

G-08 Highlighted Symposium - The Role of Exercise in Neuroplasticity: Intervention to Manage Stress and Promote Well-Being

Saturday, June 3, 2017, 9:00 AM - 11:00 AM
Room: 201

3460 **Chair:** Erica M. Taylor, FACSM. *Delaware State University, Dover, DE.*

(No relationships reported)

3461 **Co-Chair:** Steven J. Petruzzello, FACSM. *University of Illinois at Urbana-Champaign, Urbana, IL.*

(No relationships reported)

3462 June 3 9:10 AM - 9:40 AM

Keynote - Integrating Stress, Cognition, and Emotion in Exercise Interventions

Brandon L. Alderman. *Rutgers University, New Brunswick, NJ.*
(No relationships reported)

3463 June 3 9:40 AM - 9:55 AM

The Relation of Fitness and Life Stress on the Temporal Dynamics of Cognition in Older Adults: Evidence from the P3 and Lateralized Readiness Potentials

Christopher J. Brush, Brandon L. Alderman. *Rutgers University, New Brunswick, NJ.*

(No relationships reported)

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 life stress and cognition. 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 (LRP) event-related potentials (ERPs). 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 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, $ps < .05$, but not moderated by fitness. **CONCLUSION:** These findings indicate that fitness is associated with preserved cognitive processing that occurs as early as stimulus evaluation. Future research may focus on earlier ERP components (e.g., sensory ERPs) to document the precise temporal relationship between fitness and cognition.

3464 June 3 9:55 AM - 10:10 AM

Effects of Exercise on Neurocardiac Responses to a Sad Mood Induction in MDD

Peter J. Ehmann, Brandon L. Alderman. *Rutgers University, New Brunswick, NJ.*

(No relationships reported)

Chronic exposure to stressful life events is known to increase vulnerability for major depressive disorder (MDD). Thus, it is critical to identify healthy lifestyle behaviors and interventions that may decrease stress and help cope with adversity, especially among those at high risk for MDD. Previous research has demonstrated that an acute bout of exercise can buffer psychological stress, as indicated by improved positive affect and attenuated cardiovascular reactivity to laboratory stressors. However, the effects of acute exercise on a sad mood induction have received less attention and the

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.

3465 June 3 10:10 AM - 10:40 AM

Keynote - Exercise as a Neurobehavioral Therapy for Improving Cognitive Control and Attention in Major Depressive Disorder

Ryan Olson. *University of North Texas, Denton, TX.*

(No relationships reported)

June 3 10:40 AM - 11:00 AM

Overall Discussion

G-14 Thematic Poster - Biomechanics of Prolonged Running

Saturday, June 3, 2017, 9:00 AM - 11:00 AM
Room: 403

3492 **Chair:** Allison H. Gruber. *Indiana University Bloomington, Bloomington, IN.*

(No relationships reported)

3493 Board #1 June 3 9:00 AM - 11:00 AM

Effects of a Submaximal 30-Minute Run on Peak Tibial Acceleration in Novice Runners

Max R. Paquette¹, Kris Camelio¹, Douglas W. Powell¹, Allison H. Gruber². ¹University of Memphis, Memphis, TN. ²Indiana University, Bloomington, IN. (Sponsor: D.S. Blaise Williams III, FACSM)

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(No relationships reported)

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 yrs; 1.69 ± 0.12 m; 70.7 ± 15.6 kg; 24.5 ± 3.8 kg/m²) who had been training for less than two years and ran on average at least 16 km 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 a main effect of time on PTA ($p \leq 0.05$). *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 ± 1.43 g; middle: 3.67 ± 1.09 g; end: 3.60 ± 1.47 g). Both foot

contact angle and ankle angle at foot strike were unaffected by the run ($p > 0.05$). **CONCLUSION:** Our data suggest that PTA does not change over the course of submaximal prolonged run in novice runners. This finding is similar to unchanged PTA during a 20min 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.

3494 Board #2 June 3 9:00 AM - 11:00 AM
Lower Extremity Mechanical Energy Distribution Does Not Change Following A High-intensity Run
 Michael P. McNally, Margaret E. Raabe, Ajit MW Chaudhari, FACSM. *Ohio State University Wexner Medical Center, Columbus, OH.*
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 (No relationships reported)

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 male 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 $\dot{V}O_2$ 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 total 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.

3495 Board #3 June 3 9:00 AM - 11:00 AM
Hip Neuromechanics In Women With And Without Previous Iliotibial Band Syndrome During A 30-minute Run
 Eric Foch¹, John W. Westbrooks¹, Clare E. Milner, FACSM².
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 (No relationships reported)

Gluteus medius muscle activity during running may be associated with atypical hip adduction exhibited by women with previous iliotibial band syndrome (ITBS). **PURPOSE:** To determine if hip neuromechanics are different during a 30-minute run between women with and without previous ITBS. **METHODS:** Twelve women between the ages of 18 and 45 participated as part of an ongoing investigation. Women with previous ITBS ($n = 6$; age 29.8 (7.6) yrs; height 1.68 (0.07) m; mass 61.3 (7.6) kg; preferred pace 2.8 (0.5) $m \cdot s^{-1}$) were matched with controls (23.5 (5.5) yrs; 1.63 (0.07) m; 57.1 (7.6) kg; 2.7 (0.7) $m \cdot s^{-1}$). Gluteus medius muscle activity was recorded via a surface electrode during a maximal voluntary isometric contraction (MVIC). Three-dimensional marker trajectories and muscle activity were collected during a 30-minute treadmill run at preferred pace. Gluteus medius muscle activity during running was normalized to the MVIC trial for analysis. Hip angles were computed via joint coordinate systems. A moving root-mean-square created electromyography envelopes from gluteus medius muscle activity. Due to small sample size, data were analyzed using descriptive statistics with moderate effects considered clinically meaningful (≥ 0.50). **RESULTS:** Peak gluteus medius activation during the MVIC trial was less in the ITBS group compared to controls (ITBS: 0.14 (0.04) mV; Controls: 0.19 (0.10) mV; $d = 0.72$). However, women with previous ITBS had greater gluteus medius muscle activation compared to controls during the first and last minutes of the run (Table 1). Frontal plane hip kinematics were similar between groups.

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).

	Time	Group		ES
	Min	ITBS	CON	d
Peak hip adduction (degrees)	1	13.6(3.0)	13.5(2.4)	0.06
	30	14.3(3.7)	13.5(3.4)	0.23
Hip adduction excursion (degrees)	1	2.7(2.0)	3.5(1.9)	0.43
	30	3.8(3.1)	4.5(1.3)	0.32
Pre-heelstrike gluteus medius activation (%MVIC)	1	80.4(19.7)	62.0(28.4)	0.76
	30	93.9(36.9)	63.7(25.2)	0.97
Weight acceptance gluteus medius activation (%MVIC)	1	96.5(13.3)	74.6(25.6)	1.13
	30	96.4(7.7)	72.2(26.4)	1.42

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

3496 Board #4 June 3 9:00 AM - 11:00 AM
The Effect of Compression Tights on Muscle Vibration and Energy Expenditure during a High-Intensity Run
 Hannah Harris, Margaret E. Raabe, Michael P. McNally, Ajit M.W. Chaudhari, FACSM. *The Ohio State University, Columbus, OH.*
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 (No relationships reported)

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% $\dot{V}O_2$ 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' heartrate (HR) was recorded in 5-min increments during the run and energy expenditure (EE) was estimated using the model: $EE (kcal/min) = 3.56 - 0.0136(\text{weight}) + 0.00189(\text{HR})(\text{weight})$. The percent change in EE over the course of the run was analyzed. This protocol was repeated on two separate days, one with running shorts and one with high compression tights (20-25 mmHg). The order of conditions was randomly assigned. **RESULTS:** Paired two-sided t-tests revealed significant difference in muscle vibrations between the running shorts and tights conditions (quads: 15.9±5.2 mm vs 7.6±2.5 mm, $p < 0.0001$), with significantly less muscle vibration in the tights condition for all muscle groups except for the hamstrings (7.6±3.6 mm vs 7.2±2.2 mm, $p = 0.70$). However, there was no significant difference found in the percent increase in EE (9.4±6.1% vs 10.1±5.0%, $p = 0.43$) from the start to end of the run. **CONCLUSION:** 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.

3497 Board #5 June 3 9:00 AM - 11:00 AM
The Effect of Cushioned Insoles on Tibial Acceleration During Running
 Anisa Rohilla, Natalie Turner, Jake Glazer, Ryan Smith, Dimitrios Katsavelis. *Creighton University, Omaha, NE.*
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 (No relationships reported)

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 tested three times over a period of three weeks. During the first visit, lactate threshold speed (LTS) was assessed via blood samples (7.8 ± 5 mph). 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 plateau 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%).

3498 Board #6 June 3 9:00 AM - 11:00 AM

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

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(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) granted informed consent and completed a VO₂ peak test on the LBPP-TM and two separate trials consisting of 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 Bonferonni post hoc testing (SPSS Statistics 23). **RESULTS:** There was a significant main effect of BW level ($F(2,4,41.4)=81.3, p<0.01$) and DM ($F(1,17)=45.1, p<0.01$) on SR. 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 ($F(1,3,22.9)=105.6, p<0.01$) 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 ± 9.9 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 normal SR but the self-selected SR produced the greatest VO₂ reductions indicating that runners adjust temperospatial mechanics for improved economy.

G-15 Thematic Poster - High Intensity Training

Saturday, June 3, 2017, 9:00 AM - 11:00 AM
Room: 101

3499 **Chair:** John P. Porcari, FACSM. *University of Wisconsin - La Crosse, La Crosse, WI.*
(No relationships reported)

3500 Board #1 June 3 9:00 AM - 11:00 AM

Acute Physiological Responses of Very Short versus Standard Sprint Interval Training (SIT) protocols

Stefano Benitez Flores¹, Arilson F. M. de Sousa¹, Erick Carlos da Cunha Totó¹, Thiago Santos Rosa¹, Sebastián Del Rosso¹, Carl Foster, FACSM², Daniel Alexandre Boulosa¹. ¹*Universidade Católica de Brasília, Brasília, Brazil.* ²*University of Wisconsin - La Crosse, La Crosse, WI.*
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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 (VO_{2max} = 45.9 ± 3.7 mL/kg/min, age = 25.3 ± 3.6 yr) participated. VO_{2max} was measured in the 1st session. In the 2nd and 3rd sessions two different SIT protocols were completed in randomized order: SIT20s (4×20 s with 2 min of recovery) and SIT5s (16×5 s with 24 s of recovery). Both SIT sessions had the same load (7.5 % body mass), lasted 12 min, and had the same work-to-rest ratio. During SIT sessions, the following parameters were recorded: oxygen consumption (VO₂), 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 OMNI-cycle scale RPE (Omni-cycle RPE). **RESULTS:** Mean VO₂, HR, and total EE were higher in SIT5s [37.61 ± 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 kJ ($P=0.02$), respectively]. No significant differences were found between protocols in PP [911.4 ± 60.5 vs. 909.1 ± 88.5 W ($P=0.937$), for SIT5s and SIT20s, respectively]. RF was higher in SIT20s than in SIT5s [54.7 ± 5.9 vs. $39.4 \pm 9\%$ ($P=0.001$)]. Omni-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.

3501 Board #2 June 3 9:00 AM - 11:00 AM

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

Yuri Feito, 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 (HIFT) session. Even though previous studies have linked experience with performance, experience alone does not imply greater skill. **PURPOSE:** To examine the physiological response of a HIFT workout among individuals with different competitive levels. **METHODS:** Sixty-six participants (30.8 ± 7.3 y; 172.4 ± 9.1 cm; 76.2 ± 13.6 kg) with at least six-months of HIFT 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 (VO_{2peak}), heart rate (HR_{peak}), respiratory exchange ratio (R_{peak}), and blood lactate (L_{tpeak}). A week later, the same variables were measured (VO₂; HR; R; L_t) during a 15-min HIFT based workout. **RESULTS:** Analysis of variance revealed significant group differences in VO_{2peak} (Adv = 50.1 ± 5.4 , Int = 46.1 ± 4.9 , Nov = 43.8 ± 6.6 mL/kg/min; $p<0.001$) and L_{tpeak} (Adv = 12.6 ± 2.5 , Int = 11.5 ± 3.3 , Nov = 9.9 ± 3.2 mmol/L; $p=0.010$). Similarly, during the HIFT 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 L_t concentration during the HIFT 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 HIFT 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 ($r^2 = 0.658$, $p < 0.001$). **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.*
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 (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♂) 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. Systematic group differences were detected with the Mann-Whitney-U-test ($\alpha = .05$). **RESULTS:** In comparison to MAE, HIFCT increased maximum leg strength (difference of relative median pre-post changes between groups: 6%), shoulder strength (8.4%), and cycling workload (6.5%; $p < .05$). No differences were found for postural control and jump capacity ($p > .05$). Although not statistically significant, there was a tendency for increased self-concordance following HIFCT ($p < .1$). **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 effectivity in other settings.

3503 Board #4 June 3 9:00 AM - 11:00 AM
Strength and Power Acute Responses to Suspension Training

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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: 25.8±3.9years; Body Mass: 65.8±11.2kg; Height: 166.9±8.9cm; BMI: 23.5±2.4kg/m²) volunteered to participate in the study. Before (PRE) and after (POST) a 45-min ST group session, Squat (SJ) and Countermovement (CMJ) Jumps were performed on a portable force plate, while lower limb Maximum Voluntary Contraction (MVC) at 90° angle isometric knee extension and grip strength (HG) were measured in preferred and non-preferred limbs through a piezoelectric force transducer and a hydraulic hand dynamometer, respectively. ANOVA for repeated measures was used to evaluate differences ($p < 0.05$) in relation to gender and experimental session. **RESULTS:** As expected, M always showed highest strength and power values ($p < 0.02$). In the POST condition, no significant improvements were found for HG, with best performances ($p < 0.02$) emerging for the preferred limb (M-PRE: 429.3±31.2N; M-POST: 445.7±30.2N; F- PRE: 254.1±12.6N;

F- POST: 256.4±13.5N) with respect to the non-preferred one (M-PRE: 399.4±16.2N; M-POST: 407.6±28.6N; F-PRE: 231.7±15.9N; F-POST: 236.1±18.1N). For MVC, only F showed differences between limbs ($p < 0.02$), with highest values in the preferred leg (PRE: 238.8±15.1N; POST: 246.9±20.1N) and lowest in the non-preferred one (PRE: 222.4±19.9N; POST=230.9±14.5 N). After the session, M only showed improvements ($p < 0.02$) in CMJ (PRE: 32.3±1.8cm; POST: 33.7±1.7cm) and MVC for the non-preferred leg (PRE: 276.1±16.6N; POST: 292.4±24.1N), while no differences emerged for SJ. **CONCLUSIONS:** Results shown that ST is a form of exercise useful to maintain and improve acute strength and power performances, in particular in male subjects. ST could be added in warm-up programs for sports where strength and power are key components.

3504 Board #5 June 3 9:00 AM - 11:00 AM
The Effects Of 4-weeks Hiit And Continuous Based Training On The Incidence Of Plateau At Vo2max And The Anaerobic Capacity

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 (No relationships reported)

PURPOSE: The plateau at VO_{2max} has been attributed to the size of the finite anaerobic capacity which has previously been shown as a trainable parameter. Therefore the purpose of this study was to assess the effects of 4-weeks HiIT or continuous training on the incidence of plateau at VO_{2max} and the anaerobic capacity. **METHOD:** Following Institutional ethics approval $n = 30$ physically active adolescents agreed to participate (age, 17.2 ± 1.2 yrs; height, 173.7 ± 8.9 cm; mass, 67.7 ± 14.0 kg; VO_{2max} , 47.3 ± 7.9 ml·kg⁻¹·min⁻¹). They were assigned to 3 matched groups, high-intensity intermittent training (HiIT), continuous training (CET) and a no-training control group (CG), based on maximally accumulated oxygen deficit (MAOD) scores. HiIT completed 8 x 20s sprints at 170% W- VO_{2max} with 10s recovery 3 times a week for 4-weeks, CET completed 30min cycling at 70% W- VO_{2max} (70 rpm) 3 times per week for 4-weeks. Pre and post training VO_{2max} , MAOD, cardiac output (Q), HR were assessed using breath-by-breath analysis and exercising on an electronically controlled cycle ergometer. Additionally blood glucose, blood lactate and key haematological parameters were assessed. Plateau criteria was determined as $\Delta VO_2 \leq 1.5$ ml·kg⁻¹·min⁻¹ over the final 60s of the VO_{2max} trial. **RESULTS:** HiIT increased MAOD from 37.4 ± 10.7 to 41.9 ± 9.6ml·kg⁻¹ ($P = 0.029$) while there was no change in either CG or CET. ΔVO_2 during final 60s of the VO_{2max} test showed no change for HiIT or CET following 4-weeks of training, while total exercise time increased by 13.2s for HiIT ($P = 0.004$) and 15.6s CET ($P = 0.036$) with no change for CG. VO_{2max} showed no change for HiIT but increased from 47.9 ± 7.7 ml·kg⁻¹·min⁻¹ to 51.5 ± 10.0 ml·kg⁻¹·min⁻¹ ($P = 0.015$). Q_{max} decreased by 2.0 ± 2.2 l·min⁻¹ following HiIT ($P = 0.019$) coupled with an increase in a- $vO_{2diffmax}$ of 2.5 3.4 ml/100ml⁻¹ ($P = 0.042$) while for CET there was no change in either Q_{max} or a- $vO_{2diffmax}$. HiIT also showed a significant increase in HCO₃⁻ post training ($P = 0.002$) with no change in either CG or CET. **CONCLUSIONS:** These data suggest that 4-weeks of HiIT training was sufficient to induce a large increase in the finite anaerobic capacity but could not show any effect on the incidence of plateau at VO_{2max} . It is thus concluded that the plateau is not simply a product of anaerobic energy provision but a more complex psychobiological 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

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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 response 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. Protocols were separated by at minimum of 24 hours. Oxygen consumption (VO_2) and heart rate (HR) were collected continuously and monitored during each exercise protocol. Blood lactate (BLA^a), 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 effect of protocol. However, a significant effect of sex, although not found for BLA and $\dot{V}O_2$, was observed for RPE ($M=17 \pm 2.0$, $F=16 \pm 1.5$; $F=5.453$, $p=.034$), W ($M=165 \pm 33$ W, $F=137 \pm 24$ W; $F=7.519$, $p=.021$), HR ($M=168 \pm 16$ bpm, $F=181 \pm 5$ bpm; $F=14.218$, $p=.002$) and EE ($M=11.2 \pm 1.7$ kcal·min⁻¹, $F=9.0 \pm 1.5$ kcal·min⁻¹; $F=11.638$, $p=.004$); peak W also differed by sex ($M=674.5 \pm 147$ W, $F=420 \pm 61$ W; $F=18.291$, $p=.002$). 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.

3506 Board #7 June 3 9:00 AM - 11:00 AM

The Effect of High-Intensity Interval Training and Intermittent Fasting on Body Composition in Apparently Healthy Women

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Women are less likely to meet physical activity recommendations with a "lack of time" as the most commonly reported barrier to meeting the recommendations. High-intensity interval training (HIT; short bursts of high-intensity activity followed by low intensity rest periods) is a form of exercise that elicits similar cardiorespiratory responses as continuous training with less total energy expenditure required and a shorter time commitment. HIT has been found to increase whole-body insulin sensitivity and improve overall body composition. Alternate day fasting elicits similar improvements in body composition as HIT. **PURPOSE:** To examine the effect of HIT and alternate day fasting versus HIT alone on body composition in women.

METHODS: HIT was performed 3 days per week in 20 minute sessions; one day led by an instructor; two days performed at home using the study YouTube channel. Suggested exercise intensity was determined from baseline fitness levels. Participants in the HIT only group were instructed to eat a well-balanced breakfast each morning prior to the exercise sessions. The HIT+fasting group was instructed to fast for a total of 12 hours, three days per week. The fast began 10.5 hours prior to exercise (primarily overnight) and lasted at least 30 minutes after exercise. Body composition (weight, BMI, body fat percent, waist, hip, thigh, and arm circumference) was assessed at baseline and post-intervention.

RESULTS: Hip circumference significantly reduced in the HIT+fasting group (40.5 ± 3.1 to 39.4 ± 1.3 ; $p=0.041$). Weight and waist circumference decreased non-significantly in the HIT+fasting group (158.5 ± 31.2 to 145.3 ± 13.3 , $p=0.11$; 31.6 ± 3.5 to 30.6 ± 2.1 , $p=0.402$). Body fat percent reduced non-significantly in the HIT only group (27.4 ± 4.5 to 25.5 ± 5.5 ; $p=0.461$).

CONCLUSIONS: HIT resulted in significant and non-significant beneficial body composition changes in apparently healthy women. This exercise mode provides an alternative to long duration exercise, and a way to combat the "lack of time" barrier, while still achieving similar benefits as those achieved from continuous training. The combination of HIT and alternate day fasting in women requires further investigation, specifically the metabolic and cellular effects of fasting and training in women and the resulting effects on body composition.

3507 Board #8 June 3 9:00 AM - 11:00 AM

Psychological Impact Of 8-week CrossFit And Non-CrossFit Training Programs

April A. Wheeler, Tara M. Roelofs, Amanda L. Moelk, Jennifer L. Welch, Rebekah G. Ellerbusch, Trevor W. Frosig, Gabrielle S. Turcotte, Taylor K. Schmidt, Justin R. Geijer. *Winona State University, Winona, MN.*
(No relationships reported)

Introduction CrossFit utilizes both high-intensity aerobic training and resistance training using functional multi-joint movements such as squats, deadlifts, clean, snatch, and overhead press. There has been much debate over the safety, effectiveness and level of difficulty of CrossFit training for the general population. **Purpose** This study aimed to compare perceived difficulties of an 8-week CrossFit or non-CrossFit exercise regimen. **Methods** The non-CrossFit exercise group (N=13) participated in three days of exercise consisting of mobility and functional movements, cardiovascular endurance training and a resistance training circuit each week for eight weeks. The CrossFit exercise group (N=13) integrated cardiovascular training into their resistance training program by completing a maximum number of repetitions in a given time period. Each week an online survey was sent to each participant to complete. Mean values were calculated for each question and a paired sample t-test was used to compare the

responses between groups. **Results** Difficulty of the workouts was perceived as more difficult in the non-CrossFit group than the CrossFit group (3.22 ± 0.56 , 2.49 ± 0.51 , $p < 0.001$, respectively). CrossFit participants rated level of soreness higher than the non-CrossFit group (2.36 ± 0.37 , $p=0.002$). The CrossFit group rated better sleep quality than the non-CrossFit group (2.23 ± 0.17 , $p < 0.001$). **Discussion** A previous study found that perceived exertion and pain is more dependent on the load than the type of muscular contraction. The current study contradicted this finding as the CrossFit group used greater loads, but their perceived difficulty was less than the non-CrossFit group. The CrossFit group rated their perceived pain levels as higher than the non-CrossFit group, which supports previous research, and is possibly due to using greater loads. **Conclusion** Based on the findings of this study and findings of previous research, use of greater loads may lead to greater perceived pain levels while flexibility and mobility training may lead to greater perceived difficulty.

G-16 Thematic Poster - Muscle Physiology

Saturday, June 3, 2017, 9:00 AM - 11:00 AM
Room: 304

3508 **Chair:** Peter Hosick. *Montclair State University, Montclair, NJ.*

(No relationships reported)

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

Mechanomyographic Responses to Blood Flow Restricted, Fatiguing Isometric Muscle Actions

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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 y; 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 (set 1 = 30 ± 7.96 repetitions; set 2 = 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 1 ($p > 0.05$), and no interactions for set 2. When collapsed across percent repetitions, MMG frequency was lower for OCC (0.837 ± 0.045) than for NONOCC (1.116 ± 0.099) during set 2 ($p=0.046$). For MMG amplitude, there was a significant condition by set interaction ($p=0.023$). 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.

3510 Board #2 June 3 9:00 AM - 11:00 AM
Inhibitory Feedback During Fatiguing Contractions Is Similar In Males and Females.
 Bryce Campbell, Margaret Gillespie, Alia Yasen, Anita Christie.
University of Oregon, Eugene, OR. (Sponsor: David Gabriel, FACSMM)
(No relationships reported)

Whether an inhibitory feedback mechanism explains sex-related discrepancies in muscular fatigue is unclear. **PURPOSE** To examine sex-related differences in the influence of inhibitory sensory feedback during fatiguing contractions. **METHODS** A fatigue task was performed by 20 subjects (7 males and 13 females; 18-30 years), which consisted of 1) baseline assessments; 2) a 20-s sustained maximum voluntary contraction (MVC) while blood flow to the shank was occluded; 3) a 20-s MVC performed 3 minutes after the fatiguing task, while blood flow remained occluded; and 4) a 5-s MVC performed 3 minutes after blood flow was returned. Force of the ankle dorsiflexors and EMG of the tibialis anterior were monitored during all contractions. Maximal M-waves were recorded from the tibialis anterior via stimulation of the peroneal nerve prior to and immediately following each contraction. **RESULTS** No significant differences were observed between males and females for baseline measures of MVC ($p = 0.72$), EMG ($p = 0.44$), or M-wave amplitude ($p = 0.40$) or latency ($p = 0.37$). The 20-s contraction resulted in a significant reduction in MVC force ($p = 0.001$), which was similar between males and females ($p = 0.35$). MVC force remained reduced following 3 minutes of rest while blood flow was occluded, but returned to baseline when blood flow was restored ($p = 0.18$). EMG amplitude remained similar at all time points of the experiment ($p = 0.11$). The amplitude of the M-wave was similarly reduced ($p = 0.001$) in men and women ($p = 0.60$) at the end of the fatiguing contraction, increased following rest with blood flow occluded ($p = 0.03$), and returned to baseline following the return of blood flow ($p = 0.210$). M-wave latency did not change significantly at any time point ($p = 0.11$). **CONCLUSION** These results indicate the importance of peripheral feedback during fatigue for both men and women and suggest that a potential oxidative advantage for women is eliminated during a time of high oxidative stress. Without this advantage similar feedback mechanisms are likely present during occlusion.

3511 Board #3 June 3 9:00 AM - 11:00 AM
Time-Related Changes in Firing Rate Behavior is Partially Explained by Potentiation
 Jonathan D. Miller, Trent J. Herda, Michael A. Trevino, Adam J. Sterczala, Anthony B. Ciccone. *University of Kansas, Lawrence, KS.*
(No relationships reported)

PURPOSE: To determine the effects of age and influence of twitch force potentiation on motor unit (MU) firing rate behavior during steady force contractions. **METHODS:** Twenty young (YG) individuals (10 men and 10 women, mean \pm SD age = 22.5 ± 2.7 years, mass = 75.4 ± 16.7 kg) and 9 aged (AG) individuals (4 men and 5 women, age = 61.9 ± 2.5 years, mass = 77.8 ± 16.6 kg) participated in this study. A resting twitch was evoked immediately prior to and following a 50% maximum voluntary contraction (MVC) in which the targeted force was held for 12 s. Absolute difference scores were calculated between pre- and post-50% MVC twitch forces (ΔTF) (highest 0.005 s) and then normalized to pre-50% TF (ΔTF_{NORM}) for each subject. Mean firing rate (MFR) vs. recruitment threshold (Rec Thresh) relationships were analyzed for each subject during the first, median, and last 0.5 second of the steady force portion of the 50% MVC. The slopes and y-intercepts of these relationships were regressed against time to determine time-dependent changes in MU firing rate behavior. The slopes and y-intercepts of these relationships (MFRT_{SLOPE} and MFRT_{INT}) were used for subsequent analysis. Independent samples t-test were performed on ΔTF , MFRT_{SLOPE} and MFRT_{INT} to determine potential differences between YG and AG. Correlations were performed for MFRT_{SLOPE} and MFRT_{INT} vs. ΔTF_{NORM} . **RESULTS:** ΔTF was greater ($P < 0.001$) for YG (0.619 ± 0.258 N) than AG (0.311 ± 0.150 N). MFRT_{SLOPE} was greater ($P = 0.036$) for YG than AG (YG = 0.013 ± 0.016 pps/%MVC/s, AG = 0.003 ± 0.010 pps/%MVC/s), however, MFRT_{INT} was not significantly different between groups ($P = 0.070$). MFRT_{SLOPE} was directly correlated with ΔTF_{NORM} ($P = 0.003$, $r = 0.529$) while MFRT_{INT} was inversely correlated to ΔTF_{NORM} ($P = 0.003$, $r = -0.523$). **CONCLUSIONS:** The slopes and y-intercepts of the MFR vs. Rec Thresh relationship were changing in a time dependent manner to a greater extent for YG than AG. The slopes became less negative and the y-intercepts were reduced over time suggesting an increase in firing rates of higher-threshold MUs in conjunction with a decrease in the firing rates of lower-threshold MUs. The ΔTF_{NORM} accounted for part of the variance in these recruitment-related differences in firing rate behavior at steady force.

