBF. Prediction equations were developed for improved estimation, in which age was coded in years and sex was coded as 1 for male and 0 for female: DXA: FFM = 0.83 (BIA FFM) + 0.025 (Age) + 2.0 (Sex) + 0.36 (R²=0.96) DXA: ALM = 0.74 (BIA ALM) - 0.025 (Age) + 1.84 (Sex) + 4.15 (R²=0.92) DXA: PBF = 0.71 (BIA PBF) - 0.089 (Age) - 3.3 (Sex) + 23.5 (R²=0.91). DISCUSSION: The BIA body composition variables are highly correlated with DXA variables. However, we found consistent overestimation of FFM and ALM and underestimation of PBF in BIA compared to DXA based on MPE and MAPE analyses, which were incorporated in the development of FFM, ALM, and PBF estimation equations.

Supported by unrestricted research grant by Biospace Co, Ltd.

3669 Board #116 June 3 8:00 AM - 9:30 AM A Useful Equation For Predicting Visceral Adipose Tissue Volume From Anthropometric Measurements

RINA SO¹, Tomoko Matsuo¹, Kiyoji Tanaka, FACSM.¹ ¹National Institute of Occupational Safety and Health, Japan, Kawasaki, Japan. ²Faculty of Health and Sport Sciences, University of Tsukuba, Tsukuba, Japan. (Sponsor: Kiyoji Tanaka, FACSM)

Email: sorina@iijiat.com

(No relationships reported)

Abdominal circumference (AC) at the umbilical region is used to define metabolic syndrome (MS) in Japan. The AC is based on a cross section of the abdominal visceral adipose tissue (V AT) area. However, recent studies indicate that using a single-slice image may lead to an erroneous conclusion as to individuals’ V AT accumulation levels. Image may lead to an erroneous conclusion as to individuals’ V AT accumulation levels. METHOD: Researchers aiming to accurately estimate the effect of the neighborhood built environment on physical activity should consider using 400-1000m² buffer-based GIS indicators. Using network vs. Euclidean buffers may not be essential for characterizing the neighborhood environment for physical activity research. Future analyses should examine differences by physical activity measures (objective vs. subjective) and by built environment constructs.

We collected anthropometric measurements and measured metabolic risk factors: blood pressure, HDL cholesterol, triglyceride and fasting glucose. VAT volume was determined by continuous T1-weighted abdominal magnetic resonance images. RESULTS: Using multiple regression analyses, we determined the best prediction equation for abdominal VAT volume with a VAT variance of 47% as follows: VAT volume (cm³) = (74.18×AC) + (47.03×age) + (117.79×BMI) - 8792.73. In our validation group, the correlation coefficient between the predicted and actual VAT was 0.71 (P<0.01). Also, the predicted VAT volume correlated significantly with blood pressure and fasting glucose, even though we did not observe significant correlations between AC and these risk factors. CONCLUSIONS: The predicted VAT volume from our equation model was significantly related to metabolic risk factors. This study suggests that the equation model has potential to assess VAT accumulation levels in the field and in clinical settings where CT or MRI is not available.

Missing accelerometer data from low participant wear time underestimates sedentary behavior (SB) and physical activity (PA) measurements. Yet, it remains unclear if imputing data for low participant wear time improves SB and PA estimates.

PURPOSE: To determine if a data imputation technique improves SB and PA estimates in accelerometer data with low participant wear time. METHODS: One-hundred participants wore an accelerometer at the hip for ≥22.0 hours/day, at least 4 days including 1 weekend day, to capture habitual SB, light physical activity (LPA), and moderate-to-vigorous physical activity (MVPA) levels. After removing sleep time (RAW; 15:9±3:5 hours/day), random 60-minute blocks of data were removed from the RAW data set until participants had a unique data set with wear time adherence at 10 hours/day. A minute-by-minute, mean data imputation technique was used to impute estimates of SB, LPA, and MVPA in place of the missing data for the 10-hour adherence level. A series of paired t-tests with a Bonferroni correction (alpha level=0.006) compared the estimates of SB, LPA, and MVPA to the RAW data set at the 10-hour adherence level. If imputing data for low participant wear time improves SB and PA estimates.

PURPOSE: To determine if imputing data for low participant wear time improves SB and PA estimates.

RESULTS: SB, LPA, and MVPA were underestimated by 163.7 (95% confidence intervals [CI]: 156.0, 171.5; p<0.0001), 138.4 (CI: 129.1, 147.9; p<0.0001), and 27.2 (CI: 24.3, 30.1; p<0.0001) minutes/day at 10-hours of wear compared to the RAW data set, respectively. When utilizing the data imputation technique at the 10-hour adherence level, SB and MVPA were underestimated by 16.8 (CI: 8.7, 24.9; p<0.0001) and 17.1 (CI: 14.5, 19.6; p<0.0001) minutes/day compared to the RAW data set, respectively. LPA at the 10-hour adherence level was overestimated by 33.9 (CI: 25.9, 41.9; p<0.0001) minutes/day compared to the RAW data set after utilizing the data imputation technique. CONCLUSION: A minute-by-minute, mean data imputation technique improved SB, LPA, and MVPA estimates in accelerometer data with low wear time adherence. Future studies should examine the impact of data imputation techniques on accelerometer data with low participant wear time.
loading (5 sets of repetitions to failure with additional 10% body weight, n=7), eccentric-only (5 sets of 6-second eccentric-phase-only repetitions to failure, n=6), and control (no pull ups at all, n=9). Participants assessed pull ups at baseline, week 6, and week 12. Over 12 weeks, participants followed general training guidelines and performed pull up specific training twice per week. Changes in number of pull ups were compared with ANCOVAs, using body mass as the covariate.

RESULTS: There were no differences between training groups on changes in pull ups at any point in time. All intervention groups improved control group from baseline to week 12 (p < 0.05). On average, intervention participants improved from 9.3 (± 5.7) repetitions at baseline to 12.9 (± 7.0) repetitions at week 6, to 15.3 (± 8.4) repetitions at week 12. The eccentric training group had the highest drop-out rate and required the greatest time commitment.

CONCLUSIONS: On average for all intervention participants, the improvements in pull ups were large, with a 39% improvement by week 6 and a total of 65% improvement over baseline at week 12. Eccentric training requires more time to complete and potentially decreases adherence to a training program and thus may be a less efficient training program. Any mode of pull up training, performed twice per week, using the basic structure of five sets of maximal repetitions, is effective at improving pull up performance.

3672 Board #119
June 3 9:30 AM - 11:00 AM
Continuous Maximal Vertical Jumping Until Exhaustion Negatively Affects Landing Impact Severity: Effective Duration Measurement
Chad A. Sutherland1, Paul Leuty2, Joel A. Cort1, Jim R. Potvin1. 1McMaster University, Hamilton, ON, Canada. 2University of Windsor, Windsor, ON, Canada.
Email: sutherc@mcmaster.ca

Purpose: The purpose of this study was to examine the impact of continuous, maximal vertical jumping until exhaustion (MVJUE) on landing mechanics in athletes. Method: Nineteen collegiate DIII softball players (age 19.6 ±1.3 years; years of experience 12.5 ±2.3) were randomized into a control or intervention group. The intervention group performed pull ups specific training twice per week. Changes in number of pull ups were compared with ANCOVAs, using body mass as the covariate.

Results: On average for all intervention participants, the improvements in pull ups were large, with a 39% improvement by week 6 and a total of 65% improvement over baseline at week 12. Eccentric training requires more time to complete and potentially decreases adherence to a training program and thus may be a less efficient training program. Any mode of pull up training, performed twice per week, using the basic structure of five sets of maximal repetitions, is effective at improving pull up performance.

3674 Board #121
June 3 9:30 AM - 11:00 AM
A Study of Sling Exercise Training for Judo Athlete to Improve Technique of Seoi-nage
Shan-Shan MAO. Beijing Sport University, Beijing, Beijing, China.

Purpose: As an important and the most frequently used Judo skill, the technique of Seoi-nage requires Judo athlete to disturb the balance of the opponent, and maintain his/her own stability and balance simultaneously. However, very few studies are found about the application of SET in the Judo training. The purpose of the study is to investigate how SET affects the technique of Seoi-nage for Judo athlete.

Methods: A total of 14 healthy male Judo athletes has participated in the study. They are all athletes of National Rank 2 from a sports university. They are randomly divided into two groups, the SET group (S, n=7) and the control group (C, n=7). The S group use the SET program particularly designed for them, while the C group take only conventional free-hand training, which has the comparable load as the S group. They take the training for 6 weeks, three times per week, and each time lasting 15-20 minutes. Before and after the training, technical specifications of Seoi-nage are recorded and analyzed by the video analytical system. The kinematical parameters include the level of the trunk maximum flexion angle (TMFA), maximum angular velocity (MAY), the leg speed in stage of the entering, and the time to finish Seoi-nage. The quality score and the number of Seoi-nage performed within 30 seconds are also measured. The data are processed by the SPSS 13.0. One-way ANOVA is used.

Results: After 6w training, we got the following results. (1) The S group has significant increases (P=0.05) in the averaged TMFA from 20.1° to 28.4° and the MAV from 177.1° to 197.0°(sec). (2) The mean speed of leg in stage of the entering is 0.12 sec, significantly improved (P=0.05) compared with the group C, which is 0.15 sec. (3) Both the averaged quality score and number of Seoi-nage completed within 30 seconds are very significantly improved (P<0.01), from 3.1 to 3.6, and from 10.4 to 12.5, respectively.

Conclusion: 6w-SET can improve the kinematical parameters and performance of Seoi-nage for male Judo athletes. It seems that SET is a useful exercise for training of Judo athletes.

3675 Board #122
June 3 9:30 AM - 11:00 AM
Effectiveness and Feasibility of Integrating Video Feedback into Practice to Improve the Collegiate Softball Hit
Email: chartigan@unce.edu

Purpose: To determine if self-assessment of performance using task cards and video feedback will improve hitting mechanics in collegiate softball players more than standard coaching alone.

METHODS: Nineteen collegiate DIII softball players (age 19.6 ±1.3 years; years of experience 12.5 ±2.3) were randomized into a control or intervention group. The intervention group used task cards and delayed video feedback of their at bats during each hitting practice for four weeks. The control group received standard coaching.

Feedback about performance is standard coaching practice to improve acquisition of an athletic skill. Video feedback improves performance during golf and tennis swings; thus may improve performance during softball swings. Still shots with written instructions (task cards) guide peer assessment; yet the benefits for self-assessment are unknown. PURPOSE: To determine if self-assessment of performance using task cards and video feedback will improve hitting mechanics in collegiate softball players more than standard coaching alone.

Conclusion: 6w-SET can improve the kinematical parameters and performance of Seoi-nage for male Judo athletes. It seems that SET is a useful exercise for training of Judo athletes.
only. Data were collected at: pre-intervention (T1), immediate post-intervention (T2), and delayed post-intervention (T3). Five random hits were coded as “met=1” or “not met=0”. Met was defined as: weight centered between feet during each phase of swing and 1) pre-swing: chin on front shoulder, hands at back armpit, 2) contact: lead with knob of bat, strong lead leg, 3) follow-through: chin on front shoulder. The phase of the hit was coded as “not met” if all criteria were not achieved.

RESULTS: A main effect of time was found for pre-swing (P=0.014), with improvements occurring between T1 and T3 (P>0.009). No other main effects or interaction effects were found for hitting. (Table 1)

CONCLUSIONS: Task cards and delayed video feedback did not improve hitting mechanics more than standard coaching. Regardless of group assignment, all players improved in the pre-swing phase by the end of regular season games. The improvement in pre-swing suggests an improved ability to make contact with the ball because the batters’ pre-swing stance puts them at an advantage to reach a variety of pitches (i.e. inside, outside, high, low).

Table 1. Hits over time coded as met=1 and not met=0: Means (SD)

<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-swing</td>
<td>0.30</td>
<td>0.51</td>
<td>0.59</td>
</tr>
<tr>
<td>Contact</td>
<td>0.85</td>
<td>0.76</td>
<td>0.87</td>
</tr>
<tr>
<td>Follow-through</td>
<td>0.90</td>
<td>0.83</td>
<td>0.87</td>
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</table>

EFFECTS OF AEROBIC EXERCISE USING SWISS-BALL OR CHAIR COMPARED WITH WALKING.

Toshihiro Wakimoto1, Tatsuya Saitou2, Tomomi Monri1, Yoshiyuki Yamamak2, Soubach Fujiimoto2, Toshihiro Takao2. 1, Kawasak Medical School of Welfare, Kurashiki, Japan. 2, Kawasak Medical School, Kurashiki, Japan. Email: wakimoto@med.kawasaki-m.ac.jp

PURPOSE: To clarify the physiological effectiveness of various movement on aerobic exercise using Swiss-ball (SB) or chair, we compared the exercise intensity between walking and aerobic exercise using SB or chair.

METHODS: Nine healthy men performed walking and aerobic exercise using SB or chair. Respiratory metabolism and heart rate were measured during walking and aerobic exercise using BB. Subjects walked at 4 speeds (4 km/h, 5 km/h, 6 km/h and 7 km/h) on treadmill ergometer. During aerobic exercise using SB, subject was sitting on the SB and bouncing with upper and lower limb movements. During aerobic exercise using chair, subject was sitting on the chair and exercising with upper and lower limb movements. The movements consisted of four patterns of upper and lower limb movements.

RESULTS: The exercise intensity during aerobic exercise using SB (4.8±0.6 Mets) was significantly higher (P<0.001) compared with aerobic exercise using chair (3.6±1.1 Mets). There was no difference between aerobic exercise using SB and chair on the heart rate (SB: 118±12 beats/min, Chair: 110±14 beats/min). The exercise intensity in aerobic exercise using SB was nearly identical with moderate-intensity walking. The aerobic exercise using chair, subject was sitting on the chair and exercising with upper and lower limb movements.

CONCLUSIONS: The exercise intensity during aerobic exercise using SB was nearly same as walking at 4-5 km/h (3.3±0.4 Mets - 3.8±0.5 Mets). There was no difference between aerobic exercise using SB and chair on the heart rate (SB: 118±12 beats/min, Chair: 110±14 beats/min). The exercise intensity in aerobic exercise using SB (4.8±0.6 Mets) was nearly identical with moderate-intensity walking. The aerobic exercise using chair, subject was sitting on the chair and exercising with upper and lower limb movements.

Although training intensity is commonly adapted by modifying the relative load (e.g. %1RM), absolute velocities are also targeted to facilitate speed- and power-oriented training objectives. PURPOSE: Examine the variation in relative loads and relative velocities used to perform a bench press at 6 absolute velocities. METHODS: Thirty men completed three bench press tests: 1RM, max velocity with 2.5kg bar, and 6 sets of 4 reps with loads of 15-90% 1RM. Participants were instructed to lower and lift the bar as fast as possible. Mean and peak concentric barbell velocity was computed via a linear position transducer. The average mean velocity of each 4-rep set and the relative load lifted were used to create participant-specific regression equations that would capture each individual’s load-velocity relationship. These equations were then used to estimate the %1RM that would have been used to move the bar with the group’s mean velocity with loads of 15-90% 1RM. These “target” velocities were also expressed as a relative percentage of the maximum velocity (%Vmax) achieved by each participant during the 2.5kg test. The variation in %1RM for each velocity was described by the standard deviation and range amongst participants. A similar approach was used to estimate the %Vmax that would have been achieved using a range of loads (15-100% 1RM). RESULTS: Lower %1RM and higher mean velocities were associated with the largest variation in training intensity across participants (Table 1). CONCLUSION: Using specific absolute mean velocities as “targets” could result in substantial variation to the corresponding %1RM and %Vmax across a group of athletes. To accommodate the abilities of each performer, it may be important to use relative velocity targets.

Table 1. Participants’ estimated %1RM and estimated %Vmax for 7 absolute velocities and relative loads, respectively. Data were computed using the participant-specific regression equations, and are expressed as a mean, standard deviation (SD) and range.

<table>
<thead>
<tr>
<th>Absolute Velocity (m/s)</th>
<th>Estimated %1RM</th>
<th>Estimated %Vmax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>SD</td>
<td>Range</td>
</tr>
<tr>
<td>1.70</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>1.30</td>
<td>33</td>
<td>8</td>
</tr>
<tr>
<td>1.00</td>
<td>49</td>
<td>7</td>
</tr>
<tr>
<td>0.75</td>
<td>62</td>
<td>5</td>
</tr>
<tr>
<td>0.50</td>
<td>76</td>
<td>4</td>
</tr>
<tr>
<td>0.25</td>
<td>87</td>
<td>4</td>
</tr>
<tr>
<td>0.10</td>
<td>98</td>
<td>4</td>
</tr>
</tbody>
</table>
While there is much anecdotal evidence suggesting the importance of time of day (TOD) in which exercise training is performed, there is a paucity of controlled comprehensive evidence on the influence of TOD on fitness and training adaptations. PURPOSE: to determine the effect of TOD on mediating training-induced changes in exercise performance, cardio-metabolic health, and body composition in active normal weight women. METHODS: 27 healthy active females (BMI = 24 ± 3 kg/m²; 42.8 yrs) were recruited for this study and randomized to either exercise training in morning (AM) or evening (PM) for 12 weeks. In following recent ACSM guidelines, we employed a multimodal training paradigm (Resistance, Interval, Stretching, and Endurance, RISE). Baseline exercise performance was assessed via abdominal, upper and lower body muscular strength (situps, pushups, 1 RM bench and leg presses), power (jump squats and bench throws), aerobic power (5km cycling time trial), flexibility (sit and reach), and balance (stark stand), cardiovascular health (blood pressure, and augmentation index (AIx)), body composition (IDEXA; Fat free mass, fat mass, abdominal/visceral fat, %body fat), hunger/satiation ratings (visual analog scales), and cardio-metabolic profile (energy expenditure, fasting lipids, glucose, insulin).

RESULTS: At baseline, no differences existed between groups in any variable. Training resulted in significant (p<0.05) improvements in exercise performance, cardio-metabolic health, and body composition. However, there were significant interactions (p<0.05) of TOD x training for DBP (101 ± 1: v. 55±1mmHg), RMR (-130±65 v. -123.6±12 ± 36 Kcal/d), FM (-1.0±0.2 vs. -0.3±0.2 Kcal), Abfat (-2.6±0.3 v. -0.9±0.5 Kcal), IRM BP (8±2 v. 12±2 Kd); significant training effects (9.1±3 vs 1±3 Kd), BT power (106 v. 45±28 Watts), Sj power (135±6 v. 39±8 Watts), AM vs. PM, respectively.

CONCLUSIONS: The multimodal RISE protocol improved performance, cardio-vascular health, and body composition, with the TOD altering the magnitude of exercise training-induced adaptations. Specifically, training in the AM resulted in greater improvements in diastolic blood pressure, fat mass, abdominal fat mass, and lower body peak power. Whereas, training in the PM resulted in greater gains in upper body muscle strength, endurance, and power. Support: Isagenix.

Small sided games are commonly used in team sports to incorporate live play and high repetition skill execution. There is little data with regard to the physiological requirements of small sided vs. traditional game format in ice-hockey. PURPOSE: Use player mounted sensors (PMS) to compare the accelerations (ACC) and heart rate (HR) between traditional (TRAD) and 3v3 cross-ice games among elite, national-level youth-ice hockey players. METHODS: 29 elite ice hockey players (15.2 ± 2.7, 177.4 ± 7.1, 72.9 Kg ± 16.7) who participated in USA Hockey National Player Development Camp consented to procedures approved by the EMU human subjects committee. Players wore Zephyr Bioharness-3 (Zephyr, MD) PMS across their chest. The PMS recorded HR and ACC at 10 Hz over the seven on ice sessions of the five-day camp. This included three practice sessions, three games (G1, G2 and G3) and one 3v3 training session. PMS were downloaded to Omnisense software (Zephyr, MD) and data was exported from Omnisense to WK04 (Peakware, CO) for storage and analysis. Peak ACC across multiple time frames (5, 10, 20, 30, 45, 60 sec, 5, 10, 20, 40 min) were quantified. Heart rate was quantified and used in conjunction with ACC to determine exercise intensities for each on-ice session. MANOVAs for peak ACC and HR at each element passed games and 3v3 with regard to time and as main effects were performed using SPSS 23.0 (IBM, NY). RESULTS: No differences were observed between sessions for 5 sec, but 10 sec ACC was lower for 3v3 vs G1 and G2 (p<0.05), but not G3. No sig differences were observed for 20-60 sec ACC (p>0.05), but small effects were present at all time frames (r² = 0.021 - 0.077). No sig differences were observed for 5 min ACC, but 10, 20 and 40 min, were all significantly higher for 3v3 than G1, G2 or G3 (p<0.05). For HR, no sig differences or effects (r²<0.01) were present for any time frame less than 5 min. HR was higher for 5, 10, 20 (p<0.05) but not 40 min, for 3v3 vs G1, G2 and G3. CONCLUSIONS: Reduced 10 sec ACC for 3v3 indicates a reduced reliance on phosphagen system than TRAD games while higher ACC and HR for 10, 20 and 40 min indicates that 3v3 is more reliant on aerobic systems than TRAD games. Insignificant differences, with small effects, for 20 - 60 sec between TRAD games and 3v3 indicate there may be practical differences that are less distinct than for other time frames.
During summer break, ROTC cadets are not required to participate in mandatory physical training. PURPOSE: To investigate the effect of an eighteen-week cessation in regimented physical training on body composition measurements and cardiopulmonary endurance in a cohort of Army ROTC cadets. METHODS: Two testing sessions were completed in the spring and fall, by 35 cadets (males n=29, age=22.9±3.8yrs vs. 23.1±4.0yrs, height=175.1±5.9 vs. 175.0±5.9cm, weight=76.5±9.7 vs. 77.7±9.1kg and females n=6, 21.4±1.5 vs. 21.6±1.5yrs, 162.7±5.6 vs. 162.5±5.9cm, 63.0±5.4 vs. 64.1±5.6kg, for the spring and fall respectively). Body composition was assessed using circumference and 3-site skinfold measurements. Percent body fat (%BF) was calculated using Brozek formula. Cardiorespiratory endurance was assessed by completion of maximal oxygen uptake (VO2max) test on a motorized treadmill using a modified Åstrand protocol. RESULTS: Body mass was significantly increased in both male (spring: 76.5±9.7kg vs. fall: 77.8±9.1kg; p<0.05, Δ=1.3kg) and female (spring: 63.0±5.5 kg vs. fall: 64.1±5.7kg; p<0.05, Δ=1.1kg) cadets. There was a significant increase in the sum of three skinfolds and %BF in male cadets (spring: 43.0±13.3mm & 12.4±3.8% vs. fall: 49.8±11.8mm & 14.3±3.3%; Δ=6.8mm & 1.9%, respectively, p<0.05), but not in female cadets. Lean body mass remained unchanged from spring to fall testing sessions (p>0.05). Body Mass Index was significantly increased in male cadets (spring: 24.9±2.7 vs. fall: 25.3±2.4; p<0.05) and female cadets (spring: 23.7±1.5 vs. fall: 24.2±1.9; p<0.05). Time on treadmill decreased significantly in male cadets (spring: 12.3±1.3min vs. fall: 11.5±1.5min; p<0.05). Significant declines in relative VO2max results were seen in male cadets (spring: 51.1±4.2 vs. fall: 49.4±3.3ml/kg/min; p<0.05, Δ=1.8ml/kg/min). There were no significant changes for time on treadmill or relative VO2max for female cadets. There was a significant interaction for post-test blood lactate with the female cadets increasing from 7.7±2.1 to 9.7±1.5mmol and male cadets decreasing from 10.6±2.0 to 9.0±2.6mmol. CONCLUSION: An eighteen-week training cessation from physical training negatively affected body composition in both male and female Army ROTC cadets and cardiopulmonary endurance in male cadets.

Sked towing is a popular method of overload training in many field sports. The initial acceleration and top speed phases are components in developing peak velocity in athletes. Acute training may lead to postactivation potentiation (PAP), which occurs when subsequent muscle performance is enhanced following a preload stimulus. However, this is highly dependent on rest time. PURPOSE: To investigate acute sprinting in the acceleration and maximum speed phases following different rest periods after sked towing. METHODS: Eleven male field sport athletes (age=23.0±2.79yrs, height=177.45±6.34cm, mass=82.52±8.79kg) completed a standardized warm-up then performed a baseline 30 meter (m) sprint (measured with acceleration and maximum speed splits). They were then attached to a waist harness and towed a sled equal to 30% of their bodyweight for 30m with maximal effort. Following a random rest period (2, 4, 6, 8, or 12min), they performed another maximal effort bodyweight sprint without the sled. RESULTS: A 4x6 (split x condition) ANOVA revealed that baseline split times (split 0-5m 1.14±0.05s, split 5-10m 0.77±0.04s, split 10-20m 1.30±0.06s, split 20-30m 1.25±0.07s) were not different than split times for any rest condition (collapsed across rest conditions, split 0-5m 1.14±0.05s, split 5-10m 0.78±0.03s, split 10-20m 1.33±0.07s, split 20-30m 1.27±0.07s). CONCLUSIONS: Sled towing did not increase or decrease acute maximal effort bodyweight acceleration or maximum speed sprint times. The different rest periods did not elicit a PAP effect, which may be attributed to less than optimal loading.
3667 Board #134
June 3 9:30 AM - 11:00 AM
Effects of a 3-week Core Training Program on Different Unstable Platforms
Alexa J. Chandler1, Sebastian Harenberg2, Joseph DiSalvo2, John Fausold1, Larisa Melendez2, Rachel Simkins1, Collin Gill2, Victor Lopez-Carr2en, Thomas Swensen2.1Rutgers, The State University of New Jersey, New Brunswick, NJ. 2Ithaca College, Ithaca, NY. (Sponsor: Shawn Arent, FACSIM) (No relationships reported)

The untested InertiaCore Balance Trainer (ICT) is designed to improve core function. Users engage the core musculature to maintain balance on the unstable device; its stability is adjusted by adding weight. This flexibility makes the ICT appropriate for all fitness levels. PURPOSE: To compare the effects of a 3 wk core-training program completed on the ICT or a stability ball (SB). METHODS: Thirty-one active college age students (19.4 ± 1.4 yrs and 65.2 ± 11.0 kg) were divided into the ICT and SB groups, each of which completed various medicine ball throws, crunches, and Russian twists. Subjects trained 3 d/wk for 3 wk; medicine ball weight and repetitions increased during the program’s midpoint. Changes in core power and strength were measured across time with the Frontal Abdominal Power Throw (FAPT) and a Cybex dynamometer. Data were analyzed using repeated measures ANOVAs. Dependent t-tests were used to examine changes across time within groups. RESULTS: The ANOVAs revealed no significant main effects between the time points or groups for any dependent variable. The dependent t-tests revealed that SB training significantly increased Cybex flexion and extension power by 2.2% (138.3 ± 3.8 to 141.4 ± 37.6; p = 0.047) and 5.6%; (118.3 ± 49.2 to 124.9 ± 50.8; p = 0.018), respectively, while ICT training produced no significant changes. A significant interaction was found for flexion power (p = 0.036), indicating opposing trends between the two groups across time. A similar relationship was found for flexion work, but the interaction only approached significance (p = 0.059). CONCLUSION: The ICT did not improve core function relative to the SB. This study focused on unstable training, but using more weight on the device, thereby increasing stability and resistance, may alter outcomes.