3512 Board #4 June 3 9:00 AM - 11:00 AM
Simultaneous Measurement of Perfusive and Diffusive Oxygen Transport During Incremental Forearm Exercise
 Shane M. Hammer, Andrew M. Alexander, Kaylin D. Didier, Joshua R. Smith, Jacob T. Caldwell, Shelbi L. Sutterfield, Carl J. Ade, Thomas J. Barstow, FACSMM. *Kansas State University, Manhattan, KS.*
(No relationships reported)

Muscle oxygen uptake (VO_2) is comprised of perfusive and diffusive oxygen transport. Few techniques demonstrate the ability to measure both components of VO_2 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 (WR_{peak}), while muscle deoxy-[Hb+Mb] and total-[Hb+Mb] have been shown to plateau at 80-90% WR_{peak} . **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 were 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 increase 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 ($n = 16$; $n = 15$). There was no difference between deoxy-[Hb+Mb] and total-[Hb+Mb] in the work rate at which plateaus occurred (59.8 ± 21.4 and $67.9 \pm 15.8\%$ WR_{peak} , 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 ($53.1 \pm 9.3\%$ WR_{peak}), 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] ($r = 0.78$, $p < 0.05$). 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].

3513 Board #5 June 3 9:00 AM - 11:00 AM
Evaluation Of ES-induced Fatigue In Relation To Muscle Size And Fiber Recruitment: A Pilot Study
 Maria Vromans, Pouran D. Faghri, FACSMM, Magdalena Wegrzyniak, Sarina Moghadam. *University of Connecticut, Storrs, CT.* (Sponsor: Pouran D. Faghri, FACSMM)
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Electrical stimulation (ES) has been used to strengthen muscles in athletic training and rehabilitation programs. ES is an effective stimulus to increase muscle force by evoking contraction via the application of electrical current. However, fast neuromuscular fatigue development limits its application in the clinical setting. The rapid fatigue onset has been attributed to differences in ES parameters and motor unit (MU) recruitment pattern compared to voluntary contractions. **PURPOSE:** To evaluate the ES intensity needed to generate predetermined force in two muscles of varying size and fiber type (proportion of type I and type II fibers) during isometric contractions, as well as to investigate the fatigue characteristics and time to fatigue under these conditions. **METHODS:** ES-induced fatigue was initiated in the small, type I abductor pollicis brevis (APB) and large, type II vastus lateralis (VL) muscles of three healthy individuals (mean age: 22.33 ± 2.36 years). ES was delivered at three frequencies (10, 30, 50Hz) in randomized order, with a duty cycle of 4s on/4s off, pulse duration of 300 μ s, and stimulation intensity level required to achieve an initial tetanic force equal to 25% of the pre-fatigue MVC. ΔMVC values, required intensity, and %drop in force during ES were compared between APB and VL. **RESULTS:** ΔMVC values were relatively low, though higher in the VL with no apparent association to frequency (VL mean ΔMVC : 10Hz = 16.8N; 35Hz = 28.3N; 50Hz = 6.0N, APB mean ΔMVC : 10Hz = -4.0N; 35Hz = 0.32N; 50Hz = 2.38N). ES at 10Hz requires a higher intensity to achieve 25%MVC force than at 35Hz or 50Hz for both the APB (mean intensity: 10Hz = 20.3mA; 35Hz = 17mA; 50Hz = 15.3mA) and VL (mean intensity: 10Hz = 54mA; 35Hz = 46.7mA; 50Hz = 46.7mA). The %drop in force was greatest at 50Hz (APB = 21% drop; VL = 18% drop), then 35Hz (APB = 17.5% drop; VL = 19.9% drop), then 10Hz (APB = 14.75% drop; VL = 16.35% drop) at the first quartile of time to fatigue, while the second quartile values were consistent among frequencies.

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.

3514 Board #6 June 3 9:00 AM - 11:00 AM
High Threshold Motor Units Are Eventually Recruited During Low Force Efforts to Volitional Fatigue

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 (No relationships reported)

There is disagreement in the literature regarding the magnitude of relative loads necessary to optimize muscle hypertrophy. Most recommend loads of 60-80% of 1 RM, while others demonstrate similar increases with loads as low as 30% 1 RM, as long as volitional fatigue is reached.

PURPOSE: To use a deterministic model of individual motor unit and whole muscle fatigue to evaluate MU recruitment during low and high relative force efforts to volitional fatigue.

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 s 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.

3515 Board #7 June 3 9:00 AM - 11:00 AM
Muscle Specific Endurance of the Lower Back Erectors using Electrical Twitch Mechanography

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

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, 6 Hz, respectively. The coefficients of variation were 9.8%, 13.9%, and 20.3% for 2, 4, 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, 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. :

3516 Board #8 June 3 9:00 AM - 11:00 AM
Clinical Assessment Of Muscle Endurance

Thomas B. Willingham, Kevin McCully, FACSM. University of Georgia, Athens, GA. (Sponsor: Kevin McCully, FACSM)
 (No relationships reported)

Evaluation of muscle endurance is important for many clinical populations.

PURPOSE: Evaluate the utility of a clinical assessment of muscle endurance that uses twitch electrical stimulation and accelerometer-based mechanomyography (aMMG). **METHODS:** Twenty healthy participants (9 males; 11 females) and three participants with multiple sclerosis (MS) were tested. Muscle twitch acceleration was measured using an accelerometer placed over the surface of the muscle. The relationship between acceleration and torque was measured during twitch stimulation of the vastus lateralis muscle. Muscle endurance of the forearm and gastrocnemius was measured during 9 minutes of twitch electrical stimulation, in three stages (3min/stage) of increasing frequency (2Hz, 4Hz, and 6Hz). Endurance Index (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 = 83.6 ± 10.2%), 4Hz (EI = 57.2 ± 5.1%), and 6Hz (EI = 20.6 ± 8.7%) 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

Saturday, June 3, 2017, 9:00 AM - 11:00 AM
 Room: 404

3517 Chair: Bryan Taylor. University of Leeds, Leeds, United Kingdom.

(No relationships reported)

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 Wever-Pinzon, Craig H. Selzman, William H. Perry, Camila A.S. Vargas, Stavros G. Drakos, Russell S. Richardson. University of Utah, Salt Lake City, UT.

(No relationships reported)

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 HeartMateII (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 by the time averaged mean blood velocity. LVAD device pulsatility indices that are used clinically were also recorded: maximal blood velocity (V_{max}) and minimum blood velocity (V_{min}) (HVAD) and HMII PI (HMII). Relationships were evaluated using multilevel linear modeling with random intercepts and data are reported as mean ± SE. **RESULTS:** Baseline RPMs were 2509 ± 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

device across relative pump speed stages. Specifically, a 180 RPM decrease of the HVAD resulted in a 0.9 ± 0.1 (37±4%) increase in brachial PI and a 600 RPM decrease in the HMII resulted in a 0.8 ± 0.1 (38±3%) increase. These reductions in pump speed resulted in an ~20.0% fall in LVAD power consumption and a reduction in device reported blood flow of ~9%. Brachial PI correlated with $HVAD_{HW} V_{max}$ and $HVAD_{HW} V_{min}$ ($r = 0.45$ and $r = -0.31$, respectively), and HMII device $_{HMII} PI$ ($r = 0.73$), suggesting device derived indices of PI provide a fair to good linear prediction of peripheral vascular pulsatility. **CONCLUSION:** Reducing HVAD or HMII LVAD pump speed within a clinically acceptable outpatient range yields a measurable and potentially clinically and physiologically meaningful change in peripheral vascular pulsatility, accompanied by substantial power savings.

3519 Board #2 June 3 9:00 AM - 11:00 AM
Postural Induced Changes in Plasma Volume Inversely Influences Plasma Nitrite Concentration in Humans

Luke Liddle¹, Chris Monaghan¹, Luke C. McIlvenna², Mia C. Burleigh¹, David J. Muggerridge³, Chris Easton¹. ¹University of the West of Scotland, Hamilton, United Kingdom. ²Victoria University, Melbourne, Australia. ³University of Strathclyde, Glasgow, United Kingdom. (Sponsor: Professor Yannis Pitsiladis, FACSM)
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(No relationships reported)

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 [NO_3^-] and nitrite [NO_2^-] has not been reported. **PURPOSE:** To determine the change (Δ) in PV, [NO_3^-] and [NO_2^-] 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 x 70 ml of NO_3^- -rich beetroot juice the day before and 2 x 70 ml two hours before the trial (BR; total of ~31 mmol NO_3^-). 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 the age-predicted maximal heart rate. Repeated blood samples were collected to allow measurements of haemoglobin and haematocrit in whole blood and plasma [NO_3^-] and [NO_2^-] 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 $\Delta 12.6 \pm 10.3$ %; BR $\Delta 12.5 \pm 7$ %, both $P < 0.01$) and then decreased upon standing (CON $\Delta -5.2 \pm 3.8$ %, $P < 0.01$; BR $\Delta -4.0 \pm 3.5$ %, $P = 0.02$), sitting (CON $\Delta -10.1 \pm 3.7$ %; BR $\Delta -6.4 \pm 3.6$ %, both $P < 0.001$) and following exercise (CON $\Delta -18.1 \pm 5$ %; BR $\Delta -15.5 \pm 3.4$ %, both $P < 0.001$). Plasma [NO_3^-] levels at baseline were 120 ± 49 nM and 357 ± 129 nM in CON and BR, respectively. Plasma [NO_3^-] decreased from baseline after lying supine in both trials (CON 77 ± 30 nM; BR 231 ± 92 nM, both $P < 0.05$) before increasing during standing (CON 109 ± 42 nM; BR 297 ± 105 nM, both $P < 0.001$) and sitting (CON 131 ± 43 nM; BR 385 ± 125 nM, both $P < 0.002$). Plasma [NO_2^-] remained elevated following exercise in the CON trial (125 ± 61 nM, $P < 0.05$) but was not different to the 30 min supine value in the BR trial. There were no statistical differences in [NO_3^-] between measurement points in either condition (all $P > 0.05$). **CONCLUSIONS:** Plasma [NO_3^-] changes in the opposite direction to PV during changes in posture, both in the presence and absence of prior dietary NO_3^- supplementation. Given that [NO_2^-] offers the best approximation of nitric oxide bioavailability, researchers must be cognisant of these outcomes when designing and interpreting dietary NO_3^- research.

3520 Board #3 June 3 9:00 AM - 11:00 AM
Effects of Prior 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: Helaine 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 yr; BMI = 24.7 ± 1.0 kg/m²; maximal oxygen consumption (VO_{2max}) = 49.9 ± 5.1 ml/kg/min (mean \pm SE)] participated in two randomized 3 hours sitting trials preceded by a single bout of continuous treadmill exercise (45 min at 65% VO_{2max}) (EX) or 45 min of quiet rest (REST). Exercise intensity was confirmed via open-circuit spirometry during the first 15 min of exercise. Superficial femoral artery flow-mediated dilation (FMD) was measured by high-resolution ultrasonography after an overnight fast (Pre), 1 h following EX (or REST) (Post), and at 1 hour intervals during a 3 hour prolonged sitting challenge. Participants were monitored by study personnel to ensure minimal

lower extremity movement during the sitting challenge. Two-way repeated-measures ANOVA and Bonferroni post-hoc tests were used to evaluate differences within and between groups. **RESULTS:** Participants completed the 45 min of treadmill exercise at $65.6 \pm 1.2\%$ VO_{2max} (range = 60.9-72.6%). Resting femoral artery diameter and FMD responses ($2.7 \pm 0.6\%$ and $2.6 \pm 0.5\%$ for EX and REST, respectively) did not differ between trials at Pre. No time or trial effects were detected for resting arterial diameter ($P \geq 0.28$). 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 ($P \geq 0.33$). 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 ($P \geq 0.09$). **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.

3521 Board #4 June 3 9:00 AM - 11:00 AM
Comparison Of Blood Flow Characteristics Before, During, And After High-intensity Interval And Moderate-intensity Continuous Exercise

Brett B. Baughman, Stephanie D. Gagnon, Janie C. Unkefer, Kaiti A. Freeberg, Patricia Benedict, Brandon J. Sawyer. Point Loma Nazarene University, San Diego, CA. (Sponsor: Glenn A. Gaesser, FACSM)
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(No relationships reported)

PURPOSE: A comparison of blood flow characteristics in the brachial artery during high-intensity interval exercise (HIIE) and moderate-intensity continuous exercise (MOD) has not been conducted. Also, the acute effects of these exercise protocols on measures of vascular reactivity are not fully understood. **METHODS:** Sixteen healthy males (Age: 23 ± 3 years, BMI: 25.5 ± 3.0) completed HIIE (10, 1 min intervals at 90-95% of HR_{max} with 1 min of recovery between) and MOD (30 min at 70% of HR_{max}) on a cycle ergometer. Brachial artery diameter and blood flow measurements were made before, during and after exercise via high-resolution ultrasound. **RESULTS:** During exercise there were no differences in artery diameter but antegrade velocity (HIIE: 17.96 ± 6.14 cm/sec, MOD: 21.73 ± 8.11 cm/sec, $P = 0.02$) and antegrade shear rate (HIIE: 170.83 ± 55.51 sec⁻¹, MOD: 203.50 ± 76.09 sec⁻¹, $P = 0.04$) were higher during MOD compared to HIIE. Retrograde velocity (HIIE: -7.67 ± 2.79 cm/sec, MOD: -5.50 ± 2.04 cm/sec, $P < 0.01$) and retrograde shear rate (HIIE: -73.82 ± 28.37 sec⁻¹, MOD: -51.48 ± 19.77 sec⁻¹, $P < 0.01$) were of greater magnitude during HIIE compared to MOD. Baseline artery diameter decreased after HIIE ($P = 0.04$), but not after MOD ($P = 0.19$). Peak diameter after occlusion decreased with MOD ($P = 0.04$), but not with HIIE ($P = 0.80$). Minimum diameter during cuff occlusion decreased after HIIE ($P = 0.02$) and marginally decreased after MOD (Pre: $P = 0.06$). No acute changes were seen with flow-mediated dilation (FMD) or low-flow mediated constriction (L-FMC) within either group. The composite end-point of vascular reactivity (COM) increased after HIIE (Pre: 5.64 ± 3.21 , Post: $8.57 \pm 3.16\%$, $P < 0.01$) but not MOD ($P = 0.56$). Exercise x time interactions were observed for COM ($P = 0.02$), peak diameter ($P = 0.05$), and a trend for FMD (HIIE-Pre: 5.44 ± 4.11 , Post: $7.58 \pm 5.99\%$ vs. MOD-Pre: 6.3 ± 2.89 , Post: $4.2 \pm 5.75\%$, $P = 0.09$). **CONCLUSION:** We observed more positive shear stress during MOD and more negative during HIIE. These differences in exercise shear stress during exercise may result in more vascular reactivity after HIIE compared to MOD as well as potentially explain differences observed in the chronic adaptations to these distinct exercise protocols.

3522 Board #5 June 3 9:00 AM - 11:00 AM
Eccentric Exercise And Microvascular Function: Protective Role Of Dietary Nitrate And Antioxidants?

Ryan G. Larsen¹, Jens M. Thomsen¹, Rogerio P. Hirata¹, Jens B. Frøkjær², Thomas Graven-Nielsen¹. ¹Aalborg University, Aalborg, Denmark. ²Aalborg University Hospital, Aalborg, Denmark.
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(No relationships reported)

Exercise involving eccentric contractions results in reduced muscle function. Blood oxygen level dependent (BOLD) MR imaging has demonstrated slowed microvascular reactivity in eccentrically exercised tibialis anterior (TA) muscle. While the mechanism is unclear, exercise-induced inflammation and oxidative stress may reduce nitric oxide (NO) bioavailability, and consequently slow microvascular reactivity. **PURPOSE:** To test the hypotheses that ingestion of dietary nitrate or antioxidants preserve microvascular reactivity following eccentric exercise. **METHODS:** Thirty young men and women were randomized into three groups, who ingested a single dose of: i) beetroot juice (BR, 8.4mmol NO_3^-), ii) antioxidants (AO, Vitamin C and E, alpha-lipoic acid), or iii) placebo (PLA, fruit juice) at 46 hours after an exercise protocol. The

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 bilaterally 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 leg-by-session interactions for 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 ± 0.4 vs. 10.1 ± 0.4 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: 36.8 ± 5.7 vs. 54.5 ± 8.5 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.

3523 Board #6 June 3 9:00 AM - 11:00 AM
Endothelium-Dependent Vasodilation following Bikram Yoga Practiced in Hot and Thermoneutral Conditions
 Stacy D. Hunter, Jitanan Laosiripisan, Ahmed Elmenshawy, Hirofumi Tanaka, FACSM. *University of Texas at Austin, Austin, TX.* (Sponsor: Hirofumi Tanaka, FACSM)
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 (No relationships reported)

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

3524 Board #7 June 3 9:00 AM - 11:00 AM
Greater Aortic Hemodynamic Responses to Muscle Metaboreflex Activation in Older Adults with Prediabetes than Diabetes
 Arturo Figueroa, FACSM, Salvador J. Jaime, Stacey Alvarez-Alvarado, Sarah A. Johnson, Neda S. Akhavan, Negin Navaei, Shirin Pourafshar, Bahram H. Arjmandi. *Florida State University, Tallahassee, FL.*
 (No relationships reported)

PURPOSE: Wave reflection measures (augmentation pressure [AP] and index [AIx]) are similarly increased in adults with type 2 diabetes (T2D) and prediabetes (PRET2D) suggesting high cardiovascular risk. An exaggerated blood pressure (BP) response to muscle metaboreflex activation induced via post-exercise muscle ischemia (PEMI) following isometric handgrip exercise has been reported in patients with T2D. The purpose of this study was to examine the wave reflection responses to PEMI in adults with PRET2D and T2D. **METHODS:** 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 ± 6.3 y) with PRET2D ($n = 12$) and T2D ($n = 12$). **RESULTS:** Vascular parameters were similar at rest. Aortic systolic BP (PRET2D $\Delta 42 \pm 13$ mmHg vs. T2D $\Delta 31 \pm 10$ mmHg, $P < 0.001$ for both), pulse pressure (PRET2D

$\Delta 22 \pm 9$ mmHg vs. T2D $\Delta 13 \pm 10$ mmHg, $P < 0.001$ and $P < 0.01$, respectively) and AP (PRET2D $\Delta 13 \pm 5$ mmHg vs. T2D $\Delta 9 \pm 5$ mmHg, $P < 0.001$ for both) responses to PEMI were greater ($P < 0.05$) in PRET2D compared with T2D patients. The aortic diastolic BP, AIx, AIx adjusted at 75 bpm, and time to reflection responses to PEMI were similar in PRET2D and T2D. **CONCLUSIONS:** Our findings show that aortic hemodynamic responses to exercise-related metabolites are exaggerated in PRET2D. These findings suggest that an increased left ventricular afterload during muscle metaboreflex activation may contribute to augment cardiovascular risk in adults with PRET2D.

G-18 Clinical Case Slide - Cervical Spine

Saturday, June 3, 2017, 9:00 AM - 10:40 AM
 Room: 406

- 3525 **Chair:** Joseph Ihm, FACSM. *Rehabilitation Institute of Chicago, Chicago, IL.*
 (No relationships reported)
- 3526 **Discussant:** Scott Laker. *University of Colorado, Denver, CO.*
 (No relationships reported)
- 3527 **Discussant:** Matthew Sedgley. *MedStar Ortho and Sports Medicine, Ellicott City, MD.*
 (No relationships reported)
- 3528 June 3 9:00 AM - 9:20 AM
Reoccurring Neck Injury in a College Football Player
 Brian Toedebusch, Brian Davis, FACSM. *University of California - Davis, Sacramento, CA.*
 (No relationships reported)
- HISTORY:** A 20-year-old male community college football defensive end developed left shoulder paresthesia during a game. He was tackling an opponent and his head was forced into a left lateral rotation. After this, he developed immediate paresthesia in the left upper trapezius and upper deltoid. He was evaluated on the side line by medical staff and removed from the remainder of 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. **DIFFERENTIAL DIAGNOSIS:** 1. Upper trunk brachial plexopathy 2. Cervical radiculopathy 3. Cervical stenosis **TEST AND RESULTS:** 1. Cervical spine anterior-posterior, lateral and flexion-extension radiographs: No fracture or destructive change, disc spaces preserved, no pathologic movement 2. Cervical Magnetic Resonance Imaging: Left paramedian/foraminal disc protrusion at C3-4 resulting in moderate left foraminal stenosis and displacement of left C4 nerve root. No spinal canal stenosis or ligamentous injury. **FINAL WORKING DIAGNOSIS:** Left C4 radiculopathy **TREATMENT AND OUTCOMES:** 1. Orthopaedic spine referral determined to treat with non-operative management 2. Physical therapy for cervical strengthening, flexibility, and traction 3. Currently being withheld from competition with undetermined return to play date
- 3529 June 3 9:20 AM - 9:40 AM
Differential Diagnosis of Quadriplegia in an Otherwise Healthy Adult Male by a Physical Therapist
 Megan Krueger, Eric Reyes. *Harris Health System, Houston, TX.*
 Email: megan.krueger@harrishealth.org
 (No relationships reported)
- HISTORY:** A 52-year-old male was referred to Physical Therapy (PT) by his primary care physician for progressive quadriplegia related to suspected peripheral neuropathy (PN). The patient was healthy and active until two years prior when

he began experiencing weakness and paresthesias 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. However, a sinister diagnosis was suspected due to the involvement of all four extremities without risk factors for polyneuropathy. At that time, no further steps were taken as the patient did not follow up in clinic.

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 hypertonicity and hyperreflexia. This presentation was no longer consistent with the working diagnosis of PN (see table).

Cognition	Normal
Cranial Nerves	Normal
Motor	Positive for proximal quadriparesis*
Sensation	Positive for impaired arms/legs/saddle distribution
Tone	Positive for hypertonicity and muscle spasms*
Reflexes	Positive for hyperreflexia and clonus*
Gait & Balance	Unable to stand/ambulate*
Coordination	Normal
* denotes red flag	

DIFFERENTIAL DIAGNOSIS:

1. Cervical spine stenosis with myelopathy
2. Space occupying lesion in cervical region
3. Progressive motor neuron disease

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.

3531 June 3 9:40 AM - 10:00 AM

17 yo Football Player with Central Cord Syndrome after Negative Initial Neck Exam

Hersch Bhatia¹, Teri McCambridge². ¹University of Maryland, Baltimore, MD. ²Towson Sports Medicine, Baltimore, MD. (No relationships reported)

HISTORY: A 17 year old HS football receiver was injured when he sustained a hit from the opposing safety. Reported mechanism by opposing player was shoulder to head impact. He fell to the ground in the prone position. He was immediately evaluated on the field by the nearby opposing athletic trainers. He had no LOC, no neck pain on the field, and he denied tenderness to palpation. He complained of having the wind knocked out of him. He reported that he got hit in the back of the leg and it felt odd. He had an ACL brace on his right knee. Care was transitioned to his team athletic trainers. He was turned supine and his helmet was removed. Afterwards, his right arm was noted to be in an awkward position. He could not move his arms or his legs. He had good sensation but had tingling in his upper and lower extremities. He had no prior history of weakness, neck pain, or concussion. His neck was immobilized. He regained motion in the upper extremity, but continued to demonstrate weakness in grip strength. He could not move his lower extremity. On EMS arrival he was spine boarded, and then taken to the ED for further management. **PHYSICAL EXAMINATION:** He was AO x 3. He had no tenderness over the cervical spinous processes and paraspinal muscles. He had normal sensation of his bilateral extremities. After being turned supine and having his helmet removed, he developed weakness of his upper and lower extremities, but no sensory deficit. Respiratory and Cardiovascular exams were normal. **DIFFERENTIAL DIAGNOSIS:**

1. Central Cord Syndrome
 2. Anterior Cord Syndrome
 3. Posterior Cord Syndrome
 4. Brown-Sequard Syndrome
 5. Concussion
 6. Intracranial Hemorrhage
 7. Acute disk herniation
 8. Epidural Hematoma
 9. Syringomyelia
- TEST AND RESULTS:** CT Head, XR C, T, L spine: No fracture or bleed MR C-spine: Congenital stenosis of the spinal canal, with endplate osteophytes/protrusions moderately narrowing the spinal canal to 8 mm at C3-4, with expansile T2 signal suggestive of edema within the cervical spinal cord at C3-4 levels. **FINAL/WORKING DIAGNOSIS:** Traumatic Cervical Myelopathy superimposed on Congenital Stenosis of Spinal Canal **TREATMENT AND OUTCOMES:** 1. Immobilization with Miami J Collar 2. Admitted to the hospital for observation. 3. Sensory and strength deficits improved during stay. 4. Transferred to an intensive inpatient activity based rehabilitation facility.

3532 June 3 10:00 AM - 10:20 AM

Neck Injury

Özlem G. Ülger¹, Aynur 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. Vertebral 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 mm, intervertebral 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)

Victor Lopez Jr¹, Richard Ma², Douglas E. James³, Michael S. Wilinski⁴, Answorth A. Allen⁵. ¹Rugby Research and Injury Prevention Group, Inc, Hospital for Special Surgery, New York, NY. ²Missouri Orthopaedic Institute & Thompson Laboratory for Regenerative Orthopaedics, Columbia, MO. ³State University of New York Medical Center (Downstate), Brooklyn, NY. ⁴Lake Erie College of Osteopathic Medicine, Bradenton, FL. ⁵Hospital for Special Surgery, New York, NY. (Sponsor: Robert C. Cantu, FACSM) Email: drvictorlopezjr@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 droop, decreased left sided upper and lower extremity sensation, reflexes and strength. Symmetrical radial pulses with brisk capillary refills. **DIFFERENTIAL DIAGNOSIS** 1. Cervical Neck Injury 2. Stroke 3. Fracture Clavicle 4. Rib Fracture 5. Scapular Fracture 6. Sternal Fracture **TEST AND RESULTS:** Chest anterior-posterior radiographs: -abnormal right SCJ MRI Brain no contrast: -Large area/acute infarction. Mass effect of right lateral ventricle. No hydrocephalus. Midline shift 1-2mm. CT brain no contrast: -Right MCA infarction with right frontal/parietal lobes, insular cortex, thalamus, caudate nucleus, internal/external capsule, and lentiform nucleus. -Mass-effect on the right lateral and third ventricles. Increased midline shift 8mm. No hydrocephalus. Carotid Duplex: -Arteries bilaterally, normal velocities/waveforms. CT chest: -Right clavicular head dislocated posterior to the sternum, in the superior mediastinum. Subperiosteal hematoma around proximal right clavicle. **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 Nattiv, FACSM. *University of California Los Angeles, Santa Monica, CA.* (Sponsor: Aurelia Nattiv, 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:

BMI 17.4. Blood pressure 100/60. Heart rate 56. No acne, hirsutism, or oral lesions. Lanugo present. Minimal secondary sexual development.

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 stress reactions on the weight that she had been required to gain.

Upon return in the fall, the triad risk score remained high with a further decline of BMI to 17.2, and still no menarche. The athlete was placed back on contract. She remains

resistant to meeting with the psychologist, but continues to see the dietitian and team physician. She narrowly cleared her minimum weight requirement (restricting her training to 30mi/week). Free T3 was 53.6 and total T3 was 59 suggesting ongoing low energy state. She remains provisionally cleared.

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:

Afebrile. Muscle strength 4/5 with bilateral shoulder elevation and abduction. Strength 5/5 with elbow flexion and extension. Bilateral hip flexor strength 3/5. Sensation intact in upper and lower extremities bilaterally. Deep tendon reflexes 2+ bilaterally. Scaly erythematous rash on each side of nose. Erythema present across knuckles bilaterally.

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.

MRI 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 methotrexate, 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)
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(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 ranitidine. At a three month follow-up, the patient reported abdominal pain despite taking ranitidine twice daily. She was diagnosed with dyspepsia and irritable bowel syndrome at gastroenterology. Ultimately, she was unable to complete her cross country season. Six months later, the patient started training for nordic skiing and now presents with escalating headaches. Her mother believes 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.

PHYSICAL EXAMINATION: Examination revealed Body Mass Index: 21.04, HEENT: PERLLA, EOMI. NECK: no masses LUNGS: clear CV: RRR GI: hard stool palpated in the LLQ

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/MRA/MRV:
 -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 50mcg 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. Rivera-Brown, FACSM, William F. Micheo, FACSM. *University of Puerto Rico School of Medicine, San Juan, Puerto Rico.*
 Email: jjcorrea@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.

PHYSICAL EXAMINATION: Normal vital signs (BP: 116/68; HR: 68 bpm), alert, does not remember details of race. Normal cardiovascular, pulmonary, musculoskeletal and neurological exam.

DIFFERENTIAL DIAGNOSIS:

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

TEST AND RESULTS:

In ER: According to the athlete's parents: his blood pressure was low, body temperature was not measured nor any blood analysis performed. He was discharged with a diagnosis of "dehydration".

Two days after discharge from ER his primary care physician ordered urinalysis and CBC: Blood and protein trace in urine; Blood glucose=84 mg/dL; Creatinine=0.94 mg/dL; Na⁺= 142 and K⁺= 4.7 mmol/L; AST: 1,923 and ALT: 1,996 U/L. CK was not ordered.

At 9 days: AST: 100 and ALT: 424 U/L; CK ordered but not done.

At 16 days: AST: 55 and ALT: 170 U/L; CK=151 U/L

Five weeks after discharge from ER: Heat Tolerance Test (running outdoors @ 12.8 to 13.8 km/hr in 32°C, 75% RH). Test stopped at 40 min when T_e=39.3°C. HR=145-173 bpm. Sweat rate=1.8 L/h; Fluid replaced=16% Dehydration=1.9%; Rating of hot/overheated= 8 and thirst= 8 (0-10 scale).

FINAL/WORKING DIAGNOSIS:

Exertional heat stroke related to inadequate heat acclimatization.

TREATMENT AND OUTCOMES:

1. Allowed to swim and run in cool environment after 2 weeks at reduced pace but no running in the heat for 5 weeks.
2. Recommendations about proper hydration and gradual heat exposure to acclimatize to heat.
3. Referred to sports psychologist.
4. Repeat heat tolerance test for clearance to compete in the heat.

3541 June 3 10:20 AM - 10:40 AM

Gastrointestinal - Track and Field

Katherine Langley, Jocelyn Gravlee. *University of Florida, Gainesville, FL.*
 Email: langleykj@ufl.edu
 (No relationships reported)

HISTORY: A collegiate track athlete presented with a two-day history of nausea, non-bloody, non-bilious vomiting, bloating, inability to tolerate PO, and waves of sharp,

crampy abdominal pain. He denied fevers, chills, diarrhea, sick contacts, or recent NSAID or alcohol use. His last bowel movement was two days prior. He endorsed a history of similar symptoms due to constipation that resolved with a laxative suppository. He was evaluated the previous day and noted to have mild epigastric and RLQ tenderness. He was able tolerate PO after Zofran ODT and discharged with strict return precautions. Surgical history includes laparoscopic right sports hernia repair with mesh, open right adductor tenotomy, and umbilical hernia repair in 2014 and left adductor tenotomy in 2016.

PHYSICAL EXAMINATION:

Afebrile, normotensive, bradycardic.

Appears uncomfortable.

Abdomen soft. Bowel sounds present. Epigastric tenderness to palpation. Voluntary guarding. No rebound.

DIFFERENTIAL DIAGNOSIS:

1. Gastritis
2. Constipation
3. Ileus

TEST AND RESULTS:

Abdominal radiographs showed gaseous small bowel distension in a non-obstructive pattern with a large amount of stool in rectal vault. He received IV fluids, glycerin suppository, and a Fleet enema with no bowel movement but recurrent emesis. Repeat Fleet enema, 4 mg IV Zofran, and additional IV fluids were given. On re-examination he had worsening abdominal tenderness and guarding. He was transferred to the ED and the differential diagnosis was broadened to include small bowel obstruction and intraabdominal perforation. On arrival to the ED he was in distress with significant bilateral lower quadrant tenderness, rebound, and guarding. CT abdomen and pelvis showed a high-grade distal small bowel obstruction with moderate wall edema along distal ileum with concern for vascular compromise.

FINAL/WORKING DIAGNOSIS:

Small bowel obstruction related to prior sports hernia repair

TREATMENT AND OUTCOMES:

1. Emergently to OR for exploratory laparotomy.
2. Intraoperatively found to have herniation of distal ileum through peritoneum in RLQ inferior to prior mesh placement for sports hernia repair. Herniated loop of bowel non-viable with chronic ischemic changes and stricture requiring 30 cm resection and ileoileostomy.
3. Uneventful post-operative course.
4. Return to sport pending.

G-26 Free Communication/Poster - Beyond the Bounds Category!

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

3554 Board #1 June 3 8:00 AM - 9:30 AM

Photographic Method for Measuring Body Composition by Level of Physical Activity Level in Adults

Amber Kinsey, Howard W. Wiener, Ligaj Prahdan, Olivia Affuso, FACSM. *University of Alabama at Birmingham, Birmingham, AL.* (Sponsor: Olivia Affuso, FACSM)
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 (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_{DXA} and %BF_{PHOTO} 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 women and men 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

3555 Board #2 June 3 8:00 AM - 9:30 AM

Cannabis Use And Neurological Disease: An Alternative Therapy To Improve Neurological Disability?

John Harvey Kindred¹, Kaigang Li¹, Nathaniel B. Ketelhut¹, Felix Proessl¹, Brett W. Fling¹, William R. Shaffer², Thorsten Rudroff, FACSM¹. ¹Colorado State University, Fort Collins, CO. ²Banner Health, Greeley, CO. (Sponsor: Thorsten Rudroff, FACSM)

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(No relationships reported)

Medicinal cannabis use has a long history. Despite this fact current federal regulations greatly restrict research into the medicinal uses of cannabis, although this sentiment is changing. **PURPOSE:** To investigate cannabis use parameters in people with neurological diseases. **METHODS:** An anonymous online survey was created using modified neurological assessment questionnaires, Guy's Neurological Disability Scale and Nottingham Health Profile, and posted to the National Multiple Sclerosis Society and Michael J. Fox Foundation websites. The survey also included measures of past/current cannabis use, fatigue (Fatigue Severity Scale), balance confidence (Activities of Balance Confidence), physical activity (International Physical Activities Questionnaire), pain (visual analogue scale), and spasticity. The survey was available online from 15 Feb 2016 to 15 Oct 2016. **RESULTS:** There were a total of 637 records with 52% (n = 326) men and 48% (n = 311) women (mean: age 57 SD 13; BMI 27 SD 5.7). Forty-three percent (n = 277) reported currently using cannabis, although 57% (n = 158) do not have a state medical marijuana card. Smoking was the most common method of use (79%, n = 213). Among the cannabis users 75% (n = 204) have been using for > 1 year and 48% (n = 131) are using 7 days a week. Most, 85% (n = 231), felt that cannabis at least moderately improved their symptoms. Medicinal purposes (74%, n = 200) were reported as the reason for use and 60% (n = 164) stated a reduction in the use of other medications due to cannabis. Of the non-users 75% (n = 265) have considered using cannabis to help manage their disease symptoms, and 97% (n = 344), said they would use cannabis if scientifically shown to help ease disease burden. There appears to be no difference in physical activity participation between the cannabis users and non-users (t-tests: $p > 0.128$). **CONCLUSIONS:** A large proportion of neurological patients are currently using cannabis to treat their disease and/or symptoms. Current medical knowledge on the benefits and consequences of both short- and long-term cannabis use are unknown in this population. It is imperative to establish the effects of cannabis so that physicians and patients can make the most informed decisions about whether adding cannabis to the current pharmacological regiment is both effective and safe.

3556 Board #3 June 3 8:00 AM - 9:30 AM

Identifying Politically Motivated Medical Withdrawals From International Competition

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(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. Failing 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 competing 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 suspect action using available entry and withdrawal data and move 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. Rooks, Katie P. Logsdon, B. Joseph McEntire, Valeta Carol Chancey. U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL.

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(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. None of the ESs evaluated were compatible with grappling drills. **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

Andreia Naves¹, Valden Capistrano Júnior², Maria Elisabete Amaral de Moraes². ¹VP Research Institute, São Paulo, Brazil. ²Federal 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 sodium diclofenac single oral dose. Hematologic and biochemical analysis and body composition (bioelectrical impedance method) were obtained before and after the admission 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 1 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 ($r = -0.4406, p = 0.0312$), 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 (AUC_{0inf}) and lean mass ($r = -0.4908, p = 0.0149$), intracellular water ($r = -0.4401, p = 0.0314$), extracellular water ($r = -0.4946,$

p=0,0140) and basal metabolic rate (r=-0,5023, p=0,0124); and between maximum concentration (Cmax) observed and lean mass (r=-0,7290, p<0,0001), intracellular water (r=-0,6750, p=0,0003), extracellular water (r=-0,7519, p<0,0001) and basal metabolic rate (r=-0,7505, p<0,0001).

CONCLUSIONS: The results showed that low values of AUC0-24 e AUC0inf were associated with greater values of lean mass body, intracellular water, extracellular water and basal metabolic rate. The optimization of diclofenac dose based on these parameters can avoid doses of errors in prescribing, optimization of treatment outcome and minimize side effects.

3559 Board #6 June 3 8:00 AM - 9:30 AM

Reaction Time Assessment of Sickle Cell Anemia Children

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Children with Sickle Cell Disease (SCD) may have had brain damage throughout childhood that lead in neuropsychomotor changes, such as an increase in reaction time (RT). An evaluation of RT can aid in the early detection of increased brain information processing speed. This capability is of fundamental importance for full child development and can be assessed by tests such as psychometric tests and motor skills tests or computer games. In this study, the assessment was performed using an easy to handle toy-like device, developed for this purpose in Arduino platform. **PURPOSE:** To evaluate the RT in children with sickle cell anemia (SCA), using simple reaction time (SRT) and choice reaction time (CRT) tests. **METHODS:** The 46 participants, 24 SCA group (9,41±1,97 yrs) and 22 healthy children of control group (CON) (8,33±1,54 yrs), were subject to the tests SRT and CRT developed on Arduino platform. Children had to trigger the fastest response possible button, after seeing the luminous stimulus. The Arduino was programmed to generate random light stimuli, according to the purpose of each test, as well as the capture, transfer and register the data of motor responses on the computer via Bluetooth. **RESULTS:** SRT was significantly higher (p<0.01) in children with SCA (747,80 ± 523,58 ms) when compared to CON (364,48 ± 90,66 ms). In SCA group the SRT (478,06 ± 114,03 ms) was significantly lower when compared with the CRT (747,80 ± 523,58 ms). **CONCLUSIONS:** Children with SCA have a higher CRT than children without the disease.

3560 Board #7 June 3 8:00 AM - 9:30 AM

Evaluating the Science for Physical Activity Policy

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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.

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

3561 Board #8 June 3 8:00 AM - 9:30 AM

Updating The Physical Activity Guidelines For Americans: Priority Topics And Research-Related Issues

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(No relationships reported)

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 health 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.

3562 Board #9 June 3 8:00 AM - 9:30 AM

Promotion Of Nutrition Care By Australian Fitness Businesses: A Website Analysis

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(No relationships reported)

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* if being beyond scope if they advertised services that were not clearly in line within national nutrition guidelines, or *beyond scope* if they advertised nutrition care beyond the fitness professional scope of practice, such as personalized dietary prescription outside of national dietary guidelines. **Results** Of the businesses reviewed, 15% advertised content classed as *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.

3563 Board #10 June 3 8:00 AM - 9:30 AM

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

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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. T-tests revealed 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, copyrights 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.

G-27 Free Communication/Poster - Chronic Disease and Nutrition

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

3564 Board #11 June 3 8:00 AM - 9:30 AM

Influence of Ischemic Preconditioning on Glucose Tolerance in Obese and Overweight Adults

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(No relationships reported)

The ergogenic and protective cardiovascular benefits of ischemic preconditioning (brief and repeated occlusion of blood flow) have been well described; it is unclear if ischemic preconditioning also provides metabolic benefit. **PURPOSE:** To determine the influence of lower limb ischemic preconditioning on glucose regulation in overweight and obese adult humans. **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, without affecting the circulating insulin response. In addition to possessing ergogenic and protective cardiovascular properties, ischemic preconditioning may also provide metabolic benefit to overweight and obese adults.

3565 Board #12 June 3 8:00 AM - 9:30 AM

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

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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 ± 9.7 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 VO_{2max} . 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.

3566 Board #13 June 3 8:00 AM - 9:30 AM
Multiple Short Bouts Of Walking Activity Attenuate Blood Glucose Response In Obese Women
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PURPOSE: We sought to determine the effect of 2 and 5-min multiple walking breaks interspersed during sedentary time on blood glucose responses in sedentary obese women.

METHODS: 10 obese women (age = 36.1±16.3, BMI = 38.0±5.2, Body Fat= 49.57±4.35%) participated in this crossover-design study. All participants completed three conditions in randomized order; 1) 4-h of continuous sedentary behavior (SED), 2) 4-h of sedentary behavior with 2-min of walking at a moderate intensity every 30-min (SED+2m), and 3) 4-h of sedentary behavior with 5-minutes of walking at a moderate intensity every 30 minutes (SED+5m). 48-h of 'washout' occurred between conditions. A Continuous Glucose Monitor System (CGMS) was positioned on each participant's abdomen region for the entire experiment with calibration to "finger-stick" glucose values occurring 4 times/day. Body composition was assessed with iDXA and the actigraph accelerometry was used to assess sedentary behavior and physical activity.

RESULTS: 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 (PPG)-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 each 30 minutes to interrupt sedentary behavior can attenuate PPG excursions in sedentary obese women.

3567 Board #14 June 3 8:00 AM - 9:30 AM
The Effects Of Malnutrition On Muscle Strength And Self Care Ability Of Elderly Living Alone In Taiwan
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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 malnutrition 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% ($t_{(227)} = 4.401$, $p < 0.000$), 9% ($t_{(227)} = 4.947$, $p < 0.000$) and 23% ($t_{(227)} = 5.822$, $p < 0.000$), 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.

3568 Board #15 June 3 8:00 AM - 9:30 AM
Association Between Nutritional Risk, Physical Function, and Physical Activity in Older Adults
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Under nutrition in older adults leads to increased incidence of illness, disease, disability, slow recovery, and poor outcomes, as well as worsening of existing disease and illness. While community based exercise programs are available to help older adults improve mobility and increase physical activity (PA) levels, screening for adequate nutrition is often overlooked and may impede improvements in mobility and PA. **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 6MW ($r = .12$). **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.

3569 Board #16 June 3 8:00 AM - 9:30 AM
Effects of A Kefir Diet on Kidney Antioxidant Enzymes of Rats Treated with Doxorubicin
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 (No relationships reported)

Doxorubicin (DOX) is a potent chemotherapy drug whose mechanisms of action includes generation of reactive oxygen species (ROS), and as such, its use as an anticancer drug is limited by toxicities in non-cancer cells. The kidney is susceptible to oxidative stress (OS), and it has been shown previously that DOX disrupts antioxidant enzyme expression. Exogenous antioxidant administration has been shown to minimize OS associated with kidney injury, and as such, interventions to protect against DOX-induced antioxidant disruption in the kidney would be of benefit. The fermented milk product kefir (K) has antioxidant properties and acts to protect against ROS-induced cell damage, but K's effect on the DOX treated kidney has yet to be explored. **PURPOSE:** To examine the expression of catalase (CAT), glutathione peroxidase (GPx) and cytosolic superoxide dismutase (SOD1) in the kidney of rats fed K prior to and during DOX treatment. **METHODS:** Male rats were randomly assigned to one of four groups: kefir+saline (K+S), kefir+DOX (K+D), milk+saline (M+S), or milk+DOX (M+D). Rats were fed either a diet supplemented with K or a milk-based control diet for 8 weeks before and after receiving 15 mg/kg DOX or saline (SAL) as a placebo. Five days after injections, kidneys were excised and Western blotting was performed to assess CAT, GPx, and SOD-1 expression. **RESULTS:** No significant drug effect ($p = 0.11$), diet effect ($p = 0.08$), or interaction ($p = 0.76$) was observed for CAT, and a 26% greater CAT expression was observed in K+D when compared to M+D. With GPx expression, no significant drug effect ($p = 0.09$), diet effect ($p = 0.11$), or interaction ($p = 0.66$) was observed, and K+D had a 32% lower GPx expression than M+D. No significant SOD-1 drug effect ($p = 0.07$), diet effect ($p = 0.61$), or interaction ($p = 0.46$) was observed, and K+D had a 27% lower SOD1 expression than M+D. **CONCLUSIONS:** DOX did not significantly alter kidney CAT, GPx, or SOD1 expression in K or M fed animals suggesting no significant protective effect of chronic K feeding on kidney antioxidant expression versus chronic M feeding. Future work, however, should include standard chow as a control diet to better elucidate the impact DOX has on kidney as it is possible that both K and M were protective against the antioxidant changes typically observed with DOX.

3570 Board #17 June 3 8:00 AM - 9:30 AM
Pre-adolescent Cardio-metabolic Associations And Correlates: Pacmac
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The process of atherosclerosis is increasingly frequently initiating during preadulthood. 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 fitness 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 estimated using the Youth Physical Activity Questionnaire. Nutritional behavior was evaluated using the New Zealand Adolescent Food Frequency Questionnaire (processed food, fruit/veg 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 glycosylated 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 pre-adolescent children, and each of the underlying cardiometabolic health factors is associated with different lifestyle behaviors.

3571 Board #18 June 3 8:00 AM - 9:30 AM
Cardio-metabolic Risk Variables In Pre-adolescent Children - A Factor Analysis
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BACKGROUND: Atherosclerosis begins during pre-adolescence and is occurring at an accelerated rate. This acceleration has been linked to poor lifestyle behaviors and subsequent cardio-metabolic complications. Although the clustering of cardio-metabolic risk factors has been recognized for well over two decades, previous studies in children have predominantly examined the relationships between atherosclerosis and individual cardio-metabolic risk factors, or have grouped together pre-adolescent and adolescent children. Further, no known studies have included glycosylated haemoglobin (HbA1c), or central hemodynamic measures such as central blood pressure (cSBP) and augmentation index (AIx). **PURPOSE:** In pre-adolescent children, explore the: (1) underlying factors that explain cardio-metabolic risk factors using principle components analysis; (2) unique value of HbA1c, cSBP and AIx; (3) associations between cardio-metabolic risk factors and overweight-obese status. **METHODS:** Principle component analysis was performed on 392 children (9.54 y, 50% F) from three representative sample sites across New Zealand. **RESULTS** Four factors explained 60% of the variance in the measured variables. In order of variance explained, the factors were: blood pressure (cSBP, peripheral systolic and diastolic blood pressure), adiposity (waist circumference, body mass index, HbA1c), lipids (total cholesterol, low-density lipoproteins, high-density lipoproteins) and vascular (AIx, heart rate, fasting blood glucose [FBG]). For each factor, except lipids, the overweight-obese had a small-large likelihood of having higher (worse) risk scores.

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 vascular, 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-adolescents were found to have worse scores for the adiposity, blood pressure and vascular factors.

3572 Board #19 June 3 8:00 AM - 9:30 AM
Daily Heart Rate in Relation to Cardiorespiratory Fitness and Metabolic Syndrome in HIV+ Hispanic Adults
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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- Hispanic 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 (78.3±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<0.05 for all). VO₂ peak was inversely correlated with 24-hr HR, daytime HR, and night-time 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=85.0±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±9.9 bpm, P=0.009; daytime HR: low=74.1±4.9 vs. high=66.8±9.4 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:** These 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 8U54MD 007587-03.

3573 Board #20 June 3 8:00 AM - 9:30 AM
Response Of The Serum Metabolic Fingerprint To Postprandial Vs. Postabsorptive Exercise In Overweight Sedentary Men
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In individuals with cardiometabolic 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, PpEx) and HIIE in the fasted state (postabsorptive exercise, PaEx). Blood samples were collected before and immediately after exercise for targeted metabolomic analysis by liquid chromatography-mass spectrometry (HLIC-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 ±

8 %; $p = 0.03$), glutamate (PpEx, $-23 \pm 13\%$ vs PaEx, $2 \pm 17\%$; $p = 0.04$), serine (PpEx, $3 \pm 9\%$ vs PaEx, $3 \pm 16\%$; $p = 0.01$), threonine (PpEx, $9 \pm 13\%$ vs PaEx, $3 \pm 21\%$; $p = 0.01$), and uridine (PpEx, $1 \pm 20\%$ vs PaEx, $20 \pm 23\%$; $p = 0.01$). Partial least-square discriminant analysis separated the metabolic fingerprints of PpEx and PaEx immediately after exercise ($R^2Y = 0.935$, $Q^2Y = 0.629$, $CV\text{-ANOVA} = 0.03$). Discriminating metabolites with VIP score > 1 were: leucine-isoleucine, lysine, and tryptophan, which were higher after PpEx; and acetylcarnitine, hypoxanthine, taurine, pyruvate, and lactate, which were higher after PaEx. **CONCLUSION:** The response of the serum metabolic fingerprint to exercise in overweight sedentary men depends on the prior consumption of a meal. Our findings support the value of metabolic fingerprinting in the study of exercise metabolism.

**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**

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(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. **METHODS:** Eight middle-aged (39.5 ± 9.9 y), trained but non-elite ($VO_{2peak} = 48.5 \pm 4.5$ ml/kg/min) runners (1.77 ± 0.08 m; 81.7 ± 7.0 kg; $19.3 \pm 6\%$ body fat) served as participants. Venous blood was drawn from an antecubital vein after an overnight fast with standardized 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 VLDL-C and Lp(a). **CONCLUSION:** Implementing a HFLC does not appear to elicit significant negative cardiovascular disease risk in male runners 30-50 years of age with desirable pre-intervention lipid and glucose marker status.

**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.**

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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 exercise makes it a potential adjuvant to therapeutic LCHF diets. **PURPOSE:** To determine the impact of a short-term 1) LCHF diet, 2) LCHF diet with daily post-meal walking (LCHF+PW) and 3) low-fat, low glycemic index "guidelines" (G) diet on glucose control, markers of cellular inflammation, and cardiovascular risk factors in patients with T2D. **METHODS:** Nine individuals with T2D (age: 63 ± 9 , HbA1c: 6.7 ± 0.9 , means \pm SD) completed three isocaloric 4-day controlled diet conditions in a randomized crossover design. The LCHF+PW diet included three daily 15-min post meal walks at a light-to-moderate intensity. Glucose profiles were assessed by continuous glucose monitoring. Fasting blood samples were obtained before and after each intervention to measure glucose and lipids. Cellular markers implicated in the pro-inflammatory effects of excess lipids, including monocyte toll-like receptor 2 (TLR2) and 4 (TLR4) and platelet-monocyte aggregates (PMA), were measured by flow cytometry. **RESULTS:** When compared to G (7.3 ± 1.2 mmol/l), both the LCHF (6.6 ± 1.3 mmol/l) and LCHF+PW (6.4 ± 1.1 mmol/l) diets decreased the 4-day

mean glucose concentrations ($p < 0.001$). PMA count per ml increased significantly after G ($+27 \pm 16\%$, $p = 0.02$) but was not significantly altered after LCHF ($+21 \pm 68\%$, $p = 0.06$) or LCHF+PW ($-0.1 \pm 42.5\%$; $p = 0.99$). Median fluorescence intensity of TLR4 on CD16+ monocytes decreased by ~4.3% ($p = 0.05$) after the LCHF diet. No other significant changes were seen in monocyte TLR2 or TLR4 (all $p \geq 0.106$). **CONCLUSIONS:** As compared to a G 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**

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(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 and greater perceived effort is due to lower peak oxygen consumption levels (VO_{2peak}). 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 VO_{2peak} more profoundly in women than men, we also hypothesized that sex would modify the association between T2D and exercise effort. **METHODS:** During assessment of VO_{2peak} , 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 VO_{2peak} . **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% VO_{2peak} (HR) and at 35% VO_{2peak} (RPE). We found no sex differences in the association between T2D and effort.

	Healthy men and premenopausal women (n = 55)	Men and premenopausal women with T2D (n = 57)	p-value
Age (yrs)	44.7 (6.3)	45.9 (6.1)	
BMI (kg/m ²)	29.4 (3.3)	30.9 (4.1)	
VO_{2peak} (ml/kg/min)	24.5 (6.6)	20.7 (4.5)	
Peak RER	1.22 (0.08)	1.21 (0.11)	
RPE at 15% VO_{2peak}	8.1 (1.5)	8.6 (1.7)	0.24
RPE at 25% VO_{2peak}	9.3 (1.5)	9.3 (2.0)	0.92
RPE at 35% VO_{2peak}	10.2 (1.5)	10.9 (1.6)	0.04*
HR at 15% VO_{2peak}	89.1 (11.5)	91.5 (9.5)	0.13
HR at 25% VO_{2peak}	93.2 (9.3)	96.8 (10.0)	0.02*
HR at 35% VO_{2peak}	101.4 (10.9)	104.2 (10.7)	0.11

Data presented as mean (standard deviation); * $p < 0.05$; Abbreviations: BMI, Body Mass Index; VO_{2peak} , 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

3577 Board #24 June 3 8:00 AM - 9:30 AM
Prediabetes And Diabetes In College-aged Students At A Hispanic-serving Institution In South Texas

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PURPOSE: To quantify the prevalence of prediabetes and diabetes in college-aged students 18-30 years old at a Hispanic-serving institution in south Texas.

METHODS: Fasting glucose levels and hemoglobin A1C levels, along with BMI from two hundred twenty college-aged students 18-30 years old (women: 152, men: 68) were quantitatively analyzed and compared with the American Diabetes Association's (ADA) 2015 prediabetes and diabetes criteria. An independent t-test between females and males identified the statistical significance and variance of the anthropometric measurements and blood biomarkers. These results were organized and analyzed by gender and colleges across campus.

RESULTS: Females fasting glucose (92.56±27.23 mg/dL), A1C levels (5.744±0.922%), as well as BMI (32.72±9.060) and males fasting glucose (96.25±27.52 mg/dL), A1C levels (5.772±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 proved 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.

3578 Board #25 June 3 8:00 AM - 9:30 AM
Omega-3-Fatty Acids Hold Therapeutic Potential for the Prevention and Treatment of Diabetic Neuropathy

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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.

End Study Values (32 wks)	Low Fat Fish Oil (LFFO)	High Fat Fish Oil (HFFO)	Low Fat Lard (LFL)	High Fat Lard (HFL)
Body 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 ^a
Glucose AUC total (mg /120 min / dl)	5368.1 ± 678.9	7282.6 ± 1144.4	7384.3 ± 685.4	9149.6 ± 1013.8 ^a
Percent paw withdrawal (%)	22.5 ± 4.5	29.2 ± 6.4	37.5 ± 7.2	54.2 ± 5.7 ^{ab}

^aP < 0.05 vs. LFFO; ^bP < 0.05 vs. HFFO; and ^cP < 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

3579 Board #26 June 3 8:00 AM - 9:30 AM
Muscle Specific Overexpression PGC-1α1 Promotes Exercise Adaptations During Western Diet Regardless Of Exercise Volume

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Obesity 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 principle 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, ~20) mice and mice with muscle-specific overexpression of PGC-1α1 (MCK-PGC-1α, ~20) were given Western Diet (WD) at 8 wks of age and allowed to consume food *ad libitum* throughout the course of the study. At 12 wks 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-1α 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-1α animals. While there was no difference at 7 wks age, at 11 wks age MCK-PGC-1α had ~50% greater GTT 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-1α -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-1α 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.

3580 Board #27 June 3 8:00 AM - 9:30 AM
Differential Metabolic Responses to Acute Fatmax and Lactate Threshold Exercise

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Improvements in glucose tolerance and insulin action with aerobic exercise may be the result of increase 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:**

Participants (aged 20.5±1.5y, BMI 29.5±4.7kg/m²) performed a VO_{2max} and baseline 2hr OGTT (n=8). Isocaloric (400 kcal) exercise sessions at FM (41±12%VO_{2max}) and LT (68±10%VO_{2max}) were performed with an OGTT ~24-hrs post-exercise. **RESULTS:** FM exercise elicited significantly (p<0.01) greater fat utilization (18.6±12.1g) than LT (10.1±20.3g) during exercise. Accordingly, LT (82.8±12.1g) exercise elicited significantly (p<0.05) greater CHO utilization than FM (62.4±20.3g) exercise. There was no significant difference in total energy expenditure between FM (416.1±11.4) and LT (422.1±10.4) exercise (p=0.2). However, AUC for glucose was significantly higher for LT exercise than baseline and FM exercise (p<0.05). MF was significantly (p<0.05) reduced post-FM (Δ120-min RER=0.04±0.03) exercise when compared to baseline (0.13±0.04). **CONCLUSION:** LT exercise appears to have deleterious effects on oral glucose tolerance acutely, however, FM exercise does not confer improved MF. These results suggest a disconnect between glucose tolerance and MF and that preferential substrate utilization does not promote comprehensive metabolic improvements acutely in young overweight men.

3581 Board #28 June 3 8:00 AM - 9:30 AM
The Relationship Between Sedentary Bout Duration And Glucose In Adults With Type 2 Diabetes
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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 64.1±10.9 yr & BMI 29.4±6.9 kg/m²). Participants completed a demographic questionnaire and wore an activPAL accelerometer and FreeStyle Libre continuous glucose monitor for 3-14 days whilst documenting sleeping, 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 = 0.47, p <0.001) and glucose coefficient of variation (r = 0.26, p <0.001) both positively correlated with sedentary bout duration. Participant characteristics 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.