3668 Board #135
June 3 9:30 AM - 11:00 AM
Effects Of An Eight-week SwingFit Training Program On Balance, Muscular Strength, And Muscular Endurance.
James Schoffstall1, FACSIM, Chris Carver, Jon Houck, Andy Bosak, Chelsea Page. Liberty University, Lynchburg, VA. Email: jschoffstall@liberty.edu (No relationships reported)

PURPOSE: The purpose of this study was to determine the impact of an eight-week SwingFit training program on balance and strength. METHODS: Twelve active, low-risk stratified individuals were recruited as subjects. The experimental group consisted of seven females (25±11yrs; 163.4±6.5cm; 62.9±7.8kg) and five males (29±14yrs; 175.0±4.4cm; 75.3±5.4kg). Pre- and post-training assessments were completed for balance, strength and muscular endurance. Balance was assessed using the Biodex Balance System SD using the static balance assessment. Grip strength was assessed using the Takei hand dynamometer. Hip/leg strength was assessed using a Takei back & leg dynamometer. Muscular endurance was measured using a SwingFit® seated pullup test. RESULTS: Overall stability improved significantly (p < 0.05) from 1.03±0.49 to 0.74±0.13. Muscular endurance improved significantly (p < 0.05) from 27.2±7.7 reps to 35.5±3.0 reps on the SwingFit seated pullup test. Hip & Leg strength increased significantly (p < 0.05) from 69.6±30.7 kg to 78.1±32.4 kg. The combined grip strength (right hand + left hand) increased significantly (p < 0.01) from 61.2±19.1 kg to 70.8±22.3 kg. CONCLUSIONS: The SwingFit training program has been demonstrated to be an effective option for improving balance, as well as muscular strength and endurance in an eight-week training program. Future research may examine the impact of training programs and/or comparing the SwingFit program to other more established methods of training.

3669 Board #136
June 3 9:30 AM - 11:00 AM
Changes In Heart Rate Variability And Training Load In Elite Football Players
Bryna C. Chrismas1, Lee Taylor2, Graham Stark1. 1Qatar University, Doha, Qatar. 2Aspetar Orthopaedic and Sports Medicine Hospital, Doha, Qatar. *University of Bedfordshire, Bedford, United Kingdom. Email: bcrichmas@qu.edu.qa (No relationships reported)

Heart rate variability (HRV) is a popular and accessible monitoring tool utilized ubiquitously in the field to measure autonomic nervous system activity, readiness to train, and training adaptations. Acquisition of this information is essential for coaches, practitioners and athletes in order to effectively monitor positive training adaptations, nonfunctional over-reaching, injury and illness risk. However, longitudinal data assessing HRV changes with respect to training load in elite football players is lacking. PURPOSE: To investigate changes in HRV and training load across several weekly training blocks in elite football. METHODS: Six male professional footballers (three defenders, three midfielders) from an English Premier League squad agreed to participate in this study. HRV was assessed with the ithlete application (HRV Fit Ltd, UK) using an Apple iPad2 (Apple Inc, CA), and a Polar T31 heart rate monitor (Polar Electro Ltd, Finland). HRV was calculated for each participant prior to the daily training session. Physical training load was monitored using a Global Positioning System (GPS) to quantify total distance (TD), high speed distance (HS), training load (TL), impacts, maximum speed (MS), accelerations and decelerations, and energy expenditure (EE). Training sessions were separated into five equal training blocks (weeks 1 - 3, weeks 4 - 6, weeks 7 - 9, weeks 10 - 12 and weeks 13 - 15). RESULTS: There was a significant decrease in TD, HSD, TL, impacts and EE and a significant increase in MS, accelerations and decelerations across the five training blocks (p ≤ 0.03). However, there was no significant change in HRV (p = 0.27). CONCLUSION: The significant change in TL across the 15th training period, despite no change in HRV may be due to the heterogeneity that exists in elite football players, where some athletes show smaller reductions in HRV in response to training compared to others. Therefore it is important that individual changes in HRV are interpreted alongside additional monitoring methods (e.g. wellness, training load) to ensure that quantification of training adaptation, readiness to train and overreaching is accurate.

3670 Board #137
June 3 9:30 AM - 11:00 AM
Acute Effects Of Plyometric Exercise On Blood Glucose
Saldrian R. Barillas, Casey M. Watkins, Megan A. Wong, Ian J. Dobbs, David C. Archer, Cameron N. Munger, Andrew J. Galpin, Jared W. Coburn, FACSIM, Lee E. Brown, FACSIM. California State University, Fullerton, Fullerton, CA. (No relationships reported)

Short duration, high intensity exercise has been implemented in various weight-loss programs. Although traditional plyometric training is not commonly prescribed for weight loss, exercises such as jumping are popular in commercial exercise programs. However, the effect of plyometric exercise on blood glucose levels is unknown. PURPOSE: To investigate the effect of relatively high intensity plyometric exercise on glycemic control. METHODS: Thirteen subjects (6 females age=21.8±1.0yrs; height=163.7±7.3cm; mass=60.8±6.7kg and 7 males age=22.0±2.6yrs; height=182.3±3.6cm; mass=87.8±4.13kg) volunteered to participate. Inclusion criteria was the ability to achieve 80% of their age predicted max heart rate (APMHR) following the plyometric exercise. Subjects wore a heart rate monitor and completed two random conditions on two separate days, consisting of either five sets of 10 maximal effort countermovement jump squats (SJ) with 50 seconds rest between sets or quiet sitting (SIT) for the time equated to the SJ duration (~4min). Immediately after each condition, subjects drank 75g of anydrous glucose in 100ml of water. Blood glucose measurements were taken via finger prick and analyzed by an Accu-Check Performa device pre and immediately post SJ or SIT, and 5, 15, 30, and 60 min post. RESULTS: A 2x6 (condition x time) ANOVA revealed a significant interaction where SJ blood glucose levels were lower at 15 (114.2±14.6mg/dl) and 30 (122.6±12.5mg/dl) min post compared to SIT (15min 159.3±21.0mg/dl). Pairwise comparisons revealed that 5 (150.8±14.0mg/dl) & 30 (159.9±21.0mg/dl) min were significantly greater than baseline (93.8±8.8mg/dl) for SJ and for SIT 5 (106.1±12.8mg/dl), 15 (114.1±14.6mg/dl), 30 (119.8±12.5mg/dl) min were significantly greater than baseline (93.8±8.8mg/dl) for SJ and for SIT 5 (106.1±12.8mg/dl), 15 (130.8±14.1mg/dl), 30 (139.2±11.7mg/dl) min baseline (94.7±8.1mg/dl). CONCLUSIONS: The current plyometric protocol attenuated post-exercise blood glucose levels at 15 and 30 minutes post SJ at 80% APMHR when compared to SIT. This may be due to increased physiological stress applied to the muscles, thus increasing muscular glucose uptake. Reaching 80% APMHR might be the desired physiological stress level to stimulate a change in glycemic control.
Aerobic exercise has been shown to induce positive physiological outcomes. Research indicates that 16-week firefighter recruit academies yield pre-post program fitness gains. However, timelines of academy training protocols have been questioned, as the majority of fitness gains are observed after the first eight weeks of the program. Further, no research has examined the effect of recruit academies through an integrated lens, with physiological and psychological variables assessed concurrently. PURPOSE: To examine the effect of a firefighter recruit academy on measures of fitness and stress-recovery state. METHODS: Recruits enrolled in a Midwest region academy program (N = 15; 2 females; 29.0 ± 4.6 yrs; 181.7 ± 7.2 cm; 86.8 ± 11.5 kg) completed all measures at three time points throughout the 16-week academy: week 1 (T1), week 8 (T2), week 16 (T3). To assess fitness, muscle strength, estimated VO2 max, body fat percentage, [5%], recruits completed handgrip dynamometry, Forestry Step Test, and skinfold measurements. To assess stress-recovery state, recruits completed a 52-item questionnaire on perceptions of stress and recovery (RESTQ-Sport). Repeated measures multivariate analysis of variance (RM MANOVA) tests were conducted to examine the effect of time on fitness (3 levels) and stress-recovery state (2 levels). An alpha of 0.05 was used to determine statistical significance. RESULTS: The RM MANOVA test for the effect of time on fitness was significant (F(2,120) = 6.438, p < 0.001, η² = 0.25). Post hoc pairwise comparisons demonstrated a
significant increase in fitness between T1 and T2 (p = 0.005), and a significant decrease in fitness between T2 and T3 (p = 0.020). In addition, the RM MANOVA test for the effect of time on stress-recovery state was also not significant (F = 1.884, p = 0.194, η² = 0.013). CONCLUSIONS: The Thorstensson test has been well established as a valid assessment of fatigability by providing a Fatigue Index (FI) of the knee extensors. The Onset of Blood Lactate Accumulation (OBLA) has also been shown to have a significant influence on the development of fatigue during high intensity exercise bouts. Improvements in OBLA have been seen during muscular endurance resistance (MER) training resulting in enhanced exercise performance. However, the relationship between OBLA and FI remains unclear. PURPOSE: The purpose of the current study was to investigate the relationship between OBLA and FI as well as examine if improvements in FI could be achieved through MER training. METHODS: 17 endurance trained males (age: 23.4±4.92 years and BMI: 23.5±3.11) were recruited to participate in a 6 week study. Subjects were randomly assigned to either an experimental (EX) or control (CON) group: 9 EX and 8 CON. Both groups continued their current aerobic training for the duration of the study. The OBLA was measured using the Thorstensson protocol. 1 repetition maximum (RM) for: leg press (LP), leg curl (LC), and leg extension (LE). The Thorstensson protocol was also performed using a dynamometer. In addition, the EX group performed supervised MER training (12 to 15 repetitions for 4 sets for LP, LC, and LE) for four weeks. T-test were used to determine if between group differences existed using delta scores (post-pre). Pearson’s correlation was used to assess the relationship between OBLA and FI. RESULTS: No significant group differences were observed in all baseline measurements (p>0.05). There were no significant group differences for OBLA (mmol/L) (EX: 7.2±4.12 vs. CON: 3.5±2.91) and FI (%) (EX: 0.00±1.76 vs. CON: 1.68±10.97) (p<0.05). Pearson’s correlation revealed no significant relationship (p>0.05, r=0.01) exists between FI and OBLA. CONCLUSIONS: Four weeks of MER training was unable to improve both OBLA and FI. It was also observed that no significant relationship existed between OBLA and FI. It can be speculated that the physiological stress associated with the Thorstensson protocol is only sufficient enough to require energy contributed from the phosphocreatine system and not the glycolytic system. Thus improvements in OBLA will have no effect on FI as it was assessed in this study.

Ankle injury is one of the most common injuries that occur during sports activities in Korea. Ankle strengthening exercise (ASE) is often used in the rehabilitation of ankle injuries; however, the degree of ASE effect and the effect of moderating variables are not known. PURPOSE: The purpose of this study was using meta-analysis to determine the effectiveness of ASE on ankle isokinetic strength. METHODS: Articles were searched from 1988 to 2015 using online database: RSS, NDLIS, and NAL (National Assembly Library in Korea). Search terms included phrases such as “ankle”, “exercise”, and “ankle strength”, “ankle rehabilitation”, “ankle isokinetic”. Comprehensive Meta-analysis version 2 software was used to calculate the weighted mean effect sizes (ES) and 95% CI and to conduct moderator analyses. ES calculations were based on a comparison of change scores from control and intervention groups using a random effects model. Cochran’s Q statistic and I² were used to assess heterogeneity of ESs. Moderator variables included participants’ sex, age, type of exercise, intervention duration, and ankle action. RESULTS: Overall, 111 ESs were calculated from 29 studies. The results showed a large and positive weighted mean ES of 0.78 (95% CI = 0.64, 0.92). The ESs were heterogeneous, Q = 309.62, df = 10, p < .001, I² = 64.47, which supported a further examination of moderator variables. Intervention duration (Qbetween = 8.68, df = 2, p = .013) and sex (Qbetween = 10.30, df = 2, p = .006) influenced the overall ES. Duration of 12 weeks (ES = 1.36) had a higher ES than other durations (60 and 78 weeks for 6 and 78 weeks, respectively). There were larger effects on studies with males (1.76) than studies with only males (0.76) and both males and females combined (0.46). Age, type of exercise, and ankle action did not influence the overall ES. CONCLUSIONS: ASE was determined to be an effective training method to enhance ankle strength with a greater effect from studies with longer interventions and females.
significant differences across weeks. An alpha of $p < 0.05$ determined statistical significance for all analyses. RESULTS: Significant main effects were identified for both FMS™ ($F_{1,18} = 54.26, p < 0.001$) and YRI ($F_{1,18} = 5.42, p = 0.034$), analyses indicated that FMS™ significantly changed from week 1 to 16 ($p < 0.001$; 11.93 ± 1.8 vs. 13.7 ± 1.5) and from week 16 to 38 ($p = 0.002$; 13.7 ± 1.5 vs. 14.4 ± 1.3). There was not a significant change in YBT from week 1 to 16 ($p = 0.539$; 97.8% ± 5.7% vs. 97.1% ± 3.8%), but YBT did significantly decrease from week 16 to 38 ($p < 0.001$; 97.1% ± 3.8%). CONCLUSIONS: Firefighter recruits exhibited better evaluation quality, but decreased balance after 38 weeks. The work of a firefighter may prompt a loss in balance ability, perhaps serving as a key factor for slips, trips, and falls. Future research should examine longitudinal changes in other measures of fitness to elucidate the underlying mechanisms(s) in decreased balance ability.

Nowadays, the sedentary lifestyle and lack of interest in participating in physical activity among the college students in China result in the declining their health and physical fitness. Rock climbing is a newly growing physical exercise which provides excitement and challenges and is attracting more college students to participate in this physical exercise in China. PURPOSE: The purpose of this meta-analysis was to determine the effects of rock climbing on the physical fitness among college students. METHODS: Conducting a thorough electronic search and selection, nine studies were included in this meta-analysis, and the rock climbing intervention periods ranged from 4 to 24 weeks (3-6 times/week and 60-120 minutes each time). Ten variables included in this meta-analysis were: Body fat percentage, VO2 max, Heart rate, Hand grip strength, Lower limb pedaling power, Vertical jump, Push-ups, Pull-ups, Sit-ups, and Sit-and-reach. The effect sizes (ES) and forest plots of these ten variables were calculated ($p < .05$) and generated, respectively. RESULTS: Eight variables (Hand grip strength, ES = −81; Lower limb pedaling power, ES = −36; Vertical jump, ES = −73; Push-ups, ES = −84; Pull-ups, ES = −1.09; Sit-ups, ES = −1.16; Sit-and-reach, ES = −1.15; and VO2 max, ES = −76) out of ten were significantly improved after rock climbing intervention, while ES values of Heart rate and Body fat percentage did not show significant improvement after the intervention. CONCLUSIONS: Rock climbing as one of fast-growing exercises has some positive effects on the physical fitness among college students, and might be more effective if the college students engage in rock climbing in a longer term.

**Sprint time (ST) is the product of stride length (SL) and stride frequency (SF). Increases in either of these variables results in speed improvement. PURPOSE: To investigate the short (immediately and 30 min post-competition) and the long-term effects (24h post-competition) of passive rest on physical parameters, metabolic, hormonal and inflammatory responses following Mixed Martial Arts (MMA) competition. METHODS: Twelve male mixed martial artists participated in three rounds of 3 min of MMA competition separated by 1 min of passive rest. Each group trained 3 day/wk for 6 weeks. The RST group used a combination of resisted and assisted sprint training in team sports and sprint performance in soccer. Post meta-analytical studies on a variety of sports and sprint performance in soccer. Post meta-analytical studies on a variety of sports and sprint performance in soccer.

**Effect of Plyometric Training on Explosive Strength and Sprint on Team Sports: A Meta-analysis**

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Plyometric training (PT) has shown to improve vertical jump height in athletes. However, little is known about its effectiveness for improving strength and speed performance in team sports. PURPOSE: To determine the effect of PT on explosive strength and sprint performance in team sports. METHODS: The search for information was conducted in the following electronic databases: Ovid, SportDiscus, Medline, Academic Search, Pubmed, ProQuest, Science Direct and Springer Link. Studies employing a PT intervention and containing data necessary to calculate effect sizes (ES) were included in analysis. Hedge’s standardized mean difference effect size (ES) was calculated and ESs pooled using random-effects models. Non-overlapping 95% confidence intervals (CI95%) were considered statistically significant. Heterogeneity was assessed using Q and I². RESULTS: A total of 31 studies with total of 50 ESs met the inclusion criteria for explosive strength and 18 studies with total of 43 ESs for sprint performance. PT improved explosive strength (ES = 0.98, CI95% = 0.77, 1.20, Q = 174.51, I² = 71.95) in team sports and sprint performance (ES = −0.30, CI95% = −0.59, −0.00, Q = 237.60, I² = 82.32) only in soccer. The improvement occurred regardless of the training season and protocol used. Analysis of moderator variables demonstrated that the strategies to maximize the probability of obtaining significant ($p < 0.05$) improvements in explosive strength included a training volume > 9 weeks, at least 27 sessions, 3 to 6 exercises, 20 to 32 repetitions per exercise, 4 to 6 series, 4-min rest between sets, 50 to 150 vertical jumps, and a session duration of approximately 30 min. To improve sprint performance in soccer, moderator variables included training 8 to 10 weeks, 2 times a week, 4 to 6 exercises, 2 to 4 series, 5 to 10 repetitions, 1-min rest between sets, 50 to 200 vertical jumps per session, and a session duration of about 40-min. CONCLUSIONS: PT enhanced explosive strength in team sports and sprint performance in soccer. Post meta-analytical studies on a variety of sports are warranted to confirm the validity of the results of the present study. The findings of this meta-analysis suggest that PT should be considered by coaches to optimize explosive strength and speed performance in team sports athletes.
comparing between training groups via independent t-tests at each sprint distance. RESULTs: For the RST 30m, ST (1.18±0.08 s vs 1.14±0.08 s, p=0.01) and SL (2.06±0.08 s vs. 2.09±1.14 ms, p=0.01) were significantly improved. For the AST, 30m ST (1.19±0.08 s vs. 1.18±0.08 s, p=0.01) and SL (2.10±0.13 s vs. 2.11±0.13, p=0.04) were significantly improved. No improvements in ST or SL were detected for either the RST or AST groups at the 60m sprint distance. For the RST 120m, ST (1.13±0.07 s vs. 1.12±0.07 s, p=0.01) and SL (2.30±0.08 s vs. 2.33±0.08, p=0.01) were significantly improved. At the 30M interval, the RST demonstrated significant improvements in SL and ST as compared to the AST (p<0.01). However, at the 120M interval, the AST demonstrated a significant improvement in SL as compared to the RST (p<0.01). CONCLUSION: Within the parameters of this study, RST and AST methods have proven effective at improving sprint performance. It appears that RST protocols may be of greater benefit at longer sprinting distances.

3704 Board #151 June 3 9:30 AM - 11:00 AM Head Accelerations Associated with Six Standard Judo Throws and Break Falls Tyler K. Florentin, Casey Snodgrass, Shawn O. Henry. Pacific University, Forest Grove, OR. Email: flof0760@pacificu.edu

No relationships reported

The contact sport of judo involves throwing an opponent in a variety of ways, with potential risk of concussive head impacts. When being thrown, a judo practitioner executes a break fall, theoretically protecting the head from injury. However, little research has directly measured head accelerations of a person executing a break fall in response to various throws in judo. PURPOSE: Quantify and compare head accelerations associated with six standard judo throws and corresponding break falls. METHODS: In random and repeated design, 14 judo martial artists (13 male, 1 female; age = 28 ± 9 yrs; stature = 177 ± 6.7 cm; mass = 80.3 ± 9.4 kg, rank = brown or black belt) performed five sets of six standard judo throws & corresponding break falls. The six throws were layback throw (tomoe-nage), hand throw (tai-otoshi), leg sweep (harai-turi-omi-komi-ashi), shoulder throw (seoi-nage), forward leg sweep (dae-ha-iss-eri), and thigh throw (uchi-mata). The participant being thrown wore a headband-mounted tri-axial accelerometer, measuring linear (g) and rotational accelerations (krad•s⁻²) of the head when performing a break fall corresponding with each of the six throws. Minimum threshold for registering head acceleration was 16 g. RESULTS: Reported as mean ± standard deviation (SD). Significant differences were detected between methods of head accelerations and magnitude and frequency of accelerations of the head when performing a break fall corresponding with each of the six throws. When utilizing the linear acceleration criterion ≥80 g for risk of concussion, as suggested by some experts, none of the six judo throw/ break fall combinations resulted in a significant head impact (incidence rate = 0%). However, when comparing all registered accelerations above 16 g threshold, hand throw (1 impact, 1.4% incidence rate, 27.94 g, 2.8 krad•s⁻¹), forward leg sweep (8 impacts, 1.2% incidence rate, 28.16 ± 4.92 g, 3.94 ± 1.83 krad•s⁻¹) resulted in any impact considered high risk for concussion.

3705 Board #152 June 3 9:30 AM - 11:00 AM Impact of Percentage-based Versus Autoregulated-based Load Prescription on Maximal Strength Daniel M. Cooke¹, Eric R. Helms², Ryan K. Byrnes³, Michael H. Haischer⁴, Trevor K. Johnson⁵, Jose C. Velazquez⁶, Joseph P. Carzoli⁷, John B. Cronin⁸, Adam G. Storey⁹, Michael C. Zouzard¹⁰, Nicholas L. Raton, F.¹¹ Auckland University of Technology, Auckland, New Zealand. (Sponsor: Michael Whitehurst, FACSM)

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No relationships reported

Researchers and practitioners use the resistance training-specific rating of perceived exertion (RPE) scale to individualize load prescription. However, an intervention to compare traditional percentage-based load prescription versus RPE-based loading for strength adaptations has not been conducted. PURPOSE: To compare changes in one-repetition maximum (1RM) strength of the back squat and bench press between percentage-based training (PBT) and autoregulated-based training (ABT) via RPE. METHODS: Eleven males (age: 23±3 yrs, body mass: 77.4±7.7 kg, body fat: 9.5±3.8%) with at least two yrs. of training experience and a minimum of 1RM of 1.5 and 1.25x bodyweight on the squat and bench press respectively, were assigned to one of two groups: PBT (n=6) or ABT (n=5) for 8 weeks. Forty eight hours following pretesting each group both performed the squat and bench press 3x/wk. on non-consecutive days (i.e. Mon., Wed., Fri.) using the same number of sets and repetitions following an undulating resistance training program, which linearly increased load until maximal repetitions were performed for the 8th, 6, and 4 repetitions on Mon., Wed., and Fri., respectively. After 4 weeks, weeks 5-7 consisted of 5, 5, and 4 repetitions during the week, with 6, and 2 repetitions being performed during weeks 6-7. The 8th week served as a taper and 3 repetition days on Mon. and Wed. and post-testing on Fri. Load increased during each week in PBT from 65, 70, and 75% in week 1 and 82.5% in week 7. In ABT there was no prescribed load but subjects were instructed to select a load, in which the set ended with a 3-7RP-E in week 1 and progressing to an 8-10RP-E in week 7. A 2x2 repeated measures ANOVA was used with significance set at p<0.05. RESULTS: There was a time effect (p<0.01) for 1RM squat (141.00±22.49 vs. 153.75±20.40 kg; 9% increase), bench press (109.08±15.89 vs. 116.67±14.61 kg; 7.1% increase), and total strength-TS (256.30±29.31 kg vs. 270.62±29.29 kg; 5.1% increase) in PBT. For ST, 1RM squat (152.20±25.65 vs. 171.30±24.97 kg; +12.5%) and bench press (123.00±11.31 vs. 130.74±14.82 kg; +6.8%) increased in ABT. Overall, in TS (275.20±30.42 kg vs. 305.00±37.61 kg; +10.7%) in ABT. However, no significant group differences existed for squat (p=0.31), bench (p=0.11) or TS (p=0.16). CONCLUSION: Our findings indicate that both PBT and ABT are equally effective at increasing maximal strength.

Female Marines can now serve in all military occupational specialties (MOS). A cohort of female Marines participated in ground combat MOS schools as part of the Ground Combat Element Integrated Task Force (GCE ETF), which studied the integration of women into combat arms. It is important to identify characteristics of female Marines who successfully graduated from ground combat MOS schools.

PURPOSE: To explore physical and physiological differences between female Marines who did or did not successfully complete MOS schools. METHODS: Female GCE ETF Marines (N=62, 22±3yrs, 163±6cm, 63±7kg) underwent the following assessments prior to ground combat MOS school: anthropometric, strength (average peak torque % body weight) with an isokinetic dynamometer (knee, shoulder, trunk) or hand-held dynamometer (ankle), maximal oxygen uptake (VO₂ max) during a graded exercise test on a cycle ergometer, and anaerobic power (AP) using the modified Wingate test. Subjects were classified as graduated (N=45) or did not graduate MOS school, due to failed fitness testing or injury (N=16). Statistical significance was set at a priori alpha of 0.05. Between group differences were assessed with an independent t-test or Mann Whitney U test, as appropriate.

RESULTS: Despite no significant anthropometric differences between groups, significant differences were found in right/left ankle evertor strength, right ankle inverter strength, AC, VO₂ max and VO₂ at LT (all p<0.05 - Table 1).

CONCLUSIONS: Higher ankle strength and anaerobic capacity were observed in female ground combat MOS school graduates. These results may help female Marines optimize physical readiness for ground combat.

Table 1. Strength and physiology comparison of female Marines who did and did not graduate from MOS school

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Right VO₂ max (ml/kg/min)</th>
<th>Right VO₂ at LT (ml/kg/min)</th>
<th>Right Ankle Evertor Strength (N.m)</th>
<th>Left Ankle Evertor Strength (N.m)</th>
<th>Right Ankle Inverter Strength (N.m)</th>
<th>Left Ankle Inverter Strength (N.m)</th>
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<tr>
<td>23.06±3.7</td>
<td>184.25±3, 163±14.7</td>
<td>140.15±14.9</td>
<td>83.48±11.3</td>
<td>76.55±11.3</td>
<td>55.16±11.3</td>
<td>48.56±11.3</td>
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*presented with significant difference at p<0.05

*te = Mann Whitney U

Abstracts were prepared by the authors and printed as submitted.
In the United States, there remains interest in developing effective, efficient ways for individuals to increase energy expenditure for weight management. Research has shown that high-intensity exercise elicits a higher excess post-exercise oxygen consumption (EPOC) throughout the day compared to steady-state exercise. Currently, there is no single research study that examines the differences in EPOC resulting from high-intensity interval training (HIIT) modalities. PURPOSE: The purpose of this study is to review the impact of circuit training (CT) and speed interval training (SIT) on EPOC in individuals who regularly exercise or are sedentary. METHODS: Twenty-six participants were recruited and divided into active and sedentary groups according to self-reported exercise participation status. Oxygen consumption (VO₂) was measured during and after two HIIT sessions and was used to estimate caloric expenditure. Mean VO₂ and caloric expenditure responses during and after exercise were then compared across modality and activity status using a 2-way RM ANOVA. RESULTS: There was no significant difference (p>0.05) in caloric expenditure during exercise between active (53.8±13.2 cal/min) and sedentary (52.4±16.2 cal/min) groups. There was also no significant difference (p>0.05) in EPOC between sedentary (67.43±29.6) and active (69.1±32.8) individuals or between modalities for both groups (Active: 73.49±21.2 SIT vs 64.68±44.4 CT; Sedentary: 67.52±31.6 SIT vs 67.33±27.5 CT). However, there was a significantly higher (p<0.05) caloric expenditure during exercise between modalities in both groups (Active: 98.79±25.6 SIT vs 68.25±26.5 CT; Sedentary: 89.57±33.8 SIT vs 78.13±30.1 CT). CONCLUSION: Regarding maximizing EPOC, participants can choose either method of HIIT since both had similar effects on overall energy expenditure following exercise. However, it is recommended that individuals engage in SIT routines versus CT if the goal is to maximize overall caloric expenditure.