3582 Board #29 June 3 8:00 AM - 9:30 AM
Effect of Short-term Exercise Training on Novel Diabetes Risk Biomarkers in Overweight/Obese Adolescents
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Several novel biomarkers of risk for diabetes in adults have been reported that have not been carefully examined in adolescents with metabolic risk factors. We previously reported that pigment epithelial derived factor (PEDF) is increased in obese adolescents and associated with insulin resistance. 2-aminoadipic acid (2AAA) was shown to predict future diabetes onset in the Framingham study, and to decline in adults following insulin sensitizer treatment. Exercise can also increase insulin sensitivity but it is unknown whether PEDF or 2AAA are altered by exercise in adolescents. **PURPOSE:** To determine whether a short-term exercise program could alter insulin sensitivity, PEDF, and 2AAA in adolescents. **METHODS:** 22 habitually inactive, overweight/obese boys and girls (15±1 y, BMI-z 1.62±0.9, BMI 94±1 %ile, 36±2% body fat) performed 2 supervised and 1 home-based exercise session per week for 5 weeks. Half of the group performed continuous moderate intensity exercise (CME; 45-min walking at 70% HRmax) while the other half performed aerobic interval training of matched total energy expenditure (AIT; 4 x 4-min at 90% HRmax with 3-min recovery intervals at 60% HRmax plus 5-min warm up and cool down). A mixed meal test with blood sampling was performed at baseline and 40 hours after

the final exercise session. **RESULTS:** At baseline, 2AAA and PEDF were positively correlated with HOMA-IR (r = 0.54 and 0.43, respectively) and inversely correlated with insulin sensitivity (r = -0.60 and -0.62, respectively). After the exercise program, body mass and composition were unchanged. The AIT group increased peak cycling power 11% and absolute VO_{2peak} 8% (p<0.05, effect size 0.3 for both) but the CME group did not increase aerobic fitness. HOMA-IR was unchanged in either group but insulin sensitivity during the meal was modestly increased, though only in the CME group (+5%, p<0.03, effect size 0.38). Neither PEDF (-4% overall) nor 2AAA (-12% overall) were significantly altered by the exercise, though the changes in their concentrations were positively correlated with one another (r=0.62). **CONCLUSION:** A short term exercise program has only modest effect on insulin sensitivity in habitually sedentary, overweight adolescents, and does not alter the concentration of either PEDF or 2AAA. Supported by NIH Grant P20 RR024215

3583 Board #30 June 3 8:00 AM - 9:30 AM
Exercise Prescription in Type 1 Diabetes: Should We Use Percentages of Maximum Heart Rate?
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Physical activity is highly beneficial in patients with type 1 diabetes (T1D). The American Diabetes Association recommends at least 150min/week of moderate intensity aerobic physical activity, defined as 50–70% of maximum heart rate (HR_{max}); however, exercise intensity prescribed as percentages of HR_{max} leads to inhomogeneous cardio-respiratory acute responses when dealing with individuals with T1D where chronic stress may affect β₁-receptor sensitivity. **PURPOSE:** To determine the exercise intensity given as percentages of HR_{max} 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±0.6%, 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 (P_{max}), respectively. The first and the second lactate turn points (LTP₁/LTP₂), as well as the direction and degree of the time course of HRPC (k_{HR}), were determined from IET and compared to 50% and 70% of HR_{max}. k_{HR}, power output (P) and HR at LTP₁ were compared between groups in relation to 50% and 70% of HR_{max}. Group differences were calculated by an ANOVA with post-hoc testing, p<0.05. **RESULTS:** No significant differences were found between both groups for HR_{max} and P_{max} (p>0.05). HR at LTP₁ vs. 50%HR_{max} and 70%HR_{max} were significantly different for both groups, except for the nT1D group at 70%HR_{max}. P at 50%HR_{max} was significantly lower than at LTP₁ in both groups; at 70%HR_{max} P was significantly higher only in T1D (p<0.05). Significant differences for P between both groups were only found at 70%HR_{max} (133±17 W vs. 91±38 W, p<0.05) 50%HR_{max} was as low as resting conditions (0 W) in 38% of the T1D group and 50% of the nT1D. k_{HR} 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%HR_{max} is clearly too low to induce any training effects even when exercising 150min/week. A lower k_{HR} 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.

3584 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, glycosylated hemoglobin (HbA1C) 6.3 ± 0.9 %) were included in this study. Maximal heart rate (HR_{max}) and oxygen consumption (VO_{2max}) were measured before and after the interventions. Participants were then randomly allocated to AT (3 times/week, 60 minutes, at 70% HR_{max}) or HIIT (3 times/week, 10 × 1:1 work-to-rest ratio, at ~85% HR_{max}) 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 \pm SD. Statistical analysis included repeated measured 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 , $P < 0.001$ for both) and increased VO_{2max} (7.65 ± 3.2 vs. 6.51 ± 3.6 , $P < 0.001$ for both). Although glucose significantly decreased in the HIIT group (-28 ± 46 $P < 0.05$), it was not significantly different compared to the no change in the AT group.

Conclusions:

Metabolic changes, 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 enjoyed high intensity training.

Table 1. Clinical, anthropometric and metabolic characteristics

	HIIT			AEROBIC		
	BASE LINE	FINAL	p	BASE LINE	FINAL	p
AGE (yr)	45.8					
WEIGHT (kg)	71.1 \pm 7.5	69.1 \pm 7.2	0.7	77.5 \pm 19.1	76.9 \pm 20.4	0.6
BMI (Kg/m ²)	29.8 \pm 4.7	28.9 \pm 4.5	0.044	31.9 \pm 7.2	31.6 \pm 7.7	0.013
SBP (mmHg)	120 \pm 10.4	121.0 \pm 9.6	0.608	123.6 \pm 15.3	120.1 \pm 16.2	0.183
DBP (mmHg)	73.9 \pm 7.7	73.5 \pm 8.0	1.000	73.8 \pm 6.9	72.8 \pm 7.6	0.711
BF (%)	35.1 \pm 6.9	33.4 \pm 7.2	0.071	37.0 \pm 9.5	36.9 \pm 10.4	0.944
MUSCLE MASS (%)	43.4 \pm 3.6	43.4 \pm 4.0	0.829	44.1 \pm 8.15	44.6 \pm 7.6	0.638
WAIST C. (cm)	95.8 \pm 10.3	90.8 \pm 9.6	0.003	101.4 \pm 16.7	99.1 \pm 16.5	0.001
GLUCOSE (mg/dl)	156.80 \pm 60.68	112.38 \pm 33.48	0.023	142.20 \pm 50.58	145.50 \pm 7.98	0.951
HbA1C (%)	6.30 \pm 0.93	5.73 \pm 0.75	0.144	6.34 \pm 0.89	6.55 \pm 1.28	0.593
CT (mg/dl)	181.86 \pm 36.08	187.07 \pm 47.16	0.205	196.93 \pm 36.99	192.58 \pm 47.20	0.478
HDL-C (mg/dl)	55.60 \pm 10.14	55.76 \pm 13.24	0.857	51.33 \pm 11.51	52.41 \pm 12.95	0.542
LDL-C (mg/dl)	90.60 \pm 26.70	100.61 \pm 38.82	0.079	105.46 \pm 33.83	103.83 \pm 34.61	0.326
Tg (mg/dl)	178.00 \pm 98.54	154.00 \pm 54.95	0.589	200.86 \pm 78.15	180.58 \pm 72.68	0.565
VO2 MAX (ml/kg*min)	29.99 \pm 4.62	37.55 \pm 4.92	0.001	28.06 \pm 5.47	34.57 \pm 7.98	0.001

3585 Board #32 June 3 8:00 AM - 9:30 AM

Relationship Between Mitochondrial Respiration and Glucose Tolerance in Individuals at Risk of Type 2 Diabetes

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(No relationships reported)

The relationship between skeletal muscle mitochondrial respiration and development of chronic diseases is a highly contentious topic since assessment of mitochondrial function varies across studies. **PURPOSE:** To determine if ex-vivo mitochondrial respiration of permeabilized muscle fibers is related to postprandial glucose tolerance in individuals at risk of developing Type 2 Diabetes (T2D). **METHODS:** Participants ($n=27$; ≥ 55 yrs), with impaired fasting glucose (100-125 mg/dL), HbA1c (5.7-6.4%), impaired glucose tolerance (140-200 mg/dL) or family history of T2D twice arrived overnight fasted for an oral glucose tolerance test (OGTT) or a skeletal muscle biopsy. Glucose area under the curve (AUC) was determined after a standard 75g glucose load. Vastus lateralis skeletal muscle samples were permeabilized and evaluated by high-resolution respirometry during 2 substrate-uncoupler-inhibitor-titration (SUIT) protocols. SUIT1 evaluated NADH supported respiration during complex I-linked leak (CI_L) and maximal coupled oxidative phosphorylation (OXPHOS; CI_P) with sequential addition of fatty acid (CI&FAO_P) and complex II-linked carbohydrate substrates to determine OXPHOS (CI+CI&FAO_P) and uncoupled electron transport system (ETS) respiration. SUIT2 used an ADP titration to determine ADP sensitivity followed by evaluation of CI_P, CI+II_P, and ETS capacity. **RESULTS:** All p-values < 0.05 . In SUIT1 CI_L ($r=-0.45$), CI+II&FAO_P ($r=-0.48$), and ETS ($r=-0.50$) were negatively correlated with glucose AUC. In SUIT2, CI_L ($r=-0.60$), CI+II_P ($r=-0.46$), and uncoupled maximal ETS ($r=-0.52$) were all associated with glucose AUC, as well as CI_P/CI_L ($r=0.63$) and CI+II&FAO_P/CI_L ($r=0.63$). **CONCLUSION:** In both SUIT protocols maximal mitochondrial OXPHOS and ETS were negatively correlated with glucose AUC in participants at risk for T2D. These data suggest that mitochondrial capacity is associated with impaired glucose tolerance and may contribute to the progression of T2D. Further studies will determine if there are defects in proteostatic mechanisms that impair mitochondrial function in these individuals. Funding provided by the National Dairy Council.

ACSM May 30 – June 3, 2017

3586 Board #33 June 3 8:00 AM - 9:30 AM

Neuronal Inflammation: A Potential Contributing Mechanism to High Fat Diet-Induced Neuropathy

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Neuropathy, a debilitating complication of diabetes, has primarily been attributed to poor glycemic control, but has recently been associated with obesity and the metabolic syndrome in nondiabetic individuals. A robust body of evidence indicates that a high-fat diet can induce signs of neuropathy in mice but the pathogenesis of high fat diet-induced neuropathy remains unknown.

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 wks ($n = 11-12$ per group). Lumbar dorsal root ganglia were harvested and inflammatory mediators (IL-1 α , IL-1 β , IL-2, IL-3, IL-4, IL-5, IL-6, IL-10, IL-12p70, IL-17, MCP-1, IFN- γ , TNF- α , MIP-1 α , GM-CSF, RANTES) were quantified using a Multiplex ELISA and normalized to total protein. Neuropathy was characterized by the von Frey test for mechanical sensitivity at wk 0 and every other week thereafter. Hindpaw foot pad skin was harvested at end study and used to quantify intraepidermal nerve fiber density (IENFD) and pain-sensing (TrkA) nerve fibers via immunohistochemistry. **RESULTS:** After 8 wks, HF had greater bodyweight (33.3 ± 1.0 vs. 26.7 ± 0.5 g, $p < 0.001$), fasting blood glucose (160.3 ± 9.4 vs. 138.5 ± 3.4 mg/dl, $p < 0.05$) and insulin (3.58 ± 0.46 vs. 0.82 ± 0.14 μ g/L, $p < 0.001$) compared to Std. IL-1 α and IL-5 were higher in HF compared to Std after 2 wks and 4 wks, respectively (IL-1 α : 4.8 ± 1.3 vs. 2.9 ± 0.6 pg/mg, $p < 0.05$; IL-5: 5.8 ± 0.7 vs. 3.1 ± 0.5 pg/mg, $p < 0.05$). IENFD and TrkA fiber density were also higher in HF vs. Std after 4 wks (IENFD: 39.4 ± 1.2 vs. 32.2 ± 1.3 fibers/mm, $p < 0.001$; TrkA: 30.4 ± 1.8 vs. 22.4 ± 1.3 fibers/mm). 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 (TrkA) in the hindpaw footpad of high fat fed mice. Diets high in fat may increase neuronal inflammation and initiate nerve fiber changes responsible for painful neuropathy in nondiabetic and diabetic individuals.

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3587 Board #34 June 3 8:00 AM - 9:30 AM

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

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(No relationships reported)

Whole body oxygen consumption (VO_{2peak}) is a strong predictor of morbidity and mortality. In populations at risk for chronic disease, the relationship between skeletal muscle mitochondrial respiratory capacity and VO_{2peak} is relatively unexplored.

PURPOSE: To identify associations between VO_{2peak} and mitochondrial respiration in adults at risk for Type 2 Diabetes (T2D). **METHODS:** We enrolled 23 older adults (63+/-6yrs) at risk for T2D as defined by impaired fasting glucose (100-126mg/dL), HbA1c (5.7-6.4%), impaired glucose tolerance (140-200mg/dL), or a family history of T2D. VO_{2peak} was measured during a graded exercise test on a cycle ergometer while mitochondrial respiration was assessed in permeabilized skeletal muscle fibers obtained from muscle biopsy samples of the vastus lateralis. Two different substrate-uncoupler-inhibitor-titration (SUIT) protocols were implemented. SUIT1 evaluated carbohydrate supported respiration during complex I-linked leak (CI_L) and maximal coupled oxidative phosphorylation (OXPHOS; CI_P) with sequential addition of fatty acid (CI&FAO_P) and complex-II linked carbohydrate substrates to determine OXPHOS (CI+II&FAO_P) and uncoupled electron transport system (ETS) respiration. SUIT2 utilized an ADP titration to determine mitochondrial ADP sensitivity, as defined by apparent ADP Km, followed by OXPHOS and ETS capacity. **RESULTS:** VO_{2peak} (ml/kg/min) correlated with CI_P ($r=0.687$, $p=0.0003$) and ETS ($r=0.454$, $p=0.047$). When analyzing relative to VO_{2peak} expressed as fat free mass (FFM), these correlations were further strengthened (CI_P: $r=0.694$, $p=0.0002$; ETS: $r=0.547$, $p=0.007$). **CONCLUSIONS:** Our findings demonstrate skeletal muscle mitochondrial respiratory capacity is significantly correlated to VO_{2peak} in those at risk for T2D and is strengthened when adjusted for FFM. The data may provide a mechanistic link between mitochondrial dysfunction and the predictive value of VO_{2peak} on morbidity and mortality.

Supported by the National Dairy Council.

3588 Board #35 June 3 8:00 AM - 9:30 AM
The Effect of a Western Diet on Hepatic Autophagy in Age Accelerated SAMP8 Mice
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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, the effects of 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, SAMP8 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-1 α 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 (+43%; 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.

3589 Board #36 June 3 8:00 AM - 9:30 AM
Fish-oils Increase BAMBI Expression to Protect Against Fibrotic Activity in LPS Stimulated Hepatic Tissue
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 (No relationships reported)

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 be central to the development of fibrosis. Diets rich in omega-3 (ω -3) fatty acids are known to provide anti-inflammatory effects; however, the effects of ω -3 fatty acids on hepatic fibrosis are not well-established. **PURPOSE:** To determine the effects 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 one of four 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 *in situ* LPS stimulation, liver mRNA expression of CD14, TLR4, MyD88, BAMBI, and TGF- β 1 was quantified 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 when 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 HFL 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- β 1 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- β 1. These results suggest that a diet high in ω -3 fatty acids may protect against the development of hepatic fibrosis.

3590 Board #37 June 3 8:00 AM - 9:30 AM
Adiposity, Physical Activity and Sedentary Time in Overweight Children With and Without Hepatic Steatosis
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PURPOSE: To examine differences in adiposity, physical activity (PA) and sedentary time (ST) between overweight and obese children with or without non-alcoholic fatty liver disease (NAFLD). **METHODS:** A total of 35 overweight and 54 obese (IOTF) children (46 girls) aged 8- 12y from the EFIGRO trial were included in this study. Hepatic fat content was measured by magnetic resonance imaging and body fat percent (BF%) by Dual X-ray Absorptiometry. Children were categorized into two groups according to the presence (n=41) or absence (n=48) of NAFLD (\geq 4.85% or <4.85% of hepatic fat, respectively). PA and ST were measured using accelerometers over 7 days. PA was categorized into light (LPA), moderate to vigorous (MVPA) and VPA. **RESULTS:** There were not found significant differences in BMI (26.2 \pm 0.5 vs. 25.1 \pm 0.4 kg/m², respectively, age and sex adjusted P=0.10) and obesity percentage (63.4% vs. 58.4%, respectively, adjusted P=0.60) between children having or not having NAFLD. However, BF% was higher in children with NAFLD than in those without NAFLD (41.4 \pm 0.7% vs. 38.7 \pm 0.7%, respectively, adjusted P=0.01). Children with NAFLD spent less time in VPA (6.28 \pm 0.85 vs. 8.51 \pm 0.77 min/day, respectively, P=0.06) and total PA (3517 \pm 99 vs. 3815 \pm 91 cpm, respectively; P=0.03) than those without NAFLD regardless of age, sex and accelerometer wear time, but were diminished after further adjustment for BF%. There were no significant differences in ST, LPA and MVPA between children with or without NAFLD (Ps>0.05). **CONCLUSIONS:** Overweight children with NAFLD had higher adiposity and spend less time in total PA, particularly in VPA, than their peers without NAFLD, regardless of their overweight/obesity status. These results suggest that health intervention programs should promote total PA, especially VPA, to prevent an excess of adiposity and hepatic steatosis in overweight and obese children.
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3591 Board #38 June 3 8:00 AM - 9:30 AM
Effects Of Paradoxal Sleep Deprivation On Liver Functionality Of Sedentary Rats
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PURPOSE: Evaluate the influence of PSD and sleep recovery (SR) on the integrity and functionality of liver in sedentary rats
METHODS: Thirty male Wistar rats, 3 month old, were distributed into 3 groups: Control (CTRL), submitted to PSD for 96h (PSD96), and PSD for 96h plus sleep recovery period for 96h (SR96). After the protocol, the rats were euthanized and blood sample were collected to analyze corticosterone, insulin, alanine aminotransferase (ALT) and aspartate aminotransferase (AST). A central fragment of liver was process by immunohistochemistry and the 8OHdG, TNF- α , COX-2 inflammation and oxidative stress biomarkers was performed. The data were analyzed by one-way ANOVA with Tukey *post hoc*, p<0.05. The present study was approved by ethics and research committee of Universidade Federal de São Paulo (8357240615). **RESULTS:** The corticosterone and AST concentrations increased in PSD96 and SR96 respectively compared to CTRL (148.87 \pm 71.06 vs 44.58 \pm 24.34; 95.03 \pm 18.47 vs 61.44 \pm 15.5 respectively; P<0.05) and insulin in PSD96 group decreased compared to CTRL (0.96 \pm 0.94 vs 5.72 \pm 2.88 respectively; P<0.05). The qualitative immunohistochemistry analysis showed an increase in 8OHdG and COX2 in SR96 group compared to CTRL (2.4 \pm 0.89 vs 0.66 \pm 0.51; 1.16 \pm 0.40 vs 0.33 \pm 0.51 respectively; P<0.05). No changes were seen for other variables. **CONCLUSIONS:** Hormonal and metabolic changes associated with PSD can modify parameters of inflammation and oxidative stress in the liver of sedentary rats. Physical exercise could be an important strategy to minimize the effects observed with PSD.

3592 Board #39 June 3 8:00 AM - 9:30 AM
Asprosin, A Newly Identified Fasting-Induced Hormone Is Not Elevated In Obesity And Is Insensitive To Acute Exercise

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 (No relationships reported)

INTRODUCTION: White adipose tissue is the main source of circulating Asprosin - a newly identified protein hormone encoded by *FBN1*. 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:** (i) 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±2.2, 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 EIA 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 190.6±8.6) and 9 males (age 25.8±6.8; La max 7.3±2.8; HR max 193.0±12.3) serving as controls performed a treadmill running test at a starting speed of 6 km/h with 2 km/h increments every 3 min accompanied by venous blood draws pre- and immediately post exercise. **RESULTS:** Resting Asprosin levels among obese women and men were comparable (19.9±36.7 and 7.1±7.5) and also similar to non-obese subjects (9.2±9.5 and 12.4±10.4) yet with huge individual variations. These results were reflected when individuals experienced acute exhaustive exercise with high interindividual distributions but low intraindividual spreadings applying to obese and lean subjects. **CONCLUSIONS:** Contrary to findings of Romero et al. we could not reproduce differences in Asprosin levels between obese and non-obese subjects. Also an acute bout of treadmill exercise did not affect Asprosin secretion in order to refuel hemal glucose status.

3593 Board #40 June 3 8:00 AM - 9:30 AM
Cross-validation Of The Developed Obesity Cut-off Points For Korean Adults

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 (No relationships reported)

PURPOSE: Establishing valid criteria for the diagnosis of obesity is important for screening and treating obesity-related disorders. Several different cut-off points (CP) have been developed for obesity to predict cardiovascular disease risk factors (CDRF) such as hypertension, dyslipidemia, and diabetes mellitus (DM) in Korean adults; however, there are no cross-validation studies for the developed obesity CP. Therefore, the aim of this study is to examine the diagnostic accuracy of obesity CP. **METHODS:** Data (9,425 adults [≥18 years], male = 4,031) from the 2008 and 2011 Korea National Health and Nutrition Examination Survey was analyzed to examine the accuracy of obesity CP developed using three obesity indices: body mass index (BMI); 23, 24, 25, & 26kg/m², waist circumference (WC); 84, 85, & 90cm for male; 78, 80, & 85cm for female), and body fat percentage (BF%); 20, 21, & 26 for male; 36 & 37 for female). Participants with CDRF were operationally defined as having one or more of the followings; hypertension, dyslipidemia, and/or DM. CP of BMI, WC, and BF% were evaluated using Youden Index (YI; sensitivity [SE] + specificity [SP] - 1). To evaluate the CP with highest YI, adjusted odds ratios (OR) of having CDRF were calculated while controlling for age, sex, physical activity status, smoking, alcohol consumption, household income, and education level. **RESULTS:** Overall, SE and SP of the CP were low across three obesity indices (SE=29.26-75.86%, SP=46.51-85.98%). CP with highest YI were BMI of 23 (SE=69.25%, SP=53.21%), WC of 84 (SE=62.68%, SP=66.67%), and BF% of 20 (SE=75.86%, SP=46.51%) and BMI of 23 (SE=66.74%, SP=64.86%), WC of 78 (SE=69.52%, SP=67.89%), and BF% of 35 (SE=50.73%, SP=69.64%) for male and female, respectively. Obese adults were more likely to have CDRF compared to

none-obese adults (OR=2.61-2.96, 95% CI=2.19-3.63 for male; OR=2.05-3.00, 95% CI=1.69-3.60 for female, respectively). CP of WC had the highest YI and OR while the CP of BF% had the lowest for both male and female. **CONCLUSIONS:** WC of 84cm for male and 78cm for female were identified as the best obesity CP to predict CDRF for Korean adults. The overall diagnostic accuracy (i.e., SE and SP) of the obesity CP, however, was performed poorly. Therefore, caution is necessary when using the developed obesity CP.

3594 Board #41 June 3 8:00 AM - 9:30 AM
Total Body Adiposity And Accumulated Visceral Adipose Tissue: Influence Of Age, Race/ethnicity And Sex

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 (No relationships reported)

PURPOSE: It has been shown that visceral adipose tissue (VAT) does not increase linearly with an increase in total body fat percentage (BF%). Instead, a BF% threshold was identified above which VAT increases more rapidly. The primary purpose of this study was to investigate the effect of age, ethnicity, and sex on the BF% threshold at which the accumulation of VAT increases significantly. **METHODS:** A convenience sample of 3,211 (1,756 females and 1,455 males) participants, 18-75 years of age, who had a dual X-ray absorptiometry scan conducted at The Fitness Institute of Texas between 2008-2016, were included in this study. Self-selected ethnicities were Asian (18.1%), Black (6.7%), Hispanic (19.8%) and White (55.4%). A set of segmented linear regression models for each sex and ethnicity category were specified to estimate thresholds at which the relationship between BF% and VAT mass changed. **RESULTS:** The BF% threshold above which VAT increased more rapidly was identified and it varied between females and males and among ethnicities. The BF% threshold for females were: Asian 29.2%, Black 35.6%, Hispanic 31.7%, and White 34.2%. For males, the BF% thresholds were: Asian 25.3%, Black 23.9%, Hispanic 24.3%, and White 22.8%. There was more variability in VAT mass among participants above the BF% threshold than for those below. In order to attempt to explain this additional variability, age and ethnicity were added as covariates in multiple linear regression models applied to post-threshold participants, for both females and males separately. Post-threshold, the impact of BF% is amplified for older participants controlling for ethnicity for both females ($\beta = 0.28$, SE = .003, $p < .001$) and males ($\beta = 0.81$, SE = .006, $p < .001$), meaning that the VAT increased at a faster rate for older individuals. Controlling for age, BF% has a significantly lower impact on VAT mass for Black females compared to their White counterparts ($\beta = -3.05$, SE = 1.44, $p < .05$) and Asian males compared to their White counterparts ($\beta = -0.11$, SE = 2.3, $p < .001$), meaning that the VAT increased at a faster rate for White females and males than Black females and Asian males. **CONCLUSION:** The BF% threshold above which VAT increased more rapidly was identified and it varied by sex and ethnicity. Post threshold the increase in VAT was affected by age and ethnicity.

3595 Board #42 June 3 8:00 AM - 9:30 AM
Muscle Extracellular Matrix and Metabolic Outcomes Favour Moderate Intensity Training Over HIIT in Obese Mice

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PURPOSE: Skeletal muscle dysfunction is a consequence of obesity, where changes in the extracellular matrix (ECM) and adiponectin dysregulation may play a role. To determine if an exercise regimen can prevent these changes we investigated the effect

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 (%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 (HFD=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 2.2±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 protein deposition found in HFD untrained mice, was not prevented by END nor HIIT. However, decreased collagen-I (~50% of controls; $p < .05$) and increased collagen-III (~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 PGC1 α , 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.

3596 Board #43 June 3 8:00 AM - 9:30 AM

Kefir Alters Cardiac Function and Left Ventricular 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 (diet $p=0.01$, drug $p=0.002$), left ventricular dimension at diastole (diet $p=0.01$ and drug $p < 0.0001$), peak mitral flow velocity (diet $p=0.02$ 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 (diet $p=0.0006$). **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.

3597 Board #44 June 3 8:00 AM - 9:30 AM

Nexrutine, a Viable Exercise Mimetic for Prostate Cancer Prevention

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(No relationships reported)

Epidemiological data suggests that physical activity (PA) has the potential to decrease the risk of high-grade prostate cancer (Pca). However, for various reasons, cancer patients fail to meet minimum standards for physical activity. For this reason, efforts need to be made to discover biologics that confer the physiological benefits of exercise, serving as an "exercise mimetic." Previous work by our group has discovered that the natural product Nexrutine® (Nx), a bark extract of the *phellodendron amurense*, can inhibit tumor development in prostate, pancreatic and skin cancers. **PURPOSE:** To compare the effectiveness of Nx and exercise in modulating carcinogenesis of the prostate using the transgenic adenocarcinoma of mouse prostate (TRAMP) model. **METHODS:** 10-week old, male TRAMP mice were randomized to exercise, Nx or control groups (n=15 each). Mice randomized to the exercise group were given access to a running wheel and Nx treated mice were fed 600 mg/kg pelleted into their chow. Mice were sacrificed at weeks 4, 8, 12 and 20 weeks. Mice were monitored weekly for tumor development, activity and food consumption. Efficacy of exercise and Nexrutine was determined by histopathological evaluation of the prostate and tissue expression of pAkt and p65, key signaling proteins for carcinogenesis. One-way analysis of variance was performed with significance set at $p < 0.05$. **RESULTS:** No significant pathological changes were observed as a function of time, therefore, data were pooled for analysis. Animals on exercise intervention group ran an average of 4.4 km/day. Both exercise and Nx groups presented with palpable tumors 4 weeks later than the control group. While 100% of animals developed tumors (varying stages), Nx treated and exercising TRAMP mice had fewer poorly differentiated tumors compared to controls ($p < 0.05$). Only Nexrutine expressed lower pAkt in tumors. No differences were seen in p65 expression. **CONCLUSIONS:** Our data provides preliminary evidence that Nx can act as an exercise mimetic in protecting against tumor development in prostate cancer. Though both Nx and exercise decreased advanced stage tumors, only Nx has lower pAkt expression. Therefore, continued efforts need to be made to decipher the mechanisms by which exercise reduces tumors development.

3598 Board #45 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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Physical activity is effective in the management of hyperglycemia and cardiovascular disease risk in type 2 diabetes (T2D). While light activity breaks in sitting time lower postprandial hyperglycemia in the laboratory, it is unknown whether these benefits are observed in a free living environment. **PURPOSE:** We compared the effect of increasing physical activity by breaks from sitting after meals (BR) or by a continuous morning walk (EX) on daily and postprandial glucose (PPG) concentrations (measured by continuous glucose monitoring). **METHODS:** Thirty individuals with T2D completed EX, BR and a control condition [normal behavior, (CON)] in a free-living environment, but with strict dietary control, over 7 days. Participants wore an activPAL physical activity monitor during the week and this device was used to verify compliance with experimental conditions (increase their total physical activity in EX and BR by 20, 40 or 60 minutes). Using linear mixed models with repeated measures we (1) compared PPG levels across conditions and (2) assessed the dose-response relationship between activity volume (20, 40 or 60 minutes) and glucose responses. Data are presented as mean (95% confidence interval). **RESULTS:** Compared to CON, EX significantly shortened the duration of postprandial hyperglycemia by 11.4% (7.4-15.4%) but BR was not different. In a subset of participants with high postprandial hyperglycemia at CON (n=9): (1) both EX and BR significantly shortened duration of hyperglycemia compared to CON by 23% (7.0-39.8%) and 25% (8.9-42.7%), respectively and (2) the 40 and 60-minute doses of activity significantly lowered mean PPG by a similar amount. **CONCLUSION:** A continuous walk was more effective than breaks from sitting to manage free living glycemia for the group as a whole but both were equally effective in the subset with high postprandial glycemia. The utility of post-meal breaks from sitting to manage glycemia in the latter group may be due to frequent intervals of physical activity throughout the day.

Funding: Clarkson Doctoral Grant and Graduate School Dissertation Grant from UMass Amherst.

3599 Board #46 June 3 8:00 AM - 9:30 AM
Physical Activity and Self-Efficacy in Overweight/obese Adults with Type 2 Diabetes and Concurrent Kidney Disease

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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]) 594(1435) 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 ($\beta=0.364$, $p=0.004$). **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)

G-28 Free Communication/Poster - Immunology II

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

Room: Hall F

3600 Board #47 June 3 9:30 AM - 11:00 AM
Physical Activity Patterns and Markers of Muscle Contractile Efficiency in Male Mice

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(No relationships reported)

Removal of endogenous sex steroids appears to alter an organism's molecular and cellular biology resulting in immediate decreases in physical activity levels. In particular, several skeletal muscle genes have been shown to change following removal of gonadal tissues. The observed changes in expression level may be related to skeletal muscle contractile efficiency and may lead to the notable reductions in physical activity. **PURPOSE:** The purpose of this study was to evaluate changes to physical activity patterns and to quantify differences in expression in several muscle-related genes after loss of the sex hormones. **METHODS:** Physical activity patterns were observed in C57BL/6j male mice (n=28) beginning at nine weeks of age. Wheel running distance (km), duration (min), and speed (m·min⁻¹) were quantified following acclimation to wheel running use. Following acclimation, wheel running patterns were assessed under physiological (n=14, sham orchidectomy) and low circulating sex hormone conditions (n=12, bilateral orchidectomy) for ten days. End of study gastrocnemius muscle titin (Ttn; improves muscle elasticity in response to sex hormone treatment), succinate dehydrogenase (Sdhc; maintains myosin function in response to sex hormone treatment), glutathione peroxidase 3 (Gpx3; facilitates contraction by balancing oxidative stress), and mechanistic target of rapamycin (Mtor; marker for changes to protein synthesis) mRNA levels were evaluated via qPCR assays. Activity parameter and gene expression differences were determined via independent samples t-tests. **RESULTS:** Wheel running distance (sham=8.37±1.99

vs. orch=2.82±1.80; $p=0.0000001$), duration (sham=265±51 vs. orch=98±54; $p=0.00000004$), and speed (sham=31.4±2.8 vs. orch=26.1±5.4; $p=0.008$) were higher in sham treated mice than orchidectomized mice. No expression differences were identified for any of the genes of interest. **CONCLUSIONS:** The results of this study further support the notion that wheel running patterns are immediately affected by the loss of the sex hormones in male mice. Observed decrements in wheel running patterns following sex hormone loss are most likely unrelated to changes in expression of several sex hormone responsive genes in gastrocnemius tissue.

3601 Board #48 June 3 9:30 AM - 11:00 AM
The Effect Of Grape Seed Extract On Markers Of Autophagy In Cd4+ T-lymphocytes From Hiv+ Patients

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Autophagy is one of the most ancient and crucial cellular defense mechanisms against invading pathogens. Recently, autophagy has been shown to restrict HIV-1 infection through lysosomal degradation of the HIV-1 transactivator of transcription, a protein necessary for viral replication in CD4+ T-lymphocytes. However, as HIV-1 has evolved strategies to block the autophagic process, it is important to investigate novel approaches of autophagy upregulation. **PURPOSE:** We investigated whether grape seed extract (GSE) would induce autophagy in CD4+ T-lymphocytes from patients infected with HIV-1 when compared to rapamycin (Rapa) treatment (a known inducer of autophagy). **METHODS:** To test the concept of GSE as a novel HIV-1 treatment, CD4+ T-lymphocytes were harvested from three male HIV-1 subjects (45.7±14.2 years) and incubated at 37°C for 24 hours. The cells were then exposed to either dimethylsulfoxide (DMSO; control), bafilomycin (BAF; 100 nM; autophagy inhibitor), BAF + rapamycin, or BAF+GSE (40 µg/mL) and harvested after 2 hours to determine the efficacy of GSE when compared to Rapa (0.5 nM). Cells were then treated with GSE for 6, 24, and 48 hours and harvested for analysis. LC3-II and p62/SQSTM1 proteins and genes were analyzed via Western blot and qRT-PCR, respectively. **RESULTS:** We found no significant difference in LC3-II or SQSTM1/p62 protein responses between 2 hours Rapa (3.09±4.98RQ and 1.43±2.06RQ, respectively) and GSE treatment (2.25±3.37RQ and 1.13±1.82RQ, respectively) in HIV-1 infected CD4+ T-lymphocytes. Following 48 hours GSE exposure, an increase in both LC3-II (10.03±12.29RQ) and SQSTM1/p62 (18.22±30.23RQ) protein expression was observed, indicating increased autophagy. Expression of MAP1LC3B mRNA and SQSTM1/p62 genes increased above baseline for all measured time points, peaking at 6 hours GSE exposure (2.73±3.10RQ and 15.11±17.17RQ, respectively). **CONCLUSIONS:** Our preliminary findings suggest that GSE may be a potent inducer of autophagy in HIV-1 infected CD4+ T-lymphocytes. Further, GSE treatment resulted in elevated autophagy for up to 48 hours following GSE exposure, suggesting GSE supplementation may be beneficial when used with current antiretroviral therapies.

3602 Board #49 June 3 9:30 AM - 11:00 AM
Lactic Acid Suppresses LPS- Induced Mast Cell Activation and Septic Shock

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(No relationships reported)

Lactic acid levels are associated with mortality in sepsis, making clearance a treatment goal. However it is unknown if lactic acid contributes to immunosuppression in the late phase of sepsis or if it is solely a consequence of bacterial infection. **PURPOSE:** To determine the effects of lactic acid on LPS-mediated mast cell activation in vitro and in a mouse model of septic shock. **METHODS:** Bone marrow derived mast cells (BMMCs) were cultured in vitro ± lactic acid for 24-hours prior to lipopolysaccharide (LPS, 1 µg/mL) activation. For the septic shock model, an intraperitoneal (IP) injection of lactic acid (80 mg/kg) or PBS was given to C57BL/6J mice 20-hours prior to an IP injection of LPS (25 mg/kg) or PBS. Cytokine production was determined via ELISA in the supernatant or plasma, respectively. **RESULTS:** In vitro, lactic acid significantly suppressed cytokine production (pg/mL ± SEM) compared to the media control: IL-6 (3438.6 ± 352.9 vs. 5734.9 ± 953.6, $p < 0.01$) at concentrations ≥ 6mM and TNF (12.2 ± 2.9 vs. 87.4 ± 16.4, $p < 0.01$) and MCP-1 (296.5 ± 47.6 vs. 717.2 ± 75.9, $p < 0.01$) at concentrations ≥ 12.5 mM. These effects are dependent upon pH, as sodium lactate had no effect on IL-6 (15391.0 ± 2541.0 vs. 17909.1 ± 1948.6, $p = .79$) and formic acid suppressed IL-6 (9797.1 ± 935.4 vs. 17909.1 ± 1948.6, $p < .01$). Additionally, lactic acid effects are transient, since activation in fresh media following a 24-hour treatment with lactic acid did not suppress IL-6 (7423.3 ± 1094.9 vs. 6975.8 ± 535.8, $p = .99$). Similar to the results in vitro, lactic acid significantly suppressed IL-6 (54, 917.6 ± 4508.0 vs. 69,451.6 ± 2283.6, $p < 0.01$) and MIP-1a (53.1 ± 9.9 vs. 149.8 ± 47.9, $p < 0.01$) levels in vivo, with a trend towards reduced TNF and MCP-1. There

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, FACSM¹, Lisa A. Riesberg¹, Kyle Serreyn¹, Jennifer Yee¹, Geri A. Moore¹, Dimitrios Katsavelis¹, Eric Bredahl¹, Kristen Drescher¹, David Fukuda², Laura Kurata¹, Brittany Moon¹. ¹Creighton University, Omaha, NE. ²University of Central Florida, Orlando, FL.
(No relationships reported)

PURPOSE: The purpose of this study was to examine the effect of creatine (CR) loading on upper body strength and immune system function in men. **METHODS:** Using a double-blind design, physically active males (X age \pm SD = 22 \pm 3 yr) were randomly assigned to a CR (n=22) or placebo (PL; n=22) group and were instructed to consume their respective treatments (20 g d⁻¹; CR monohydrate or maltodextrin in powder form) dissolved in water over four equal time periods for 5 d. At baseline (BL) and after the 5 d loading phase, body weight (BW) and one-repetition maximum bench press (1 RM BP) were assessed. At BL and 5 d, a 50 ml blood draw was also 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 creatinine assay was used to measure the amount of creatinine 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. **Acknowledgements:** 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 Cytokine Network

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PURPOSE: Chemotherapy is hypothesized to cause pain partly via dysregulation of the inflammatory cytokine network - namely, by weakening the normal co-regulatory couplings between concentrations of pro- and anti-inflammatory cytokines. Although research suggests that exercise reduces pain in cancer patients by favorably influencing individual markers of inflammation, no studies have examined whether exercise influences the co-regulatory couplings between concentrations of pro- and anti-inflammatory cytokines. The purposes of this study were to assess how regulation of the inflammatory cytokine network is (1) affected by exercise and (2) related to pain. **METHODS:** We performed simple network analyses (i.e., correlations matrices) on data from 348 cancer patients enrolled in a randomized trial of chemotherapy plus 6 weeks of moderate-intensity walking and resistance exercise (N = 173) vs. chemotherapy alone (N = 175) in mixed-type, early/mid-stage cancer patients (mean age = 56, 93% female). At pre- and post-intervention, patients (1) provided blood to assess concentrations of IL-1 β , IL-6, IL-8, IL-10, IFN γ , and sTNFR1 via ELISA and (2) reported pain in the last 7 days (0=not present, 10=as bad as you can imagine). **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 participants, decreased pain 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 mediate the beneficial effects of exercise on pain, considering that IL-6 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.

3605 Board #52 June 3 9:30 AM - 11:00 AM
The Influence of Menstrual Cycle on Salivary Antimicrobial Proteins during Endurance Exercise

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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 microbials. 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 an acute bout of endurance exercise. **METHODS:** Eight healthy recreationally active females completed a cycling exercise at 70% V \dot{O}_2 peak for 45 minutes at two time points of the menstrual cycle: during the mid-follicular phase (day 8 \pm 2) and the mid-luteal phase (day 21 \pm 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 immunoassays. **RESULTS:** The menstrual cycle modified the resting levels of lysozyme (follicular: 23435.0 \pm 314.0 vs. luteal: 15951.7 \pm 7743.4 ng/mL, $p < 0.05$). The menstrual cycle did not significantly modify the levels of lactoferrin at rest (follicular: 4896.6 \pm 1885.0 vs. luteal: 5300.0 \pm 2488.2 ng/mL, NS). Lysozyme concentration was 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.

3606 Board #53 June 3 9:30 AM - 11:00 AM
Post-STEMI Age-related Non-classical Monocyte CCR2 Expression Differences In Response To Stress Hormones

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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-classical 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-classical 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 exercise, 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-classical 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 \pm 6.0 yrs] or \geq 50 [OLD, n=12, 61.7 \pm 6.9 yrs]). Blood was diluted to 1 x 10⁶ cells/mL and cultured for 4 hours either unstimulated, stimulated with EPI (10⁻⁸ M), or CORT (10⁻⁶ M). Cultures were stained against CD14, CD16, and CCR2. Flow cytometry was performed and non-classical monocytes were determined based on CD14 and CD16 expression. **RESULTS:** Unstimulated CCR2 expression

in non-classical monocytes was neither significantly different between groups (50.75 ± 22.91 [YNG] vs. 71.52 ± 28.79 [OLD], $p=0.104$), nor was there a significant correlation between age and CCR2 expression ($r=0.44$, $p=0.059$). However, there was a significant difference in non-classical monocyte CCR2 expression following EPI (47.69 ± 7.22 [YNG] vs. 80.74 ± 45.60 [OLD], $p=0.03$) and CORT (44.29 ± 21.27 [YNG] vs. 83.77 ± 30.53 [OLD], $p=0.008$). **CONCLUSION:** The results suggest an age-related difference in non-classical monocyte CCR2 expression after EPI and CORT stimulation. It is plausible that aged individuals have an increased sensitivity to EPI and CORT, which increases non-classical monocyte CCR2 expression. Post-STEMI exercise prescriptions may need to be modulated in older individuals to account for exercise induced hormonal responses. Supported by NIH Grant R34HL121402

3607 Board #54 June 3 9:30 AM - 11:00 AM
Exercise Normalizes Dysfunctional Adipose Tissue Phenotype in FGF21-Null Mice

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 (No relationships reported)

Adipose tissue (AT) immunometabolic health predicts systemic metabolic 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 pleiotropic 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 knock-out (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 BAT (interscapular region) depots were removed, weighed and flash-frozen in liquid nitrogen. Techniques used: EchoMRI - body composition, real-time PCR - gene expression, Western blotting - protein content, and H&E staining - histology. **RESULTS:** FGF21KO mice weighed more ($p<0.05$) and had greater overall adiposity. In addition to having greater systemic insulin resistance (IR) based on HOMA-IR ($p<0.01$), AT from FGF21KO mice was more insulin resistant ($p<0.01$) based on fasting plasma insulin and free fatty acids. EX decreased AT IR ($p<0.01$) but only tended to decrease HOMA-IR ($p=0.112$). Phospho-Akt and GLUT4 proteins were increased in AT of FGF21KO mice, combined with increased IR, is suggestive of dysregulated glucose uptake. In WAT and BAT, inflammatory and oxidative stress genes (e.g., MCP-1, TNF α , CD11c, P22phox) were significantly upregulated in FGF21KO and normalized by EX. Mitochondria content, indicated by COX III and IV protein, were significantly reduced in BAT of FGF21KO. **CONCLUSION:** Absence of FGF21 increases AT IR as well as WAT and BAT inflammation; EX rescues this phenotype. Normal WAT mitochondrial adaptations to EX may be adversely affected by loss of FGF21. Metabolic dysfunction in FGF21KO appears largely due to excess AT, and is almost completely normalized by EX. Supported by grant number R25GM056901 from the NIGMS of the NIH, VA-CDA2 IK2BX001299 (RSR), and MU Research Board, Corporate Advisory Board, and Research Council.

3608 Board #55 June 3 9:30 AM - 11:00 AM
Resistance Exercise and Polyphenol Supplementation elicits Unique Recruitment of Monocyte Subsets in Untrained Men

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 (No relationships reported)

PURPOSE: To examine the monocyte subset response to resistance exercise and supplementation with an aqueous proprietary polyphenol blend (PPB) sourced from *Camellia sinensis*. **METHODS:** Untrained men ($n=38$, 22.1 ± 3.1 yrs; 174.0 ± 7.9 cm; 77.8 ± 14.5 kg) were randomized to: PPB ($n=13$), placebo (PL; $n=15$) or control (CON; $n=10$). PPB and PL supplemented for 28 days prior to an acute bout of resistance exercise, consisting of 10 repetitions at 70% of 1-RM for the squat (6 sets), leg press (4 sets) and leg extension (4 sets). Blood was drawn pre (PR),

immediately (IP), 1 (1H), 5 (5H), 24 (24H) and 48 (48H) hours post exercise (PPB/PL), or rest (CON). Biopsies were obtained from the vastus lateralis at PR, 1H, 5H and 48H. Plasma and intramuscular monocyte chemoattractant protein-1 (MCP-1) was assessed by multiplex assay. Relative percent of classical (CLAS; CD14⁺⁺/CD16⁻), intermediate (INT; CD14⁺⁺/CD16⁺) and nonclassical (NC; CD14⁺/CD16⁺) monocytes were assessed via flow cytometry. Repeated measures ANOVA were applied, and non-normally distributed data were LN transformed. **RESULTS:** A group x time interaction was observed for circulating MCP-1 ($p=0.005$), which was greater at 5H in PPB (502.0 ± 154.2 pg·ml⁻¹; $p=0.001$) and PL (416.8 ± 109.9 pg·ml⁻¹; $p=0.012$) than CON (307.3 ± 142.6 pg·ml⁻¹). A time effect was observed for intramuscular MCP-1 content ($p<0.001$), with elevations observed (PR: 9.6 ± 5.0 pg·mg⁻¹; $p<0.001$) at 1H (374.2 ± 388.8 pg·ml⁻¹), 5H (595.7 ± 528.6 pg·ml⁻¹) and 48H (217.0 ± 189.1 pg·ml⁻¹). Interactions were observed for CLAS, INT and NC ($p<0.001$) populations. At IP, CLAS was reduced in PPB ($86.2 \pm 7.6\%$; $p=0.008$) and PL ($85.9 \pm 5.1\%$; $p=0.003$) versus CON ($93.8 \pm 4.3\%$). At 1H, PPB ($96.3 \pm 2.0\%$; $p=0.002$) and PL ($95.3 \pm 4.0\%$; $p=0.006$) was greater than CON ($90.8 \pm 4.3\%$). INT were greater at IP in PPB ($4.9 \pm 2.3\%$; $p=0.034$) and PL (6.0 ± 2.0 ; $p=0.001$) than CON ($2.9 \pm 1.8\%$) and reduced at 1H in PPB ($1.6 \pm 1.0\%$; $p=0.003$) and PL ($2.0 \pm 1.2\%$; $p=0.008$) versus CON ($3.4 \pm 1.6\%$). PPB was greater than CON at 24H ($6.7 \pm 2.9\%$; $4.0 \pm 0.9\%$; $p=0.016$) and 48H ($7.9 \pm 3.4\%$; $4.1 \pm 1.6\%$; $p=0.007$). NC was greater at IP in PPB ($8.9 \pm 6.9\%$; $p=0.020$) and PL ($8.1 \pm 4.0\%$; $p=0.028$) than CON ($3.4 \pm 3.2\%$). **CONCLUSIONS:** Exercise resulted in increased MCP-1 and the mobilization of specific monocyte subsets. Supplementation with PPB may augment the monocyte response. Funded by Kemin Foods, L.C.

3609 Board #56 June 3 9:30 AM - 11:00 AM
Acute Resistance Training Induced Increases in Plasma Interleukin-6 are Volume-dependent

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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 yrs, Body Mass: 84.4 ± 12.3 kg, Body Fat Percentage: $11.7 \pm 4.7\%$) 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 immunosorbent assay. A 2x2 repeated measures ANOVA with a Tukey post-hoc was used to determine changes in IL-6 response. Significance was set at $p \leq 0.05$. **RESULTS:** A significant time effect was detected for IL-6 response in both groups: HR (0.71 ± 0.19 to 1.39 ± 0.18 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.

G-29 Free Communication/Poster - Motor Control Across the Lifespan

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

3610 Board #57 June 3 9:30 AM - 11:00 AM

Motor Unit Action Potential Sizes of the First Dorsal Intersosseus in Young and Older Individuals

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Slopes from the motor unit action potential size (MUAP_{size}) vs. recruitment threshold (RT) relationships provides a non-invasive measurement of MU sizes. As such, the slopes (AP_{slopes}) may be able to quantify age-related MU atrophy. **PURPOSE:** To determine if AP_{slopes} 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 interosseus (FDI) during an isometric trapezoidal muscle action with the steady force plateau set at 50% maximal voluntary contraction (MVC). The signals were decomposed to yield MUAP_{sizes} and RTs for each MU. The AP_{slopes} was calculated via the MUAP_{sizes} vs. RT relationships for MUs recruited between 10 and 50% MVC for each subject. Few MUs with RTs < 10% MVC were observed in young or old 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 AP_{slopes}, CSA and EI between groups were examined with independent samples t-tests. **RESULTS:** OG demonstrated significantly reduced AP_{slopes} (OG: 0.033 ± 0.010; YG: 0.048 ± 0.020; p = 0.048) and greater EI (OG: 41.3 ± 7.0 AU; YG: 50.6 ± 7.5 AU; 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 AP_{slopes} suggested non-uniform differences in MUAP_{sizes} 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 AP_{slopes} 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 OG, supporting the speculation that the AP_{slopes} differences were due to MU atrophy.

3611 Board #58 June 3 9:30 AM - 11:00 AM

Ankle Proprioception And Soccer Skills in Youth Recreational Players

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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_{1,25}=5.01, p=0.03, and F_{1,25}=5.77, p=0.02, 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.

3612 Board #59 June 3 9:30 AM - 11:00 AM
Force-Time Characteristics During A Reactionary Gripping Task: Effects Of A 10-Week Introductory Judo Course

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(No relationships reported)

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 reactionary gripping task.

METHODS: Sixteen healthy men (age: 22.6±3.4yr; 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, 5s 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 (TPF), force at peak RFD (F@RFD), 1s impulse (AUC1) and 2s impulse (AUC2). A 2x2 [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 = 5.75, p = 0.031, η² = 0.291).

CONCLUSIONS: A 10-week introductory judo class did not have an effect on handgrip performance during a reactionary 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

	Judo (n=8)		Controls (n=8)	
	Pre	Post	Pre	Post
PF (mV)	1.707 ± 0.240	1.773 ± 0.201	1.697 ± 0.220	1.696 ± 0.183
TPF (s)	2.539 ± 0.985	2.025 ± 0.682	2.346 ± 0.772	2.622 ± 0.510
AvgF (mV)	1.498 ± 0.215	1.551 ± 0.157	1.483 ± 0.218	1.533 ± 0.176
AUC1 (mV·s)	1.412 ± 0.206	1.454 ± 0.166	1.378 ± 0.188	1.436 ± 0.155
AUC2 (mV·s)	2.987 ± 0.472	3.162 ± 0.386*	2.965 ± 0.415	3.048 ± 0.323*
RFD (mV/s)	6.600 ± 1.260	6.182 ± 1.297	6.971 ± 1.615	6.880 ± 1.812
F@RFD (mV)	1.196 ± 0.167	1.241 ± 0.150	1.205 ± 0.129	1.243 ± 0.139

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

3613 Board #60 June 3 9:30 AM - 11:00 AM

Differences in Mobility Among Older Adults are Associated with Motor Unit Activity and Muscle Strength

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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:** 20 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

± 0.5 m/s) were measured in the same visit. A best-subsets regression was performed to identify predictor variables from which the models with the lowest Bayesian Information Criterion score for each functional task was selected as the regression model. **RESULTS:** 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 ($0.47 \pm 0.2\%$) and mean ISI during the 10% LS task (150 ± 27 ms) explained 54% of the variance for 400 m walk time ($p < 0.0001$). The mean ISI during the 10% LS task, PF maximal torque (23 ± 12 N·m), and mean ISI during 10% TA task (105 ± 18 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.

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

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 (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 the course of 7-10 days. During each visit, transcutaneous electrical stimulation was applied over the tibial nerve while surface EMG recordings were obtained from the soleus muscle. Initially, single 1 ms pulses were delivered every 5 to 10 seconds in 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 during MVC. Intra-class correlation coefficients ($ICC_{3,1}$) were calculated to determine test-retest reliability and repeated-measures ANOVAs were used 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 $95 \pm 9\%$ ($p = 0.06$); twitch force 117 ± 33 , 109 ± 29 , 112 ± 28 , and 108 ± 25 N ($p = 0.61$), or the V-to-M ratio 0.42 ± 0.23 , 0.50 ± 0.28 , 0.49 ± 0.21 , and 0.48 ± 0.22 ($p = 0.65$). MVC increased across the test days ($p = 0.008$), 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 V-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

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ABSTRACT. Relative, percent change differences between homologous vastus lateralis muscles across different resting muscular lengths have not previously been reported following the cessation of unilateral fatiguing aerobic exercise. **PURPOSE:** The purpose of the present study was to compare contralateral cross-over adaptations following unilateral fatiguing 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 \pm SD; age = 22.9 ± 3.5 years and 22.8 ± 2.6 years; height = 181 ± 7.5 cm and 180 ± 5.9 cm; weight = 87.2 ± 10.7 kg and 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 = 15.55 ± 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 dominant 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 provide further evidence to the concept 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.

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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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 μ V at 30 and 50% RMS, resulting in a MUNE of ~23 and ~16 at the two respective intensities. In contrast young adults had CMAPs of ~5.5 mV, but similar S-MUPS of ~155 and ~240 μ V 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

3617 Board #64 June 3 9:30 AM - 11:00 AM
The Difficulty Of EMG Burst Identification: Visual And Bayesian Changeoint Analysis

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Surface electromyography (EMG) is commonly used to add physiologic context to observed patterns of movement. The onset of the EMG is often used to determine when a person responds to stimuli or to identify maladaptive muscle coordination strategies. Our research group has previously shown that Bayesian Changeoint Analysis (BCP) is superior to the standard linear envelope methodologies when determining a single EMG onset in a data series. **PURPOSE:** Examine the effectiveness of visual inspection and the novel BCP algorithm to detect EMG bursts in multiple muscles during complex movements. **METHODS:** Muscle activity from 10 healthy subjects was collected from the gastrocnemius, biceps femoris, and vastus lateralis muscles using surface EMG electrodes (4kHz sampling rate). Subjects completed 4 minutes of exercise on three modalities: treadmill running, ergometer cycling and stair climbing. All exercises were performed at self-selected low-to-moderate intensities. Six to ten seconds of EMG was collected at 90 and 210 seconds into the exercise. Three researchers visually identified the number of bursts in a trial twice

(randomized, double-blind methodology). The instances where all six identifications (three reviewers, twice) agreed on the number of bursts, were compared with the identification results from the BCP algorithm. **RESULTS:** While the within rater reliability (ICC: 0.85) and between rater reliability (ICC: 0.83) were good, the visual review only resulted in 111 trials (out of 180) where all raters agreed on the number of bursts (61.7% total agreement). The correlation between the number of bursts raters identified and the BCP algorithm was moderate (Pearson's R: 0.52). Furthermore, across all trials, there was a difference of 711 EMG bursts between the two methods. **CONCLUSIONS:** While visual assessment of the EMG is the "gold standard" for burst detection, its reproducibility is generally poor in dynamic tasks. Despite initial success with the BCP algorithm in determining EMG onset, the current iteration of the algorithm is insufficient for EMG burst identification in complex waveforms. This work highlights the need for a standardized algorithm of EMG burst detection, but also indicates that further work is necessary to make algorithms of sufficient accuracy and reliability.

3618 Board #65 June 3 9:30 AM - 11:00 AM
Comparisons Between Voluntary Muscle Activation And Evoked V-wave Responses As A Function Of Torque

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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 ITT 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-second maximal voluntary 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. Lastly, 3 randomized series of submaximal contractions (20%, 40%, 60%, and 80% of MVC) 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 $6 \pm 14\%$ to $51 \pm 18\%$ to $82 \pm 13\%$ to $94 \pm 11\%$ to $95 \pm 8\%$ 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 $5 \pm 3\%$ to $13 \pm 8\%$ to $23 \pm 7\%$ to $38 \pm 18\%$ to $48 \pm 20\%$ 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 ($R^2 = 0.99$) while a linear model better fit the relative V-to-M ratio ($R^2 = 0.97$). **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.

3619 Board #66 June 3 9:30 AM - 11:00 AM
Exploring Bilateral Handgrip Forces Control During Inter-limb Coordination Task After Hemiparetic Stroke: A Preliminary Study

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Interhemisphere cooperation plays an important role in daily living because the most functional performances of daily activities require the participation of bilateral hands simultaneously. However, the influence of stroke-related impairments 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 III recovery or beyond, mean age = 57.0 ± 7.8 yrs) 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% MCV 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 paired samples t-test and 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% ($41.3 \pm 15.6\%$ vs. $23.7 \pm 12.0\%$, $p = .006$) and 40% ($52.8 \pm 19.4\%$ vs. $26.0 \pm 14.6\%$, $p = .004$) 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 coordination control 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.

3620 Board #67 June 3 9:30 AM - 11:00 AM
Inter-individual Variability In The Mechanomyographic Frequency Response During A Sustained Isometric Force Task

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Inter-individual variability in the mechanomyographic frequency response during a sustained isometric force task.

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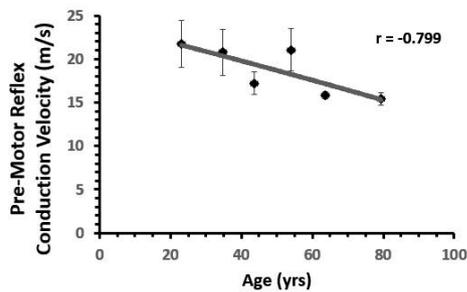
There is recent evidence that suggests a relationship exists between the frequency content of the mechanomyographic signal (MMG MNF) and motor unit activity. The fatigue-based changes that occur in the MMG MNF during a sustained force task may provide insight regarding the alterations in motor control that lead to task failure. **PURPOSE:** To examine the individual patterns of response for MMG MNF during a sustained submaximal isometric force task to failure. **METHODS:** Twenty males (mean \pm SD: age = 24 ± 3 years) volunteered for this investigation and were familiarized with the procedures prior to testing. Before the fatigue test, the subjects maximal voluntary contraction force (MVC_v) of their dominant elbow flexors was established. The subjects then performed a sustained submaximal isometric force task (60% MVC_v) for as long as possible. A piezoelectric accelerometer was used to detect the MMG signal from the biceps brachii. Polynomial regression was used to determine the relationships for MMG MNF versus time for each subject. **RESULTS:** The results indicated significant ($p < 0.05$) relationships for MMG MNF versus time for all subjects, and that the majority of subjects demonstrated curvilinear reductions in MMG MNF during the fatigue task. Specifically, the relationships were fit with linear (4 of 20, $R^2 = 0.72$), quadratic (12 of 20, $R^2 = 0.49$), and cubic (4 of 20, $R^2 = 0.86$) models. **CONCLUSIONS:** These results demonstrated that the MMG MNF response was capable of monitoring the fatigue-based changes in muscle function that progressed to task failure. The consistent declines exhibited for MMG MNF during the sustained isometric force task likely reflects alterations in the twitch properties of the contributing motor units. The inter-individual variability in the patterns of response may be due to differences in training status, muscle fiber type composition, or subject-specific motor control strategies related to the demands of the fatigue task.

3621 Board #68 June 3 9:30 AM - 11:00 AM
An Examination of Patellar Tendon Reflex Pre-Motor Conduction Velocity across the Adult Lifespan

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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 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 ($r = -0.799$; $p = 0.028$). The resulting regression equation was $y = -0.1113x + 24.216$. 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.