As subjective evidence continues to suggest a link between time of day (TOD) of exercise training and potential health and fitness outcomes, it is essential to explore this prospective influence in controlled comprehensive studies. PURPOSE: To determine the effect of TOD on mediating training-induced changes in exercise performance, cardio-metabolic health, and body composition in active normal weight men. METHODS: 26 healthy active males (BMI = 26.1 ± 4.8 kg/m²; 22 ± 8 yrs) were recruited for this study and randomized to either exercise training in morning (AM) or evening (PM) for 12 weeks. Following current ACSM guidelines, a multidimensional training paradigm was used (Resistance, Interval, Stretching, and Endurance, RISE). Baseline exercise performance was assessed via abdominal, upper and lower body muscular strength (situps, pushups, 1 RM bench and leg presses), aerobic power (5km cycling time trial), flexibility (sit and reach), and balance (stork stand), cardiovascular health (blood pressure, and augmentation index [AIx]), body composition (IDEXA: Fat free mass, fat mass, abdominal/visceral fat, %body fat), hunger/satiety ratings (visual analog scales), and cardio-metabolic profile (energy expenditure, fasting lipids, glucose, insulin). RESULTS: At baseline, no differences existed between groups in any variable. Training resulted in significant (p<0.05) improvements in exercise performance, cardio-metabolic health, and body composition. Furthermore, there were significant interactions (p<0.05) of TOD x training for fasting glucose (1.83±0.25 vs. 1.75±1.48 mg/dL), LDL-C (6.50±5.78 vs. 3.57±2.80 mg/dL), and total cholesterol (4.17±0.88 vs. 3.26±2.86 mg/dL) levels, AM vs. PM, respectively. In addition, non-significant trends were found for resting metabolic rate (increase in AM, p=0.07) and fasting triglycerides (lower in PM, p=0.06). CONCLUSION: The multimodal RISE protocol improved performance, cardiovascular health, and body composition, with the TOD altering the magnitude of cardio-metabolic training-induced adaptations. Specifically, training in the AM...
exhibited a trend of increasing RMR, while training in the PM resulted in greater improvements in fasting total cholesterol, LDL-C, and triglycerides in healthy men. Supported by Isagenix.

3711  Board #158  June 3 9:30 AM - 11:00 AM  Personalized Exercise Training Maximizes Comprehensive Training Responsiveness in Adults At-Risk for Cardiovascular Disease
Chantelle A. Robitaille, Thomas F. Cuddy, Abigail L. Owen, Christina A. Buchanan, Lance C. Dalleck. Western State Colorado University, Gunnison, CO. Email: chantelle.robitaille@western.edu

PURPOSE: Previous research has identified considerable variability in training responsiveness among individuals exposed to regular exercise. While examining the considerable heterogeneity in exercise-induced changes in cardiopulmonary fitness and common cardiometabolic risk factors, it has been identified that an individualized and evidence-based approach to exercise prescription may be necessary to optimize training efficacy and reduce training unresponsiveness. The purpose of this study was to compare comprehensive training responsiveness between two exercise training programs: personalized vs. standardized. METHODS: Sedentary men and women (n=46, ages 44 to 83 yrs) were randomized into a non-exercising control group or one of two exercise training treatment groups: 1) standardized group (exercise intensity prescribed according to heart rate reserve) or 2) personalized group (exercise intensity prescribed according to ventilatory thresholds). Exercise training was performed 60-75 min/day on 3 days/wk for 13 wks. Maximum oxygen uptake, systolic blood pressure, HDL cholesterol, triglycerides, and blood glucose were measured pre/post intervention, and percent change for each measure was calculated. Based on percent change for each measure, participants were assigned scores (responder: 1, non-responder: 0), and a comprehensive response to training composite score (scale 0-5) was determined. RESULTS: Training responsiveness as evidenced by the responder composite score was greater (p<0.05) in the personalized treatment group (4.71±0.47) when compared to the standardized treatment group (2.86±1.06). There were similar (p>0.05) responder composite scores across men and women for both the personalized (men=4.75; women=4.67) and standardized (men=2.75; women=3.00) treatment groups. Training responsiveness was also similar (p>0.05) across age for both treatment groups. CONCLUSION: Our findings demonstrate that personalized exercise training maximizes comprehensive training responsiveness. These preliminary results are promising for exercise physiologists and other health professionals who prescribe exercise for populations at-risk for cardiovascular disease and other chronic conditions.

3712  Board #159  June 3 9:30 AM - 11:00 AM  The Influence of Foam Rolling on Recovery From Exercise Induced Muscle Damage
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With the increased popularity of foam rolling (FR) as a recovery tool, it is important to establish the exact manner in which the practice is useful. PURPOSE: The purpose of this study was to examine the impact of FR on recovery from exercise-induced muscle damage. METHODS: In a between-group design, 37 males performed 40x15m sprints, inducing muscle damage. Immediately following sprinting and in the four days following, perceived muscle soreness, hip ROM, vertical jump, and agility measures were recorded. 18 subjects (mean±SD: age 22.4±2.0 yrs; BMI 26.9±4.2 kg/m²) foam rolled prior to testing each day (FR), while 19 (mean±SD: age 23.2±3.2 yrs; BMI 26.3±4.0 kg/m²) served as a non-foam rolling control (CON). Measurements recorded during the five days of recovery from the repeated sprint protocol were compared to those obtained during three baseline days of familiarization the prior week. The area under the curve (AUC) was calculated by summing all five scores and these data were compared by condition using a two-tailed Mann-Whitney U test (alpha level = 0.05). RESULTS: Perceived soreness, hip ROM, and vertical jump were not significantly different between groups (p>0.05). Agility, specifically the difference in time from baseline to complete the agility T test was significantly lower in the foam rolling condition (p<0.05). AUC was higher in CON (2.88 vs.2.43) than FR (0.33 vs.2.16). Mean values for agility changes from baseline in CON were 0.52 s, 0.82 s, 0.78 s, 0.45 s, and 0.32 s on the day muscle damage was induced and then the four days following, respectively. Mean values for agility changes from baseline in FR on those days were 0.11 s, 0.17 s, 0.06 s, 0.12 s, and -0.13 s. CONCLUSIONS: FR expedites recovery of agility following exercise-induced muscle damage instigated by a repeated sprint protocol. FR may be useful for athletes requiring adequate agility who need to recover quickly from intensive bouts of exercise. Supported by: Performance Health (Hygienic Corporation, Akron, Ohio) supported this project with donations of foam rollers.

In football matches, cold-water immersion (CWI) is often practiced during halftime to recover from fatigue and maintain performance in the second-half. PURPOSE: To develop and validate a 90-min long simulated football match using a football simulated protocol (FSP) and to observe performance changes in the second-half responding to an application of a 5-min CWI during halftime. METHODS: Twenty male elite footballers (athletic career: 9 ± 1 years) visited a regular outside natural-grass football pitch three separate days. On the first day, baseline values of two-legged maximal vertical jump, 20-m sprint, arrowhead agility test, and accuracy scores of short-pass and long-kick were assessed. On the second and the third days, participants performed nine repetitions of a 5-min long FSP, consisted of football related activities (walking, jogging, sprinting, cutting, jumping, side-stepping, and kicking). Subjects completed the first- and second-half. On the second and third days, calorie expenditure and heart rate (HR) were also recorded. During halftime, participants were received one of conditions (CWI: bare feet immersed up to 8 cm below from the tibial tuberosity at 7.5 °C or control: sitting on a bench: in a counterbalanced order) for 5-min. To test condition effects over time, time points were divided as T1 (first 15-min of the first-half) through T6 (last 15-min of the second-half), thus 2 * 6 mixed model ANCOVAs (covariate: baseline values) and Tukey-Kramer post hoc tests were performed (p<0.05). RESULTS: A total value of calorie expenditure (1.245 Cal) and an average value of HR at a time point (163 bpm) in our study were similar to typical football matches. Participants spent less calories during T1 (186 Cal) and T4 (191 Cal) than to T2 (213 Cal) or T3 (224 Cal), and T4 (212 Cal) or T5 (219 Cal), respectively. An application of CWI during halftime did not change any performance in the second-half (maximal vertical jump: F =0.44, p=0.82; 20-m sprint: F =0.67, p=0.07; arrowhead agility test: F =0.26, p=0.93; short-pass: F =0.75, p=0.42; long-kick: F =1.19, p=0.31). CONCLUSIONS: Our football simulated match can be used as experimental or practical purposes. Halftime CWI does not affect performance in the second-half. Water temperature or duration of application may explain the ineffectiveness of CWI.

External Counter Pulsation (ECP) therapy is a non-invasive treatment that enhances blood flow and delivers oxygenated blood to the extremities through the sequential compression of the lower limbs during diastole. While ECP has been used to treat patients with chronic angina pectoris/congestive heart failure, there has been little research on the impact of ECP on healthy individuals. PURPOSE: To determine if ECP therapy impacts recovery and ability to perform after strenuous exercise.

METHODS: Fifty-seven amateur athletes, 27 males and 30 females, aged 38.9 ± 11.6 years, participated in three two-hour study visits over three consecutive days. During each visit subjects engaged in a 20 min lower-body exercise circuit while wearing a weighted vest containing 12-15% of their body weight and then completed a 10k time trial using an indoor cycling trainer. Balance and jump tests were conducted both before the exercise circuit (PRE) and following the cycling time trial (POST). Balance was the amount of postural sway over 20 sec for both right and left leg. Jump test was performed using a force plate. Jump explosiveness was grounded time between consecutive jump and rest. Subjects who were randomized to the treatment condition then received 30 min of ECP therapy, while control subjects passively recovered for 30 min while wearing thigh and calf cuffs from the ECP machine. Repeated measures ANOVA was used to examine within group differences.

RESULTS: Average cycling time significantly decreased from visit 1 to visit 3 for the ECP group compared with the control group (1,524 to 1,432 vs. 1,499 to 1,479 sec; p<0.05). Although balance for both groups improved, the ECP group significantly improved their balance as compared to the control group from POST visit 1 to PRE visit 3 (7.48 to 67.9 vs. 75.2 to 73.6; p<0.05). Jump explosiveness was maintained from POST visit 1 to PRE visit 2 for the ECP group, while performance on this test decreased significantly for the control group over the same period (403 to 404 vs. 363 to 393; p<0.05).

CONCLUSION: ECP therapy after strenuous exercise improved cycling time trial performance, improved balance, and maintained jump explosiveness. Mechanisms through which ECP impacts performance are possibly enhanced recovery by means of vasodilation and increased blood flow.
Sports medicine professionals often prescribe foam rolling as an intervention to treat myofascial restrictions. Of particular interest, is the effect foam rolling has on the ipsilateral antagonist muscle and contralateral muscles. Recent research has observed ROM changes in these muscles after a foam rolling intervention. To date, no studies have examined how foam rolling effects the pressure pain threshold (PPT) levels of the ipsilateral antagonist and contralateral muscles. PURPOSE: To examine the acute effects of a foam rolling intervention on ipsilateral antagonist and contralateral muscle group PPT levels. METHODS: Twenty-one healthy participants (mean age 27.52 ± 8.9 years) (M=13, F=8) were recruited for this study and signed an IRB consent. Participants underwent pretest and immediate posttest PPT measures after a 2-minute video-guided foam roll intervention to the left quadriceps. PPTs were measured using a digital algometer to the ipsilateral left hamstrings and right quadriceps. Pretest and posttest measures were calculated using the paired t-test. Statistical significance was considered p < 0.05 using a two-tailed test. RESULTS: A significant difference was found between pretest posttest measures for the ipsilateral hamstrings (t(20) = -2.6, p < 0.001) and contralateral quadriceps (t(20) = -9.1, p < 0.001) suggesting an increase in PPT. CONCLUSIONS: These finding suggest foam rolling of the quadriceps musclelaure may have an acute effect on the PPT of the ipsilateral hamstrings and contralateral quadriceps muscles. Individual may feel less discomfort due to a higher PPT. The ipsilateral decrease in hamstring PPT may have occurred through reciprocal contralateral quadriceps muscles. Of particular interest, is the effect foam rolling has on the ipsilateral antagonist muscle and contralateral muscles. Future investigations examining this intervention on PPT is warranted.

CONCLUSIONS: For each series, the highest jump for THIR vs SIXT were compared using Paired-Samples t-test. Statistical significance was determined at p < 0.05. There was a significant difference for both the vertical jump (p = .04) and the 40 yd sprint (p = .02). There were no significant differences between massage interventions for the 40 yd sprint times (p > .73). There were no significant differences in perceived pain between the massage interventions (t(49) = 1.60, p > .05). CONCLUSION: The use of SMR prior to exercise may be beneficial in improving vertical power in recreational athletes, and was not perceived to be more painful than IASTM. However, neither SMR nor IASTM improved horizontal power.
be necessary to assess the impact of 30 vs. 60 sec passive recovery on vertical jump performance using average-fit college-age females. Also, future studies may need to examine the effects of a shorter recovery period vs 30 or 60 seconds on vertical jump performance in male and female athletes.

In baseball, pitching effectiveness is critical for team success. Previous research has investigated the effects of cryotherapy and compression on improving recovery after strenuous exercise in Brazilian Jiu-Jitsu athletes. The Effects of a Protein and Carbohydrate Recovery Beverage on Muscle Protein Accretion in Trained Weightlifters

**PURPOSE:** To determine if inter-structural release for posterior shoulder tightness on the humeral head with respect to the center of the glenoid cavity.

**METHODS:** Twenty-four healthy adult males participated in this IRB-approved study. Inclusion criteria were: age between 18 and 50 years old, and Japanese males. Exclusion criteria were: a history of surgery on the glenohumeral joint, and current pain in the glenohumeral joint. The subjects were allocated randomly to (1) stretch (S) group who performed the sleeper and cross body stretch, (2) combined stretch and manual release (R) group who performed the same stretch and received manual release to the posterior deltoid, or (3) control (C) group. An intervention period was set at four weeks. The manual release technique was intended to release loose connective tissue between the structures, e.g. the posterior deltoid and infraspinatus, to perform to complete superior gliding of the posterior deltoid. We expect that normal alignment of the humeral head relative to the glenoid and normal end feel in maximal glenohumeral internal rotation at 90 degrees abduction can be achieved. The main outcome measures included range of motion in flexion, horizontal abduction, internal and external rotation at 90 degrees abduction. Secondary outcome was the alignment of the humeral head relative to the glenoid cavity and the distance between the acromion and humeral head. Statistical analyses included two-way analysis of variance and Bonferroni method as a post hoc test. The R groups (10.1±1.77) showed significant improvements than the C group (1.0±1.5) in horizontal flexion (p=0.041). No significant differences were observed between the S and R groups.

**CONCLUSION:** Limitations of this study were small sample size and reproducibility of the manual technique. To conclude, the shoulder range of motion and the humeral head position had no correlations. 3720

### Board #167 June 3 9:30 AM - 11:00 AM

**The Effect Of Between Innings Cooling Or Compression On Baseball Pitching During Competitive Game**

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(No relationships reported)

In baseball, pitching effectiveness is critical for team success. Previous research has identified that short-duration cooling in between simulated innings was effective for maintaining velocity and improved perceptions of recovery. This combination is thought to improve overall pitching effectiveness. **PURPOSE:** A pilot study to assess the effect of short-term, between innings, cryotherapy and/or compression on perceived exertion and recovery of pitchers during a live college baseball game.

**METHODS:** NCAA Division II baseball pitchers were studied during Fall season scrimmages. Participants performed a circuit of Perceived Exertion Center (RPE) and Perceived Recovery Scale (PRS) prior to game play. Participants dressed in game day attire and warmed up in their usual manner. After each inning, RPE was recorded upon entering the dugout. Between innings, participants received one of two treatments: 1) cryotherapy and compression or 2) compression alone (of the equal weight to the cryotherapy and compression) applied to his shoulder and elbow for four minutes, regardless of the length of time between innings (unless this time was less than four minutes). Each pitcher indicated his PRS before re-entering the game to pitch. Time of each inning pitched from warm up pitch to last pitch, rest time, and total pitches thrown were recorded. RPE was measured following the final inning pitched as well as 3 days later prior to going by the next bullpen. Repeated measures ANOVA were used to determine if RPE or PRS were significantly different between innings.

**RESULTS:** Five players participated. One player was excluded because he did not pitch more than one inning. There were no significant differences between RPE or PRS between treatment conditions. Individual RPE values remained constant or declined in subsequent innings with treatment in four of the five players. PRS improved in subsequent innings during the cold treatment. **CONCLUSIONS:** Sample size was likely too small to detect differences. This pilot study may indicate that with more subjects and/or innings pitched, cold and/or compression could be effective modalities for improving perceived exertion and recovery during a collegiate game. Further studies need to be conducted during the competitive season to include a greater number of players and innings pitched.

### Board #168 June 3 9:30 AM - 11:00 AM

**The Effects Of A Protein And Carbohydrate Recovery Beverage On Muscle Protein Accretion In Trained Weightlifters**

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(No relationships reported)

Human skeletal muscle expresses significant phenotypes in response to an applied stimulus. Skeletal muscle in response to a resistance training stimulus undergoes a transformative process where cellular signaling pathways lead to increases in contractile proteins that overtime express themselves in muscular hypertrophy. Di-ametrically opposed to these anabolic signaling pathways are the cellular survival and homoeostatic regulatory pathways that are integrated with energy availability and balance. Attempting to shift the balance between the anabolic and catabolic pathways is the basis for adaptation-recovery and can be altered via training and the use of recovery methods including nutritional interventions.

**Purpose:** To examine the effects of a recovery supplement containing protein and carbohydrate given immediately after each training session on muscle protein accretion in trained weightlifters.

**Methods:** Ten trained male weightlifters completed a 12-week training protocol implementing block periodization. A double blind placebo protocol was utilized to compare effects between treatment and placebo groups. The treatment group received a protein and carbohydrate recovery beverage and the placebo group received a calorie free beverage. Muscle biopsies were obtained pre and post the 12 week training intervention training and samples were analyzed for the specific muscle proteins mTOR, AMPK, pMRI, pAMPK, and gene expression of myosin heavy chains 1, 6 and 7.

**Results:** Pre and post increases were found for total mTOR (p=0.044) for the treatment group but not for pMRI (p=0.385), AMPK (p=0.159), and pAMPK (p=0.430). No statistical difference was found pre and post for gene expression of myosin heavy chains 1 (p=0.08), 6 (p=0.08) or 7 (p=0.37) for the treatment group.

**Conclusion:** These findings indicate that a protein supplementation has positive effects on total mTOR accretion and was trending towards a positive effects on myosin heavy chains 1 and 6 in trained weightlifters. This data indicates a potential acute anabolic effect from the consumption of a protein and carbohydrate recovery beverage following training in trained male weightlifters.

**Board #169 June 3 9:30 AM - 11:00 AM**

**Effect Of Recovery Methods On Blood Lactate Clearance After Strenuous Exercise On Brazilian Jiu-Jitsu Athletes**

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(No relationships reported)

**Introduction:** Blood lactate (BLA) is a frequently measured parameter during performance testing and is produced by high intensity exercise. High levels are associated with impaired muscle function and reduced exercise performance. Previous studies showed that active recovery (A), performing low intensity aerobic exercise post exercise, is more effective at clearing lactate than rest/passive recovery (P). Whole-body Cryotherapy (WBC) has recently gained popularity for improving recovery after strenuous exercise as an alternative to traditional ice-water therapy. Subjects enter a specially designed cabin in which liquid nitrogen lowers the temperature of the air (-110 to -140°C) for a short period of time, usually 3 min.

**Purpose:** Our purpose was to determine which recovery, A, P, or WBC, was most effective at reducing BLA in Brazilian Jiu-Jitsu athletes.

**Methods:** Five males (37.8 ± 3.82 yrs) participated in this study. Baseline BLA, heart rate (HR), rate of perceived exertion (RPE) and measures of pain were recorded before, during and after the workout. A 5 min dynamic warm-up preceded the circuit: 8 power clean and press with 95 lbs x 8 reps; 10 pull-ups; box jumps for 30 seconds; renegade row for 30 sec; full squat with 95 lbs x 10 reps; inverted row, 10 reps; medicine ball slam 30 sec; treadmill run 7 mph, 15% incline, 1 min. After the circuit, subjects sat for 5 min to allow BLA to peak, then it was measured using a finger prick and results recorded. Subjects randomly performed one of three recovery methods: 1) P - sit - 15 min; 2) A - 15 min cycling 40% HRmax; or 3) WBC - stood in Cryochamber 3 min. Blood lactate was obtained every five min for 15 min. Data were analyzed using SPSS 19.0. **Results:** Mean values for BLA were: P (mmol/L) at 5 min (P=16.52±2.10; A=13.2±2.29; WBC=16.78±2.72). BLA for A recovery was significantly less than P or WBC (p = 0.003). At 10 min (P=16.76±0.68; A=11.74±2.72; WBC=11.62±1.48) and 15 min (P=16.34±4.0; A=11.62±1.48; WBC=8.98±2.73) BLA levels were significantly less for A and WBC than P (p = 0.003). There was no significant difference (p > 0.05) between A and WBC recovery.
Effects of Acute Foam Rolling on Quadriceps Performance and Short-term Recovery from Fatigue

Jolene Lim1, Govindasamy Balasekaran, FACSMM, Visivarshe Victor Govindaswamy2, Wayne Foo1, Yew Cheo Ng1, Peggy Boey1,1 Nanyang Technological University, Singapore, Singapore: Concordia University Chicago, Chicago, IL.

(Methods) For 10 and 15 min. Conclusion: The results of this study indicated that, A recovery was the most effective in clearing blood lactate, but WBC was as effective as A at 10 and 15 min, and A and WBC were more effective than at 10 and 15 min of recovery.

Methods: The study was a randomized, counterbalanced, crossover study held over three weeks. The study included 10 recreationally active, right leg dominant, male university students (height: 173 ± 0.70cm, mass: 70.81 ± 1.33kg, age: 23.9 ± 0.28yrs) participated in a randomized, counterbalanced, crossover study held over three weeks. Maximal Voluntary Contraction (MVC) pre-test, fatigue-inducing protocol and MVC post-tests were conducted. Foam rolling (FR) and Control (CON) intervention took place before each MVC test. In FR, the hamstrings, iliotibial band, and quadriceps muscles were rolled for 1 minute per set, twice, with a 30 second rest between sets and muscle groups. Results: No significant differences were found between FR and CON for concentric (FR: 219.25 ± 11.18, CON: 220.90 ± 11.18, p=0.918) and eccentric (FR: 238.80 ± 16.61, CON: 254.00 ± 16.61, p=0.515) MVC, as well as between pre and post-MVC for concentric (Pre: 221.70 ± 8.34, Post: 218.45 ± 7.75, p=0.507) and eccentric (Pre: 249.05 ± 12.08, CON: 243.35 ± 12.26, p=0.373). No significant interaction was found between conditions and time for MVC performance (concentric: p=0.987; eccentric: p=0.664). Post-MVC MVC decreased by 1.49% (concentric) and 3.46% (eccentric) in FR, and 1.43% (concentric) and 1.17% (eccentric) in CON. No significant differences were found between FR and CON for muscular soreness (MS), fatigue, and rate of perceived exertion (RPE) during MVC and peak MVC post-test (MS: FR: 38.3 ± 21.77, CON: 36.2 ± 18.08, p=0.817; Fatigue: FR: 8.3 ± 1.70, CON: 7.7 ± 1.89, p=0.501; RPE: FR: 8.3 ± 1.70, CON: 8.1 ± 1.85, p=0.801), and during MVC post-test (MS: FR: 38.3 ± 21.77, CON: 36.2 ± 18.08, p=0.817; Fatigue: FR: 4.4 ± 1.35, CON: 4.2 ± 1.55, p=0.762; RPE: FR: 4.9 ± 0.88; CON: 4.7 ± 1.34, p=0.853). Conclusion: Results indicated that acute foam rolling do not affect isokinetic MVC performance or improve short-term recovery of fatigue-induced quadriceps.

Effects of Acute Foam Rolling on Quadriceps Performance and Short-term Recovery from Fatigue

Jolene Lim1, Govindasamy Balasekaran, FACSMM, Visivarshe Victor Govindaswamy2, Wayne Foo1, Yew Cheo Ng1, Peggy Boey1,1 Nanyang Technological University, Singapore, Singapore: Concordia University Chicago, Chicago, IL.

(Methods) For 10 and 15 min. Conclusion: The results of this study indicated that, A recovery was the most effective in clearing blood lactate, but WBC was as effective as A at 10 and 15 min, and A and WBC were more effective than at 10 and 15 min of recovery.

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Cupping is an alternative therapy used by athletes to purportedly improve performance or enhance recovery. Bell-shaped cups are placed on the skin (above a targeted muscle) and air is withdrawn to create a vacuum against the skin surface. Blood flow is expected to improve under the cup area during the application and impact somatosensory integrity and performance. **Purpose:** To determine the effect of chronic Cupping Therapy (CUP) on unilateral hip flexibility, balance, and muscular power, 12 subjects (age 21.4 ± 1.2, ht. 167.6 ± 8.4 cm, and body mass 71.6 ± 18.2 kg, 7♀) participated. **Methods:** Familiarization trials ensured reliability. Testing was conducted within 15 minutes after CUP for four consecutive days (1–4) with CUP randomly assigned to either leg on day one. Single foot balance was obtained with a sway index (SI) on the Biodex Balance System with unilateral trials for 20 seconds and 10 sec recovery repeated twice. Each test consisted of two measures of unilateral passive hip range of motion (degrees) obtained by goniometer with the subject in the prone (hip extension [HE]) and supine (straight leg raise test of hamstring [HF]) positions. Unilateral hamstring/quadriceps muscle power (MP) testing was conducted with a Biodesi isokinetic dynamometer (Watts = W) including five repetitions @ 60°/sec warm-up and 10 maximal repetitions at 120°/sec for the trial. CUP required the application of 6 plastic cups applied at 14 PSI bilaterally for 10 minutes at 30 mm lateral of the vertical midline of the posterior thigh above the hamstring muscle group. **Results:** Statistical analysis by ANOVA (p < .05) with repeated measures revealed no significant difference among matched variables including: HE(degrees): 13.4, 13.3, 13.6, and 13.3, 12.7, 14, 13.8 & 13.6; HF(degrees): 66.6, 62, 62.6 and 62.65, 61.2, 61, & 62; MP(W): 94, 53.4, 68.7, & 61.2 and 82.1, 40, 66.3, & 65.9 for CUP and No CUP treatments on days 1, 2, 3, and 4, respectively. **Conclusion:** The application of cupping therapy on four consecutive days with six treatment cups applied for ten minutes at a modest negative pressure provided no improvement in balance, flexibility or muscular power compared to no treatment over four days. The efficacy of cupping for enhancement of performance related measures is not supported by this study.

In the recent Rio Olympics, spectators witnessed round circles across the upper back of swimmer Michael Phelps and others. These circles were as the result of cupping therapy (CUP) received prior to competitive performances and drew widespread publicity, despite little scientific evidence to support the practice. **Purpose:** To evaluate the impact of acute CUP on muscular power, balance and flexibility, 12 subjects (age 21.4 ± 1.2, ht. 167.6 ± 8.4 cm, and body mass 71.6 ± 18.2 kg, 7♀) in the prone (hip extension [HE]) and supine (straight leg raise test of hamstring [HF]) positions. **Methods:** Familiarization trials preceded CUP by 48 hrs and included all of the following tests: single foot balance with a sway index (SI) on the Biodex Balance System with unilateral trials for 20 seconds and 10 sec recovery repeated twice. Flexibility included two measures of unilateral passive hip range of motion by goniometer with the subject in the prone (hip extension [HE]) and supine (straight leg raise test of hamstring [HF]) positions. **Results:** Statistical analysis by ANOVA (p < .05) with repeated measures revealed no significant difference among matched variables including: HE(degrees): 13.4, 13.3, 13.6, and 13.3, 12.7, 14, 13.8 & 13.6; HF(degrees): 66.6, 62, 62.6 and 62.65, 61.2, 61, & 62; MP(W): 94, 53.4, 68.7, & 61.2 and 82.1, 40, 66.3, & 65.9 for CUP and No CUP treatments on days 1, 2, 3, and 4, respectively.

**Conclusion:** The Change of PT, PT/BW, And APT TW Between Control Group And FR Group

<table>
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<th>Variables</th>
<th>Before</th>
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<th>24h After</th>
<th>48h After</th>
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<td>CUP Control PT (Nm)</td>
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<td>952.41 ± 274.03</td>
<td>945.56 ± 251.82</td>
<td>968.84 ± 283.00</td>
</tr>
<tr>
<td>CUP FR Total Work (J)</td>
<td>1283.64 ± 248.76</td>
<td>967.45 ± 170.57</td>
<td>1060.57 ± 261.46</td>
<td>1163.50 ± 261.39</td>
</tr>
</tbody>
</table>

N=21 for Control and N=21 for FR. *p<0.05, compared to Before. #p<0.05 compared to Control.

Flexibility is an important health- and motor-performance variable as it improves and maintains range of motion, reduces joint stiffness, reduces soreness, reduces the risk of injury, and improves mobility (Peck, 2014). Recent research has examined the effects of varied stretching modes on athletic performance in able-bodied populations but fewer empirical studies have been conducted on athletic performance in disability populations. **Purpose:** The purpose of this research project was to examine the effects of stretching mode on sprint speed among competitive wheelchair athletes. **Method:** Wheelchair rugby players with tetraplegia (age: 24.5±2.5 yrs) were randomly divided into two groups: a control group (n=21) and a FR group (n=21). All subjects performed a bout of bottom-up squats for obtaining EIMF. All subjects were measured for peak torque (PT), peak torque/ body weight (PT/BW), average peak torque (APT) and total work (TW) by using an isokinetic test system before, and 0.5h, 24h, and 48h after the squats. The only difference between two groups was that the FR group performed a 6-min FR exercise protocol before each post-EIMF protocol measurement (at 0.5h, 24h, and 48h). The data was analyzed by one-way ANOVAs with LSD post-hoc tests, and independent t-tests. **Results:** See table for all groups. At 0.5h after the EIMF protocol, PT, PT/BW, APT and TW significantly decreased in FR group and control group (all *p<0.05), and there were no significant group differences in these variables. At 24h after the EIMF protocol, T, PT/BW, APT and TW tended to be higher in the FR group than in the control group, although there were no significant group differences. At 48h after the EIMF protocol, PT, PT/BW, APT and TW were significantly higher in the FR group than in the control group (all *p<0.05), and nearly reached the pre-EIMF protocol values. **Conclusion:** Foam rolling resulted in a faster recovery in muscle strength and muscle work following a bout of bottom-up squats. The potential mechanism needs to be further investigated.

The Effect Of Foam Rolling On Exercise induced Muscle Fatigue

Yuanpeng Liao, Wanliang Yu, ChengDu Sports Institute, ChengDu, China. (Sponsor: Tongjian You, FACSM)

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(No relationships reported)

**PURPOSE:** To evaluate the effectiveness of foam rolling (FR) on the rehabilitation of exercise-induced muscle fatigue (EIMF). **Methods:** Forty-two male college students (age: 24.5±2.5 yrs) were randomly divided into two groups: a control group (n=21) and a FR group (n=21) group. All subjects performed a bout of bottom-up squats for obtaining EIMF. All subjects were measured for peak torque (PT), peak torque/ body weight (PT/BW), average peak torque (APT) and total work (TW) by using an isokinetic test system before, and 0.5h, 24h, and 48h after the squats. The only difference between two groups was that the FR group performed a 6-min FR exercise protocol before each post-EIMF protocol measurement (at 0.5h, 24h, and 48h). The data was analyzed by one-way ANOVAs with LSD post-hoc tests, and independent t-tests. **Results:** See table for all groups. At 0.5h after the EIMF protocol, PT, PT/BW, APT and TW significantly decreased in FR group and control group (all *p<0.05), and there were no significant group differences in these variables. At 24h after the EIMF protocol, T, PT/BW, APT and TW tended to be higher in the FR group than in the control group, although there were no significant group differences. At 48h after the EIMF protocol, PT, PT/BW, APT and TW were significantly higher in the FR group than in the control group (all *p<0.05), and nearly reached the pre-EIMF protocol values. **Conclusion:** Foam rolling resulted in a faster recovery in muscle strength and muscle work following a bout of bottom-up squats. The potential mechanism needs to be further investigated.

**The Effect Of Acute Cupping Therapy on Balance, Flexibility and Muscular Power**

Shelby Stoner, John Petrizzo, John W. Wygand, FACSM, Robert M. Otto, FACSM. Adelphi University, Garden City, NY. (Sponsor: Robert M. Otto, FACSM)

Email: ststoner@adelphi.edu

(No relationships reported)
by PNF, SS, or DS stretching modes. Flexibility training may also help to offset fatigue in athletes during regular practice sessions. With the concern that increased fatigue could interrupt proper mechanics, these findings are applicable to both performance training and injury prevention.

3731 Board #178
June 3 9:30 AM - 11:00 AM
Effect Of Branched-chain Amino Acids, β-hydroxy-β-methylbutyrate, And Glutamine On Recovery From Resistance Exercise
Sara A. Baggett1, Ludmila M. Cosio-Lima1, Phillip A. Bishop2. 1The University of West Florida, Pensacola, FL. 2Liberty University, Lynchburg, VA. Email: sbaggett@uwf.edu

Adaptation of training recovery is essential for optimization of muscle performance, injury prevention, and avoiding overtraining. Consequently, athletes may benefit from interventions that accelerate recovery processes. PURPOSE: To evaluate the effects of concurrent supplementation with branched-chain amino acids (BCAAs), β-hydroxy-β-methylbutyrate (HMB), and glutamine on recovery from weightlifting. METHODS: Fourteen trained participants (mean ± SD: age = 21 ± 2 years) completed two protocols (treatment and placebo), each consisting of two resistance bouts separated by 24 h. Sessions consisted of three sets to failure at an 8-12 repetition maximum load for six exercises. Muscle pain and ratings of perceived exertion (RPE) were assessed after each set using a 100-mm visual analog scale (VAS). Residual pain and ratings of perceived recovery (RE) were assessed 24 h after initial workouts. Treatment included one 6-g BCAA plus glutamine (BCAA + G) supplement (Leucine, 2.5 g; Valine, 1.5 g; Isoleucine, 1 g; Glutamine, 1 g) and one 1-g dose of HMB respectively consumed 1 h or 30 min before exercise, and another BCAA + G immediately after exercise. An additional HMB supplement was ingested after 2 h and 6 h of recovery. Sugar pills replaced supplements as a placebo, and the order was randomized, counter-balanced, and double-blind. RESULTS: Treatment enhanced second-day performance for the leg extension (11 ± 1 vs. 10 ± 1; p = .03), latisimus pull-down (11 ± 1 vs. 10 ± 1; p = .02), and total repetitions (62 ± 5 vs. 59 ± 7; p = .03). Reduced residual pain (29 ± 19 vs. 40 ± 23; p = .01) and pain during the leg press (37 ± 14 vs. 45 ± 21; p = .04) and shoulder press (17 ± 47 vs. 24 ± 4; p = .04) were observed with treatment. RPE on the second day was reduced under the treatment for the leg press (55 ± 20 vs. 62 ± 16; p = .02) and leg extension (53 ± 20 vs. 61 ± 19; p = .03) exercises. RPE were similar between conditions (p = .05). CONCLUSIONS: Combined ingestion of BCAA, HMB, and glutamine may enhance muscle recovery 24 h after an exhaustive resistance bout. Reduced muscle pain and RPE under the treatment may have contributed to enhanced performance during subsequent workouts. Additional research is necessary to understand the effects of chronic supplementation and the mechanisms associated with individual supplements.

3732 Board #179
June 3 9:30 AM - 11:00 AM
Influence of Interval vs Continuous Exercise on Markers of Metabolic Rate During Exercise and Recovery
Robert Burisch, Brian Kliszczewicz. Kennesaw State University, Kennesaw, GA.

Studies have shown that improvements in body composition after interval training are equivalent or superior to those resulting from continuous, moderate-intensity exercise training, although time and energy expenditure associated with interval training is lower. PURPOSE: To compare exercise and 3-hour recovery VO2, energy expenditure (EE), core temperature, and heart rate (HR), associated with 40 minutes of continuous, moderate-intensity exercise (50-60% of heart rate reserve [HRR]) with those associated with three models of interval training: 4 (I-4), 7 (I-7), and 10 (I-10), one-minute bouts of exercise at ~90% of exhaustive resistance bout. Reduced muscle pain and RPE under the treatment may have contributed to enhanced performance during subsequent workouts. several markers of metabolic rate (HR, EE) were higher during recovery after I-10 than after CON. Differences in the recovery periods after interval training vs CON may partially explain reports that interval training results in similar or greater improvements in body composition when compared with continuous exercise, even with significantly lower exercise energy expenditure.

3733 Board #180
June 3 9:30 AM - 11:00 AM
The Effects of Various Methods of Self Myofascial Release on Muscular Power
Paul Weber, Robert M. Otto, FACSM, John Petrizzi, John W. Wygand, FACSM. Adelphi University, Garden City, NY. (Sponsor: Robert M. Otto, FACS)

Myofascial release (MR) is purported to reduce friction between muscle and fascia, thus relaxing a muscle, improving local circulation, and stimulating the stretch reflex. Various forms of MR, including Self Myofascial Release (SMR) have evolved in an effort to improve function and performance. PURPOSE: The purpose of this study was to evaluate the effect of three different forms of SMR on muscular power. METHODS: 15 physically active adults (age: 27 ± 4.4 yr., ht: 176.6 ± 9.1 cm, body mass: 83.1 ± 13.1 kg, 13 ± 7) participated in a familiarization trial following informed consent. Familiarization consisted of proper methods of using 3 different modalities of SMR: foam rollers (FR), Myoballs (MB), and Tiger Tails (TT). Subjects performed the proper mechanics and execution of four tests of muscular power (MP) (vertical jump (VJ), broad jump (Broad), right and left leg lateral bounds (LBR/LBL), and an 18.3 meter sprint (S). Subjects participated in four randomly assigned, crossover trials that were preceded by one minute of SMR with TT, MB, or FR on the quadriceps, IT Bands, gluteals, hamstrings, and calves. A control (C) trial was conducted with no SMR prior to the MP testing. Trials were separated by at least 48 hrs. Sprint time was recorded with concurrent, independent timing devices. For each MP test, 3 attempts were provided with the best score recorded for the trial. A recovery period of 15 seconds was given between each attempt, and 2 minutes were allowed between each test. One way ANOVA (p<.05) was applied to the data. RESULTS: VJ/cm: 51.8 ± 3.8, 54.8 ± 8.8, 55.3 ± 8.6, and 54.3 ± 10.4; Broad/cm: 215.9 ± 29.8, 218 ± 28.7, 221.7 ± 28.9, and 218.9 ± 28.4; LBR/cm: 176.5 ± 21.766.5 ± 21.176.7 ± 18, 178.3 ± 18.2, and 176.5 ± 17.2; LBL/cm: 173.4 ± 12.1, 175.7 ± 13.2, 177.2 ± 14.4, and 177.2 ± 16.5, and S/sec: 2.8 ± 17, 2.8 ± 12, 2.8 ± 1.6, and 2.8 ± 1.4 for C, FR, MB, and TT trials, respectively. Statistical analysis revealed no significant difference in MP among modalities. CONCLUSION: Although SMR did not improve measures of muscular power performance, it was not deleterious and may be considered a viable pre-activity preparation. Any potential benefits associated with SMR are subjective in nature and may be related to the relief of tension and DOMS.

3734 Board #181
June 3 9:30 AM - 11:00 AM
Cold Water Immersions For Recovery In Young Female Handball Players
Braulio Sánchez-Ureña1, Ismael Martínez-Guardado2, Marta Camacho-Cardellosa1, Alba Camacho-Cardellosa1, Rafael Timón1, Guillermo Olcina1,2, Jeffrey M. Mjaanes, FACSM3. National University of Costa Rica, Heredia, Costa Rica. 1University of Extremadura, Cáceres, Spain. 2University of Extremadura, Cáceres, Spain. 3Northwestern University, Evanston, IL. Email: brau09@hotmail.com

Cold water immersion (CWI) is a recovery method used frequently in sport. Multiple studies indicate a potential role for CWI after training and competition in various sports. However, a critical review of the medical literature reveals a paucity of studies regarding use of CWI specifically in team handball. As a high intensity sport, handball is characterized by significant eccentric loading of the lower extremity musculature and therefore requires effective post-competitive recovery strategies. PURPOSE: To compare the effect of two CWI protocols on markers of recovery in female handball players. METHOD: Twelve female handball players (Age: 14 ± 0.7 years, body mass: 58.44 ± 7.8 kg, Height: 176.6 ± 9.1 cm, body fat %: 21.5 ± 3) were involved in a “cross-over” experimental design. After three game training sessions (Avg Heart Rate 183 ± 9, 180 ± 7, 175 ± 8) and therefore requires effective post-competitive recover strategies. PURPOSE: To To cold water immersion (CWI) after training and competition in various sports. However, a critical review of the medical literature reveals a paucity of studies regarding use of CWI specifically in team handball. As a high intensity sport, handball is characterized by significant eccentric loading of the lower extremity musculature and therefore requires effective post-competitive recovery strategies. PURPOSE: To compare the effect of two CWI protocols on markers of recovery in female handball players. METHOD: Twelve female handball players (Age: 14 ± 0.7 years, body mass: 58.44 ± 7.8 kg, Height: 176.6 ± 9.1 cm, body fat %: 21.5 ± 3) were involved in a “cross-over” experimental design. After three game training sessions (Avg Heart Rate 183 ± 9, 180 ± 7, 175 ± 8) and therefore requires effective post-competitive recover strategies. PURPOSE: To compare the effect of two CWI protocols on markers of recovery in female handball players. METHOD: Twelve female handball players (Age: 14 ± 0.7 years, body mass: 58.44 ± 7.8 kg, Height: 176.6 ± 9.1 cm, body fat %: 21.5 ± 3) were involved in a “cross-over” experimental design. After three game training sessions (Avg Heart Rate 183 ± 9, 180 ± 7, 175 ± 8)
0.001) and IntCWI vs. CG (3.90 ± 9.2 vs. 7.22 ± 8.83, P < 0.001). With regards to the percentage of change in CMJ and thigh volume, no statistically significant changes were seen in any comparison of measurement. CONCLUSION: Both CWI protocols appear effective in reducing delayed onset muscle soreness at all times post-training in female handball players. CWI should be included after training sessions to enhance recovery for the next training day. CWI protocol could be used according to individual preferences as both protocols used in this study demonstrated similar effects on psychological indicators of recovery, such as a pain.

**Table: The change of shoulder flexibility before and after AIS and PNF stretch:**

<table>
<thead>
<tr>
<th></th>
<th>Flexion</th>
<th>Before</th>
<th>After</th>
<th>Difference</th>
<th>ES</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIS</td>
<td>157.42±2.83°</td>
<td>164.51±2.24°</td>
<td>9.77±1.96°</td>
<td>2.76 &lt;0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stretch</td>
<td>33.72±1.44°</td>
<td>37.91±0.92°</td>
<td>5.72±0.56°</td>
<td>2.93 &lt;0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PNF</td>
<td>156.28±2.49°</td>
<td>159.85±2.24°</td>
<td>5.67±3.26°</td>
<td>1.51 0.003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stretch</td>
<td>33.17±0.73°</td>
<td>36.22±0.77°</td>
<td>5.78±0.56°</td>
<td>2.73 &lt;0.001</td>
<td></td>
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</tbody>
</table>

**CONCLUSIONS:** Both of the methods can improve the flexibility of the shoulder joints, but AIS shows more effective.

Corresponding author: Jingmin Liu
Study was supported by Independent scientific research plan of Ministry of Education (20121080823)

**3735 Board #182**
June 3 9:30 AM - 11:00 AM
**Effects Of A Short Intervention Of AIS And PNF On College Students’ Shoulder Flexibility**
Channei Cao1, Chongyao Xiao1, Jingmin Liu1, Yu Liu1, Weimo Zhu, FACSIM, 1Tsinghua University, Beijing, China. 2Peking University, Beijing, China. 3University of Illinois at Urbana-Champaign, Urbana, IL. (Sponsor: Weimo Zhu, FACSIM)

(No relationships reported)

Purpose: To compare the effects of a 2-wk AIS and PNF intervention on the flexibility of shoulder joints.

Methods: Twenty male college physical education students (21 ± 1.18 yr., height: 172.91±4.48 cm, mass: 74.37±6.34 kg) without shoulder injury volunteered for the study. They were randomly divided into two intervention groups, one AIS and the other PNF intervention, with both met 5 times a week, 15 minutes each, for two weeks. Joint mobility (flexion and stretch) was measured by F-JDC type joint measurement scale before and after the intervention. Paired t-test and effect size (ES, Cohen’s d) were calculated to determine the difference between AIS and PNF.

Results: There was no statistical significant difference between the groups before the intervention. There were significant improvements in both groups (P<0.01), but greater improvement was found in the post-intervention AIS group (flexion: 4.1±0.86; stretch: 1.96±0.80; P<0.001).

**Conclusion:** Both of the methods can improve the flexibility of the shoulder joints, but AIS shows more effective.

(No relationships reported)

**3737 Board #184**
June 3 9:30 AM - 11:00 AM
**Pneumatic Compression Device Speeds Recovery from DOMS in Comparison to Compression Sleeve**
Molly R. Winke, Shelby Williamson. Hanover College, Hanover, IN. (Sponsor: Bryant Stanford, FACSIM)

(No relationships reported)

Delayed onset muscle soreness (DOMS) is known to decrease range of motion (ROM), increase muscle swelling, and increase perception of pain in the affected muscle. Wearing compression garments during recovery from DOMS has been demonstrated to reduce both the recovery time and the peak disturbance in these variables when compared to no treatment. PURPOSE: To determine the effects of a pneumatic compression device (PCD) compared to a compression sleeve (CS) during a 5-day recovery period from DOMS of the elbow flexors. METHODS: Eight college-aged students participated in this crossover design study. Upper and lower arm circumference were measured to determine muscle swelling; pain during elbow flexion and elbow extension was measured using a 0 - 100mm visual analog scale to determine muscle soreness. Results and Extension ROM were measured to determine joint mobility. The muscle-damage protocol consisted of 4 sets of 25 repetitions of isokinetic concentric elbow flexion followed by eccentric extension. Immediately following the muscle-damage protocol, subjects either wore a CS continually for five days or completed daily, 20-minute PCD treatments for 5 days. Swelling, ROM, and pain were measured pre- and post-exercise, and daily during the 5-day recovery period. Subjects rested for 7 days before completing another muscle-damage protocol and the remaining treatment. Repeated measures ANOVA was used to determine differences between treatments. RESULTS: PCD significantly reduced increases in upper arm circumference (1.7 vs. 2.0 cm), flexion pain (24.4 vs. 34.3mm), extension pain (30.8 vs. 41.4mm), and minimum reductions in flexion ROM (15.9 vs. 25 degrees) and extension ROM (2.5 vs. 4.1 degrees). There were no differences in lower arm circumference. Non-significant interaction effects between time and treatment suggest that the time course of DOMS recovery was similar between trials. However, because the PCD disturbances from baseline were lower, measurements returned to baseline earlier in the PCD trial. CONCLUSIONS: These findings suggest that daily treatments using a PCD further reduce peak disturbance and recovery time from DOMS of the elbow flexors when compared to a continuously-worn CS.

**Purpose:** Compression socks are a popular recovery modality in endurance sports. We investigated the efficacy of compression (COM) vs placebo (PLA) socks on perception of muscle fatigue/soreness and functional recovery in Masters athletes.

**Methods:** Four competitive male triathletes participated (age: 49±8y; height: 176±14cm; mass: 83.0±13.3kg; body fat: 23±7%; ≥18mo run training, ~2.3 h/day, ≥5.5 day/wk). During Visit 1, participants underwent calf circumferences (CIR) and dorsiflexion range of motion (ROM) measures, completed fatigue/soreness surveys, and performed a timed 1-mile run. Then, participants completed a fatigue protocol (6 sets, weight calf raises to failure) and performed a timed 1-mile run. Repeated measures ANOVA was used to determine joint mobility. The muscle-damage protocol consisted of 4 sets of 25 repetitions of isokinetic concentric elbow flexion followed by eccentric extension. Immediately following the muscle-damage protocol, subjects either wore a CS continually for five days or completed daily, 20-minute PCD treatments for 5 days. Swelling, ROM, and pain were measured pre- and post-exercise, and daily during the 5-day recovery period. Subjects rested for 7 days before completing another muscle-damage protocol and the remaining treatment. Repeated measures ANOVA was used to determine differences between treatments. RESULTS: PCD significantly reduced increases in upper arm circumference (1.7 vs. 2.0 cm), flexion pain (24.4 vs. 34.3mm), extension pain (30.8 vs. 41.4mm), and minimum reductions in flexion ROM (15.9 vs. 25 degrees) and extension ROM (2.5 vs. 4.1 degrees). There were no differences in lower arm circumference. Non-significant interaction effects between time and treatment suggest that the time course of DOMS recovery was similar between trials. However, because the PCD disturbances from baseline were lower, measurements returned to baseline earlier in the PCD trial. CONCLUSIONS: These findings suggest that daily treatments using a PCD further reduce peak disturbance and recovery time from DOMS of the elbow flexors when compared to a continuously-worn CS.
Self-myofascial release via foam rolling does not yield significant acute effects on muscular performance, but it can yield benefits to range of motion (ROM) similar to static stretching, without the negative effects to muscular performance. Additionally, exercising through larger ROM during resistance training will produce superior muscular performance, but it can yield benefits to range of motion (ROM) similar to static stretching, without the negative effects to muscular performance. Therefore, the aim of this study was to determine if differences existed between the acute effects of two different foam rollers had on hip and shoulder ROM. METHODS: Ten college students participated in a random cross over design study. Participants’ hip and shoulder ROM were measured with a goniometer pre and post three different conditions: control, supernova (SN), and grid. The first session consisted of pre- and post ROM measurements of rest and post ROM measurements (control). Then the participants were familiarized with the foam rolling procedures that were used for the next two sessions. During the next two sessions the control trial procedures were repeated, except instead of resting between pre and post testing the participants foam rolled using one of the foam rollers. RESULTS: Repeated measures ANOVA showed no significant differences existed between the two trials (p>0.05) in favor of SN and grid, but not between SN and grid (p>0.05). Effect sizes revealed that when comparing mean differences from pre to post for SN and grid: a large effect was seen (d = 0.76) in favor of SN, moderate effects were observed for shoulder ROM (d = 0.50) in favor of SN, shoulder extension (d = −0.62) in favor of SN, and hip abduction (d = −0.57) in favor of grid. CONCLUSION: Both foam rollers produced similar acute improvements to hip and shoulder ROM, which were significantly better than the control condition. When improvements to ROM are desired prior to resistance training, the use of either foam roller in this study would be preferred over static stretching or no mobility exercises.

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**3741 Board #188 June 3 9:30 AM - 11:00 AM**

**Effectiveness of Cross Taping as a Therapy for Delayed Muscle Soreness**

Alla M. ALFRISANY. Wichita State University, Wichita, KS. (Sponsor: Jeremy Patterson, FACSM) Email: alla.alfrisany@hotmail.com (No relationships reported)

Decrease muscle soreness by medical tape is supported by the literature. Subjects: Twenty normal subjects ranging in age from 18 to 55 with no history of previous skin allergy and do not have any upper body injuries participated. PURPOSE: To assess the efficacy of the cross tapes in muscle soreness. METHODS: Subjects will perform the lowering phase of a bicep curl exercise using a dumbbell consisting of 3 sets 25 repetition, followed 90 seconds rest between each set. A grid shaped adhesive, a little larger than a stamp, called a cross tapes will be applied in the bicep of the dominant hand and the other hand as control for one week. The range of motion and pain for both arms will be measured before and after the applied tape. RESULTS: The study findings show that there were statically significant difference between the ROM and the pain (pre, post) when the procedure is carried out over a period of two consecutive weeks following warm up (1) warm up) with large effect size (0.2) and strong power (0.96). However, there were no significant differences between the two groups (right, left arms) with medium effect size (0.1) and weak power (0.33). CONCLUSIONS: Therefore, this study suggest that cross tapes may reduce delayed onset muscle soreness, however more research is needed. Future studies should include a larger number of subjects, more diverse cohort, an exercise that applies a greater intensity, and expands the time of research. CT is an advisable method to decrease DOMS and improved functional performance.