3622 Board #69 June 3 9:30 AM - 11:00 AM

Motor Execution And Imagery With Greater Task Difficulty Increases Corticospinal Excitability

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PURPOSE: To elucidate the influence of task difficulty during actual and imaginary force control by the unilateral first dorsal interosseous muscle (FDI) on the corticospinal excitability of 1) the contracting and contralateral resting hands and 2) the resting hand, respectively. **METHODS:** Seventeen young adults were asked to perform isometric abduction with their left index fingers (contracting hand) at 5 and 15% of maximal voluntary contraction (MVC) with visual guidance in actual force control task and to imagine isometric abduction at 15% MVC in imaginary force control task with the same procedure to actual force control task. Task difficulty was adjusted by the size of range about target force displayed on the computer monitor, which was defined by upper and lower lines, i.e., $\pm 7\%$ of target force between lines as 'easy' task and 0% of target force between lines as 'difficult' task. Subjects actually or imaginarily attempted to match their abduction force within the target range as steady as possible. In each task, transcranial magnetic stimulation was applied twenty times to the optimal scalp position for eliciting the motor evoked potential (MEP) in FDI overlying right or left motor cortex. The averaged MEP was normalized by the maximal motor response (% Mmax) that was obtained during supramaximal electrical stimulation to the ulnar nerve. **RESULTS:** In actual force control task, the MEP of the contracting hand was significantly larger ($P < 0.05$) during difficult task (24.8% Mmax) compared with easy task (22.3% Mmax) when collapsed across force levels. The MEP of the resting hand was also significantly larger ($P < 0.05$) in difficult task (12.3% Mmax) than in easy task (9.5% Mmax) when collapsed across force levels. In imaginary force control task, the MEP for difficult task (11.0% Mmax) was significantly larger ($P < 0.05$) compared with that for easy task (8.1% Mmax) in the resting hand. **CONCLUSION:** These results indicate that 1) actual force control task with greater task difficulty increases corticospinal excitability of the contracting hand, and 2) corticospinal excitability of the resting hand is enhanced when subjects actually and imaginarily perform force control task with greater task difficulty by the unilateral hand.

3623 Board #70 June 3 9:30 AM - 11:00 AM

Bilateral Arthrogenic Muscle Inhibition in the Soleus Muscle Following Acute Ankle Sprain

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Arthrogenic muscle inhibition (AMI) is characterized by decreased spinal excitability, and has been suggested to be one of the neurophysiological mechanisms responsible for muscle dysfunction following joint injury. AMI has been found in individuals with chronic ankle instability, yet it is unclear whether AMI is present in patients with acute ankle sprain (AAS). **PURPOSE:** To determine the effects of AAS on spinal excitability in lower leg muscles. **METHODS:** Nineteen subjects with AAS within 72 hours of the injury onset (10 females; age=21 \pm 2.7 years; height=173.2 \pm 9.2cm; weight=71.7 \pm 11.7kg) and 19 healthy controls without any history of ankle sprain (10 females; age=22 \pm 2.2 years; height=170.8 \pm 9.2cm; mass=68.9 \pm 14.2kg) participated.

Hoffman reflex (H-reflex) was used to quantify AMI. H-reflex tests of the soleus, fibularis 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 $H_{max}:M_{max}$ 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 ($F_{(1,34)}=1.763$, $P=0.19$), fibularis longus ($F_{(1,31)}=1.194$, $P=0.28$) and tibialis anterior ($F_{(1,32)}=.887$, $P=0.35$). However, there was a significant group main effect for the soleus ($F_{(1,34)}=5.219$, $P=0.029$). The $H_{max}:M_{max}$ ratio in the AAS group (0.56 \pm 0.04) was significantly lower than in the healthy control group (0.68 \pm 0.04). No significant main effects were found in the fibularis longus ($F_{(1,31)}=0.084$, $P=0.77$) and tibialis anterior ($F_{(1,32)}=1.255$, $P=0.27$). **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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3624 Board #71 June 3 9:30 AM - 11:00 AM

Changes In Motor Unit Recruitment And De-recruitment Strategies Are Not Associated With The Repeated-bout Effect

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The "repeated bout effect" (RBE) is an adaption that attenuates muscle damage following eccentric exercise. Several neural adaptations have been proposed to underlie the RBE. **PURPOSE:** This study used decomposition of surface EMG signals (dEMG) to examine the relationship between recruitment (RT) and de-recruitment thresholds (DRT) and changes in firing rates or motor units during recruitment and de-recruitment prior to and following eccentric exercise resulting in the RBE. **METHODS:** Nine participants performed 5 sub-maximal isometric trapezoid contractions at force levels corresponding to 50% and 80% of maximal isometric strength (MVC). Eccentric exercise was then performed until biceps brachii MVC had decreased by $\sim 40\%$. MVC, range-of-motion (ROM), and delayed onset muscle soreness (DOMS) were measured 24-hours, 72-hours, and 1-week following eccentric exercise. Three weeks later all procedures were repeated. EMG signals of the biceps brachii were decomposed into individual motor-unit action potential trains. The relationship between RT and DT was examined using linear regression. The slope of the change in mean firing rate (MFR) during the ramp-up and ramp-down phase of the trapezoid contraction was also examined. **RESULTS:** No changes were found in the slope of the RT vs DT relationship for 50% MVC (1.13 \pm 0.17 vs 1.29 \pm 0.43; $p=0.42$) and 80% MVC (1.09 \pm 0.18 vs 1.25 \pm 0.41; $p=0.25$). There were also no changes in the y-intercept of the RT vs DT relationship at 50% (-13.79 \pm 6.77 vs -15.37 \pm 17.07; $p=0.80$) and at 80% (-9.29 \pm 10.71 vs -23.07 \pm 20.28; $p=0.06$) of MVC. The mean slope of the increase in firing rate during recruitment did not change between bouts 10.2 \pm 1.8 vs 10.5 \pm 2.2 pps/s ($p=0.77$) and 8.4 \pm 0.7 vs 9.0 \pm 1.6 pps/s ($p=0.28$) for 50% and 80% of MVC, respectively. The slope of the decrease in firing rate during de-recruitment did not differ at 50% of MVC -9.7 \pm 1.5 vs -10.2 \pm 1.8 pps/s ($p=0.48$), but became steeper during contractions at 80% of MVC -7.3 \pm 0.9 vs -8.7 \pm 1.7 pps/s ($p=0.04$). However, no relationship was observed between the change in DT slope and the magnitude of the RBE. **CONCLUSION:** A bout of eccentric exercise conferred protection from a subsequent identical bout. Few changes in motor-unit recruitment and de-recruitment behavior were observed suggesting changes in these parameters are not responsible for the RBE.

3625 Board #72 June 3 9:30 AM - 11:00 AM

Myosin Heavy Chain Influences Firing Rate Behavior from Moderate to High Intensity Targeted Forces

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PURPOSE: It is suggested the ratio of myosin heavy chain (MHC) isoforms and their influence on twitch forces and fatigability effect motor unit (MU) behavior. However, no study has correlated changes in MU firing rates among moderate- to high-intensity contractions with MHC area *in vivo*.

METHODS: Twelve individuals (age=20.89 \pm 2.52 yrs, weight=72.03 \pm 14.02 kg) performed 3 isometric maximal voluntary contractions (MVC) of the leg extensors on an isokinetic dynamometer followed by randomly ordered isometric muscle actions at 50, 70, and 90% MVC. An electromyographic (EMG) sensor was placed over the

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 I %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 I %MHC area. Alpha was set at 0.05.

RESULTS: Pearson's product moment correlations were significant among type I %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).

CONCLUSIONS: Individuals with lower percentages of type I MHC area had greater increases in MU firing rates with increments in targeted forces for MUs with REC Thresh of 35 - 45% MVC. This may indicate that MU firing rate and recruitment patterns differ as a function of MHC area.

3626 Board #73 June 3 9:30 AM - 11:00 AM

Fatiguing Knee Extensors Has Differential Effects on Contralateral Homologous and Non-Related Heterogenous Muscles

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Non-local muscle fatigue (NLMF), defined as a temporary motor performance deficit in a non-exercised muscle group following a fatiguing protocol on a different muscle group, has been gaining attention in the recent decade.

PURPOSE: To examine the possible NLMF-induced changes in isometric strength and surface electromyographic (EMG) of both the contralateral homologous and non-related heterogenous muscles after fatiguing the unilateral knee extensor (KE) muscle group.

METHODS: Ten men (27 ± 3 years) and five women (27 ± 2 years) participated in a 3-visit investigation which consisted of a familiarization visit and 2 separate randomly sequenced experimental visits. During the experimental visits, the same fatiguing intervention (six sets of 30-second maximal isometric KE contractions, with 30-second rest interval between sets) were applied. Before and after the fatiguing intervention, the maximal isometric strength and the corresponding surface EMG amplitude were measured on the non-exercised left elbow flexors (EF) or KE. Separate paired sample t-tests were used to examine the potential changes in the dependent variables described above.

RESULTS: After the fatiguing intervention, there was a significant decrement in isometric strength for the non-exercised EF (Pre- vs. Post-fatigue = 382.06 ± 34.28 vs. 354.20 ± 120.76 N, $t = 3.676$, $p = 0.001$), but not for the non-exercised KE. For the non-exercised EF, there was also a decreased normalized EMG amplitude in the biceps brachii (Pre- vs. Post-fatigue = $100.0 \pm 0.0\%$ vs. $86.5 \pm 6.6\%$, $t = 2.049$, $p = 0.03$). However, the normalized EMG amplitude did not change in the non-exercised vastus lateralis (VL).

CONCLUSIONS: Fatiguing the unilateral KE did induce the NLMF in the non-related heterogenous upper body muscle group (the EF), which was possibly due to the fatigue-induced decreased voluntary drive. However, for its contralateral homologous muscle group (non-exercised KE), the NLMF effect on isometric strength was absent, which could be explained by the unaltered maximal muscle activation level in the non-exercised VL. Therefore, fatiguing unilateral KE has differential effects on contralateral homologous and non-related heterogenous muscles.

3627 Board #74 June 3 9:30 AM - 11:00 AM

Recruitment Properties In Vastus Medialis And Vastus Medialis Oblique In Individuals With Patellofemoral Pain Syndrome

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Patellofemoral pain syndrome (PFPS) is a commonly diagnosed knee pathology that is twice as prevalent in women. Sports medicine clinicians commonly use exercises to attempt to preferentially activate the vastus medialis oblique (VMO) to enhance medially vectored forces on the patella. Recently, our group confirmed clinical theory that the VMO is neurologically distinct from the vastus medialis (VM). However, the ability to voluntarily activate these muscle sub-sections is still disputed. **Purpose:** To determine how PFPS affects neuromuscular control of VM/VMO and examine if hip rotation during a straight leg raise (SLR) modifies motor patterns. **Methods:** Thirteen healthy women and four women with PFPS performed isometric SLR in neutral hip rotation (SLR-NR) and during 30 degrees hip lateral rotation (SLR-LR). Participants performed ramp contractions by tracing a line on a screen with a rate of rise of 7.5% maximal voluntary contraction (MVC) per second up to 75% MVC. Bipolar intramuscular fine-wire electrodes were inserted into the VM and VMO. Initial motor unit firing rates (IFR) and recruitment threshold (RT) forces were measured. Generalized linear mixed models and Tukey post hoc tests were used to assess significant differences. The recruitment thresholds were log-transformed to meet the assumptions of normality of residuals and constant variance within each level. **Results:** A total of 420 motor units were analyzed. There was a significant interaction effect for Muscle \times Group for RT ($p=0.02$), demonstrating that women with PFPS activated their VMO later ($20.4 \pm 2.5\%$ MVC) than healthy women ($11.2 \pm 1.5\%$ MVC; $p=0.01$). The Group \times Hip Position interaction effect was also significant for RT ($p=0.02$). Healthy women activated their VMO earlier during SLR-NR ($9.9 \pm 1.5\%$ MVC) than during SLR-LR ($14.9 \pm 1.5\%$ MVC; $p=0.02$). Women with PFPS had a delayed VMO onset time ($19.1 \pm 2.5\%$ MVC) compared to healthy women ($9.9 \pm 1.5\%$ MVC) in SLR-NR ($p=0.02$). There was no significant difference in IFR between muscles or hip positions between groups. **Conclusions:** Targeted strengthening of the VMO in SLR with a neutral hip rotation is a more effective training position for women with PFPS than using lateral hip rotation.

3628 Board #75 June 3 9:30 AM - 11:00 AM

Sensorimotor Cortex Neuroplasticity Following Neuromuscular Training Augmented With Real Time Biofeedback

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Non-contact anterior cruciate ligament (ACL) injury is associated with motor coordination errors leading to comprised knee positioning and resultant knee loads that exceed ligament structural integrity. The nature of the ACL injury event (non-contact) and typical occurrence during high neurocognitive demand situations indicate a nervous system mechanism underlying the inciting event associated with injury. A better understanding of the neural contribution to ACL injury prevention training may enhance the ability to target the underlying mechanisms associated with injury risk. However, it is unknown what neuroplastic mechanisms contribute to the improved motor control documented after neuromuscular training.

Purpose: To compare the knee sensorimotor cortex activation level before and after neuromuscular control training.

Methods: Ten high school female soccer participants from the local community (age: 15.7 ± 0.95 years; height: 168.4 ± 4.60 cm; mass: 59.91 ± 5.62 kg.) were included in the analysis. fMRI data were collected during performance of a unilateral knee motor task of the left knee consisting of repeated cycles of extension-flexion before and after neuromuscular training. The activation level (blood oxygen level dependent signal) was calculated within the sensorimotor cortex as the primary region of interest. The neuromuscular training program consisted of 6 weeks of standardized ACL injury prevention training augmented with real time feedback designed to reduce movement related knee injury risk factors.

Results: Sensorimotor cortex activation increased after training (cluster data: voxels:1120; $p < 0.0001$; z -max: 8.55; MNI coordinate peak voxel:12,-26,80; %signal difference: 0.37 ± 0.81) relative to pre-training.

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

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(No relationships reported)

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 measurements 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 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

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(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. These '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 (17.91 ± 0.51 years of age) 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 was observed in vertical gaze ($p < .05$). Follow up assessments indicated greater gaze excursions (VT = 871.74 ± 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 moved 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

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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

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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, were normalized to MVC, and the overall mean for all contractions was used for comparison. 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 higher overall mean torque ($11.2 \pm 0.5\%$ MVC vs. $8.0 \pm 0.6\%$ MVC, $p < 0.01$) and FTI sum ($38,030.0 \pm 1724.9$ Nm·s vs. $32,128.0 \pm 1668.0$ Nm·s, $p < 0.01$). There was no difference between frequencies for peak torque ($14.0 \pm 0.6\%$ MVC vs. $12.3 \pm 0.7\%$ MVC) or stimulation intensity required to achieve 15% MVC during the first 5 mins (80.2 ± 3.8 mA vs. $120.7 \pm 8.0\%$ 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 compared to a high-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
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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 and 20±3 s, $p<0.01$) and GPT (60±9 s and 78±16 s, $p<0.01$). MA adults also had superior tactile discrimination (95±11 au and 72±20 au, $p<0.01$). 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 ($r = 0.60$) with the first IC, which explained 24.4% of the covariance and included wrist extension strength 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 ($r = -0.90$) 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.
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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 have 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 a constant force signal on a computer monitor. This 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).

G-30 Free Communication/Poster - Neuromuscular Physiology

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

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

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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 quadrupedal 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 (T9 laminectomy), 2) severe (250 kdne) contusion SCI, 3) SCI+T (7.0 mg/week, 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 function, 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 ($p \leq 0.001$) and altered *in vitro* force mechanics, characterized by 35% lower maximal tetanic force ($p \leq 0.001$), 8% faster time to peak tension (TPT, $p \leq 0.001$), and 50% faster half-relaxation time (half RT, $p \leq 0.01$) 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 ($p \leq 0.001$). In addition, T+TM ameliorated muscle loss and produced a near-complete preservation of muscle mechanical properties, exemplified by 33-40% higher soleus mass ($p \leq 0.001$), 35% higher maximal tetanic force ($p \leq 0.001$ vs SCI-only), 9-11% slower TPT ($p \leq 0.001$), and 130% slower half RT ($p \leq 0.001$) 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.

3636 Board #83 June 3 8:00 AM - 9:30 AM
Relationship Between Body Composition And The Autonomic Nervous System Behavior At Rest

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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 ± 32 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 directly 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 ($r=0.40$; $p<0.05$), the deviation of the scattergram plot in the "short" direction SD1 ($r=0.40$; $p<0.05$), and Vagal Cardiac index VCI ($r=0.46$, $p<0.05$), while body fat was associated with sympathetic indicators as the ratio Low Frequency / High Frequency ($r=0.36$; $p<0.05$) 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 the sympathetic activity, the evidence suggests that there are some hormones produced by the muscles (myokines) like the Fibroblast Growth Factor 21 or the Brain Derivate neurotrophic Factor that produce

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.

	HR	RMSSD	pNN50	LF/HF	HFnu	SD1	SCI	IVC
Fat Percentage	0.27	-0.25	-0.25	0.36*	-0.33	-0.25	0.36*	0.19
Muscle Percentage	-0.43*	0.40*	0.45*	0.18	0.25	0.40*	-0.41*	0.46*

3637 Board #84 June 3 8:00 AM - 9:30 AM
The Effects of Short-Term Resistance Training with & without Blood Flow Restriction on Neuromuscular Adaptations

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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 trained each leg with their assigned training protocol for 2 weeks, 3 times/wk. 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 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 isokinetic 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 an increased demand on the cardiovascular system, but subjects experienced higher perceived exertion during BFR.

3638 Board #85 June 3 8:00 AM - 9:30 AM
Validation of the Neuromuscular Fatigue Threshold Treadmill Test

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PURPOSE: To examine the validity of the physical working capacity at the fatigue threshold (PWC_{FT}) model as a neuromuscular fatigue-threshold during incremental treadmill running. **METHODS:** Twelve aerobically-trained individuals [(mean ± SD) 24.0 ± 14.8 yr, 73.1 ± 13.1 kg, 178.8 ± 9.1 cm] volunteered to perform a treadmill test to exhaustion on four separate visits with electromyographic (EMG) signals recorded from the vastus lateralis. The first visit required each subject to complete an incremental treadmill test to exhaustion that started at 9.0 km·hr⁻¹ and increased 1 km·hr⁻¹ (1% constant grade) every two minutes for determination of their PWC_{FT}. During the second, third, and fourth visits, the subjects completed constant-velocity treadmill runs to exhaustion at 90, 100, or 110% PWC_{FT} in random order. Each laboratory visit was separated by at least 48 hours. **RESULTS:** Mean ± SD values were calculated for the running velocities associated with 90% (11.6 ± 1.5 km·hr⁻¹), 100% (13.0 ± 1.6 km·hr⁻¹), and 110% (14.3 ± 1.8 km·hr⁻¹) PWC_{FT}. The one-way ANOVA with repeated measures and post-hoc analyses indicated that the time to exhaustion (TTE) at the constant velocity of 110% PWC_{FT} (19.44 ± 10.26

min) was significantly less than at 90% PWC_{FT} (60.00 ± 0.00 min) and 100% PWC_{FT} (48.86 ± 14.59 min). Individually, ten of the subjects (83.3%) were able to maintain the running velocity associated with 100% of their PWC_{FT} for at least 40 minutes, whereas only one of the subjects (8.33%) was able to maintain 110% PWC_{FT} for more than 30 minutes. All subjects maintained 90% PWC_{FT} for 60 minutes. Furthermore, the normalized EMG amplitude values increased across time (R² = 0.98, p < 0.001) during the 110% PWC_{FT} run to exhaustion, but resulted in no change during the 90% PWC_{FT} (R² = 0.23, p = 0.16) and 100% PWC_{FT} (R² = 0.03, p = 0.64) runs to exhaustion. **CONCLUSIONS:** The findings of the present study indicated that the PWC_{FT} treadmill test was able to accurately estimate the fastest running velocity that could be maintained for an extended period of time (i.e. ≥ 40 min) without evidence of neuromuscular fatigue (i.e. slope coefficient of zero for the EMG amplitude versus time relationship).

3639 Board #86 June 3 8:00 AM - 9:30 AM
Correlation Between Muscle Strength And Vagal Cardiac Autonomic Modulation In Healthy Men

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Unsatisfactory muscle strength (MS) and low degree of cardiac autonomic modulation (CAM) at rest are related to higher morbidity and mortality in apparently healthy men. However, the association between MS and CAM at rest in this population is still unclear. **Purpose:** We aim to correlate the muscle strength with resting and responsiveness vagal CAM in healthy men. **Methods:** We evaluated 14 clinically normal men, aged 24.1 ± 5.6 years showing BMI = 24.9 ± 1.9 kg/m². MS was assessed by isokinetic dynamometer Biodex during knee extension with 60°/s in 2 sets of 4 maximum repetitions and 60s between them. The highest peak torque (PT), absolute and relative, was adopted as the maximum MS value. CAM was assessed by 5-min heart rate variability (HRV) at rest, supine and orthostatic postures by the time-domain rMSSD and Poincaré plot SD1 vagal indexes, using the Polar RS800* to RR-interval acquisition and the Kubios software for analyses. CAM responsiveness was estimated by the absolute variation (Δabs) of rMSSD and SD1 from supine to orthostatic postures. Due to non-normal distribution of variables (*Shapiro-Wilk test*) we used the Spearman correlation at the 5% level of significance. **Results:** We observed a positive correlation between rMSSD and SD1 in supine position with relative PT and a positive correlation between the Δabs of rMSSD and SD1 with PT absolute and relative, as shown in Table 1.

variables	r-MSSD sup	r-MSSD ort	Δabs r-MSSD	SD1sup	SD1ort	ΔabsSD1
PT(N-M)	r _s = 0.27 (p = 0.17)	r _s = 0.09 (p = 0.36)	r _s = 0.45 (p = 0.05)*	r _s = 0.27 (p = 0.17)	r _s = 0.09 (p = 0.36)	r _s = 0.45 (p = 0.05)*
PT (%)	r _s = 0.51 (p = 0.03)*	r _s = 0.32 (p = 0.12)	r _s = 0.51 (p = 0.03)*	r _s = 0.51 (p = 0.03)*	r _s = 0.32 (p = 0.12)	r _s = 0.51 (p = 0.03)*

PT: peak torque; (N-M): newton-meters; %: relative; sup: supine; ort: orthostatic; Δabs: 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 is the MS the higher is the tonic (resting supine) and phasic (withdrawn on standing up) vagal modulation.

G-31 Free Communication/Poster - Perception

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

3640 Board #87 June 3 8:00 AM - 9:30 AM
Sport Events, Task Motivation Climate and Motivation in Physical Education Learning

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 (No relationships reported)

The impact of differences in sport events on the motivation of Physical Education Learning (PEL) has rarely been investigated although it has been reported that task

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: $F_{intrinsic} = 5.147, P < 0.05$; $F_{autonomy} = 5.013, P < 0.05$; 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 ($T_{relatedness} = -3.995, P < 0.01$). 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 autonomic 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

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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 functionality. Previous 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?

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ABSTRACT

Objective: To examine how maximal oxygen uptake (VO_{2max}) is related to rating of perceived capacity (RPC) and evaluate VO_{2max} at onset of training in healthy untrained adults.

Methods: 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 VO_{2max} . 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 answered before measurement of VO_{2max} (using a stepwise modified Balke-protocol until exhaustion) 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. VO_{2max} 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 higher than objectively measured values of VO_{2max} . The mean differences between the two methods were + 0.98 (± 1.96) and + 1.31 (± 1.96) 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 $r = 0.426$ ($p < 0.01$). VO_{2max} 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 VO_{2max} individually.

Key words: Rating of perceived capacity, RPC scale, VO_{2max} , METs

3643 Board #90 June 3 8:00 AM - 9:30 AM

Can Rate Of Perceived Exertion Be Used To Estimate Muscle Activation?

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(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 ranks test were used to compare relative iEMG with RPE. Sex differences were assessed with Mann-Whitney U tests.

RESULTS: Relative iEMG for breaststroke was [mean ± standard deviation (SD)] 74 ± 14 for UBM, 64 ± 13 for LBM and 69 ± 13 for 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

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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-seven college aged men were assigned to one of two groups based upon training age: experience benchers (EB) (n=14, 4.7±2.0 yrs of training) and novice benchers (NB) (n=13, 1.1±0.6 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 RIR-based 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-tail independent-sample t-tests examined differences in RPE and velocity between EB and NB. **RESULTS:** ACV at 100% of 1RM in EB was slower (0.14±0.04 m·s⁻¹) compared to NB (0.20±0.05 m·s⁻¹) (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 yrs 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= .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 category. Percent body fat and muscular endurance (curl-up test) also had low levels of agreement with only 19% of participants accurately identifying their body fat category and muscular endurance category. Flexibility was the category with the highest level of agreement (33%) between actual and perceived category. **CONCLUSION:** The results of this study suggest that college students do not accurately perceive their actual health-related fitness compared to their measured fitness. Thinking one is more fit than one is could impact behaviors such as food choice and exercise that increases one's risk of hypokinetic diseases. 1. Arts, J., Fernandez, M. L., & Lofgren, I. E. (2014). Coronary heart disease risk factors in college students. *Advances in Nutrition: An International Review Journal*, 5(2), 177-187.

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. Heatherly, Gavin W. Hall, Eric K. O'Neal. *University of North Alabama, Florence, AL.* (Sponsor: Matt Green, FACSM)
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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:** Trained (VO₂max = 53.0 ± 6.8 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 (1.02 ± 0.10 vs 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 overall did not differ significantly between treatments. **CONCLUSION:** Although gait and pace were altered significantly, physiological and perceptual responses between the MT and NMT were similar. NMT time trial testing can be expected to elicit similar endurance exercise stresses when a more "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 #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 Dolan², Michael C. Zourdos¹. ¹Florida 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: 88.95±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 3. **RESULTS:** Average TA was 4.7±3yrs and CA was 25±3yrs. There were moderate inverse correlations approaching significance between TA and the RIR difference at the called 5RPE (r=-0.35, p=0.094) and 7RPE (r=-0.34, p=0.096), however no relationship for TA at the called 9RPE (r=-0.23, p=0.32). Regarding CA, no difference existed with the RIR difference at 5RPE (r=-0.27, p=0.20), however, CA had a moderate inverse relationship with RIR difference at a 7RPE (r=-0.36, p=0.07), and a moderate significant correlation with a 9RPE (r=-0.50, p=0.021). **CONCLUSION:** Our findings suggest that a lower TA is related to increased difficulty of RIR assessment when 3 or more RIR exist. However, TA was not related to RIR accuracy close to failure (i.e. 9RPE). Interestingly, greater CA is associated with more accurately assessing RIR closer to failure.

3648 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. Perlmutter¹, Jacob A. Goldsmith¹, Daniel M. Cooke¹, Ryan K. Byrnes¹, Michael H. Haischer¹, Jose C. Velazquez¹, Adam Sayih¹, Eric R. Helms¹, Chad Dolan², Michael C. Zourdos¹. ¹Florida Atlantic University, Boca Raton, FL. ²University of Houston, Houston, TX. (Sponsor: Michael Whitehurst, FACSM)
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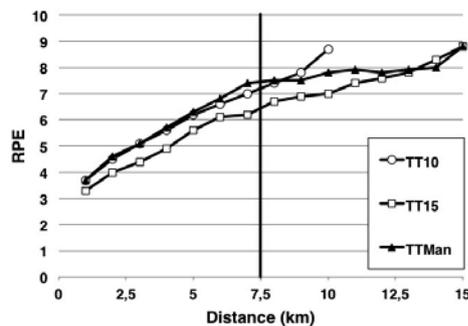
The resistance training-specific rating of perceived exertion (RPE) scale measuring repetitions in reserve (RIR) has been validated to gauge effort per set in resistance exercise. However, it is unknown what descriptive factors of the lifter influence RPE/RIR accuracy. **PURPOSE:** The purpose of this study was to examine the relationship between total repetitions per set and the accuracy of intra-set RPEs of 5, 7, and 9 on the 1-10 RIR-based RPE scale. **METHODS:** Twenty-five college-aged and resistance trained men (Age: 25±3yrs, Body Mass: 88.95±14.72kg) performed a one-repetition maximum (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 product moment 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 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 5RPE ($r=0.64, p=0.01$) and 7RPE ($r=0.56, p=0.004$), however no relationship between total repetitions and the RIR difference existed at the called 9RPE ($r=0.01, p=0.97$). **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

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 (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. **Results:** A significant main effect of time-trial condition on RPE scores until kilometer 7.5 was found (P=0.016). Post-hoc comparisons showed that the RPE values of the TT15 were lower than the RPE values of the TT10 (Diff:0.60; CI:0.11, 1.0) and TTman (Diff:0.73; CI:0.004, 1.5). After the 7.5 km, a transition phase occurs, in which an interaction effect is present (P=0.011). After this transition phase, the RPE values of TTman and TT15 did not statistically differ (P=1.00). **Conclusions:** This novel distance-endpoint manipulation demonstrates that it is possible to switch between RPE templates. A clear shift in RPE during the TTman is present between the RPE template of the TT10 and TT15. The shift strongly supports suggestions that pacing is regulated using a RPE template.



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

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 (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 oxygen consumption (average HR% = 76.6±6.3%). HR and RPE were recorded every 5min during exercise. Respiratory values (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=.001) and Week 12 (0.93, 95% CI [0.91, 0.95]; 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 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

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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 either FEV₁ (% predicted) (changes in VO₂ peak were also significantly associated with changes in CRP ($r=-0.248, p=0.041$) after controlling for FEV₁ (% predicted), BMI, and sex. Longitudinal changes in VO₂ peak 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).