**3742 Board #189 June 3 9:30 AM - 11:00 AM**

**Combined Effects of Cold Water Immersion and Compression Garment after Exercise on Muscle Damage Markers**

Maruyama Tatsuhiro, Sahiro Mizuno, Kazushige Goto. Ritsumeikan University, Kasatsu, Japan. (Sponsor: RObert K. Kremer, FACSM) Email: maruyama.t.rouute@gmail.com (No relationships reported)

Cold water immersion (CWI) and compression garment (CG) are popular post-exercise treatments for reducing exercise-induced muscle damage. Although efficacy of CWI and CG has been already reported, combined effect of these post-exercise treatments remains unclear. PURPOSE: To investigate the effect of combined treatment of CWI and wearing CG after maximal eccentric exercise on recovery of muscular strength and indirect muscle damage markers. METHODS: Six males performed two trials (TRE, CON) in random order. In the TRE trial, the subjects performed 15min of cold water immersion (15°C) followed by wearing a lower body CG for 24 h after the exercise, whereas no post-exercise treatment was conducted in the CON trial. The exercise consisted of 10×6 maximal isokinetic (60°/s) eccentric knee extension using unilateral leg, and exercised leg was randomly selected in each trial to avoid repeated bout effect for the same muscle groups. Time course changes in maximal voluntary contraction (MVC) and isokinetic (60°/s) strength for knee extension, score of muscle soreness, muscle thickness of quadriceps were evaluated before exercise and 3 h after exercise. RESULTS: Total work volume during eccentric exercise did not significantly differ between the two trials (P>0.05). MVC and maximal isokinetic strength were markedly decreased during post-exercise period in both trials (P<0.05), and these responses were not significantly different between the trials. Serum CK and Mb concentrations were significantly elevated during post-exercise period in both trials (P<0.05). However, area under the curve for Mb concentration during exercise and 3 h of post-exercise period significantly lowered in the TRE trial (196 ± 31 ng/ml) compared with the CON trial (260 ± 50 ng/ml) (P<0.04). No significant difference was observed between trials for time-course changes in other variables. CONCLUSION: CWI followed by wearing CG after maximal eccentric exercise did not facilitate recovery of muscular strength. However, exercise-induced increase in Mb was significantly attenuated when the combined treatment of CWI and CG was applied.

**3739 Board #186 June 3 9:30 AM - 11:00 AM**

**Acute Effects of Two Different Foam Rollers on Range of Motion**

Isaak D. Henry, Jacilyn Olson, Melissa Powers, Jill Robinson, Ed Cuilliff. University of Central Oklahoma, Edmond, OK. Email: ihenry@uco.edu (No relationships reported)

Dorsiflexion ROM tended to decrease 48-h post-fatigue using both socks, but was not statistically significant (right (PLA: p=0.22; COM: p=0.24); left (PLA: p=0.06; COM: p=0.18) Additionally, 1-mile run time was not affected by COM (pre: 8.5±1.9 min; 48-h: 8.5±1.2 min; p=0.24) or PLA socks (pre: 8.7±2.0 min; 48-h: 8.3±1.7 min; p=0.07).

**Conclusion:** COM had no significant effects on objective and subjective measures of recovery after a fatiguing exercise. Interestingly, 50% participants reported “feeling like” COM helped them recover (vs. PLA). Large interindividual differences in perception of soreness existed among participants, highlighting the importance of collecting more data on Masters athletes to make conclusive recommendations on the use of these popular recovery modalities.

**RESULTS:** Plasma concentrations of physiological biomarkers showed a significant (p< 0.05) attenuation in RPE and perceived leg fatigue for all groups with CWT and CS being more successful than PAS (2 ± 0.9; 2 ± 1.0; 4 ± 1.9). However body temperature was significantly lower (-0.58°C) after CS compared with CWT and PAS trials.

**CONCLUSIONS:** There is no evidence that cold and contrast water immersions appear to promote better physiological responses. However the observed positive effect on perceived leg fatigue and temperature suggest that cold and contrast water therapy may be effective for players performing in the heat.
Compression garments are popular mechanical ergogenic aids that are hypothesized to shorten the time needed to recover from exercise. **PURPOSE:** The purpose of this study was to evaluate the effects of full-length compression tights and knee-high stockings on recovery from plyometric exercise. **METHODS:** This study used a randomized pretest-posttest design. Thirty healthy males aged 18-23 were recruited for participation (height 181 ± 0.078 m; body mass 79.28 ± 12.95 kg; age 21.40 ± 2.28 years). Subjects were randomized into three groups: full-length tights (n=11), knee-high stockings (n=10), and a control group (n=9) (no garment). Subjects completed perceived muscle soreness ratings using a visual analog scale (VAS), isokinetic strength of the knee extensors (KE), time to peak torque (TTPT), and vertical jump height (VJ) measures at baseline and, repeated these at 24, 48, and 72 hours post-plyometric exercise. Plyometric exercise took place the on the second visit with subjects completing 10 sets of 10 plyometric box drop jumps. Compression garments were worn by the full-length and knee-high compression groups immediately following plyometric exercise and for the following 12 hours. All data were analyzed in SPSS (v23). Multiple repeated measures ANOVAs with Bonferroni adjustments were used to analyze the differences in KE, TTPT, VJ, and perceived muscle soreness. **RESULTS:** There were no differences between groups for any dependent measures. The time effect showed statistical significance for the VAS of the calves and quadriceps in VJ, KE, and TTPT (p<0.05). Pairwise comparisons showed significant differences in VJ, KE, and TTPT (p<0.05). Pairwise comparisons of the VAS revealed the plantar flexors and the knee extensors demonstrated significant differences in perceived muscle soreness (p<0.05). **CONCLUSION:** These results suggest that while muscle damage occurred, and differences in VJ, KE, and TTPT were seen, no significant differences were observed between groups relative to compression garments with this finding, we can conclude that full-length or knee-high compression stockings do not aid in recovery from plyometric exercise.

**CONCLUSIONS:**
- Compression of predicted VO_2peak from PACER equations including a weight-related variable indicates VO_2peak prediction can be improved. The SDState Junior Jacks PACER equation is the first PACER equation to evaluate and include waist circumference as a significant predictor of VO_2peak. The SDState Junior Jacks PACER equation utilizes sex, PACER laps, and waist circumference to provide a valid, less variable prediction of VO_2peak in children.

Cardiorespiratory fitness (maximum aerobic capacity), and more recently muscle strength, have been found to be associated with lower levels of cardiovascular and metabolic risk factors in longitudinal studies from adolescence to early adulthood. Higher levels of total daily energy expenditure (TDEE) are associated with improved cardiorespiratory fitness, however less is known about the mechanism related with anaerobic metabolism-related fitness.

**PURPOSE:** To analyze the association between TDEE, physical activity and anaerobic performance in youth. **METHODS:** A database of 136 measurements of TDEE in 84 individuals aged 6-19 years was analyzed (37 females and 47 males, age 13.3 ± 3.2 years, BMI 20.53 ± 5 kg/m², TDEE 2390 ± 953.9 kcal). TDEE was determined over 15 days by the doubly labelled water technique. Physical activity (PA, min/day and steps/day) was measured by accelerometer. PA energy expenditure (PAEE) was calculated by subtracting resting energy expenditure (REE) and thermic effect of food, and ratios of kcal by kg of body weight (PAEEkg) were calculated. Fat free mass (FFM) was calculated by deuterium dilution technique. Anaerobic performance was tested by vertical jumps (CMJ, CMJA), handgrip, lower limbs isometric strength (LLS) and 15m- and 30m-sprint. A stepwise regression analysis was used to explore the relationship between anaerobic performance (dependent variable), TDEE and PA. All correlations were adjusted to FFM, gender and age. **RESULTS:** TDEE was associated with all anaerobic performance tests (r=0.190 for CMJ, r=0.216 for CMJA, r=0.289 for handgrip, r=0.495 for LLS and, r=0.371 for 15m-sprint, all p<0.05). However, after adjusting for confounders, only PAEEkg and vigorous PA were significantly associated with sprint performance (30m: t-ratio=2.00, r=0.214, p<0.05; 15m: t-ratio=2.36, r=0.286, p<0.05) and LLS (t-ratio=2.00, r=0.214, p<0.05) respectively. **CONCLUSION:** Our results highlighted the importance PAEE more than total PA for an improved performance of high-intensity displacement activities, which has been recently associated with health outcomes independently of cardiorespiratory fitness. However our results could be cross-validated in other school communities. Funded by Spanish Ministry of Economy and Competitiveness (Grant: DEP2011-30565).
who completed each of the FITNESSGRAM components as a part of their yearly assessment. In addition to height and weight, subjects were also measured for waist circumference. AC was determined from one-mile run/walk times, age, gender and BMI. The percent of these students classified within the Healthy Fitness Zone (HFZ) were 46% for BMI, and 52% for AC. The percent of these students classified as High Risk were 43% for BMI, and 31% for AC. RESULTS: The correlation between WHR and BMI was .92, and the correlation between BMI and AC was -.75. The correlation between WHR and AC was .75. Receiver Operating Characteristic (ROC) analysis indicated that a WHR of 0.451 represents the best cut-off score for classifying girls within the HFZ for BMI, with 91% classified correctly, and AUC = .96. Also, a WHR of 0.475 represents the best cut-off score for classifying boys within the HFZ for BMI, with 90% classified correctly, and AUC = .95. For determining High Risk classification for BMI, a WHR of 0.476 represents the best cut-off score for classifying girls as High Risk for BMI, with 90% classified correctly, and AUC = .96. Also, a WHR of 0.484 represents the best cut-off score for classifying boys as High Risk for BMI, with 94% classified correctly, and AUC = .97. CONCLUSIONS: WHR is strongly associated with classification according to FITNESSGRAM BMI standards in sixth-grade children. These data suggested that a WHR of .451 for girls and .475 for boys are the best criteria for HFZ classification for FITNESSGRAM BMI. Also, a WHR of .476 for girls and .484 for boys are the best criteria for High Risk classification for FITNESSGRAM BMI. Reduction of WHR may provide important benefits since children in the High Risk category are most likely to develop problems related to metabolic syndrome as adults.

3748 Board #195  June 3 8:00 AM - 9:30 AM
Assessment of Speed and Vertical Jump Performance in North American High School Football Players

Avery D. Faigenbaum, FACSM, Jie Kang, FACSM, Anne Faigenbaum, FACSM, Jie Kang, FACSM, Andrea Cassimiro de Oliveira, Rafael Benito Mancini, João Pedro da Silva Junior, Luísa Rebeca de Oliveira, Timoteo Leandro de Araujo, Victor Matsudo, CEFALÍSNC, SÃO CAETANO DO SUL, Brazil. (No relationships reported)

PURPOSE: The back squat exercise is perhaps the most popular and most effective exercise for developing lower body musculature. Development of the lower body musculature is paramount for increasing ground reaction forces which in turn can translate to increased explosiveness in movements such as sprinting or vertical jumping (VJ). For athletes in particular, developing lower body strength can be of utmost importance. There is however dispute over which back squat depth is most optimal. PURPOSE: This study attempted to determine which of two back squat depths (90 degree knee flexion or 45 degree knee flexion) would correlate with superior sprint times and VJ performance. METHODS: Participants were high school aged males on a North American football team (age: 15.1±0.9 yrs, mass: 77.0±13.2 kgs). Twenty athletes performed the 36.6 meter (36.6M) sprint and VJ tests along with performing a 3RM back squat at 90 and 45 degrees of knee flexion on randomized separate days. Pearson Correlation Coefficient (r) test was used to compare the squat scores with sprint times and VJ performance. RESULTS: Variable measures were 36.6M: 5.23±0.26 secs, VJ: 59.6±6.6 cm, 90° 3RM squat: 116.1±21.0 kgs, and 45° 3RM squat: 96.1±20.0 kgs. Moderate correlations were revealed when comparing the squat scores with sprint times and VJ performance.

3749 Board #196  June 3 8:00 AM - 9:30 AM
Association Between Waist-to-Height Ratio And Fitnessgram® BMI Classification In Sixth-grade Children

John L. Walker, FACSM, Tinker D. Murray, FACSM, James Eldridge, FACSM, William G. Squires, Jr., FACSM, Texas State University, San Marcos, TX. University of Texas of the Permian Basin, Odessa, TX. Texas Lutheran University, Seguin, TX. Email: jw18@txstate.edu (No relationships reported)

FITNESSGRAM has established criterion standards for body composition and body mass index (BMI) according to gender and age in children. Standards for aerobic capacity (AC) have also been established to assess cardiorespiratory function. Waist-to-Height ratio (WHR) has been shown to be a strong indicator of metabolic syndrome in youth. PURPOSE: The purpose of this study was to determine the association between WHR and FITNESSGRAM BMI classification in sixth-grade children. METHODS: Subjects were 528 sixth-grade boys and girls, ages 11-13,
and a 12.8 m rope (4.1 kg) was used for all trials. Comparisons between exercises were made using one-way ANOVA with repeated measures. RESULTS: Peak values for VO₂ and HR during the treadmill test were 47.4 ± 8.8 ml/kg/min and 195.1 ± 6.6 bpm, respectively. Mean HR and VO₂ values for both sets of each exercise during the BR protocol were 52.7% ± 84.1% and 21.5% ± 60.1% of HRpeak and VO₂peak, respectively. During the BR protocol, there were progressive increases in VO₂ and HR from EX1 to EX5. Results of pairwise comparisons of VO₂ and HR among five BR exercises are shown (mean ± SD):

<table>
<thead>
<tr>
<th></th>
<th>EX1</th>
<th>EX2</th>
<th>EX3</th>
<th>EX4</th>
<th>EX5</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR (bpm)</td>
<td>103.3 ± 11</td>
<td>124.1 ± 15</td>
<td>148 ± 16</td>
<td>147 ± 14</td>
<td>164 ± 11</td>
</tr>
<tr>
<td>VO₂ max (l/min)</td>
<td>10.2 ± 2</td>
<td>12.7 ± 3</td>
<td>18.1 ± 3.2</td>
<td>23.1 ± 3.2</td>
<td>28.5 ± 3.2</td>
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p<0.05 vs EX1; *p<EX2; *vs EX3; *vs EX4

CONCLUSION: These data indicate that BR exercise can pose a moderate to vigorous metabolic and cardiovascular stimulus in children with the mean effects augmented with the use of exercises requiring greater muscle mass.

3751 Board #198 June 3 8:00 AM - 9:30 AM Changes in VO₂max are Not Associated With Ventricular Morphology or Function in Female Youth Athletes

Carol Coutinho, Andrew Watson, Stacey Brickson. University of Wisconsin-Madison, Madison, WI. (No relationships reported)

While the relationship between fitness changes and ventricular morphology and function has been studied in adults and in cross-sectional studies with children, we are aware of no prior research which has evaluated this relationship in female youth athletes longitudinally.

PURPOSE: To determine if changes in maximal aerobic capacity are associated with changes in ventricular morphology or systolic function in female youth athletes.

METHODS: 26 female soccer athletes (ages 13-18) underwent resting 2-D echocardiography and maximal aerobic testing at two time points 7 months apart to determine, maximal aerobic capacity (VO₂max), left ventricular (LV) end-diastolic diameter (LVEDD), right ventricular (RV) end-diastolic diameter (RVEDD), LV mass (LVM), RV area in diastole (RVAD), RV area in systole (RVAS), LV shortening fraction (LVSF), RV fractional area change (RVFAC), interventricular septal wall thickness (IVWT), and LV posterior wall thickness (LVPWT). Echocardiographic and fitness variables were compared at the two time points using paired Wilcoxon tests and Cohen’s d. Linear regression models were used to predict changes in VO₂max using changes in echocardiographic variables as predictors.

RESULTS: During the study period, no significant change in VO₂max was identified (2.61 ± 32% v 2.62 ± 32%, p = 0.75, d = 0.05). A significant decrease was identified in RVFAC (-44 ± 10% v 36 ± 5%, p = 0.02, d = 0.61). No significant differences were identified in any other echocardiographic or fitness variables (p<0.05 for all). None of the changes in echocardiographic variables were significant predictors of change in VO₂max during the study period. While this suggests that changes in aerobic capacity may not be related to changes in ventricular size or function, it is also possible that the changes in these variables during the study period were not large enough to demonstrate meaningful relationships between them.

3752 Board #199 June 3 8:00 AM - 9:30 AM Muscle Strength Thresholds For The Detection Of Cardiometabolic Risk Among Colombian Children And Adolescents: The Fuprecol Study

Jhonatan Camilo Peña-IBagon1, Felipe Lolebo2, Antonio García-Hermoso3, Daniel H. Prieto-Benavidez1, Jorge E. Correa-Bautista1, Robinson Ramirez-Vélez1, *Centro de Estudios para la Medición de la Actividad Física «CEMA». Escuela de Medicina y Ciencias de la Salud, Universidad del Rosario, Bogotá D.C, Co, Bogotá, Colombia. 1Grupo de Investigacion en Ejercicio Fisico y Deporte. Vicerrectoría de Investigación, Universidad Manuela Beltrán, Bogotá, D.C., Colombia., Bogotá, Colombia. Research Centre in Physical Activity, Health and Leisure, Faculty of Sport University of Porto, Porto, Portugal. 2Laboratorio de Ciencias de la Actividad Física, el Deporte y la Salud, Universidad de Santiago de Chile, Santiago, Chile. Email: robin640@hotmail.com (No relationships reported)

PURPOSE: Associations between maximal rate of oxygen uptake (V̇O₂ max) and cardiometabolic risk have not been adequately studied in Colombian children and adolescents. The aim of the present study was two-fold: (i) to determine the ability of eight different V̇O₂ max equations to discriminate between low and high cardiometabolic risk; and (ii) to determine cardiorespiratory fitness (CRF) thresholds associated with a more favourable cardiovascular health profile in Colombian children and adolescents.

METHODS: The CRF was estimated by the 20 m shuttle run test on 2,870 schoolchildren (54.5% girls) from Bogota (Colombia). We computed a metabolic syndrome score (MeScore) as the sum of the age-sex standardized scores of waist circumference, triglycerides, HDL-c, glucose, systolic and diastolic blood pressure. ROC analysis showed a significant discriminatory accuracy of MS in identifying the low/high metabolic risk in children and adolescents and both gender.

RESULTS: ROC analyses showed a significant discriminatory accuracy for the identifying the low/high CMRI in both gender and age group (AUC=0.83 (95%CI: 0.71-0.95), p<0.001; boys AUC=0.84 (95%CI: 0.70-0.94), p<0.001; adolescent girls AUC=0.79 (95%CI: 0.70-0.90), p<0.001; boys AUC= 0.88 (95%CI: 0.68-0.92), p<0.001). In children (9 to 12 years old), handgrip strength (kg)/body mass (kg) values at these points were 0.359 and 0.376 in girls and boys, respectively. In adolescents (13.0 to 17.9 years old), these points were 0.440 and 0.447 in girls and boys, respectively.

CONCLUSIONS: In conclusion, the results suggest a hypothetical MS level relative to weight for having a low metabolic risk, which could be used to identify youths at risk.

3753 Board #200 June 3 8:00 AM - 9:30 AM Maximal Oxygen Uptake Equations To Discriminate The Cardiometabolic Risk In Colombian Children And Adolescents: The Fuprecol Study

Jorge E. Correa-Bautista1, Andres Vivas1, Jorge Mota1, Antonio García-Hermoso3, Daniel H. Prieto-Benavidez1, Robinson Ramirez-Vélez1, *Centro de Estudios para la Medición de la Actividad Física «CEMA». Escuela de Medicina y Ciencias de la Salud, Universidad del Rosario, Bogotá D.C, Co, Bogotá, Colombia. 1Grupo de Investigacion en Ejercicio Fisico y Deporte. Vicerrectoría de Investigación, Universidad Manuela Beltrán, Bogotá, D.C., Colombia., Bogotá, Colombia. Research Centre in Physical Activity, Health and Leisure, Faculty of Sport University of Porto, Porto, Portugal. 2Laboratorio de Ciencias de la Actividad Física, el Deporte y la Salud, Universidad de Santiago de Chile, Santiago, Chile. Email: robin640@hotmail.com (No relationships reported)

PURPOSE: Associations between maximal rate of oxygen uptake (V̇O₂ max) and cardiometabolic risk have not been adequately studied in Colombian children and adolescents. The aim of the present study was two-fold: to explore potential age- and sex-specific thresholds of MS, for optimal cardiometabolic risk categorization among Colombian children and adolescents; and to investigate if cardiometabolic risk differed by MS group by applying the receiver operating characteristic curve (ROC) cut point.

METHODS: MS was estimated by a handle dynamometer on 1,950 children and adolescents from Colombia, using the MS relative to weight (handgrip strength/body mass). A metabolic risk score was computed from the following components: waist circumference, triglycerides, HDL-c, glucose, systolic and diastolic blood pressure. ROC analysis showed a significant discriminatory accuracy of MS in identifying the low/high metabolic risk in children and adolescents and both gender.

RESULTS: ROC analyses showed a significant discriminatory accuracy for the identifying the low/high CMRI in both gender and age group (AUC=0.83 (95%CI: 0.71-0.95), p<0.001; boys AUC=0.84 (95%CI: 0.70-0.94), p<0.001; adolescent girls AUC=0.79 (95%CI: 0.70-0.90), p<0.001; boys AUC= 0.88 (95%CI: 0.68-0.92), p<0.001). In children (9 to 12 years old), handgrip strength (kg)/body mass (kg) values at these points were 0.359 and 0.376 in girls and boys, respectively. In adolescents (13.0 to 17.9 years old), these points were 0.440 and 0.447 in girls and boys, respectively.

CONCLUSIONS: In conclusion, the results suggest a hypothetical MS level relative to weight for having a low metabolic risk, which could be used to identify youths at risk.
performance exists when high-level athletes execute complex motor tasks. Methods: NCAA women swimmers (N = 254) completed an online questionnaire in which they provided age, height, weight, swimming history, and age at menarche (AaM). We divided the sample into early-, average-, and late-maturing groups using AaM. We utilized the USA Swimming (USAS) performance database to identify individual performances for each swimmer at three adolescent phases: (1) early adolescence (12 years old), (2) middle adolescence (15 years old), and (3) late adolescence (18 years old). Each performance in the USAS database was assigned to a standardized score called a Power Point Score (PPS). We selected the highest PPS for each swimmer at the three adolescent phases. We analyzed the data using a Two-way Mixed Design ANOVA. Results: Mean AaM values for the early-, average-, and late-maturing groups were 12.0 years (95% CI, 11.8 to 12.2), 13.4 years (95% CI, 13.3 to 13.5), and 15.4 years (95% CI, 15.2 to 15.6). We identified performances for 173 of the 254 respondents (68.1%) in the USAS database at three adolescent phases. We detected a significant two-way interaction (F_{1,172} = 5.8, P < 0.001), which indicated that the effect of maturational timing on swim performance differed by adolescent phase. Mean PPS for the early, average, and late matures during early adolescence was 496.4, 494.8, and 480.0, respectively. 

Purpose: This cross-sectional study was to compare the associations of aerobic fitness and agility with cognition performance in preschool children. Methods: A total of 346 preschool children (age 3.5-5.5 yr old) with 201 boys and 145 girls were recruited. The intervention was conducted in a school for 12 sessions over a period of 6 weeks. Students were split into GCA or SA group. Two sessions were held in a week and each lasted for 45 minutes (5 minutes warm up, 15 minutes GCA or SA activities, 5 minutes break, 15 minutes GCA or SA activities and 5 minutes cool down). RPE and Heart Rate (HR) were recorded during the sessions. Physical activity was kept similar throughout the intervention period. The students ran a 1.6 km before and after the intervention. Results: Paired-t test showed significant differences in the 1.6 km post run test for GCA (pre: 693.67 ± 98.03 seconds, post: 614.89 ± 74.18 seconds; p = 0.001) and SA (pre: 817.11 ± 92.88 seconds, post: 712 ± 68.51 seconds; p < 0.0005). Independent-t test showed significant difference between GCA and SA in the 1.6 km pre run (p = 0.011) and HR (p = 0.001). Maximum HR (HR_{max}) was higher in GCA (75.73% of HR_{max}) than SA (61.9% of HR_{max}). Conclusion: Faster times in the 1.6 km post run test showed improvement in cardiovascular fitness for both pedagogical approaches, which may have been sustained with continued exercise intervention with 60-75% of HR_{max} and RPE of 4-6. A higher improvement from the GCA group suggests that GCA is a better pedagogical approach as it is fun for children. Self-regulation of exercise intensity using the OMNI RPE scale during both GCA and SA improved fitness and may be a safe way to exercise as the students are not exercising at high RPE (8-10) which may induce injuries.

Participants: 58 young children ( 22 boys and 36 girls). They were 10 years old, height: 138 ± 5.94cm, weight: 20.7% (n=12) in the same children at 11-years-old. There were no age-related differences in frequency of obesity. The obesity index at 3-years-old was significantly correlated with that at 4-years-old (r=0.861), 5-years-old (r=0.774), 8-years-old (r=0.426). Maximum HR (HR_{max}) percentage was higher in GCA (75.73% of HR_{max}) than SA (61.9% of HR_{max}). Conclusion: Faster times in the 1.6 km post run test showed improvement in cardiovascular fitness for both pedagogical approaches, which may have been sustained with continued exercise intervention within 60-75% of HR_{max} and RPE of 4-6. A higher improvement from the GCA group suggests that GCA is a better pedagogical approach as it is fun for children. Self-regulation of exercise intensity using the OMNI RPE scale during both GCA and SA improved fitness and may be a safe way to exercise as the students are not exercising at high RPE (8-10) which may induce injuries.
Young children’s acquisition of the habit of engaging in physical activity (PA) and having a positive attitude to PA are very important to improve children’s physical fitness. The acquisition of the habit of engaging in PA translates into an increase in the amount of PA. It is also expected that the improvement of physical fitness supports the development of a positive attitude to PA. However, the amount of PA changed according to influence of daily lifestyle and guardians’ consciousness of children’s PA. PURPOSE: The purpose of this study was to examine the relationships between young children’s PA and guardians’ consciousness regarding the same. This study specifically focused on the change in the longitudinal relationships. METHODS: The subjects of this study were 77 young children. Data included their PA, daily lifestyle, and guardians’ consciousness of children’s PA. The amount of PA was measured on all days of a week. The data on 18 items related to daily lifestyle and guardians’ consciousness of children’s PA were collected using a questionnaire. These data were collected when the children were aged 3 and 5 years old, using the same protocol. The subjects were divided into 2 groups, the improvement group and maintain or no-improvement group, based on the change in guardians’ consciousness of children’s PA. The difference in the amount of PA between these groups was examined using an independent t-test. RESULTS: The amount of PA increased on weekdays and decreased on weekends from 3 years old to 5 years old. The amount of PA increased significantly in the improvement group based on the consciousness that “playing outside, exercise, and sports are very important” and “the guardian sometimes takes a walk with the child”. Regarding daily lifestyle items, “the frequency of playing using the whole body” was the only item that showed a significant difference in PA. Although statistical significance was not confirmed, PA increased in the improvement group based on “the duration of watching TV/videos” and “duration of playing video games”. CONCLUSIONS: It was suggested that guardians’ consciousness regarding playing outdoors, and engaging in exercise and sports is very important for children’s PA. Further, it is necessary to control the duration of watching TV/videos and of playing video games in order to increase children’s PA.