3652 Board #99 June 3 8:00 AM - 9:30 AM

Prevalence of Asthma and Exercise-induced Bronchoconstriction In College Wrestlers

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Exercise-Induced Bronchoconstriction (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) ($35 \cdot FEV_1 \cdot 0.5$ and $35 \cdot FEV_1 \cdot 0.6$). After the baseline spirometry was obtained the athlete performed exercise on a treadmill at 80-90% of their age predicted maximum 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%) having 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 FEV₁ drop post-exercise $12.8 \pm 2.2\%$) indicating EIB. In total, undiagnosed asthma (n=2) and EIB (n=4) were present in 18.8% of the college wrestlers who were unaware of their condition. **CONCLUSION:** Results of this study are important for raising awareness and potentially improving performance due to unknown pulmonary conditions in college wrestlers.

3653 Board #100 June 3 8:00 AM - 9:30 AM

Asthma, Undiagnosed Asthma, And Exercise-Induced Bronchoconstriction In Collegiate Men's Basketball

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Asthma and Exercise-Induced Bronchoconstriction (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 ongoing analysis is to systematically investigate these pulmonary conditions in athletes across the University-affiliated athletics program. **METHODS:** The current focus was on men's basketball players. The EIB protocol commenced with spirometry. Participants were encouraged to expire as forcefully as possible (and achieve a six second plateau). Values were collected in duplicate, with readings ideally within 150ml. Subjects with asthma and those failing to achieve a forced expiratory volume (FEV₁) of at least 70% of the predicted value were removed from ongoing testing. After the baseline spirometry was evaluated, the athletes performed a single-bout of exercise, intensifying to 80-90% of age predicted maximal heart rate (HR). Once at target HR, the stage was held for 4 minutes. Confirmation of an appropriate exercise intensity was established by confirming that 40-60% of the maximal ventilation was achieved ($35 \cdot FEV_1 \cdot 0.5$ and $35 \cdot FEV_1 \cdot 0.6$). Post exercise, participants repeated the spirometry efforts at 2, 5, 10, 15, and 20-min time points. A fall in FEV₁ > 10% from baseline was considered positive for EIB. Values were reviewed by a registered respiratory therapist. **RESULTS:** Fifteen student-athletes volunteered for testing, as 1 (6.67%) had been previously diagnosed with asthma, he was excluded from ongoing testing. In the cohort tested, all athlete's obtained a minimum of 70% of predicted FEV₁ at pre-test. Of the 14 subjects completing the protocol, 2 (13.3%) failed to obtain 90% of their pre-exercise FEV₁ (mean drop $11.6 \pm 1.2\%$) at one of the post-test time points; an indication of EIB. In one subject (6.67%), results were not conclusive. **CONCLUSIONS:** There is value in raising awareness of these pulmonary conditions in athletes. Also, future research should simultaneously consider the divergent physiological, environmental, and bioenergetic demands placed on the athlete to investigate the prevalence rates from a more comprehensive view.

3654 Board #101 June 3 8:00 AM - 9:30 AM

Muscle Oxidative Capacity Is Low In The Upper And Lower Limbs Of COPD Patients

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Muscle 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 *biceps brachii* endurance in COPD (Franssen et al. *MSSE* 37:2-9, 2005). We were therefore interested whether loss of muscle oxidative capacity was different between upper and lower limbs in COPD.

PURPOSE: 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%pred 44.1 ± 18.7 ; 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 vascular 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 ($F=11.7$, $\eta_p^2=0.14$, $p<0.001$): COPD patients had significantly lower *k* in both upper and lower limb muscles (upper 1.01 ± 0.17 , lower $1.05 \pm 0.24 \text{ min}^{-1}$) compared with CON (1.27 ± 0.49 , $1.49 \pm 0.67 \text{ min}^{-1}$). However, there was no effect of limb ($F=1.8$, $\eta_p^2=0.03$, $p=0.18$) and no group x limb interaction.

CONCLUSION: We found that muscle oxidative capacity is lower in COPD than 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 forearm (-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.

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3655 Board #102 June 3 8:00 AM - 9:30 AM

Prevalence of Exercise Induced Bronchoconstriction in Puerto Rican Athletes with Respiratory Symptoms during Exercise

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Athletes in endurance sports such as running, swimming and cycling, are at increased risk for exercise-induced bronchoconstriction (EIB). Exercise hyperventilation and frequent exposure to allergens and bronchial irritants, such as chlorine by-products in swimming pools, have been implicated in bronchial hyperresponsiveness, especially in those with a history of asthma. There is a high prevalence (~11%) of asthma in the general population of Puerto Rico and asthmatic athletes may be at risk of severe asthma exacerbations precipitated by exercise. **PURPOSE:** We examined the prevalence of EIB in athletes with respiratory symptoms during exercise, which underwent an exercise challenge test in our Center. **METHODS:** 54 athletes (14 adults, 40 adolescents; 25 females, 29 males) in 16 sport events classified as either low (skill, sprint/power, multiple events; N=18), medium (team, combat; N=12), or high (endurance; N=24) risk for EIB were examined. They completed an exercise challenge test, either running, cycling, or swimming at an intensity of 70-95% of estimated maximal heart rate for at least 7 to 15 min. Spirometry was measured pre-exercise and at 2, 5, 8, 11, and 15 min post-exercise. A fall in forced expiratory volume in 1 second (FEV₁) >10% was considered positive for EIB. **RESULTS:** Of the 54 athletes, 17 (31.5%) were positive for EIB. The prevalence among female and male athletes was 20% and 41%, respectively. 15/17 EIB positive athletes were adolescents, including 8 swimmers. Half of the EIB positive athletes were from events classified as high risk for EIB such as: long distance running (n=2) and swimming (n=4), road cycling (n=1), and triathlon (n=1). Eleven of the EIB positive athletes (65%) had a previous diagnosis of asthma, and 7 of those also had allergic rhinitis. Two of EIB positive athletes had allergic rhinitis only. Swimmers had an EIB prevalence of 53% (8/15). **CONCLUSION:** Results indicate that EIB may affect 1 in 3 athletes who

report respiratory symptoms during exercise. The prevalence is highest in swimmers suggesting airway hyperresponsiveness that may be associated to a previous history of asthma, allergic rhinitis, 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.

3656 Board #103 June 3 8:00 AM - 9:30 AM

Relationship between Vascular Health and Maximal Exercise Capacity Following Sildenafil Treatment in Cystic Fibrosis

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Patients with cystic fibrosis (CF) have compromised exercise capacity (VO_2 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 VO_2 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 (FEV_1) was assessed via spirometry as an index of disease severity, and VO_2 peak was determined on a cycle ergometer using the Godfrey protocol. Pearson correlations were used to investigate associations between changes (Δ) in VO_2 peak, FMD, and PWV while controlling for potentially confounding variables. **RESULTS:** VO_2 peak increased from 44.4 ± 8.7 to 46.6 ± 10.0 ml/kgFFM/min ($p = 0.010$) after controlling for baseline disease severity (FEV_1). FMD increased from 8.3 ± 5.2 to 9.3 ± 3.6 % ($p = 0.07$). There was a significant relationship between ΔVO_2 peak and ΔFMD ($r = 0.636$, $p = 0.035$) 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, $p = 0.077$); however, the change was not associated with ΔVO_2 peak ($r = 0.400$, $p = 0.373$) or ΔFMD ($r = 0.063$, $p = 0.894$) 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.

3657 Board #104 June 3 8:00 AM - 9:30 AM

<Using Active Video Game For Home Rehabilitation With COPD Patients: A Feasibility Study>

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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 never been tried with COPD patients. Thus, the objective was to observe the feasibility of using this device safely and easily with COPD patients. **METHODS:** A total of 14 patients (8 men 69±6 years, 6 women, 74±6 years), with a moderate to severe COPD diagnostic (FEV_1 % predicted: 44.0 ± 14.8 %, FEV_1/V_C (%): 43.8 ± 15.2 % and FEV_1 : 1.12 ± 0.38 L, without a significant difference between the genders $F(1)=3.307$, $p=0.096$) performed 4 mini-games (Shape-Up, Ubisoft) adapted for their condition. During the games, the oxygen uptake, ventilation, heart rate and saturation was taken with a portable metabolic analyser (Metamax, Cortex Medical, Germany). Gaming sessions of 10 to 15 min duration 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): 23.1 ± 5.6 , 31.8 ± 9.8 L/min, and 3.7 ± 1.2 METs; To the Core (Core twist), 22.2 ± 7.3 , 29.2 ± 9.9 L/min, and 3.3 ± 1.1 METs, and Squat me 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 that the game 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.

3658 Board #105 June 3 8:00 AM - 9:30 AM

The Acute Response to Sprint Interval Exercise in Adults With and Without Confirmed Airway Hyper-responsiveness

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Among those with airway hyper-responsiveness (AHR), acute bronchoconstriction typically follows an acute bout of moderate intensity continuous exercise (MICE) due to an increase in ventilation. Similar to high intensity interval exercise, sprint interval exercise (SIE) may reduce the risk of bronchoconstriction due to the recovery periods between sprints. **Purpose:** To compare changes in lung function following a SIE and a MICE session in those with and without confirmed AHR. **Methods:** Participants completed four sessions. Session 1 was to confirm AHR using a $\geq 15\%$ decline in forced expiratory volume in 1 second (FEV_1) following a eucapnic voluntary hyperpnea challenge. In session 2, participants completed a maximal exercise test to determine maximal O_2 uptake and peak power output (PPO). Participants then completed SIE (4 x 30 second sprints at 0.075kg/kg bodyweight, separated by 4.5 minutes of unloaded cycling) and MICE (65% PPO for 20 minutes) sessions in random order separated by at least 72 hours. All exercise sessions were completed on a cycle ergometer. Lung function was assessed pre and post exercise (1, 5, 10, 15, and 20 mins post) as well as at 3.5, 8.5, 13.5 and 18.5 minutes during exercise to coincide with time points post-sprint. Expired O_2 and CO_2 were collected breath-by-breath, and deoxygenated hemoglobin (HHb) was continuously monitored throughout exercise using near-infrared spectroscopy. **Results:** No statistically significant difference was observed for FEV_1 when comparing SIE and MICE ($8.56 \pm 7.07\%$ vs. $8.48 \pm 3.09\%$, respectively, $p=0.98$) among those with AHR. One participant with AHR experienced a $\geq 10\%$ decline in FEV_1 following SIE and another participant experience a clinically relevant decline following MICE. In participants with AHR, no statistically significant differences were observed in average ventilation during MICE compared to SIE (66.97 ± 10.69 vs. 64.20 ± 9.89 , $p=0.35$). Peak ventilation was greater during SIE (108.27 ± 17.00) compared to MICE (87.66 ± 13.88 , $p<0.05$). In participants with AHR, maximum ΔHHb was not significantly different when comparing SIE and MICE (5.03 ± 3.73 vs. 5.79 ± 2.67 , respectively, $p=0.43$). **Conclusion:** SIE and MICE lead to similar post-exercise declines in lung function. This may be due to the similar average ventilation observed in both sessions.

3659 Board #106 June 3 8:00 AM - 9:30 AM

Abnormal Gas Exchange in Dyspneic Veterans with Normal Spirometry

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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 (45.3±11.6 years) reported ≥ 2 lower respiratory symptoms on a bi-weekly basis over the preceding 6 months (High Sx), and 13 (46.5±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: 99.9 ± 10.8 , 98.0 ± 12.8 %predicted) and forced expiratory volume in 1 second (99.5 ± 12.5 , 97.0 ± 14.7 %predicted) were similar between groups. On CPX, veterans in the High Sx group had lower peak oxygen consumption (VO_2) 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 (52.5 ± 15.9 , 51.7 ± 11.1 % peak VO_2). High Sx veterans had a significantly higher ventilatory equivalent for carbon dioxide (VE/VCO_2) slope (34.7 ± 11.4 , 27.0 ± 3.2 , $p<0.05$), and revealed significantly lower end-tidal carbon dioxide ($PetCO_2$) levels at ventilatory threshold (36.6 ± 7.3 , 41.4 ± 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.

3660 Board #107 June 3 8:00 AM - 9:30 AM
Postoperative Complications After Surgical Treatment For Exercised Induced Laryngeal Obstruction

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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 for a postoperative follow-up exercise laryngoscopy (mean interval 5.8 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.

3661 Board #108 June 3 8:00 AM - 9:30 AM
Influence of Respiratory Limitation on Exercise Capacity with Potential Implication of Ventilatory Muscle Fatigue

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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 (Vt), respiratory rate, expiratory time (T_e), 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 Vt (1449±83 vs 1795±124 ml; p=0.04) and Ve (61±6.7 vs 71.4±4.1, Cohen's ES=0.70) and prolonged T_e (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 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 Vt, and an increase in T_e coupled with a decreased time to exhaustion suggest that respiratory muscle fatigue may have contributed to low cardiorespiratory fitness and endurance in these subjects.

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3662 Board #109 June 3 8:00 AM - 9:30 AM
Health Related Quality of Life in COPD Patients Completing Aerobic and Resistance Training

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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 (CRDQ) - 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 CRDQ 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.

3663 Board #110 June 3 8:00 AM - 9:30 AM
Supplemental Oxygen Enhances the Effects of Interval Training On Exercise Capacity in Cystic Fibrosis

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PURPOSE: to examine the effect of interval exercise training with supplemental O₂ on VO₂ kinetics and endurance time in individuals with cystic fibrosis (CF).

METHODS: Using a single blind design, adults with different severities of CF were randomly assigned to a room-air group (n=4, FEV₁ = 43(31-109) % of predicted) or supplemental O₂ group (n=5, FEV₁ = 45(31-86) % of predicted). The training program consisted of interval training on a cycle ergometer, 2 days a week for 8 weeks at an intensity of 30% and 75% of the initial peak work rate (WR). All subjects performed a pulmonary function test, incremental symptom-limited cardiopulmonary exercise test on a cycle ergometer, and a submaximal constant WR exercise test at 30% and 70% of the initial peak WR. VO₂ kinetics assessed by mean response time (MRT) and physiological responses during low and high constant exercise were assessed before and after the exercise program. Within each group, data were compared using the Wilcoxon sign rank test.

RESULTS: Breathing supplemental O₂ during the training program improved the total duration of high intensity interval training by 93% (p<0.05) in the supplemental O₂ group between week 1 and week 8 (15±3 vs. 29±2 min, p<0.05), with no change in the room-air group (17±4 vs. 25±9 min). The improved in VO₂ kinetics (MRT) was significantly greater in the supplemental O₂ group than the room-air group following exercise training, 40(36-58) to 32(26-53) versus 42(28-67) to 36(26-58) min, respectively, p<0.05. Endurance time to exhaustion in high intensity constant load exercise improved following exercise training in the supplemental O₂ group [11 (11-14) vs. 27 (14-30) min, p<0.05], and did not change in the room-air group [10 (7-20) versus 18 (8-27) min].

CONCLUSIONS: The provision of supplemental O₂ during exercise training yields higher training volume and improves VO₂ kinetics and endurance capacity in CF patients. Supported by the Cystic Fibrosis Hopesource Foundation in Ireland

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
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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:

	Endurance Time (sec)	Pull-up (#)	Plank (sec)	Handgrip (kg)	Leg extension (pounds)
Male	663.30±152.44	6.32±6.38	63.86±49.58	45.8463±21.42	113.88±65.16
Female	636.83±122.74	3.56±4.15	58.08±40.92	39.3208±14.33	104.25±50.67
Total	649.52±138.31	4.94±5.55	60.96±45.52	42.57±18.49	109.02±58.47
Male	-.49	.12	.22	.79	.70
Female	-.47	-.21	.12	.79	.67
Total	-.47	-.01	-.18	.78	.69

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
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(No relationships reported)

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. The purpose of this study was to create a procedure that would determine if a running wheel was accurately functioning based on the measured data.

METHODS: The TAMU IACUC approved all procedures. SENCAR breeder pairs were mated and at 3 weeks of age, the female pups were co-caged. At 4 weeks of age, two running wheels were mounted in each cage, with an odometer attached to the top of the cage to record daily distance (km/day), duration (mins/day), and to calculate speed (m/min). At 14 weeks of age, the number of manual rotations required to reach a 0.01 km change on the odometer was determined with the number of rotations averaged across three trials. Each wheel's position in relation to the computer pick-

up was then adjusted until the total spins to reach a 0.01 km odometer change were as close to 61 (calculated to be the true distance of 0.01 km) as possible. Resulting average daily distance, duration, and speed were compared to the amount of rotations before and after adjustment using a one-way ANOVA.

RESULTS: 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±6.6 rotations, respectively). Before adjustments, rotations had varying correlations with distance (R²=0.080; p=0.18), duration (R²=0.027; p=0.44), and speed (R²=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). **CONCLUSIONS:** 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
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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 (V_E/V_{O₂}) for T1 and LTP₂, VT₂, V_E/V_{CO₂}, 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 LTP₂, VT₂, lowest turn point of V_E/V_{CO₂} and the HRTP with any of the three calculation methods. To compare the results with the PO at the maximal lactate steady state (MLSS), the following criterion was used: a valid MLSS prediction was provided if the difference between the PO estimate and the PO at the MLSS was within a range of ± 4% from the maximum PO resulting from the incremental test. Pearson's chi-square was used to test for the effects. To determine the association between the variables, pairwise comparisons were calculated via Bonferroni-Holm tests. **RESULTS:** Prediction frequencies were only significantly different between the angle and regression for LTP₂, as well as the angle and regression and regression and error variance in VT₂. **CONCLUSION:** The implemented calculation methods had a prediction accuracy of ~75-80% using a ± 4% criterion. Based on the present results it is not possible to identify a single best method whereby angle seems to be the most robust variable. To improve calculations and estimations of the above listed variables should be the leading priority for future research endeavors.

3667 Board #114 June 3 8:00 AM - 9:30 AM
Effect Of Neighborhood-unit Definition On The Relationship Between Physical Activity And The Built Environment
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(No relationships reported)

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

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 400-500m (OR: 3.2, 95% CI: 1.4, 5.8), and 800-1000m (OR: 2.9, CI: 1.3, 7.1), had greater odds of reporting a significant association between GIS built environment measures 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:** Researchers aiming to accurately estimate the effect of the neighborhood built environment on physical activity should consider using 400-1000m 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. Supported by NIH 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

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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 for sarcopenia, 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 720) with the gold-standard DXA scan (Hologic Horizon W). **METHODS:** Participants were 277 older adults from 65 to 96 years old without history of cancer and severe medical or mental conditions. Individuals completed a 12-hour fast, refrained from activity that morning and wore scrubs. BIA and DXA analyses were taken immediately after each other. **RESULTS:** Correlation between the two methods for fat free mass (FFM), ALM, and percent body fat (PBF) were 0.93, 0.86 and 0.92, respectively, after adjusting for age and sex. Mean Percent Error (MPE) (DXA - InBody) 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:

$$\text{DXA FFM} = 0.83 (\text{BIA FFM}) + 0.025 (\text{Age}) + 2.0 (\text{Sex}) + 0.36 (R^2=0.96)$$

$$\text{DXA ALM} = 0.74 (\text{BIA ALM}) - 0.025 (\text{Age}) + 1.84 (\text{Sex}) + 4.15 (R^2=0.92)$$

$$\text{DXA PBF} = 0.71 (\text{BIA PBF}) - 0.089 (\text{Age}) - 3.3 (\text{Sex}) + 23.5 (R^2=0.91)$$

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.

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

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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 (VAT) area. However, recent studies indicate that using a single-slice image may lead to an erroneous conclusion as to individuals' VAT accumulation levels. Therefore, relying only on AC may be an inadequate method for evaluating individual VAT accumulation levels and defining MS. **Purpose:** To develop a new equation model for predicting VAT volume using anthropometric values and to clarify the association between metabolic risk factors and actual and predicted VAT volume values. **Methods:** The cross-sectional data of 214 participants (derivation group) were used to develop an equation model for VAT volume, and data from 66 of the participants (validation group) were used to validate this anthropometric model for predicting VAT volume.

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) - 8792.733. 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.

3670 Board #117 June 3 8:00 AM - 9:30 AM
Data Imputation Improves Sedentary Behavior and Physical Activity Estimates in Low Wear Time Accelerometer Data

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(No relationships reported)

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. Similarly, imputed estimates of SB, LPA, and MVPA were compared to the RAW data set at the 10-hour adherence level. **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.

G-34 Free Communication/Poster - Training and Recovery

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

3671 Board #118 June 3 9:30 AM - 11:00 AM
Effects Of Different Pull Up Training Strategies On Pull Up Scores

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PURPOSE: The ability to perform pull ups is important for improving mission readiness and for career advancement and retention for tactical athletes such as military, fire, and police. The purpose of this study was to investigate different strategies for improving pull ups. **METHODS:** Healthy adults were recruited via the internet and randomized into one of four training groups: traditional (5 sets of repetitions to failure, n=17), additional

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 up training, $n=9$). 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. All intervention groups improved significantly more than the 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 Measure

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Non-contact ACL injuries account for ~75% of all knee injuries. Landing criteria have been recommended as a prevention strategy: proper knee and hip flexion angles, minimize knee abduction and land softly on both feet simultaneously. However, when fatigued, individuals have been shown to adopt higher risk landing strategies.

PURPOSE: Evaluate landing impacts during maximal vertical jumping (MVJ) until exhaustion using a novel measurement method. **METHODS:** 14 male and 14 female, recreational athletes performed a MVJ every 5 s until exhaustion. We monitored 3D lower limb kinematics and vertical ground reaction forces (VGF) with parallel force plates. Effective duration (ED) is calculated as the VGF impulse during landing (first ground contact to the bottom of crouch when vertical velocity becomes zero) divided by the peak VGF, and represents the magnitude of the peak force relative to the downward momentum that was arrested during the landing. A decreasing ED would be associated with less hip, knee and/or ankle flexion during a landing and would pose a higher risk for instability and injury at the knee. For example, a peak GRF of 1779.9 N would need to be exerted for 0.122 s (ED), to equal the total impulse (217.4 Ns) of the entire landing curve. Jump height was also recorded and normalized to body mass and time was expressed as a percent of trial duration (%trial = 0, 20, 40, 60, 80, and 100%). **RESULTS:** There was a main effect of time and gender on both jump height and ED. Males jumped 53% higher than females but both genders had a significant decrease in jump height with fatigue. Females maintained an ED that was an average of 14.5% longer than males, but both demonstrated progressive and significant decreases in ED in response to fatigue (18% decrease by the end of the trial). **CONCLUSION:** This measure was found to provide an excellent representation of the impact severity, independent of the height jumped, so it was an effective single measure that could monitor the adverse effects of fatigue on the risk of knee joint injury over the course of the trials. Effective duration shows promise for instantaneous feedback of landing impact injury risk so that athletes at risk can be identified and trained to maintain safe landing mechanics in the face of fatigue.

3673 Board #120 June 3 9:30 AM - 11:00 AM
11-wk Preparation With Polarized Compared To Pyramidal Intensity Distribution Is Not Superior In Sub-Elite Rowers

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Polarized intensity distribution (POL) is discussed to be superior to pyramidal distribution (PYR) in high performance endurance sports. POL is characterized by relatively high training volume performed in zone (Z) 1 (low intensity; < 2 mmol/L blood lactate) and Z3 (high intensity; > 4 mmol/L blood lactate), with far less volume in Z2 (close to lactate threshold). PYR is characterized by greater volume in Z2 than in Z3, albeit similar total volume. **Purpose:** The aim of this prospective study was to evaluate whether the gains in performance was superior with POL when compared to

traditional PYR in sub-elite rowers during the final 11 weeks of a preparation period.

Methods: Fourteen internationally competing German male rowers participated in the 11-wk intervention and pre-post testing (age: 20 ± 2 y, VO_{2max} : 66 ± 5 mL/min/kg). The sample was split into a PYR and a POL group by varying the percentage spent in Z2 and Z3 and matched for overall training and rowing volume including strength, unspecific endurance and other training (e.g. stretching). The actual training and intensity distributions were calculated from all athletes' official training diaries and heart rate. To quantify the level of polarization, an index was calculated as follows: Pol-Index = $\log(Z1/Z2*Z3)$. Main outcome variable was average power in 2000 m ergometer test (P2k) (Concept 2). **Results:** PYR and POL did not significantly differ regarding specific training volume (1334 ± 67 km and 1255 ± 264 km) or total volume (5953 ± 315 min and 5919 ± 1216 min), but POL had a significantly higher percentage of Z3 intensities ($6 \pm 3\%$ vs. $2 \pm 1\%$; $p < .005$) and lower amount of Z2 ($1 \pm 1\%$ vs. $3 \pm 2\%$; $p < .05$) than PYR while Z1 was similar ($94 \pm 3\%$ vs. $93 \pm 2\%$, $p = .37$). P2k significantly improved from 443 ± 30 W to 445 ± 26 W ($p = .023$), but no changes were found between groups or between measurements within groups. 6/7 (86%) of the rowers with a Pol-Index > 2 improved P2k by more than 1.3%, being the estimated error of measurement for this specific test. **Conclusion:** POL was not significantly superior to PYR during 11 wk of preparation in 14 rowers. However, results suggest that POL could be beneficial and advantageous, if it is particularly pronounced.

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

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(No relationships reported)

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 own stability and balance at the same time. This lies on the strong support of core muscles. As we known, sling exercise training (SET) is an effective method for core stability training, which can enhance core strength and stability and improve the ability of balance control. 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 athletes.

Methods: A total of 14 health 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 (MAV), 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 $177.1^\circ/\text{sec}$ to $197.0^\circ/\text{sec}$. (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

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(No relationships reported)

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.

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

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).

	T1	T2	T3
Pre-swing	.30 (.37)	.51 (.45)	.59 (.43)
Contact	.85 (.30)	.76 (.41)	.87 (.19)
Follow-through	.90 (.23)	.83 (.23)	.87 (.20)

3676 Board #123 June 3 9:30 AM - 11:00 AM
Effects Of Aerobic Exercise Using Swiss-ball Or Chair Compared With Walking.

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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 were nearly identical with walking at 6 km/h (4.5±0.4 Mets). In contrast, the exercise intensity and heart rate in aerobic exercise using chair were nearly same as walking at 4-5 km/h (3.3±0.4 Mets - 3.8±0.5 Mets).

CONCLUSIONS: The exercise intensity and heart rate during aerobic exercise using SB or chair was nearly identical with moderate-intensity walking. The aerobic exercise using SB or chair can be alternative to walking for people who cannot walk.

3677 Board #124 June 3 9:30 AM - 11:00 AM
Time Course for Physiological Adaptations with Hypobaric Exposure: A Research-Pedagogical Project

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PURPOSE: The purposes were: 1) determine physiological change following a brief sojourn training period at altitude; 2) through pedagogy, facilitate student proficiency in methods of testing and interpretation in determining rate of change in adaptation. **METHODS:** A pre-post testing measurement design utilizing twelve (n=12) volunteers from the Midwestern State University Cycling Team was used. Subjects signed an Informed Consent, approved by the Institutional Review Board for Humans as Subjects at Midwestern State University. Measures were sub-categorized into Resting and Exercise. A Repeated Measures ANOVA determined differences between pre and post-tests. Alpha was set *a priori* at p < 0.05. **RESULTS-Physiological:** Subject means and standard deviation (SD) for descriptive measures were: age, 21.56 (2.83) y; height, 161.83 (34.68) cm; weight, 69.36 (8.37) kg; body fat, 6.6 (1.98) %; maximal oxygen consumption, 70.41 (8.61) ml*kg⁻¹*min⁻¹; peak lactate, 14.25 (2.56) mM; maximal power, 372.22 (55.12) watts. Significant (p<0.05)

changes in baseline vs. altitude exposure were seen in average heart rate, 164 vs 162 (b*min⁻¹), respectively and average blood lactate 6.01 vs 5.83 (mM) respectively, across the workload continuum. Maximal oxygen consumption (Max VO₂) and time to exhaustion (TE) after altitude exposure improved (increase and decrease, respectively) over baseline. Hematocrit, hydration status via urine specific gravity (USG), fasting blood glucose (mg*dL⁻¹) and kilocalorie (Kcal) consumption were not significantly altered during five days of altitude exposure. **RESULTS-Pedagogical:** Students showed proficiency in the following: anthropometry, blood pressure, electrocardiograph (ECG), urine specific gravity (USG), blood glucose, blood lactate, Max VO₂. In addition, students were involved in research literature review and article summation. Following the research data collection, the students were shown statistical procedures for research analysis. **CONCLUSION:** This project involved a research component and a pedagogical component. Physiologically, exposure to altitude showed trends toward positive performance measures after five days of exposure. Pedagogically, this project allowed for experiential learning for undergraduate students and involvement in research.

3678 Board #125 June 3 9:30 AM - 11:00 AM
Velocity-based Training: Exploring The Potential Implications Of Training With Absolute Versus Relative Velocities

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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.

Absolute Velocity (m/s)	Estimated %1RM			Relative Load (%1RM)	Estimated %VMax		
	Mean	SD	Range		Mean	SD	Range
1.70	11	11	-32-27	15	42	6	33-57
1.30	33	8	-1-45	30	32	5	25-44
1.00	49	7	23-58	45	25	4	19-35
0.75	62	5	43-71	60	18	4	13-27
0.50	76	4	63-83	75	12	3	6-19
0.25	87	4	82-96	90	6	3	1-12
0.10	98	4	89-105	100	3	1	1-6

3679 Board #126 June 3 9:30 AM - 11:00 AM

Does Time of Day in Which Exercise Training is Performed Alter Fitness and Health Outcomes in Women?