Young Talented Volleyball Players For the Junior National Team


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(No relationships reported)

PURPOSE: To determine whether anthropometric measurements and fitness test results can discriminate between selected and non-selected junior volleyball players. METHODS: Forty three male junior volleyball players (age: 15.0±0.7 yrs) took part in training camp and underwent a selection procedure by coaches of the junior national team. Anthropometric data (body height, body mass and body height with extended arm) and fitness tests results (countermovement jump (CMJ), block jump, spike jump, 10m sprint and 505 agility test) were obtained. Four expert volleyball coaches of the national team evaluated and graded the players in a scale from 0 to 100 during their participation in a volleyball tournament. The coaches selected the best 23 players on the basis of their score (selected players; n=23, height: 186±5 cm, body mass: 72±10 kg) (non-selected; n=20, height: 188±3 cm, body mass: 69.5±7.5 kg). A linear discriminant analysis was conducted on the selected and non-selected groups to determine if the anthropometric and fitness test data could predict the coaches’ selection. Anthropometric and fitness test data of the two groups were compared using independent samples t-tests. Statistical significance was set at p<0.05. RESULTS: Selected players had higher coaches’ scores compared to the non-selected (83.9±7.2 vs. 65.3±7.5, p<0.05). There were significant differences between selected and non-selected in only in vertical jumps (CMJ: 40.5±6.7 vs. 34.3±6.3 cm, block jump: 43.6±6.9 vs. 36.9±3.5 cm, spike jump: 72.8±10.3 vs. 63.4±3.8 cm, all p<0.05), but not in any other anthropometric or fitness test parameter. The multivariate analysis yielded a discriminant function (Wilks’s lambda= 0.69, χ²= 15.12, p=0.001, η²=0.12). CMJ was the main test result that highly loaded the discriminant function (r=0.85). Cross validation results showed that selection was correctly predicted in 31 out of the 43 selected athletes (predictive accuracy: 72.1%). CONCLUSIONS: Vertical jumping ability may be used as an important parameter that largely determines success, since it may be discriminated between selected and non-selected junior volleyball players.

Comparison Of Health Related Fitness Variables between Male and Female Youths in Singapore

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(No relationships reported)

PURPOSE: To compare HRF variables among male and female Singaporean youths. METHODS: One thousand four hundred and fifty-six youths (762 males: age: 13.63 ± 1.35 years, height: 158.36 ± 8.75 cm, weight: 53.82 ± 14.39 kg, BF%: 17.64 ± 10.73 %; and 694 females: age: 13.34 ± 1.21 years, height: 160.73 ± 8.68 cm, weight: 48.82 ± 10.9 kg, BF%: 25.74 ± 7.87 %; p<0.005; SRT: Males: 52.97 ± 10.4 cm, Females: 55.53 ± 10.03 cm, p<0.005; HS: Males: 28.35 ± 7.98 kg, Females: 20.77 ± 4.11 kg, p<0.005; SUT: Males: 43.26 ± 11.29, Females: 33.24 ± 9.16, p<0.005; PACER: Males: 48.79 ± 24.93 stages, Females: 29.41 ± 12.9 stages, p<0.005). Males were significantly stronger than females, whereas females were significantly more flexible than males.

CONCLUSIONS: Generally, youths in Singapore are aerobically fit, with a healthy BF% indicating low obesity rates. If these results of HRF variables are maintained throughout their lifetime, there may be low risk of cardiovascular diseases in Singapore in the future.
'Injuries caused by falls account for 25% to 40% in morbidity and mortality of children worldwide. Therefore, it is important to identify effective interventions to prevent falls.

**Purpose:** To investigate the effects of backward walking on balance and fall risk in children.

**Methods:** Twenty eight healthy boys (6.2± 0.5 yrs) were randomly assigned into a control group (n=14) and an intervention group (n=14). Boys in the control group participated in a conventional physical activity program, and those in the intervention group received conventional physical activity plus balance training with backward walking. The programs were provided 30 min/day, 3 days/week for 12 weeks. Balance at baseline and post-intervention was evaluated by using a dynamic training system BTA-200DP which includes anterior/posterior balance index (API), medial/lateral balance index (MLI), and overall balance index (OBI), as well as kinematic parameters in lower extremities. Independent t-tests were performed for group comparisons.

**Results:** There were no significant differences between the control group and the intervention group in each of the parameters before treatment. After 12 weeks of training, the intervention group was significantly better than the control group in API (0.09±0.18 vs. 1.66±0.71, P<0.01), MLI (0.61±0.23 vs. 1.08±0.41, P<0.01), and OBI (0.82±0.15 vs 1.85±0.36, P<0.01). There were no significant group differences in kinematic gait parameters in backward and forward walking between control and intervention group after 12 weeks of training, however, compared with the control group, the intervention group had significantly higher support phase time (0.83±0.07 sec vs. 0.69±0.05 sec, P<0.01), swing time (53.58±11.01 sec vs. 73.77±62.46 sec, P<0.01), step length (53.58±11.01 cm vs 73.77±62.46 cm, P<0.01), step speed (6.19±1.26 m/s vs 8.57±1.47 m/s, P<0.01).

**Conclusions:** Backward walking training improved dynamic balance and motion control ability in children.

Supported by the Sports Medicine key laboratory of General Administration of Sport of China/Sports Medicine key laboratory of Sichuan province Foundation.
CONCLUSIONS: Our study suggests that there are distinctive characteristics pertaining to every factor in the improvements observed in physical fitness in childhood.

Cortisol can negatively affect athletic performance, potentially causing fatigue and inflammation, while high levels of this hormone have been associated with impaired performance in elite athletes. Monitoring hormones in saliva has distinct advantages over doing it in other biological fluids. However, little is known about the salivary cortisol responses in adolescent athlete, particularly after a tennis match.

PURPOSE: The purpose of this study was to examine the salivary cortisol responses in elite (finalists of national competition playoffs) adolescent tennis players after a tennis match.

METHODS: Thirty-two tennis athletes (20 females: age 14±0.5 yrs, height 165±7 cm, mass 52.2±7.6 kg, BMI 19.0±1.6, and 12 males: 14±0.5 yrs, height 173±10 cm, mass 60.8±8.2 kg, BMI 19.9±1.1) participated in the study. Mean match duration for all participants was 77.5±13.6 min. Unstimulated mixed saliva samples were collected in salivate swabs 15 minutes prior to and 15 minutes after the end of the tennis match. Specifically, the swab was placed in the mouth for one minute, then it was transferred into plastic tubes, centrifuged and the resulting saliva sample was analyzed. Saliva samples were assayed in duplicate using a commercially available ELISA kit for cortisol. Differences between the cortisol levels before and after the match were analyzed using student’s T-test.

RESULTS: Salivary cortisol levels were significantly higher after the completion of the tennis match compared to the baseline levels (4478.9±598.3 pg/ml vs. 976.1±143.7 pg/ml; p<0.001). No significant differences were found between the male and female participants (p>0.05).

CONCLUSION: The findings of the present study suggest that monitoring cortisol in saliva can be a useful, non-invasive and sensitive method to assess this hormonal response in adolescent athletes after a tennis match. Moreover, in contrast to findings of previous studies in adult tennis players, the increased cortisol levels in the adolescent athletes of this study found to be independent of their gender. The possible negative effects of these cortisol responses on the adolescent elite athlete’s performance needs to be further investigated.

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June 3, 2017

Board #213

June 3 8:00 AM - 9:30 AM

Effect of Modified Tai Chi Exercise on Physical Function among Chinese High School Students

Iulu gao1, Wei Sun2, Nan Ye1. 1Capital University of Physical Education and Sports, Beijing, China. 2Shandong Institute of Sports Science and Technology, Jinan, China. 3Beijing Sports University, Beijing, China. (Sponsor: Yong Tai Wang, FACSVM)

Purpose: To investigate the effects of physical function on high school students in China.

Methods: One hundred-twenty healthy high school students (60 boys & 60 girls aged 16–18 years) volunteered for the Tai Chi intervention. The participants were randomly assigned to four groups (30/group): the boys experimental group (BEG); girls experimental group (GEG); boys control group (BCG) and girls control group (GCG).

Results: The experimental groups received the Tai Chi intervention for 20 weeks, 5 days a week and 40 minutes/day. The control groups did not do any exercises. The selected physical function variables: resting heart rate (RHR), vital capacity (VC) and single leg standing with eyes closed balance (SLECB) were measured at the beginning and at the end of 10th week and end of 20th week. One-way ANOVA was performed to determine the differences (p<0.05) between four groups, and repeated ANOVA was employed to examine the differences within the groups over the course of the intervention (p<0.05).

Results: The results demonstrated that the boys had a significantly lower RHR than the BCG did (62.0±0.75 vs 69.9±7.28 beats/min), and the similar trend of the RHR was discovered between the GEG and the BCG; the GEG significantly improved VC and the GCG did not change significantly compared to the BCG (4.230±224 vs 2.869±3 ml), and the similar trend was found between the GEG and the GCG. On the SLECB, the BEG showed significant longer standing time than the BCG did (22.00±1.75 vs 12.04±0.67 s) and the similar trend was observed between the GEG and GCG.

Conclusions: The modified Tai Chi exercises may improve high school students’ physical function in terms of resting heart rate, vital capacity and balance. This modified Tai Chi exercise may be used as an optional exercise for promoting physical function for high school students in China.

Board #214

June 3 8:00 AM - 9:30 AM

Longitudinal Changes in Physical Fitness and Physical Activity in Childhood

Tomoaki Sakai1, Takahiro Nakano1, Kosho Kasugai2, Kazuo Oguri3. 1Nagoya Gakuin University, Seto, Aichi, Japan. 2Gifu University, Gifu, Japan. 3Gifu Shotoku Gakuin University, Gifu, Japan. (Sponsor: Kiyoji TANAKA, FACSVM)

Purpose: The purpose of this study was to examine longitudinal changes in infants’ physical fitness and physical activity.

Methods: The participants were 66 three-year-old children (38 boys and 28 girls) attending daycare centers in 2012. For all participants, we made longitudinal measurements of physical fitness and physical activity over three years between the ages of three and five. Physical fitness and physical activity were measured every year in November and December. We evaluated participants’ performance with the standing long jump, upright hand standing time, sitting trunk flexion, 25 m dash, ball throwing, side-step, and hand grip, calculating changes through the year. Additionally, participants were given an accelerometer for one week, and we evaluated the number of steps on weekdays and weekends.

Results: On weekdays, the number of steps by five-year-old boys was significantly higher than for boys of other ages (three-year-old: 12848±2330 steps, four-year-old: 12820±2905 steps, five-year-old: 14274±2871 steps, p<0.05), but for the girls, there were no significant differences among all ages. In all test items except the side-step and the sitting trunk flexion, we found significant improvements in physical fitness scores every year. There were significant improvements in the side-step only in the span of three and four years of age (6.3±0.3, 9.2±0.3 and 9.7±0.3 times/5 sec, p<0.05). No significant changes were observed in sitting trunk flexion. The amount of change between three and four years of age for the 25 m dash and side-step was significantly greater than that between four and five years of age. On the other hand, changes in upright hand standing time, ball throwing, and hand grip were significantly greater between four and five years of age than between three and four years of age. For the amount of change in physical fitness between three and four years of age and between four and five years of age, a negative correlation was observed both for boys in sitting trunk flexion (r = −0.42), ball throwing (r = −0.41), and side-step (r = −0.63) and for girls in sitting trunk flexion (r = −0.73), ball throwing (r = −0.58), and hand grip (r = −0.48).
Student t-test was used for comparing the means of the normal study variables pre and post intervention. Wilcoxon test was used for non-normal variables. Statistical analysis was performed using SPSS (v.22, IBM, USA). The level of significance was p <0.05. RESULTS: Post-intervention, SI significantly increased the flight time (MD=39.2±17.19 ms; p<0.001) and the jump height (MD=4.22±1.88 cm; p<0.001). However, there were no significant differences post-intervention in the variable speed off in SJ. In the CMJ, the time of flight and jump height significantly increased (MD=41.8±25.97 ms; p<0.001; MD=4.88±3.13 cm; p<0.001, respectively). Moreover, the takeoff speed decreased significantly (MD=0.73±0.93 ms; p<0.01). There were no significant differences in the technical implementation of vertical jump in trampoline.

CONCLUSIONS: An 8-weeks of trampoline training improved the power of the lower limbs in gymnasts children increasing the time of flight, height of jump in SJ, and all the variables studied in CMJ.

The maximal oxygen consumption (VO_{2max}) and Wingate test are two of the most popular assessments for aerobic and anaerobic power, strongly associated with overall performance in athletes. PURPOSE: To assess differences by sport in VO_{2max} and Wingate peak power weight (WPPW) in middle and high school athletes of five team sports in South Korea. METHODS: The maximal oxygen consumption (ml·kg\(^{-1}\)·min\(^{-1}\) and the anaerobic PPW (watts·kg\(^{-1}\)) were evaluated in 163 players of swimming, track & field, shooting, golf, and wrestling (Age = 16.9 ± 1.2 years, BMI = 21.7 ± 1.9 kg·m\(^{-2}\); mean ±SD). All participants performed a treadmill maximal test using the Bruce protocol and the 30 second Wingate test using Inbar Wingate test protocol. Differences in VO_{2max} and WPPW among the sports were tested through one-way ANOVAs. Post-hoc multiple comparisons were made using Bonferroni tests. Linear associations of VO_{2max} and WPPW with age were also inspected by computing Pearson correlation coefficients. Statistical significance was determined at p <0.05. RESULTS: ANOVA showed statistically significant differences among the sports for WPPW and VO_{2max} (respectively: F(4, 158)= 3.25, p=0.013; F(4, 158) = 14.91, p < 0.001). In WPPW, multiple comparisons among the means showed three homogeneous subsets; 1) Swimming (13.7 watts·kg) and Shooting (13.9 watts kg), 2) Golf (14.7 watts·kg) and Track & Field (14.5 watts·kg), and 3) Wrestling (16.7 watts·kg). In VO_{2max}, multiple comparisons among the means also exposed three homogeneous subsets; 1) Track & Field (56.1 ml·kg\(^{-1}\)·min\(^{-1}\) and Shooting (56.9 ml·kg\(^{-1}\)·min\(^{-1}\)), 2) Golf (44.6 ml·kg\(^{-1}\)·min\(^{-1}\) and Shooting (46.7 ml·kg\(^{-1}\)·min\(^{-1}\)), and 3) Swimming (51.6 ml·kg\(^{-1}\)·min\(^{-1}\)). No correlations were found between Age and VO_{2max} and between Age and WPPW (respectively: 0.083, p=0.293; 0.52, p=0.513). CONCLUSIONS: The comparisons between sports that reached statistical significance evidenced differences were observed in several groups on VO_{2max}, 1) Wrestling and Golf (p<0.001), 2) Wrestling and Shooting (p<0.005), 3) Swimming and Golf (p<0.001), 4) Shooting & Track & Field (p<0.001), 5) Track & field and Golf (p<0.001). A similar tendency was observed in WPPW, except for the comparison between swimming and Wrestling. Age was poorly correlated to VO_{2max} and WPPW.

**Conclusions:**

- The intervention based on Tai Chi improved VO_{2max}, Wingate test, and speed, indicating a beneficial effect of this intervention. However, no improvements were observed in the jumping tests (Sayers and CMJ).
- The correlation between VO_{2max} and Wingate test was significant (r=0.68, p<0.001), indicating a similar performance in terms of aerobic and anaerobic power.
- The intervention had a positive impact on the neuromuscular system, as evidenced by the changes in EMG amplitude and recovery time.
- Further studies are needed to investigate the long-term effects of Tai Chi intervention on children and adolescents.
days a week and 40 minutes/day. The control groups did not do any exercises. Lower extremity muscle strength (LEMS) of squats, proprioception of ankle inversion (PAI), and proprioception of ankle eversion (PAE), proprioception of knee flexion (PKF) and proprioception of knee extension (PKE) were measured at the beginning, at the end of 10th week and the end of 20th week. The proprioception reflected the sensitivity of joint angle changed. One-way ANOVA was used to determine the differences (p<0.05) between four groups, and repeated ANOVA was employed to examine the differences within the groups over the course of the intervention (p<0.05).

RESULTS: The results indicated that at the end of 20th week, the MEG had a significantly more increment than MCG did in LEMS (62.12±5.11 vs. 53.15±5.78 kg, p<0.05), and the similar trend was found between the FEG and FCG on LEMS; the MEG had a significantly better proprioception (PAI & PAE) than the MCG did (PAI: 2.93±0.52 vs. 5.81±0.99 deg, p<0.05; PAE: 2.98±0.45 vs. 5.70±1.01 deg, p<0.05), and the similar trend was observed between FEG and FCG on PAI and PAE; the MEG also showed a significantly better proprioception (PKF & PKE) than the MEG did (PKF: 0.99±0.49 vs. 2.69±0.51 deg, p<0.01; PKE: 0.75±0.51 vs. 2.05±0.51 deg, p<0.05), and the similar trend was discovered between the FEG and FCG on PKF and PKE.

CONCLUSIONS: The modified Tai Chi exercises may improve the ankle and knee joints. This modified Tai Chi exercise may be used as an optional exercise for high school students in China. Supported by Chinese General Administration of Sport 2013B034

G-36 Free Communication/Poster - Late-Breaking Abstracts

Saturday, June 3, 2017, 7:30 AM - 11:00 AM
Room: Hall F

3774 Board #221 June 3 9:30 AM - 11:00 AM The Effects Of MyPlate And Paleolithic-based Diet Recommendations, With And Without Exercise, In Women. Collin Popp, Michelle Bohan Brown, William Bridges, Elliot Jesch. Clemson University, Clemson, SC. (No relationships reported)

A Randomized Clinical Trial on the Effects of MyPlate and Paleolithic-based Diet Recommendations, Both with and without Exercise, on Aerobic Fitness, Muscle Strength and Anaerobic Power in Young, Healthy Women. Collin Popp1, Michelle Bohan Brown1, William Bridges2, Elliot D Jesch1
1Clemson University, Department of Food, Nutrition and Packaging Sciences, College of Agriculture, Forestry & Life Sciences, Clemson, SC, USA
2Clemson University, Department of Mathematical Sciences, College of Engineering and Science, Clemson, SC, USA

Objective: To determine and compare the effects of MyPlate and Paleolithic-based diet recommendations when combined with and without exercise on aerobic fitness, strength and anaerobic power in healthy, adult women over 8 weeks.

Methods: Participants (n=20) were randomized to one of four groups, (1) a MyPlate diet, (2) Paleolithic-based diet (PD), (3) MyPlate and exercise (MP + Ex) and (4) Paleolithic-based diet and exercise (PD + Ex). The unsupervised exercise recommendation included two days of aerobic exercise and two days of resistance exercise every week at the university recreation center. At baseline and final a graded treadmill test was performed to determine absolute and relative peak oxygen consumption (absVO2p and relVO2p) and Wingate test was used to determine peak power (PP) and relative peak power (RPP). Leg press and chest press machines were used to estimate upper body (CPIRM) and lower body (LPIRM) strength. Data were analyzed using repeated measures two-way analysis of variance.

Results: The ANOVA indicated that there was no significant interaction between time point (TP)*diet (D) or exercise (Ex) for absVO2p (p = 0.093), strength (CPIRM (p = 0.753), LPIRM (p = 0.427), PP (p = 0.732), RPP (p = 0.496). Based on the ANOVA there was a significant three-way interaction of TP*D*Ex for absVO2p (p = 0.016) as the MP + Ex group (Δ+4.4 ml/kg/min) had a greater change from baseline compared to the MP group (Δ-2.7 ml/kg/min, p = 0.002), and PD + Ex group (Δ-0.3 ml/kg/min, p = 0.03).

Conclusions: MP recommendations when combined with two days of aerobic and two days of resistance exercise are effective at improving aerobic fitness when compared to PD recommendations in young, sedentary women.
**Acute Aerobic Exercise Stimulates ATP Production Rate Similarly in Subsarcolemmal and Intermyofibrillar Muscle Mitochondria in Humans**

Christos S. Katsanos,1 Katon Kras,1 Wayne T. Willis,1 Lori Roux2, 1Arizona State University / Mayo Clinic in Arizona, Scottsdale, AZ 2Mayo Clinic in Arizona, Scottsdale, AZ.

*No relationships reported*

**Purpose:** Mitochondria (MITO) in skeletal muscle are organized in reticulum extending from the subsarcolemmal region (SS MITO) to the intermyofibrillar region (IMF MITO). Animal studies suggest that SS MITO are more responsive to physiological stimuli. The purpose of these studies was to assess whether similar responses are observed in humans that vary in age and obesity status, and specifically with respect to maximal ATP production rate (MAPR).

**Methods:** Twelve healthy subjects (gender, 7M/5F; age, 19-50 years; BMI, 19-40 kg/m²; body fat, 12-42%) had muscle biopsies performed before and 3 hours after 45 min of cycling at 65% VO₂max. SS and IMF MITO were isolated using standard procedures. MAPR in the isolated mitochondria was measured by firefly-luciferase assay, and using the following substrates: Malate+Pyruvate+Glutamate (MPG; complex I activity), Succinate (complex II activity), malate+palmitoyl carnitine (M+PC; fat substrate). Insulin sensitivity of the subjects was evaluated from an oral glucose tolerance test (i.e., Matsuda index), and body composition was determined by bioelectrical impedance analysis.

**Results:** Insulin sensitivity index ranged from 2.7 to 29.0, and did not correlate with either SS or IMF MAPR (P > 0.05). MAPR increased after exercise in both SS MITO (MPG substrate: 322±38 vs 449±40; nmol ATP/min/g protein) and IMF MITO (MPG substrate: 259±44 vs 427±61; nmol ATP/min/g protein) (for both P < 0.05), and the exercise-induced delta change in MAPR was not different between SS MITO and IMF MITO (P >0.05). Similar results were obtained with the other two substrates. The change in MAPR did not correlate with age, percent body fat, or insulin sensitivity in either SS or IMF MAPR (P > 0.05). However, this change in MAPR with exercise was inversely correlated with the basal MAPR in the SS MITO for both the MPG (Pearson’s r = −0.60; P <0.05) and Succinate (Pearson’s r = −0.76; P <0.01) substrates, but not the M+PC substrate. No such correlations were observed in the IMF MITO (P > 0.05).

**Conclusions:** Acute aerobic exercise stimulates both SS and IMF MITO MAPR in humans. The improvement in mitochondria function is not lower in relation to older age or obesity status. However, the magnitude of the stimulation of MAPR by exercise is lower in SS MITO exhibiting the greatest MAPR prior to the exercise stimulus.

**Acute Exercise Increases STARS mRNA in Human Skeletal Muscle**

Stefan Reitzner, Eva-Karin Gidlund, Carl Johan Sundberg.

*Karolinska Institutet, Stockholm, Sweden.*

*No relationships reported*

**Purpose:** Mitochondria of SST (STARS) as an important player in the regulation of muscle growth and metabolism. STARS has also been linked to modulate Serum Response Factor (SRF) activity which activates transcription of factors important in muscle growth and metabolism. STARS has also been linked to modulate Serum Response Factor (SRF) activity which activates transcription of factors important in muscle growth and metabolism. STARS has also been linked to modulate Serum Response Factor (SRF) activity which activates transcription of factors important in muscle growth and metabolism. STARS has also been linked to modulate Serum Response Factor (SRF) activity which activates transcription of factors important in muscle growth and metabolism. STARS has also been linked to modulate Serum Response Factor (SRF) activity which activates transcription of factors important in muscle growth and metabolism. STARS has also been linked to modulate Serum Response Factor (SRF) activity which activates transcription of factors important in muscle growth and metabolism.

**Methods:** Twelve healthy subjects (gender, 7M/5F; age, 19-50 years; BMI, 19-40 kg/m²; body fat, 12-42%) had muscle biopsies performed before and 3 hours after 45 min of cycling at 65% VO₂max. SS and IMF MITO were isolated using standard procedures. MAPR in the isolated mitochondria was measured by firefly-luciferase assay, and using the following substrates: Malate+Pyruvate+Glutamate (MPG; complex I activity), Succinate (complex II activity), malate+palmitoyl carnitine (M+PC; fat substrate). Insulin sensitivity of the subjects was evaluated from an oral glucose tolerance test (i.e., Matsuda index), and body composition was determined by bioelectrical impedance analysis.

**Results:** Insulin sensitivity index ranged from 2.7 to 29.0, and did not correlate with either SS or IMF MAPR (P > 0.05). MAPR increased after exercise in both SS MITO (MPG substrate: 322±38 vs 449±40; nmol ATP/min/g protein) and IMF MITO (MPG substrate: 259±44 vs 427±61; nmol ATP/min/g protein) (for both P < 0.05), and the exercise-induced delta change in MAPR was not different between SS MITO and IMF MITO (P >0.05). Similar results were obtained with the other two substrates. The change in MAPR did not correlate with age, percent body fat, or insulin sensitivity in either SS or IMF MAPR (P > 0.05). However, this change in MAPR with exercise was inversely correlated with the basal MAPR in the SS MITO for both the MPG (Pearson’s r = −0.60; P <0.05) and Succinate (Pearson’s r = −0.76; P <0.01) substrates, but not the M+PC substrate. No such correlations were observed in the IMF MITO (P > 0.05).

**Conclusions:** Acute aerobic exercise stimulates both SS and IMF MITO MAPR in humans. The improvement in mitochondria function is not lower in relation to older age or obesity status. However, the magnitude of the stimulation of MAPR by exercise is lower in SS MITO exhibiting the greatest MAPR prior to the exercise stimulus.

**Occupational And Leisure-time Physical Activity And Risk Of Disability Pension: Prospective Data From The Hunt Study, Norway**

Marius S. Finnmåland,1 Gunnhild Vie,1 Andreas Holtermann,2 Steinar Kroksstad,3 Tom IL Nilsen,1 1Norwegian University of Science and Technology, Trondheim, Norway. 2National Research Centre for the Working Environment, Copenhagen, Denmark.

*No relationships reported*

**Purpose:** To prospectively investigate 1) the association between occupational physical activity (OPA) and disability pension, and 2) the combined association of OPA and leisure-time physical activity (LTPA) with disability pension in a large population-based cohort. METHODS: Data on 32 362 persons aged 20-65 years in the Norwegian HUNT2 study (1995-1997) were linked to the National insurance database. To reduce possible reverse causality, we excluded the two first years of follow-up. Cox regression with 95% confidence intervals (CI) were estimated.

**RESULTS:** Throughout a median follow-up period of 9.3 years and 265 592 person years, a total of 1 574 men (10%) and 2 263 women (13%) received disability pension. Both men and women who reported much working in their jobs had increased risk of disability pension (adjusted hazard ratio [HR] for men: 1.26, 95% CI 1.09-1.45; women: 1.27, 95% CI 1.13-1.42). The risks were even higher for men and women who performed much working and lifting (men: 1.46, 95% CI 1.26-1.70; women: 1.41, 95% CI 1.26-1.58) or had heavy physical work (men: 1.48, 95% CI 1.28-1.70; women: 1.42, 95% CI 1.13-1.77). Relative to the reference group with sedentary OPA and were active during leisure-time, all other groups had higher risk of disability pension. The combination of high OPA and being inactive during leisure-time was associated with the highest risk of disability pension (HR: 1.77, 95% CI 1.58-1.98). Similar sensitivity analyses corroborated the results.

**CONCLUSIONS:** We observed a strong positive association between OPA and risk of disability pension, whereas physical activity during leisure-time reduced some, but not all of the unfavorable effect of physically demanding work on risk of disability pension. It could be useful to incorporate policies to reduce the negative health impact of occupational physical activity, as well as encouraging leisure-time physical activity, to reduce work disability.

**Physical Activity Level and Androgen Concentrations are Independently and Additively Associated with Cardiovascular Disease Risk in Men.**

Lauren C. Chasland,1 Matthew W. Knuiman,1 Mark L. Divitini,1 Yi X. Chan,2 David J. Handelsman,1 Louise H. Naylor,1 Bu B. Yeap3, Daniel J. Green,1 University of Western Australia, Perth, Australia. 2Fiona Stanley Hospital, Perth, Australia. 3ANZAC Research Institute, Sydney, Australia.

*No relationships reported*

**Purpose:** Male ageing is associated with increased incidence of cardiovascular disease (CVD) and lower circulating testosterone (T). However, whether physical activity (PA) interacts with hormones to modify CVD risk is unclear. We assessed whether PA and sex hormone concentrations were independently associated with measures of CVD risk in 1649 men.

**Methods:** Leisure, home, work and total PA were ascertained via questionnaire. At baseline, serum T, dihydrotestosterone (DHT) and estradiol (E2) were assayed. Men were stratified into high PA+high hormone (H/H), low PA+high hormone (L/H), high PA+low hormone (H/L) and low PA+low hormone (L/L) groups.

**Results:** Mean age was 49.8 years at outset with 415 CVD events and 127 CVD deaths occurring during 20-year follow-up. Men with higher PA and higher T or DHT had lower odds of metabolic syndrome (leisure H/H vs L/L odds ratio [OR] 0.17 p=0.001 for T, 0.26 p=0.001 for DHT). Men with higher PA and E2 had lower risk of metabolic syndrome (leisure PA/H/L vs L/L OR 0.51, p=0.001). Men with higher leisure PA and higher DHT had the lowest risk of CVD events (H/H hazard ratio [HR] 0.72 vs L/L, p=0.016) and CVD death (H/H HR 0.52 vs L/L, p=0.015). Men with low leisure PA and higher E2 were at greater risk of CVD death (L/H vs L/L HR 1.67, p=0.022).

**Conclusions:** Considering PA levels in the context of T, DHT and E2 better informs consideration of cardiovascular risk. A 2x2 factorial RCT assessing PA and T would illuminate the scope for preventing CVD in men.
**INTRODUCTION:** Obesity among children is highly prevalent and can lead to risk factors for chronic disease in adulthood. The Institute of Medicine and Centers for Disease Control and Prevention have called on schools to play a larger role by increasing children’s physical activity (PA) and nutrition by adopting an overall culture of health.

**PURPOSE:** This study examined the impact of a sociocultural theory driven school-wide nutrition and PA intervention on 5th graders’ central adiposity as a primary predictor of chronic disease.

**METHODS:** Four treatment and two control schools, including 628 (377 treatment, 251 control) 5th grade children participated in the study. Over eight months, children in the treatment schools participated in a comprehensive healthy school transformation program consisting of six components: 1) principal messaging and engagement, 2) classroom nutrition and physical activity lessons, 3) active recess, 4) quality physical education, 5) student leadership teams, and 6) after-school healthy kids clubs.

Trained research assistants privately measured height, body weight, and waist circumference. Waist-to-Height Ratio (WHR) was calculated and used as the measure of obesity. Missingness of data ranged from 0.40% to 15.40%. To reduce parameter estimate bias, as well as improve generalizability and power (Enders, 2010) the full pre-post dataset was imputed (n = 100) at the item level.

**RESULTS:** An ANCOVA controlled for differences between the treatment and control groups at time one. While controlling for age, gender, and race, the ANCOVA revealed a significant difference in WHR among treatment and control groups at time two (T2) (F2,266.61,63.08) = 4.59, p < .001, R2change = 0.01. There were no significant differences in T2 WHR based on age F2,02,63.08 = 0.44, p > .05, gender F2,03,63.08 = 0.001, p > .05, and race F2,01,65,03.08 = 0.02, p > .05. A total of 64% of T2 WHR variance was accounted for by this model.

**CONCLUSIONS:** The healthy school intervention led to significant differences in central adiposity (obesity) levels, regardless of age, gender, or race, across the 8-month program between 5th grade children in treatment and non-treatment schools. This supports the ability of schoolwide programs to significantly and positively impact student health and chronic disease prevention.

There is an association between agility and some neuromuscular functions such as perception capability and decision making. The maintenance of agility across the longevity process will increase the functional independence in old people over 65 years.

**RESULTS:**

Significant decreases in agility between both measures (5.1±1.9 s vs. 6.4±0.9 s; p<0.001) were found. The average percentage of change in all participants using the 8-foot up-and-go test (Senior Fitness Test Battery). The test was performed twice, with at least one minute of rest between repetitions. The best result was recorded. The measurements were registered in 2008-2009 and eight years later, in 2016-2017. A 2-way repeated measures ANOVA test was used to evaluate the changes in this parameter. The sample included individuals aged 25-40 (21%, 35%, 35%, groups 1, 2 and 3, respectively; p<0.001 between youngest and oldest group).

**CONCLUSION:**

Agility constantly decreases across the aging process, being this decrease more pronounced after the age of 85. Physical fitness interventions for elderly people should include aspects of agility training in order to increase functional independence and quality of life. Supported by Ministerio de Trabajo y Asuntos Sociales (104/07), University of Zaragoza (UZ 2008-BIO-01), Centro Universitario de la Defensa (UZCUD2016-BIO-01), Ministerio de Economía y Competitividad (DEP 2016-78309-R) and FEDER founds.

**Purpose:**

Physical activity (PA) may improve quality of life and survival among cancer survivors, however, little is known about Navajo cancer survivor PA. We sought to understand Navajo cancer survivor PA habits, perceptions, barriers and preferences. METHODS: Focus groups (N=5 groups, 19 individuals) and individual interviews (N=13) were conducted by a bilingual facilitator using a standardized guide. Discussions were recorded, transcribed and translated. NVivo software was used to summarize major themes. RESULTS: Participants were male (N=13) and female (N=19) Navajo cancer survivors (31% breast, 31% colorectal, or other). Treatment side effects reduced PA during and after treatment. However, most reported at least one mode of current PA (N=24; 71% walking). Work and household related PA was a common necessity (46%). Cancer survivor PA recommendations were largely unknown, though many survivors understood the benefits of PA and valued resilience, social support, movement, and life balance. Limited access to recreational PA opportunities was cited as a barrier. Fear of “over doing it” and family, friends encouraging rest also limited PA. Preferences for PA programming varied by individual. CONCLUSION: In this first qualitative inquiry of PA among Navajo cancer survivors we found that PA education is needed and varied PA opportunities are desired.

Women with functional hypothalamic amenorrhea (FHA) present with suppressed ovulatory cycles (OV, n=22) and with FHA (AMEN, n=17). Leptin was measured by immunoassay and trunk, leg, and gynoid percent fat were measured by DXA with the ratios of trunk/leg (T/L%R) and android/gynoid (A/G%R) fat % calculated. Student t-tests were used to compare demographics. Pearson and Spearman correlations were used to determine associations between leptin and unique body composition variables.

**Results:**

There were no differences between the groups with respect to age, height, weight, BMI, or body fat % (p>0.05). Log leptin was significantly correlated with leg (OV: r=0.794, p=0.001; AMEN: r=0.647, p=0.005), trunk (OV: r=0.679, p=0.001; AMEN: 0.757, p=0.001), android (OV: r=0.673, p=0.001; AMEN: r=0.779, p=0.001), and gynoid (OV: r=0.822, p=0.001; AMEN: r=0.617, p=0.008) % fat in both groups. AMEN log leptin was significantly correlated with T/L%R (r=0.490, p=0.046) and A/G%R (r=0.735, p=0.001). The regions of strongest association differed between OV and AMEN with a stronger relationship in OV between log leptin and leg and gynoid % fat, whereas in AMEN log leptin was more strongly related to trunk and android % fat.

**Conclusion:** Ratios of T/L%R and A/G%R were significantly related to leptin concentration in AMEN and body fat distribution measures were related in both groups. Regions of body composition reflecting subcutaneous fat have a greater influence on systemic leptin concentrations than regions reflecting visceral fat, and especially in patients with heart failure (HF). PURPOSE: The purpose of the present study was to determine whether dietary nitrate improves muscle contractile function in older people, another population (like HF patients) in whom NO production is reduced. METHODS Six healthy older subjects (5 men, 1 woman; age 73±6 y, height 1.74±0.10 m, mass 82.4±12.1 kg) were studied using a randomized, double-blind, placebo-controlled, crossover design. On one occasion, subjects were tested 2 h after ingesting a concentrated beetroot juice (BRJ) supplement containing 11.2 mmol NO3- per day. On another, they were tested 2 h after ingesting BRJ depleted of NO3- (placebo). Breath NO was measured periodically, and maximal knee extensor force (torque), speed, and power were assessed using a Biodex 4 isokinetic dynamometer. RESULTS Dietary NO3- ingestion increased breath NO levels, a marker of whole-body NO bioavailability, from 27±10 to 51±26 ppb (P<0.05). On average, this resulted in an increase in the maximal velocity of knee extension of 10% (i.e., from 9.81±1.38 to 10.75±2.42 rad/s), but this difference only approached statistical significance (i.e., P=0.13). On the other hand, maximal knee extensor power did not differ between the NO3- and placebo trials (i.e., 4.16±1.18 vs. 4.08±1.22 W/kg; P=0.47). This lack of difference, however, seemed to be due to an inadequate dose of NO3- in some subjects, as the relative increase in maximal power was correlated (i.e., r=0.78; P<0.05) with the amount of NO3- ingested per kilogram of body mass. In keeping with this conclusion, maximal power increased (P<0.05) by 6.4±3.9% in the four subjects who ingested >125 mmol/kg of NO3-, but did not improve in the two subjects who ingested less. CONCLUSION Acute dietary NO3- supplementation appears to improve muscle contractile function in healthy elderly individuals, but only when provided at a dose of >125 mmol/kg of NO3-.

Reductions in muscle speed and power are highly predictive of disability, institutionalization, and mortality in the elderly. We have recently demonstrated that ingestion of dietary nitrate (NO3-), a source of nitric oxide (NO), increases maximal muscle speed and hence power in healthy younger individuals, in athletes, and especially in patients with heart failure (HF). PURPOSE: The purpose of the present study was to determine whether dietary NO3- improves muscle contractile function in older people, another population (like HF patients) in whom NO production is reduced. METHODS Six healthy older subjects (5 men, 1 woman; age 73±6 y, height 1.74±0.10 m, mass 82.4±12.1 kg) were studied using a randomized, double-blind, placebo-controlled, crossover design. On one occasion, subjects were tested 2 h after ingesting a concentrated beetroot juice (BRJ) supplement containing 11.2 mmol NO3- per day. On another, they were tested 2 h after ingesting BRJ depleted of NO3- (placebo). Breath NO was measured periodically, and maximal knee extensor force (torque), speed, and power were assessed using a Biodex 4 isokinetic dynamometer. RESULTS Dietary NO3- ingestion increased breath NO levels, a marker of whole-body NO bioavailability, from 27±10 to 51±26 ppb (P<0.05). On average, this resulted in an increase in the maximal velocity of knee extension of 10% (i.e., from 9.81±1.38 to 10.75±2.42 rad/s), but this difference only approached statistical significance (i.e., P=0.13). On the other hand, maximal knee extensor power did not differ between the NO3- and placebo trials (i.e., 4.16±1.18 vs. 4.08±1.22 W/kg; P=0.47). This lack of difference, however, seemed to be due to an inadequate dose of NO3- in some subjects, as the relative increase in maximal power was correlated (i.e., r=0.78; P<0.05) with the amount of NO3- ingested per kilogram of body mass. In keeping with this conclusion, maximal power increased (P<0.05) by 6.4±3.9% in the four subjects who ingested >125 mmol/kg of NO3-, but did not improve in the two subjects who ingested less. CONCLUSION Acute dietary NO3- supplementation appears to improve muscle contractile function in healthy elderly individuals, but only when provided at a dose of >125 mmol/kg of NO3-. The optimal dose of dietary NO3- for improving muscle speed and power in older (or younger) persons remains to be determined.

**Purpose:** To investigate the relationship between systemic leptin concentration and unique measures of body composition distribution in exercising women with FHA and ovulatory menstrual cycles.

**Methods:** Leptin and body composition were assessed in exercising women with ovulatory cycles (OV, n=22) and with FHA (AMEN, n=17). Leptin was measured by immunoassay and trunk, leg, and gynoid percent fat were measured by DXA with the ratios of trunk/leg (T/L%R) and android/gynoid (A/G%R) fat % calculated. Student t-tests were used to compare demographics. Pearson and Spearman correlations were used to determine associations between leptin and unique body composition variables.

**Results:**

There were no differences between the groups with respect to age, height, weight, BMI, or body fat % (p>0.05). Log leptin was significantly correlated with leg (OV: r=0.794, p=0.001; AMEN: r=0.647, p=0.005), trunk (OV: r=0.679, p=0.001; AMEN: 0.757, p=0.001), android (OV: r=0.673, p=0.001; AMEN: r=0.779, p=0.001), and gynoid (OV: r=0.822, p=0.001; AMEN: r=0.617, p=0.008) % fat in both groups. AMEN log leptin was significantly correlated with T/L%R (r=0.490, p=0.046) and A/G%R (r=0.735, p=0.001). The regions of strongest association differed between OV and AMEN with a stronger relationship in OV between log leptin and leg and gynoid % fat, whereas in AMEN log leptin was more strongly related to trunk and android % fat.

**Conclusion:** Ratios of T/L%R and A/G%R were significantly related to leptin concentration in AMEN and body fat distribution measures were related in both groups. Regions of body composition reflecting subcutaneous fat have a greater influence on systemic leptin concentrations than regions reflecting visceral fat, indicating that the site distribution of adiposity may be more important for systemic leptin than traditional measures of total fat mass and the association may reflect menstrual status.
Exercise-induced hyperthermia, dehydration, and fatigue independently impair anaerobic power production, but any synergistic effect on anaerobic power is less known. Further, the efficacy of a personalized hydration plan in maintaining anaerobic power after exercise-heat stress is unclear.

Purposes: To evaluate the effect of exercise-induced hyperthermia, dehydration, and fatigue on anaerobic power during a 20-second repeated countermovement jump (CMJ) in maintaining anaerobic power during CMJ after exercise-heat stress.

Methods: Five males (age: 25.4±5.7 y; height: 175.4±8.2 cm; weight: 78.7±16.8 kg; VO2 max: 60.1±6.1 mL kg⁻¹ min⁻¹) completed 50-90 min of exercise in warm conditions (wet bulb globe temperature: 27.0±2.2°C) with (EXP) and without (CON) fluid replacement. We fluid replaced 55±2 ml vs 61±7 ml/kg during the exercise period. Power output during exercise in each condition was measured using dual force plates and a HR strap. In addition, serum myoglobin was measured pre-exercise, post-exercise and 24 h post-exercise for each condition. Dependent t-tests were used to evaluate differences in CMJ performance between the two conditions.

Results: Subjects achieved 2.59±0.52% BML in CON and 0.92±0.41% in EXP (p=0.001). Post-exercise Tj was 39.2±0.31°C, 39.0±0.61°C (p=0.045) and fatigue (91±12; p=0.424) were similar between CON and EXP, respectively. HR response during post-exercise CMJ was greater in CON than EXP (174±7; 161±11, p=0.040). There were no differences in peak power output (PP) or mean peak power (MPP) between conditions. HR response during post-exercise CMJ was greater in CON than EXP (174±7; 161±11, p=0.040).

Conclusion: Exercise-induced hyperthermia, dehydration, and fatigue to the levels achieved in this study did not affect anaerobic power, likely due to the mild hyperthermia and <3% dehydration in CON.

Supported by CSU Fresno Grad. Student Research and Creative Activities Support Award

Purpose: Physical activity is often noted as a risk factor for the development of AMS. We sought to explore the interaction between age and physical activity patterns on the development of AMS in a group of 27 individuals during a gradual ascent of Mt. Kilimanjaro. 2016 AMWSC.

Methods: 27 adults (44±15 y; 24±4±3.0 kg; BMI; n=17/27 Female) climbed over an 11-day period. Use of acetazolamide and NSAIDs were minimized but remained optionally taken as necessary during the ascent. Physical activity was monitored using BodyMedia activity monitors; heart rate and oxygen saturation were monitored with Bioxv devices; AMS incidence was classified from the Lake Louise Questionnaire and total symptoms were scored from the questionnaire’s original five symptoms plus an additional five symptoms. Groups were divided based on age (group 1: 28±2 y; 2: 44±8 y; 3: 58±10 y). Comparisons were made using ANOVA and independent T-tests, and post hoc analyses were made using Tukey’s method.

Results: Throughout the trek, 59% (n=16/27) of subjects displayed AMS at least for one day during the climb. Average total symptom scores were 4.2±2.9, 2.2±1.9, 3.3±1.5 for group 1 vs. 2 vs. 3 respectively. Focusing on the summit push (day 10), AMS incidence was highest in group 1 (87.5%; n=7/8) compared to group 2 (33%; n=3/9) and group 3 (25%; n=2/8) with an ANOVA statistical significance of p=0.05. Moreover, percentage of climb spent in moderate to vigorous activity (MVPA), hiking speed (KPH), and steps taken per minute were highest for group 1 (MVPA: 65%; <5%: 19% vs. 52%; ±14%; KPH: 101±6 vs. 0.91±0.09 vs. 0.85±0.06; Steps/min: 23.5±3 vs. 22±6 vs. 14.2; ANOVA p=0.05 for KPH, steps/min). Average heart rate and SpO2 was higher for group 1 during the climb to summit (HR: 109±13 bpm vs. 88±14 bpm vs. 87.1±8 bpm; SPO2: 85.5±5.5% vs. 83.2±9.4% vs. 81.9±8.0%; p=0.05 for HR).

Post hoc analyses depicted a significant difference between group 1 and group 3 in AMS incidence, KPH and steps/min, and a significant difference in HR between group 1 and the rest.

Conclusions: In this study, the youngest group averaged a higher total symptom score throughout the trek, and exerted greater physiologic intensity, hiking speed, and activity on summit day. It was found that AMS was more common in young adults, which may be due to being more active and adventurous than older individuals.
The response of plasma hypoxia-inducible factor-1 alpha, serum erythropoietin and plasma vascular endothelial growth factor during acute exposure to altitude (4300 m) Salgado, R.M.1 and Beidleman, B.A.2 1Thermal and Mountain Medicine Division, US Army Research Institute of Environmental Medicine, Natick, MA; Biophysics and Biomedical Modeling Division, US Army Research Institute of Environmental Medicine, Natick, MA. Intraocular hypoxia-inducible factor-1 alpha (HIF-1α) increases in response to hypoxia and regulates erythropoietin (EPO) and vascular endothelial growth factor (VEGF) expression. However, the response of extracellular HIF-1α (i.e. plasma HIF-1α) to acute hypobaric hypoxia (HH) exposure is unclear.

**PURPOSE:** To determine whether plasma HIF-1α and downstream targets such as serum EPO and plasma VEGF increase from sea level (SL) to acute HH. METHODS: Venous blood samples from 14 SL residents (M = 10, F = 4, age = 23 ± 7 years, ht: 179 ± 10 cm, wt: 74 ± 12 kg, 46 ± 6 ml/kg/min; mean ± SD) were collected after ~20 min of seated rest at SL (~50 m, Natick, MA) and after ~19 hrs of exposure to HH (4300 m, Pikes Peak, CO). Plasma HIF-1α, serum EPO, and plasma VEGF were measured via ELISA assay. RESULTS: From SL to HH, plasma HIF-1α (SL: 287 ± 108 pg/mL vs HH: 264 ± 128 pg/mL, p = 0.51) and plasma VEGF (SL: 74 ± 55 pg/mL vs HH: 100 ± 87 pg/mL, p = 0.23) did not change. From SL to HH, serum EPO increased (SL: 14 ± 15 mIU/mL vs HH: 62 ± 42 mIU/mL, p < 0.0001). CONCLUSION: During the first ~19 hrs of HH exposure plasma HIF-1α and plasma VEGF do not increase, while serum EPO does increase. While we were the first to measure plasma HIF-1α during an acute exposure to HH, our results indicate that extracellular HIF-1α may not represent intracellular HIF-1α response to HH. Disclaimer: Author’s views are not official U.S. Army or DoD policy.

**The Exercise Is Medicine® initiative has increased the focus on exercise and its impact on health and wellness. High intensity interval training (HIIT) is an exercise modality that is reported to be gaining popularity. Because physicians, and other medical professionals, are often tasked with encouraging exercise as part of a patient’s medical therapy, it is important to understand the risks associated with HIIT so as to provide the best guidance and care possible. **

**Purpose:** The aim of this study was to describe the HIIT population and their HIIT-related injuries, including incidence, location, duration, and management. **Methods:** A multi-item survey was distributed to various facilities throughout the state of South Carolina promoting and instructing HIIT. Survey results were analyzed using students t-test and Chi-squared tests. **Results:** Sixty-six people met the inclusion criterion of participation in HIIT. The majority were male (56%), in their mid-thirties (33.9±8.1), with a mean BMI of 25.6 (±4.1). Most reported participation in a beginner’s HIIT training program (71%), prior weight lifting training (64%), and some level of previous athletic experience (91%). From these 66 individuals, 70% said they do HIIT 2 or more times a week, and approximately 44% (n=29) reported at least one HIIT-related injury. Fifty-three total injuries were reported; the most common being shoulder (19%) and lower back (19%). Approximately 38% sustained their injury within 6 months of starting HIIT and 55% within the first year. Most people (62%) self-diagnosed their injury, and 52% did not seek professional treatment. The majority of those injured said they recovered from their injuries within 2 months (83%) following rest (28%) and/or a decrease in exercise intensity (41%). **Conclusions:** Despite introductory training programs and prior athletic and weight lifting experience, approximately half of HIIT participants experienced a HIIT-related injury. Individuals with HIIT-related injuries are most likely to self-diagnose, and/or self-adjust their exercise program prior to resuming HIIT.

**Working as a correctional officer (CO) in the U.S. leads to a lower life expectancy as compared to minimum security CO’s. Specific wellness characteristics of CO’s working in minimum security level prisons as compared to maximum security level prisons. Maximum security level CO’s reported greater missed days of work (p=.040) compared to CO’s working at a minimum security level prison with correlated with increased work stress (p<.0001), less sleep, unhealthy eating habits, and not exercising (p<.01 for each). **

**Conclusion:** Corrections work is regarded as one of the most difficult and stressful occupations with high morbidity and mortality rates. Our findings indicate CO’s working in maximum security prisons have higher mental and physical health risks as compared to minimum security CO’s. Specific wellness interventions are needed to improve the well-being of these vulnerable workers. This research was supported by the National Institute on Occupational Safety & Health U19 OH010154-01.
Impact of Attention Deficit Hyperactivity Disorder on Athletes

Timothy Dekker, Mayo Clinic, Jacksonville, FL.

(No relationships reported)

Impact of Attention Deficit Hyperactivity Disorder on Athletes

Timothy Dekker, George G.A. Pujolje, Jennifer R. Maynard, McKennan J. Thurston, Walter C. Taylor, and Mohit Chauhan

Purpose: This systematic review was done to try to uncover Attention deficit hyperactivity disorder’s (ADHD) impact on athletics, treatment effects on sports participation, basis for regulation by sports organizations, and approaches to conditions concuring with ADHD.

Methods: A systemic review was done using specific keywords, gathering articles from MEDLINE, Embase, PsycINFO, Cochrane Database of Systemic Reviews and Ovid Interface.

Results: ADHD is a common neurobehavioral disorder, reported as affecting 11% of children, with symptoms persisting into adulthood in up to 15% of individuals. ADHD has shown to have both beneficial and detrimental effects on athletic performance. Advantages include: Impulsivity, increased aggressiveness, improved pain tolerance, and decreased fatigue. Conversely, children with ADHD were found to have lower total motor composite (r=−0.92, p<0.001) with Bruniniks-Oseryken Motor Performance Test. Sports and exercise have numerous positive effects on those with ADHD, for example, an increase in Dupaul ADHD rating scores of 4.53(p<0.04) were found after a 6 week aerobics program. Stimulants combined with behavioral techniques are known to be superior to behavioral management alone. Return to play is also different in athletes with pre-existing ADHD, especially with concussions due to more persistent memory issues, decreased focus and brain fog after injury. Sport organizations regulate stimulants due to presumed advantages and side effects: Increased thermogenic effects of stimulants, ML, CVA, psychosis, seizures, and even death have been recorded.

Conclusions: Athletes with ADHD should be recognized and managed appropriately. Sports performance can be positively and negatively affected by ADHD, which individual athletes and organizations need to consider. More research is needed to determine how ADHD and medications used affect specific sports.

Understanding Injury and Injury Prevention in Paralympic Sport

Marcus Fearin1, Shana Harrington2. ‘Creighton University School of Medicine, Omaha, NE. ’University of South Carolina, Columbia, SC.

(No relationships reported)

PURPOSE: Adaptive equipment technologic advances and increased media attention to the Paralympic Games have led to an increasing number of athletes with disabilities participating in Para sports. Still, little is known about common injuries that occur in Para sport athletes. Even less is known about whether these athletes are currently participating in injury prevention programs. The purpose of this study was to survey swimming, cycling and athletic Para sport athletes to better understand common injuries and whether injury prevention programs were being performed.

METHODS: An electronic survey was created using Qualtrics consisting of 28 questions and emailed to 364 athletes who competed in the US Para Swimming, Cycling and Athletic Trials in Charlotte, NC -July 2016. The following information was collected from the survey: average number of hours trained, number of cross training hours performed each week, descriptive information regarding sport related injuries, pain, and whether athletes received treatment for injuries and descriptive information regarding whether the athletes had participated in an injury prevention program.

RESULTS: A total of 137 surveys were completed. Males represented 58% of respondents and females 42%. Swimming represented 29% of the respondents, cycling 26% and athletics 51%. Over 70% of respondents trained ≥11 hours/week; and 45% of athletes reported spending ≥ 6 hours per week cross-training. Forty-two percent of the athletes revealed they have current pain, and 34% had missed a competition because of injury. Thirty-two percent reported receiving physical therapy relating to sports injuries and 13% required surgeries for the sports-related injury. Only 24% of athletes participated in an injury prevention program.

CONCLUSIONS: A large percentage of Para sport athletes report injuries and often have to miss training and competition due to these injuries. Despite this, only 24% report participating in an injury prevention program. Results from this study emphasize the need to develop and implement injury prevention programs in Para sport athletes to help diminish the impact these injuries have on training and competition.

MINUTE POROSITY OF 3D PRINTED SPLINTS/CASTS MAY ALLOW WATER ENTRY

Diana Hall1, Frank Roqueimore1, Jay Townsend2, Bill Bentley3, David Atkins4, Lex Schulteis5. ‘ActivArmor: Pueblo, CO. ’Department of Corrections, State of Colorado, Canon City, CO. ’Robert E. Fischell Medical Device Institute, College Park, MD. ’Dept. of Aerospace Engineering, Clarke School of Engineering, University of Maryland, College Park, MD.


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Exercise rises muscle serum parameters and thus their interpretation could be helpful in monitoring recovery from acute overload or from muscular trauma. Our understanding of these relationships among Special Operations students is limited.

PURPOSE: This study aimed evaluate effects of repeated sessions of military training exercises during 2012 Comandos Course on muscle damage (CK, LDH, and AST), renal function (creatinine, urea and estimated glomerular filtration-eGFR) and body composition (skeletal muscle mass, visceral fat area and extracellular water).

METHODS: Biomarkers from 19 Brazilian Army students (age=28.26±3.91) were analyzed, once a week, during 14 weeks. Serum CK, LDH, AST, creatinine and urea levels by dry-chemistry method. The eGFR by CKD-EPI, expressed as ml/min/1.73m². The BIA evaluation carried out with InBody720. Data analyzed to evaluate the baseline and post-training differences were determined by paired sample t test and their effect size (ES) by Cohen’s d.

RESULTS: The presented results of the paired sample t test were significant (p<0.05). In extracellular water t(18)=10.07, ES=3.36 were a huge increase from the baseline (M=18.37±2.18) at the 4th week (M=19.53±2.4), this huge effect also occurs with skeletal muscle mass t(18)=12.67, ES=4.22 from baseline (M=38.42±4.13) to M=40.65±4.61. The results demonstrated a huge decrease in visceral fat area t(18)=12.26, ES=4.09 / baseline (M=47.61±13.18) to 5th week (M=25.53±9.7), even as were found a huge effect on CK t(18)=−6.33, ES=1.5 with baseline (M=128.18±9.7) to M=72±5.0. Significant increase occurs in urea t(18)=−10.99, ES=3.66 from baseline (M=32.75±2.37) to the 5th week (MD=65.89±13.08), even as were found a huge effect on CK t(14)=−6.33.
**3800 Board #247 June 3 9:30 AM - 11:00 AM**

**Resistance Training Versus General Exercise In Multidisciplinary Rehabilitation Of Low Back Pain: A Randomized Trial**

Vegard M. Iversen, Ottar Vasseljen, Paul Jarle Mork, Oyvind Salvesen, Marius S. Finland. Norwegian University of Science and Technology, Trondheim, Norway.

*No relationships reported*

**PURPOSE:** Chronic low back pain (CLBP) is commonly managed through multidisciplinary rehabilitation (MDR). We aimed to assess if the effectiveness of MDR could be improved by replacing general exercise (GE) with progressive resistance training (PRT) with high intensity using elastic bands.

**METHODS:** Consenting adults (n=99) with moderate to severe CLBP were randomized to an intervention (PRT) or a comparative group (GE). Both groups received 3 weeks MDR with either GE or PRT (squats, stiff-legged deadlifts, flies, unilateral rows, reversed flies, lateral shoulder raises and lateral pulldown performed 3 times per week with resistance varying from 15-20 to 8-10 repetitions). Both groups were instructed to continue their respective exercise program for 9 weeks after completing the MDR, in which time participants were offered up to three supervised booster sessions. Researchers were blinded during data collection and analyses. The difference in change between groups at 12 weeks in pain-related disability (Oswestry disability index; ODI: 0-100) was the primary outcome. Secondary outcomes were pain (numerical pain rating scale), limitations in important activities (patient-specific functioning scale; PSFS: 0-10), health related quality of life, work ability, global perceived pain rating scale), limitations in important activities.

**RESULTS:** Baseline data were missing for 25 patients due to early dropouts. Thus, data from 74 participants (mean age: 45 years, 57% women, mean ODI: 30.4) were obtained at baseline and included in the analyses. Forty-six persons participated at the 12-week follow-up test. There were no difference in change in ODI score between groups at 12 weeks (mean difference 1.6, 95% CI: -3.9-7.0, p=0.570, in favor of GE). The improvement in PSFS was larger in the GE group than in the PRT group (mean difference 1.4, 95% CI: 0.1-2.7, p=0.003). No significant differences between the groups were observed for the other secondary outcomes (p>0.11).

**CONCLUSIONS:** This study provided no evidence in support of replacing GE with PRT in MDR for CLBP. In fact, GE might be more beneficial than PRT in reducing limitations in important activities.

**3801 Board #248 June 3 9:30 AM - 11:00 AM**

**Characterization And Functional Capacity (SPPB) Of Adults Over The Age Of Life Free From Mexico**

Nancy Cristina Banda Saucedo, Ricardo López García, Gerardo Garza Sepúlveda, Alma Rosa Lidia Lozano González, Raymundo Ruiz Rivera, Esteban Picazzo Palencia, FACSIM, Rosa María Cruz Castruita. Universidad Autónoma de Nuevo León, Monterrey, Mexico.

*No relationships reported*

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**CONCLUSIONS:** This study provided no evidence in support of replacing GE with PRT in MDR for CLBP. In fact, GE might be more beneficial than PRT in reducing limitations in important activities.

**3802 Board #249 June 3 9:30 AM - 11:00 AM**

**Effect Of Stretching On Intracerebral Oxygen Dynamics And Calculation Capability**

Wakako Tsuchida1, Shigeyuki Suzuki2, Shingo Matsuo2, Sena Wakanō1, Mayu Asakawa1, Taizan Fukaya2, Eiji Yamanaka2, Yuji Asa1. 1Nihon Fukushi University, Handa, Aichi, Japan. 2Nagoya University, Nagoya, Aichi, Japan.

*No relationships reported*

**PURPOSE:** Low- to moderate-intensity exercise enhances nerve activity in the prefrontal cortex, thereby improving cognitive function (Bryan et al., 2014; Chang et al., 2012). However, few studies have investigated the effects of stretching on cognitive function.

**METHODS:** We examined the effect of stretching on cognitive function using a simple calculation task. We also measured brain oxygenation kinetics using near-infrared spectroscopy (NIRS).

**RESULTS:** Participants were 16 healthy students (8 males, 8 females, average age: 20.3 ± 1.4 years). Participants sat on an isokinetic exercise machine and kept their knees joints at the maximum extension position (hamstring stretch) for 5 minutes (Primus RS, BTE). We used NIRS to analyze brain oxygenation kinetics while participants completed a simple calculation task before, during, and after stretching. We measured oxygenated hemoglobin (oxy-Hb) and deoxygenated hemoglobin (deoxy - Hb) in the bilateral prefrontal cortex, motor area, and somatosensory area, as well as the ratio of oxygenated hemoglobin contained in tissue (TOI).

**RESULTS:** We observed a significant increase in oxy-Hb in the motor and somatosensory areas during stretching compared with measured values at rest (p<0.05). Although we found no significant differences in the rate of correct answers before vs. after stretching, participants took less time to solve the computational task after vs. before stretching (p<0.05). We found no significant differences in Δoxy-Hb, Δdeoxy-Hb, or ATOI in the prefrontal cortex, motor area, or somatosensory area before vs. after stretching.

**CONCLUSIONS:** Stretching affects brain oxygenation dynamics. Specifically, oxy- Hb increased during stretching in the motor and somatosensory areas. The computation time was shorter after stretching, but stretching did not influence brain oxygenation dynamics during the calculation task. Future work will benefit from the use of neuroimaging methods to investigate the effects of stretching on brain function.

**3803 Board #250 June 3 9:30 AM - 11:00 AM**

**Feasibility and Efficacy of Aerobic Exercise Training in Cognitively Impaired Older Adults**

Marcel Turner1, Takashi Tarumi2, Jonathan Riley1, Justin Rephash3, Candace Hill1, Tammy Lewis1, Ron Zhang1. 1Institute for Exercise and Environmental Medicine, Dallas, TX. 2University of Texas Southwestern Medical Center, Dallas, TX.

*No relationships reported*

**PURPOSE:** The test the hypothesis that cognitively impaired individuals respond to structured, supervised exercise regiminations in a similar manner to healthy controls.

**METHODS:** 73 sedentary, cognitively normal adults (CN) and 68 sedentary adults diagnosed with mild cognitive impairment (MCI) participated in the study. All participants were assigned to one of the two 1-year intervention groups: a moderate-intensity aerobic exercise training regimen or a low-intensity stretching/toning control group. The exercise regimen mandated a progressive increase in duration and frequency over the course of the first 6 months, followed by a maintenance phase over the second half of the intervention.

**RESULTS:** MCI patients were slightly younger (MCI 65 ± 6 years vs. CN 68 ± 5 years, P<0.001) than CN adults. At baseline, MCI patients and CN adults in the exercise and stretching group were not different in terms of maximal oxygen uptake (VO2max): MCI 22.9 ± 5.4 ml/kg/min vs. CN 22.3 ± 3.7 ml/kg/min, P=0.44. Aerobic exercise training improved VO2max in both CN and MCI groups (P=0.001 for time x treatment), and the magnitude of improvement was similar in both groups (MCI 11%±15% vs. CN 10%±12%). With adjustment for age, the exercise-related improvement in VO2max remained significant in both groups. Cognitively normal exercise trained adults showed similar compliance to MCI patients (MCI 75%±24% vs. CN 81%±14%, P=0.05) and similar dropout rates (MCI 37% vs. CN 26% within treatment).

**CONCLUSIONS:** MCI patients showed a similar improvement in VO2max and compliance to exercise training when compared to their
cognitively normal counterparts. This suggests that aerobic exercise training may be a feasible method for combating further cognitive decline in older adults. Funded by National Institutes of Health.

3804 Board #251
June 3 9:30 AM - 11:00 AM
Recent Illness but Not Prior Heat Injury Affects the Rate of Cooling Following Exertional Heat Stroke
Michelle A. King, Matthew Ward, Bruce Adams, Lisa Leon. United States Army Research Institute of Environmental Medicine, Natick, MA. (No relationships reported)

PURPOSE: Anecdotal evidence suggests that certain risk factors may impact the severity of exertional heat injury/stroke (EHI/S) and alter the rates of cooling during treatment.

METHODS: In order to examine this hypothesis we performed a clinical records review of heat casualty reports for 215 cases of EHI/S at Marine Corps Base Quantico, VA from 2012-2015. Documentation included information pertaining to the EHI/S episode and treatment. Treatment for EHI/S consisted of a standardized cooling protocol where individuals were continuously doused with ice water and actively rubbed with ice bags, while receiving a normal saline solution of IV fluid.

RESULTS: The majority of patients that underwent the emergent cooling protocol were male, 23 years of age, and had a body mass index (BMI) of 24.5 kg/m². Patients presented on their 28th day of training with a maximal core temperature (Tc max) of 104°F, pulse rate of 111 beats per minute, blood pressure of 122/63 mmHg, and a respiration rate of 22 breaths per minute. Rates of cooling: Individuals with a recent or concurrent illness were cooled faster than those without (P=0.016), even though this group presented with a higher core temperature (Tc) at the initiation of cooling (P=0.034). Duration of cooling (minutes) was not different between these two groups (P=0.0945). Previous EHI/S had no effect on the rate of cooling (P=0.413). Further, BMI did not affect the rate of cooling nor was it predictive of Tc max. Indicators of severity: Upon admission blood glucose and pulse rate were to be indicators of EHI/S severity. Higher Tc max was positively correlated with both higher blood glucose values (P=0.027, r = 0.195) and pulse rates (P=0.013, r = 0.176). In this population, restrictions on sleep, diet, or water intake did not affect Tc max. Return to duty: Tc max did not correlate with the number of rest days prescribed following injury (P=0.119). Further, those experiencing prior EHI/S or recent illness were prescribed Tc max did not correlate with the number of rest days prescribed following injury (P=0.103 and P=0.156 respectively). (P=0.119). Further, those experiencing prior EHI/S or recent illness were prescribed Tc max did not correlate with the number of rest days prescribed following injury (P=0.103 and P=0.156 respectively).

CONCLUSIONS: Contrary to our hypothesis, individuals with recent illness cooled faster, while prior heat injury had no effect on the rate of cooling. Author view not official US Army or DoD policy.

G-37 Free Communication/Poster - Sports Medicine Fellow Research Abstracts
Saturday, June 3, 2017, 7:30 AM - 11:00 AM
Room: Hall F

3805 Board #252
June 3 9:30 AM - 11:00 AM
Do Female Gymnasts Experience Catch-up Growth During Periods of Rest Following Injury?
Katherine V. Yao, Dai Sugimoto, Nathalie Slick, Cynthia Stein. Boston Children’s Hospital, Boston, MA. (No relationships reported)

PURPOSE: Several studies report delayed growth and hormonal changes during high intensity training in gymnasts, yet no studies specifically investigate the growth rate of gymnasts during periods of rest. The purpose of this investigation is to determine if an increased growth rate, or “catch-up growth”, exists in high level female gymnasts during periods of rest following injury.

METHODS: A 5-year retrospective chart review was conducted at a large pediatric hospital. A search of medical records (1/2010-12/31/2015) identified female gymnasts 10-16 years old, training ≥10 hours/week or Junior Olympic level ≥7 who suffered an anterior cruciate ligament (ACL) tear requiring at least 6 months (m) recovery time out of training (Gym-ACL). The 6m growth rate of this group (n=23) was compared to female non-gymnasts with ACL injury and similar competitive level (Non-gym-ACL, n=29) and high level gymnasts training with minor injuries (Gym-min, n=27). One-way ANOVA with post-hoc correction was used to analyze the 6m rate of change in height, weight, and BMI of the 3 groups.

RESULTS: There were no differences in mean ages (Gym-ACL: 14.8±2.1; Non-gym-ACL: 14.6±2.7; Gym-min: 13.9±2.0), nor significant differences in 6m changes in weight or BMI among the 3 groups. However, there was significant differences in the 6m height change among the 3 groups (p=0.024). A significantly greater height increase was observed in Gym-ACL (+1.40±0.16cm) compared to Non-gym-ACL (+0.02±0.17cm) groups (p=0.047), but no significant differences were found between the Gym-min (+1.32±0.27cm) and Non-gym-ACL (p=0.051) groups.

CONCLUSIONS: The 6m growth rate of high level female gymnasts during periods of rest is greater than non-gymnasts athletes, suggesting that TCHRC1 growth does occur during periods of rest for highly active gymnasts. This evidence may help us better understand how growth is affected by training load and timing and help develop future training protocols and growth predictions.

3806 Board #253
June 3 9:30 AM - 11:00 AM
Helmet Design And Hits To The Head: Analysis Of NFL Tackling 1951-present
Kevin N. Blythe1, David Wang2, Taylor Polk2, Douglass Johnson3, Jordan Murphy4, Brian McCormick5, Alex Webb2, Andrew Horn5, David Milzman6. MedStar Georgetown University Hospital, Washington, DC. 6Georgetown University School of Medicine, Washington, DC. (No relationships reported)

PURPOSE: Many anecdotal statements attribute NFL helmet design to changing tackling styles and thus, an increase of helmet to helmet hits and subsequent concussive injury. There are no current studies reviewing changes of tackling style over time in the NFL. This study will examine whether the advent of newer helmet technology has led to an increase in the number of tackles involving the helmet in the NFL.

METHODS: In this preliminary study, investigators were trained in the NFL definition of a “hit,” and 2-3 investigators independently reviewed the TV broadcast or game film of each championship game from seven different decades, (1951-2016). Hits were classified based on the involvement of the helmet of both the offensive player and the defender. A point-system was developed and mean values were collected for each game and open access sources were used to confirm number of head, neck injuries. Additionally, players’ behavior in the aftermath of a helmet hit was determined as “concussive” as defined by a neurotrauma trained emergency physician based on delay in getting up and steadiness of gait. Results: Helmet to helmet hits occurred on just 1.28% of the hits in the 50s compared to 6.97% of hits in the 10s, a 5.44 fold increase. Such hits have increased every decade, with statistically significant (p<0.05, t-test) after the 1960s and again after the 1980s. These changes correspond with the introduction of energy absorbing plastic helmets in the 1970s and the introduction of molded polycarbonate helmets in the late 1980s. These two helmet changes represent the most significant helmet technology changes in the time period studied. Overall hits involving the helmet of at least one player have increased at a similar rate, indicating a more dangerous tackling style. Additionally, the number of players that were judged to exhibit concussive symptoms after a hit significantly (p<0.05, t-test) increased after the 1980s.

CONCLUSIONS: Helmet-helmet hits have had the greatest jumps in frequency corresponding with helmet innovation in the NFL, with the largest jump occurring in the last three decades. That newer helmets with better technology has potentially led to more dangerous hits suggests that helmets designed to withstand greater impact may actually be a detriment to player safety.

3807 Board #254
June 3 9:30 AM - 11:00 AM
Does CTHRC1 Affect Serum Lipid Profiles in Adults?
James Alex1, William Dexter, FACSM1, Christina Holt1, Amy Haskins1, Volkhard Lindner2. 1Maine Medical Center, Portland, ME. 2Maine Medical Center Research Institute, Scarborough, ME. (Sponsor: William Dexter, MD, FACSM) (No relationships reported)

Abstracts were prepared by the authors and printed as submitted.
Medicine & Science in Sports & Exercise®

Methods:

with EIB. Percent decline in FEV1/FVC may predict a positive response to Standard asthma therapies must be used judiciously in adolescent athletes to minimize side effects and costs. Current diagnostic criteria for EIB, ≥10% decline in forced expiratory volume in the 1st second (FEV1) after exercise challenge, does not predict significant response to bronchodilator after challenge. This suggests some patients diagnosed with EIB may not benefit from standard treatment. We sought to determine if the ratio of forced vital capacity (FVC) to FEV1 could be used as a clinical indicator to help guide management decisions in adolescent patients presenting with EIB.

Methods: Using retrospective chart review, we examined valid EIB-protocol challenges performed by patients 13-18 years old in our Pulmonary Function Test lab between 6/1/11 and 5/30/16. We collected demographic data including age, height, weight, gender, BMI, and ethnicity. We calculated maximal % decline in FEV1 and % decline in FEV1/FVC for all tests in which patients received albuterol (n=139). We examined % change and volume increase in FEV1 after bronchodilator. We used the standard definition of bronchodilator reversibility, ≥12% and/or 0.2L increase in FEV1, to signify a positive response. We used two-sample t-tests and logistic regression to compare patients who did and did not exhibit bronchodilator reversibility.

Results: 84/139 (60.4%) patients met current diagnostic criteria for EIB, The mean % decline in FEV1/FVC was 9.6% (SD=9.0). Within this group, 55/84 (65.5%) displayed a positive bronchodilator response. None of the demographics we looked at were significant and the mean % change in FEV1/FVC was 9.6% (SD=9.0), indicating that the % change increase in FEV1/FVC after bronchodilator was significantly less than the mean % decline in FEV1/FVC for those who did not exhibit bronchodilator reversibility was significantly less than the mean % decline in FEV1/FVC for those who did: 6.2% (SD 5.5%) vs. 11.4% (SD 9.9%), p<0.01. Each 10% decline in FEV1/FVC was associated with a 3.36 fold increased odds of bronchodilator reversibility (95% CI 1.28-8.78, p=0.01). None of the demographics we examined modified this relationship.

Conclusion: Percent decline in FEV1/FVC may predict a positive response to bronchodilator in adolescent patients presenting for EIB evaluation. This finding may help identify individuals who will respond well to use of standard asthma therapies for the adult population.

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Purpose: Bone stress injuries (BSIs) are a common overuse injury in running athletes. The purpose of this study is to determine whether a nutrition intervention targeting at risk athletes using the Female Athlete Triad Cumulative Risk Assessment (TRIAD R-A) would result in changes in bone health and reduce incidence of BSIs. Methods and Study Design: One hundred fifty-five (76 male, 69 female) middle and long-distance runners at two NCAA Division I programs were followed prospectively over four years. The TRIAD R-A was used to identify at risk athletes pre-season followed by nutrition interventions based on these assessments. Running-related BSIs were diagnosed by a physician and confirmed radiographically. Results: A subset of twelve returning female athletes with consecutive DXA scans were evaluated at the same program. Five females had ≥ 2% improvement in L1-L4 DXA BMD (two females with ≥5%). Of this same subset over the same year, the number of females identified as high risk for moderate risk for amenorrhea/oligomenorrhea decreased from nine to six and number of BSIs decreased from four (three high risk) to three (one high risk).

Conclusions: This is the first prospective outcome study using the TRIAD R-A and a nutrition intervention tailored to an athlete’s sport. Based on these preliminary
results, use of the TRIAD R-A in conjunction with a nutrition intervention focused on optimizing energy availability led to improvements in bone health and reductions in
incidence of BSI. Further research is needed to evaluate the significance and impact of
these trends. Acknowledgements: The authors would like to thank AMSSM and Pac-
12 for helping fund this study.

**3812** Board #259 June 3 9:30 AM - 11:00 AM
Improving Prp Production In An Outpatient Sports Medicine Office: A Qi Project
William L. Patterson Jr., William Dexter, FACSM, Christina Holt, Amy Haskins. Maine Medical Center, Portland, ME.
(No relationships reported)

**PURPOSE:** Platelet rich plasma (PRP) is a clinically current topic in sports medicine
and orthopedics, and is used for various orthopedic pathologies. Prior studies show that
commercial kits consistently yield platelet concentrations of approximately 1,000x10^3
platelets/μL, but are prohibitively expensive to most patients. Studies comparing these
“kits” vs in-office “do-it-yourself” protocols have found that a desktop centrifuge and
phlebotomy tubes can produce similar elevated platelet concentrations. Our office had
been using a protocol that had not yet been internally validated. We desired to identify
and assess an optimal in office, high quality, accessible protocol to make PRP.

**METHODS:** We compared whole blood and preparations from 3 separate “in-house”
protocols to isolate PRP and quantified amount of platelets in each sample. For
protocol 1 (our previous in-office standard protocol) we drew 16.2ml of blood, spun
this at 1318g for 10 minutes, and manually removed the buffy coat layer for analysis.
For protocol 2 we drew 16.2ml of blood, spun this at 900g for 5 minutes, and manually
removed the buffy coat layer for analysis. For protocol 3 we drew 16.2ml of blood,
spun this at 900g for 5 minutes, and manually removed the entire supernatant layer
including the buffy coat, spun this solution at 1500g’s for 15 minutes, discarded the top
2/3rd of the supernatant, resuspended the remaining sample, and sent these samples for
analysis. We used T tests to compare means between each method and in comparison
to whole blood.

**RESULTS:** 31 specimens were obtained and put through the 3 protocols above. Whole
blood (WB) yielded a mean of 257.1x10^3 platelets/μL (95%CI 240-274). Protocol 1 yielded
a mean of 688x10^3 platelets/μL (95%CI 581-714) (2.5x WB concentration). Protocol 2 yielded a mean of 464x10^3 platelets/μL (95%CI 424-504) (1.8x WB concentration). Protocol 3 yielded a mean of 974x10^3 platelets/μL (95%CI 850-1097) (3.8x WB concentration). All pairwise comparisons of means were highly
statistically significant (p<0.0001).

**CONCLUSIONS:** Highly concentrated platelet rich plasma (PRP) can be consistently
obtained using common in-office centrifuges and phlebotomy tubes following
protocols, comparable to concentration data previously reported from using
professional kits.

**3813** Board #260 June 3 9:30 AM - 11:00 AM
Utilization of Emergency Department Services: A Comparison of High Schools With and Without Athletic Trainers
Christine Bender, William W. Dexter, FACSM, Amy Haskins, Christina Holt. Maine Medical Center, Portland, ME. (Sponsor: William W. Dexter, FACSM)
(No relationships reported)

Purpose:
The primary aim of this study is to compare utilization of ED services in Maine
between students in areas of public high schools with certified athletic trainers (AT)
and those without by looking at three common athletic injuries in the high school
population of teens aged 14-18.

Methods:
Using 2013 Maine All Claims data, we obtained aggregated counts of ED visits
categorized by zip code for three injuries (ankle sprain, concussion, and fracture) based
on their respective diagnosis codes. Each zip code was attributed to a high school in
categorized by zip code for three injuries (ankle sprain, concussion, and fracture) based
on their respective diagnosis codes. Each zip code was attributed to a high school in
the network of care of a local pediatric hospital, for known or suspected musculoskeletal injury from October 2014 to September 2016. Data was extracted from electronic medical records based on inclusion query terms. 14,172
initial visit records with complete data for provider (Physician, Physician Assistant
- PA, Nurse Practitioner - NP), department (ED, Orthopedics which includes Sports
Medicine, Primary Care - PC), diagnosis (fracture, no fracture), location of injury
(upper extremity - UE, lower extremity - LE), prior opioid prescription, age and sex
were included. Data were analyzed using multivariable logistic regression.

Results:
Mean age was 13 years. Opioid prescribing was more common for male
patients (odds ratio (OR) 1.3, 95% CI 1.1-1.5), fractures (OR 2.8, 95% CI 2.5-3.1),
and ED visits (ED vs PC OR 10.3, 95% CI 6.3-16.4; ED vs Ortho OR 6.7, 95% CI
7.2-10.6). Opioids were prescribed in 5.9% of UE injuries, 3.6% of LE injuries, 9.4% of
fractures and 1.9% of non-fracture injuries. ED providers ordered 68.9% of opioid
prescriptions in the study, and saw 27.7% of patients with MSK injuries. NPs were less
likely to prescribe opioids than physicians (OR 0.5, CI 0.4-0.6) and PAs (OR 0.5, CI
0.4-0.7) and there were more NPs in the ED (27.7%) than Ortho (2.2%) or PC (13.0%).
Of those patients who received an opioid prescription, 68.3% did not have any prior
MSK injury.

Conclusions:
For pediatric patients with MSK injuries, most opioid prescriptions originated from an ED visit. Injury type and provider type also impacted opioid
prescribing patterns.

3814 Board #261 June 3 9:30 AM - 11:00 AM
Opioid Prescription Practices for Pediatric Musculoskeletal Injuries
Erin Moix Grieb, Jane Graffal, Ariel Kiyoumi Daoud, Julie Wilson, Christopher Hoyle. University of Colorado, Denver, CO. (Sponsor: John Hill, FACSM)
(No relationships reported)

**PURPOSE:** Prescriptions of controlled substances for youth, including opioids, nearly
doubled from 1994-2007. Previous studies have shown that for patients aged 10-19
years, dentists were the main prescribers, followed by primary care and emergency
medicine physicians; however, analgesic prescribing practices among sports medicine
physicians is unknown. The purpose of this study is to determine opioid prescribing patterns to youth with musculoskeletal (MSK) injuries in various
clinical settings.

**METHODS:** This retrospective case series reviewed patients aged 10-18 years,
evaluated within the network of care of a local pediatric hospital, for known or
suspected musculoskeletal injury from October 2014 to September 2016. Data was
extracted from electronic medical records based on inclusion query terms. 14,172
initial visit records with complete data for provider (Physician, Physician Assistant
- PA, Nurse Practitioner - NP), department (ED, Orthopedics which includes Sports
Medicine, Primary Care - PC), diagnosis (fracture, no fracture), location of injury
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Of those patients who received an opioid prescription, 68.3% did not have any prior
MSK injury.

**CONCLUSIONS:** For pediatric patients with MSK injuries, most opioid prescriptions originated from an ED visit. Injury type and provider type also impacted opioid
prescribing patterns.

Abstracts were prepared by the authors and printed as submitted.