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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 studies examining the influence of TOD on training-induced 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 (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. However, there were significant interactions ($p < 0.05$) of TOD x training for DBP (-10 ± 1 v. -5 ± 5 mmHg), RMR (-130 ± 65 v. -12 ± 36 kcal/d), FM (-1.0 ± 0.2 vs. -0.3 ± 0.2 kg), Abfat (-2.6 ± 0.3 v. -0.9 ± 0.5 kg), 1RM BP (8 ± 2 v. 12 ± 2 lb), Pushups (9 ± 1 v. 13 ± 2 reps), BT power (10 ± 6 v. 45 ± 28 Awatts), SJ power (135 ± 6 v. 39 ± 8 Awatts), AM vs. PM, respectively. **CONCLUSIONS:** The multimodal RISE protocol improved performance, cardiovascular 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.

3680 Board #127 June 3 9:30 AM - 11:00 AM

Differences in Physiological Responses Between Traditional and 3v3 Game Sessions Among Elite Developmental Ice-hockey Players

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(No relationships reported)

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 yrs \pm .27, 177.4 cm \pm 7.1, 72.9 Kg \pm 10.7) 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 WKO4 (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 exertion profiles for each on-ice session. MANOVAs for peak ACC and HR at each time point across games and 3v3 with magnitude and time 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 ($p < .05$), but not G3. No sig differences were observed for 20-60 sec ACC ($p > .05$), but small effects were present at all time frames ($\eta^2 = 0.021 - 0.077$). 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 ($p < .05$). For HR, no sig differences or effects ($\eta^2 < .01$) were present for any time frame less than 5 min. HR was higher for 5, 10, 20 ($p < .05$) 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 vs 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.

3681 Board #128 June 3 9:30 AM - 11:00 AM

Three Weeks of CrossFit Training Does Not Contribute To Overtraining Syndrome in Recreationally Trained Males: A Pilot Study

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(No relationships reported)

CrossFit® (CF) is currently one of the most popular health and fitness activities. However, CF faces strong opposition and criticism claiming it causes injury. **PURPOSE:** The purpose of this study was to investigate if CF participation contributes to overtraining syndrome. A secondary purpose was to determine if there are differences between CF original methodologies and real-world practice. **METHODS:** Six recreationally trained males (height, 182.8 ± 8.6 cm; weight, 84.3 ± 12.4 kg, and age, 25.0 ± 5.4 years) were randomized into two groups, theoretical (TH) or real-world (RW) prior to the intervention. Both groups completed pre-testing assessment of body composition, physiological, biochemical, psychological, and performance-based data. Both groups participated in CF training 5 days/week. The TH group completed training designed to follow original CF methodology while the RW group followed programming designed by a randomly selected CF affiliate. Prior to and at the end of each week blood was collected for serum analyses and select joint range-of-motions (ROM) were measured. Additionally, prior to each training session, resting heart rate (RHR), blood pressure (BP), muscle soreness (DOMS), and select training variables were collected. Following the completion of each training session, HR and perceived exertion (RPE) were collected. **RESULTS:** There are no significant differences in physiological, biochemical, immunological, psychological, or performance outcome variables assessed in this study for both between groups and pre-post testing (all $p > .05$). However, there are differences in intervention programming between TR and RW groups. In practice, there were significantly less element priority sessions in practice compared to what is recommended (40% vs 0%; $\chi^2 = 8.25$; $p = .016$). Element priority sessions had significantly lower associated training heart rates (127.4 vs 167.0 , 172.4 bpm; $F = 8.63$; $p = .001$) and ratings of perceived exertions (9.4 vs 14.8 , 14.7 ; $F = 15.26$; $p = .000$) than other session designs common in CF. **CONCLUSION:** These data suggest that short-term CF participation does not contribute to the development of overtraining syndrome in recreationally trained males.

3682 Board #129 June 3 9:30 AM - 11:00 AM

The First Twenty Exercise Training Program and Fire Academy Recruits' Fitness and Health

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(No relationships reported)

PURPOSE: To examine the effects of a novel high-intensity training program on fire academy recruits' health, fitness, and performance. **METHODS:** 13 participants were recruited from a fire academy and were randomly assigned to the control (CG, n=6) or intervention group (IG, n=7). Due to attrition 10 male recruits (23.8 ± 2.7 years) completed the study (CG, n=3, IG, n=7). The CG was asked to continue their current exercise habits. The IG was provided a 10-week online-based periodized training program developed by firefighters specifically for firefighters that included nutritional and mental readiness education. Participants completed pre/post-intervention assessments including a timed simulated fireground test (SFGT). A feasibility analysis was also completed for the IG. Due to the small sample size and group differences at baseline, descriptive statistics were calculated and each participant was reviewed as an individual case study. The Wilcoxon Signed Rank Test was used to compare pre- and post- changes among groups. **RESULTS:** The IG showed marked improvement on SFGT performance (40% to 86% passing); four improved their passing time. The IG significantly increased estimated VO_{2max} ($p = 0.028$), improved body composition (decreased fat mass and body fat %, $p = 0.028$), and increased grip strength ($p = 0.018$). With a small sample size we were unable to discern if the intervention improved recruit fitness and performance compared to the control group or other covariates, however, the CG showed no statistically significant changes. Though the IG completed ~75% of the assigned workouts, there may be a better way to implement this intervention. Participants mentioned they'd like group workouts led by a certified strength and conditioning coach/peer fitness trainer as opposed to workouts completed on their own. **CONCLUSIONS:** This study showed that a high-intensity training program improved fireground performance, aerobic fitness, body composition, strength, and agility among fire academy recruits. A larger randomized controlled trial is necessary to further investigate program effects among this population.

Abstracts were prepared by the authors and printed as submitted.

3683 Board #130 June 3 9:30 AM - 11:00 AM
Effect Of An Eighteen-week Cessation Of Physical Training On Army Rotc Cadets

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 (No relationships reported)

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 cardiorespiratory 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±3.8 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 Brozak formula. Cardiorespiratory endurance was assessed by completion of maximal oxygen uptake ($\dot{V}O_{2max}$) 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%; Δs =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 (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 $\dot{V}O_{2max}$ 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 $\dot{V}O_{2max}$ 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 effected body composition in both male and female Army ROTC cadets and cardiorespiratory endurance in male cadets.

3684 Board #131 June 3 9:30 AM - 11:00 AM
Training Unloading During Winter Break Improves Fitness in Male Rugby Players

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When athletes experience training distress, a break in training may facilitate recovery and improve performance. Conversely, when team training is interrupted, such as occurs during winter break in collegiate athletes, deconditioning may result. In the current study, physiological responses to exercise were made before and after an unstructured winter break in male collegiate rugby players. **PURPOSE:** The purpose of the study was to examine detraining effects that occurred when structured training was interrupted for four weeks. **METHODS:** Fourteen (n=14) male club rugby players underwent exercise testing to assess aerobic capacity ($\dot{V}O_{2max}$), strength (maximal bench press and leg squat), speed (10 yd dash), power (vertical jump), and body composition (body weight and % body fat by underwater weighing). A subject orientation of the testing was performed for all tests, and the treatment data were collected just prior to, and after the winter school break. T-tests were performed on pre- and post-winter break values. **RESULTS:** There was no evidence of detraining after four weeks of unstructured training. No changes were observed in bench press strength (183 versus 188.6 lbs) or speed (1.69 versus 1.69 seconds) across the break. However, performance measures for aerobic capacity (45.45 versus 47.70 ml/kg/min), squat strength (269.6 versus 308.2 lbs) and vertical jump (22.52 versus 23.94 inches) all showed significant improvements following the break. Additionally, there were significant increases in body weight (176.96 versus 178.63 lbs) and percent fat (12.76 versus 15.27% fat). **CONCLUSION:** Four weeks of unstructured training over the winter school break appears to have provided a recovery period that allowed for increases in physiological function despite increases in body fat.

3685 Board #132 June 3 9:30 AM - 11:00 AM
No Acute Effect of Sled Towing on Sprint Acceleration or Maximum Speed

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 (No relationships reported)

Sled 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 sled towing. **METHODS:** Eleven male field sport athletes (age=23.00±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±0.75s, 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.

3686 Board #133 June 3 9:30 AM - 11:00 AM
The Effect of Reduced Training Volume during Tapering on Kicking Response in Taekwondo Competitors

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PURPOSE: The purpose of the study was to evaluate the effect of training volume during tapering on kicking performance in college Taekwondo competitors trained under a periodization block model.

METHODS: Participants were eight men and four women of the taekwondo team at the University of Costa Rica. All individuals completed a 13-week macrocycle loading phase (10 weeks of load and 3 weeks of taper). Following the loading phase, participants were paired by gender and randomly assigned to either a condition in which they kept the same training volume or a condition where training volume was reduced by 50% using a linear pattern. Kicking motion time was measured by instructing individuals to perform a circular kick to a target located at 1.10m high followed by another kick to a target located at 1.60m high. Kicking time response was obtained by recording the time required to kick a random sequence of 10 targets. The "Fitlight Trainer system" was used to time both dependent variables. Measurements were recorded at the beginning of the loading phase, the sixth week of the load period and twice a week during each of the three weeks of the tapering phase. Effect sizes (ES) were computed and analysis of variance (ANOVA) tests were used to detect significant interactions.

RESULTS: No significant interactions were found on kicking motion-time (Pre = 1.39 ± 0.09s vs. Post = 1.26 ± 0.06s) and kicking time response times (Pre = 9.63 ± 1.01s vs. Post = 8.47 ± 0.51s) in the group following the same training volume and the group with reduced training volume (Pre = 1.35 ± 0.10s vs. Post = 1.26 ± 0.11; Pre = 9.42 ± 1.52s vs. Post = 9.57 ± 1.78s, respectively). ANOVA results showed that regardless of the training volume, during the tapering phase improvements were observed on kicking motion time (p = 0.03) and kicking time response (p = 0.04), with the best performance observed at the end of the third week of the tapering phase. The 50% training volume reduction produced a higher ES on kicking motion time (1.50) and kicking time response (3.32) compared to no reduction in training volume (0.86 and 0.04, respectively).

CONCLUSIONS: The reduction of volume training during tapering under a periodization block model improved kicking performance on taekwondo competitors. In the analyzed conditions, tapering must extend at least three weeks.

3687 Board #134 June 3 9:30 AM - 11:00 AM
Effects of a 3-week Core Training Program on Different Unstable Platforms

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 (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 y 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⁻¹ 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 Front 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 ± 38.1 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.

3688 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.

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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; 175.9±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±0.3 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 longer duration training programs and/or comparing the SwingFit program to other more established methods of training.

3689 Board #136 June 3 9:30 AM - 11:00 AM
Changes In Heart Rate Variability And Training Load In Elite Football Players

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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 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 athlete 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 (HSD), 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 15 week 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. Subsequently 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.

3690 Board #137 June 3 9:30 AM - 11:00 AM
Acute Effects of Plyometric Exercise on Blood Glucose

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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±7.8cm; mass=60.8±6.7kg and 7 males age=22.0±2.6yrs; height=182.3±3.6cm; mass=87.4±12.5kg) 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 squat jumps (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 anhydrous glucose in 100ml of water. Blood glucose measurements were taken via finger prick and analyzed by an Accu-Chek 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 (114.0±14.6mg/dl) and 30 (142.1±22.5mg/dl) min post compared to SIT (15min 130.8±14.0mg/dl & 30min 159.3±21.0mg/dl). Pairwise comparisons revealed that 5 (106.1±9.5mg/dl), 15 (114±14.6mg/dl), 30 (142.1±22.5mg/dl), and 60 (146.5±34.1mg/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±14mg/dl), 30 (159.3±21mg/dl), and 60 (144.6±19.1mg/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.

3691 Board #138 June 3 9:30 AM - 11:00 AM
Effects Of Lifestyle Modifications On Serum Testosterone Levels In Overweight And Obese Men

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 (No relationships reported)

PURPOSE: Testosterone is associated with lots of physiological functions in men. Obesity results in reduced serum testosterone levels in men. Previously, we demonstrated that combination of dietary modification and regular aerobic exercise increased serum testosterone levels in overweight/obese men. However, the differences in the effects on serum testosterone levels between dietary modification and regular aerobic exercise are unknown. The aim of this study was to compare the effects of dietary modification and regular aerobic exercise on serum testosterone levels in overweight/obese men.

METHODS: Twenty-four overweight/obese men completed 12-week dietary modification class (well balanced 1680 kcal/day diet: diet group) and twenty-seven overweight/obese men completed 12-week regular aerobic exercise intervention (1-3 days/week, 40-60 min/day: exercise group). Before and after the intervention, we measured serum testosterone levels in overweight/obese men.

RESULTS: At baseline, there were no significant differences in all parameters between both groups. Body mass was significantly decreased in both groups (both $P < 0.01$), and the magnitude of weight loss was greater in diet group than exercise group ($-7.8 \pm 2.0\%$ vs. $-2.1 \pm 0.6\%$, $P < 0.01$). While, serum testosterone levels were significantly increased only in exercise group, and we found a significant difference in the percentage change in serum testosterone level (diet group: $-0.3 \pm 8.6\%$, exercise group: $11.6 \pm 3.1\%$, $P < 0.01$). Moreover, in diet group, we found a significant correlation between percentage change in body mass and that in serum testosterone levels ($r = -0.77$, $P < 0.001$), but not in exercise group ($r = -0.16$, n.s.).

CONCLUSIONS: We demonstrated regular aerobic exercise significantly increased serum testosterone levels, while dietary modification did not change serum testosterone levels in overweight/obese men. Moreover, percentage change in serum testosterone levels did not correlate to that in body mass in exercise group. Thus, these results suggest that regular aerobic exercise increases serum testosterone levels independent of the change in body mass in overweight/obese men. These findings may provide a new insight into the role of regular aerobic exercise for prevention and/or treatment of obesity-induced health disorders.

3692 Board #139 June 3 9:30 AM - 11:00 AM
Comparison Of HR And BP Among A Non-exercise Session And Before HIIE And MICE Sessions

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Understanding changes in cardiovascular post-exercise values requires the accurate measurement of pre-exercise values. Exercise anticipation can elevate heart rate (HR) and blood pressure (BP). However, no study has compared these variables among a non-exercise session and before high intensity interval exercise (HIIE) and moderate intensity continuous exercise (MICE) with equivalent workloads. The development and implementation of a pre-exercise HR and BP measurement protocol that controls for the anticipatory response could provide a more precise understanding of acute HR and BP responses to exercises of different intensities. **PURPOSE:** To compare HR and BP among a non-exercise session and immediately before HIIE and MICE sessions. **METHODS:** Healthy participants ($n = 14$, 21.5 ± 2.1 yrs, 171.0 ± 9.4 cm, 72.6 ± 11.4 kg) reported to the laboratory on four occasions. Session 1 included HR and BP assessment, session 2 consisted of a maximal exercise test, and sessions 3 and 4 consisted of HR and BP assessments before either HIIE or MICE in a random order. Participants were previously informed that HIIE and MICE would be equivalent in total workload. HR and BP were measured using an oscillometric automated device (Omron 10 series, Illinois, USA) after 10 minutes of rest. The average of three readings taken 60 seconds apart was used for all measurements. **RESULTS:** Repeated measures ANOVAs compared HR and BP among sessions ($p < .05$). Systolic blood pressure was not significantly different among baseline (111.6 ± 8.6 mm Hg), HIIE (108.9 ± 7.4 mm Hg) or MICE (111.3 ± 8.0 mm Hg) ($F_{(2,26)} = 1.15$, $p = .33$). Diastolic blood pressure was not significantly different among baseline (74.4 ± 6.8 mm Hg), HIIE (71.7 ± 6.6 mm Hg), or MICE (72.7 ± 4.5 mm Hg) ($F_{(2,26)} = 1.55$, $p = .23$). Mean arterial pressure was not significantly different among baseline (86.8 ± 6.9 mm Hg), HIIE (84.1 ± 6.1 mm Hg) or MICE (85.6 ± 4.9 mm Hg) ($F_{(2,26)} = 1.66$, $p = .21$). HR was not significantly different among (70.6 ± 11.0 bpm), HIIE (68.6 ± 12.5 bpm) or MICE (70.4 ± 12.6) ($F_{(2,26)} = 0.39$, $p = .68$). **CONCLUSION:** This study demonstrates that non-exercise associated HR and BP can be similar to pre-HIIE and pre-MICE HR and BP with equivalent workloads. Study findings indicate that using a protocol similar to ours may account for exercise anticipation before exercise sessions.

3693 Board #140 June 3 9:30 AM - 11:00 AM
Sprint Interval Training and Associated Improvements in VO2max Amongst College Age Women

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Aerobic exercise has been shown to induce positive physiological outcomes. Research into the effects of high intensity interval training (HIIT) is rapidly growing, with specific interest in sprint interval training (SIT). Current research on SIT emphasizes its applications to young, recreationally active males. **PURPOSE:** The present investigation focuses on SIT in college age, recreationally active females thus addressing the dearth of research in women. **METHODS:** Participants ($n=11$) were randomly assigned into one of three groups: two intervals (2INT), three intervals (3INT), or endurance group (END). All groups cycled three times a week for eight weeks for a total of 24 sessions. 2INT sprinted two 20 second bouts and cycled five

minutes total. 3INT sprinted three 20 second bouts and cycled ten minutes total. END cycled for 20 minutes at 60% of their VO_{2max} . VO_{2max} was measured pre and post intervention. **RESULTS:** While there were no significant differences in VO_{2max} within or between groups (2INT 43.3 ± 1.2 v. 46.0 ± 0.9 ml $kg^{-1} min^{-1}$, 3INT 43.1 ± 5.6 v. 44.6 ± 6.3 ml $kg^{-1} min^{-1}$, END 37.0 ± 6.9 v. 37.4 ± 7.7 ml $kg^{-1} min^{-1}$), it is important to note that the 2INT group improved their VO_{2max} by an average of 8% and the 3INT group by 2.3%. The END group remained unchanged. **CONCLUSIONS:** The findings of this study suggest that women engaging in SIT have the potential to increase their VO_{2max} in a time efficient manner.

3694 Board #141 June 3 9:30 AM - 11:00 AM
Comparison Between Unilateral and Bilateral Plyometric Training on Single and Double Leg Jumping Performance

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The phenomenon of bilateral deficit in jumping implies that greater muscle power can be developed when performing maximal single leg jumps, compared with two-leg jumps. Thus, it may be hypothesized that training with single leg plyometric exercises would be more effective compared to an equivalent volume of double leg plyometric training. **PURPOSE:** To compare the effects of unilateral and bilateral plyometric training on single and double leg jumping performance. **METHODS:** Fifteen moderately trained subjects (age: 19.6 ± 2.1 yrs, height: 172 ± 9 cm, body mass: 65.6 ± 10.6 kg) were randomly assigned to either a unilateral (U, $n=7$) or a bilateral group (B, $n=8$). Both groups performed maximal effort plyometric leg exercises two times per week for 6 weeks (6 exercises per session, 3 sets of 10 repetitions per exercise), as well as 3 sets of knee extensions and flexions at 70%-90% of their 1 repetition maximum. The U group performed all plyometric and knee flexion/extension exercises with both legs, while the B group performed half the repetitions with each leg, so that the total exercise volume was the same. Jumping performance was assessed by double and single leg countermovement jumps (CMJ) and drop jumps (DJ) from 30 cm, measured using an optical measurement system (Optojump). Reactive strength index (RSI) was calculated from DJ data (jump height and ground contact time). Results were analyzed using a 2 x 2 ANOVA with repeated measures in one factor and Tukey's post-hoc test. **RESULTS:** CMJ with both legs significantly improved equally in the U and B groups by $12.1 \pm 7.2\%$ and $11.0 \pm 5.5\%$ ($p < 0.001$), respectively. However, single-leg CMJ, quantified as the sum of dominant and non-dominant single leg CMJ, only improved in the U group ($19.0 \pm 7.1\%$, $p < 0.001$) and was unchanged in the B group ($3.4 \pm 8.4\%$, $p = 0.80$). Similarly, RSI for single leg only improved in the U group (from 0.95 ± 0.21 to 1.17 ± 0.25 m s^{-1} , $p = 0.002$), but not in the B group. **CONCLUSIONS:** Plyometric training with single leg exercises was more effective in increasing both single and double-leg jumping performance, compared to bilateral training.

3695 Board #142 June 3 9:30 AM - 11:00 AM
An Integrated Perspective on Firefighter Recruit Academies: Examining the Sustainability of Fitness Gains

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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 (i.e., muscular strength, estimated VO_{2max} , body fat percentage [%]), 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 .05 was used to determine statistical significance. **RESULTS:** The RM MANOVA test for the effect of time on fitness was significant ($F_{(2,12)} = 6.438$, $p = .013$, $\lambda = .482$). *Post hoc* pairwise comparisons demonstrated a

significant increase in fitness between T1 and T2 ($p = .005$), and a significant decrease in fitness between T2 and T3 ($p = .020$). In addition, the RM MANOVA test for the effect of time on stress-recovery state was not significant ($F_{2,12} = 1.884, p = .194, \lambda = .761$). **CONCLUSIONS:** Results of the study indicate that current firefighter recruit academies may not generate sustainable fitness gains from onset to graduation. This conclusion is supported by the non-significant stress-recovery state results, as previous research has established a dose-response relationship between acute training load and stress-recovery state. Thus, the periodization of firefighter recruit academies may need careful examination to ensure a progressive physiological and psychological training stimulus is applied throughout the program to achieve sustainable outcomes.

3696 Board #143 June 3 9:30 AM - 11:00 AM

Relationship between Training Volume and Dietary Status in Triathletes A Preliminary Study

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PURPOSE. Optimal sports training, especially for long endurance athletes, is dependent on favorable genetic, environmental and behavioral profiles. Dietary intake is central to and interacts with each of these domains. Therefore, the purpose of this preliminary study was to explore potential relationships between dietary intake and training volume in triathletes over a competitive season. **METHODS.** Participants were 18 male (36.6 ± 10.7 years old) and 19 female triathletes (31.8 ± 6.8 years old). Body fat percent, determined through dual-energy x-ray absorptiometry, for male and female triathletes was 12.5% (±4.5%) and 21.3% (±5.0%) respectively. Training volume was determined by exercise duration and intensity over 24 weeks. Nutrient intake was assessed through a seven-day dietary recall. **RESULTS.** Average daily energy intake for males was 2776 (±774) kcals and 1987 (±386) kcals for females. Relative contribution to total energy intake of fat was 25% for males and 28% for females, protein was 19% for males and 16% for females, and carbohydrates was 52% for males and 53% for females. For males, bivariate correlations revealed that total kcals ($r = 0.81$), protein ($r = 0.86$), and carbohydrates ($r = 0.72$) were significantly associated with total training volume. For females, only protein had a significant association ($r = 0.62$). Preliminary analyses using multiple linear regression indicated that for males the independent variables (kcals, protein, carbohydrates, fat) explained 79% of the variance in total training volume ($p = .045$) while controlling for age. However, none of the predictors were significant at a univariate level. The multiple regression for females indicated that the independent variables (kcals, protein, carbohydrates, fat) explained 82% of the variance in total training volume ($p = .015$) while controlling for age. Protein was the only significant predictor of total training volume for females ($\beta = .860; t = 3.18; p = 0.02$). **CONCLUSIONS:** Given the high training volumes associated with triathlon training it is important to consider the potential relationships among energy and nutrient intake and training volume. Further studies are required to better understand the potential influence energy and nutrient intake may have on triathlete performance.

3697 Board #144 June 3 9:30 AM - 11:00 AM

Relationship Between Fatigue Index And Obla Before And After Muscular Endurance Training

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The Thorstenson 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. Baseline measures included OBLA, using a cycle ergometer, 1 repetition maximum (1RM) for: leg press (LP), leg curl (LC), and leg extension (LE). The Thorstenson 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: -7.24 ± 12.09 vs. CON: 3.54 ± 9.21) and FI (%) (EX: -0.06 ± 17.62 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 Thorstenson 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.

3698 Board #145 June 3 9:30 AM - 11:00 AM

Effect of Ankle Exercise on Ankle Isokinetic Strength: A Meta-Analysis

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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 1998 to 2015 using online database: RISS, NDSL 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, $Q = 309.62, df = 110, p < .001, I^2 = 64.47$, 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 for 8 weeks and 6 weeks, respectively). There were larger effects on studies with only females (1.18) than studies with only males (0.76) and both males and females combined (.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.

3699 Board #146 June 3 9:30 AM - 11:00 AM

Impact of a Firefighter Recruit Training Academy on Movement Quality & Balance Ability

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Approximately 55% of the annual injuries to firefighters are classified as sprains and strains and may be related to movement quality and/or balance ability. The Functional Movement Screen™ (FMS™) and Y-Balance Test (YBT) have previously been associated with musculoskeletal injury risk among athletic populations. Although research has reported fitness-related changes in firefighter recruits during a 16-week training academy, the responses of the FMS™ and YBT are unclear. Whether any changes in movement quality and balance are retained after a 22 week, post-academy probation period are unknown. **PURPOSE:** To determine the changes in FMS™ and YBT during a 16-week recruit academy and subsequent 22-week active-duty probationary period. **METHODS:** Twenty-seven male firefighter recruits volunteered to participate (29.3 ± 4.1 yrs, 179.8 ± 4.6 cm, 87.2 ± 9.7 kg). FMS™ and YBT measures were collected at start and end of the 16-week recruit training program and again at week 38. The FMS™ was scored on a 0–21 scale. The YBT scores for each limb were formed by normalizing the reach distances to limb length, summing these distances in each direction, and dividing by three. The scores for right and left limbs were then averaged to create a composite score (%). Two separate (FMS™ and YBT) repeated measures ANOVAs and follow-up pairwise analyses were used to identify

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™ ($F_{2,55} = 44.9, p < 0.001$) and YBT ($F_{2,52} = 276.9, p < 0.001$). Pairwise analyses indicated that FMS™ significantly increased 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 ($p = 0.539$; $97.8\% \pm 5.7\%$ vs. $97.1\% \pm 3.8\%$), but YBT did significantly decrease from week 16 to 38 ($p < 0.001$; $97.1\% \pm 3.8\%$ vs. $91.9\% \pm 3.7\%$). **CONCLUSIONS:** Firefighter recruits exhibited better movement quality, but decreased balance after 38 weeks. The work of a firefighter may prompt a loss in balance ability, perhaps serving as a key risk factor slips, trips, and falls. Future research should examine longitudinal changes in other measures of fitness to elucidate the underlying mechanism(s) in decreased balance ability.

3700 Board #147 June 3 9:30 AM - 11:00 AM
Effects Of Rock Climbing Exercise On Physical Fitness Among College Students: A Meta-Analysis

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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 excitations 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, VO_2 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 VO_2 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.

3701 Board #148 June 3 9:30 AM - 11:00 AM
Short and Long Term Effects of a Simulated Mixed Martial Arts Competition

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PURPOSE: 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. Passive recovery was monitored for 24h post-competition. Blood samples, physical measures, arterial blood pressure, perceptual measures, lactate and heart rate (HR) were measured pre-competition, immediately, 30 min and 24h post-competition. During the period rest between rounds, perceptual measures, lactate and HR were recorded.

RESULTS: Blood lactate, HR were affected by the moment ($P < 0.001$), with lower values pre and 24h post-competition compared to post-1, 2 and 3 rounds. Systolic blood pressure changed across the moments with higher values at post-competition compared to 30 min and 24h recoveries. White blood cells count was affected by moments with higher values at post-competition compared to pre-competition, 30 min and 24h post-competition ($P < 0.001$) and higher values at 30 min compared to 24h recovery. Hemoglobin was also affected with higher values post-competition compared to pre, 30 min and 24h post-competition ($P < 0.001$) and higher values at pre compared

to 24h post-competition. Uric acid was affected across time with higher values at 30 min recovery compared to all other moments ($P < 0.001$). Cholesterol, glycemia, proteids, cortisol and testosterone were also affected by moment with higher values at post-competition compared to all other moments. No change in creatine kinase was detected but lactate dehydrogenase changed with lower values at pre compared to post-competition, 30 min and 24h recovery. CounterMovement Jump and Hand Grip were affected by the moment with lower values at post-competition compared to pre and 24h post-competition. Rating of Perceived Exertion was affected by the moment, with lower values at post-1 compared to post-2 and post-3 and lower values at post-2 compared to post-3.

CONCLUSIONS: Long-term recovery appears to promote better restoration of physiological changes (alterations), physical performance and psychometric measures than short-term rest.

3702 Board #149 June 3 9:30 AM - 11:00 AM
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 the analysis. Hedge's standardized mean difference effect size (ES) was calculated and ESs pooled using random-effects models. Non-overlapping 95% confidence intervals ($CI_{95\%}$) were considered statistically significant. Heterogeneity was assessed using Q and I^2 . **RESULTS:** A total of 31 studies with total of 50 ESs met the inclusion criteria for explosive strength and 18 studies with a total of 43 ESs for sprint performance. PT improved explosive strength (ES = 0.98, $CI_{95\%} = 0.77, 1.20, Q = 174.51, I^2 = 71.95$) in team sports and sprint performance (ES = -0.30, $CI_{95\%} = -0.59, -0.00, Q = 237.60, I^2 = 82.32$) 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.

3703 Board #150 June 3 9:30 AM - 11:00 AM
A Comparison of Resisted and Assisted Sprint Training in Collegiate Sprinters

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 (No relationships reported)

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 compare resisted (RST) and assisted sprint training (AST) on sprint performance. **METHODS:** Twenty (10 male, 10 female) collegiate sprinters and hurdlers were randomly divided into two training groups: RST (age: 21.8 ± 1.8 yrs, Ht: 1.73 ± 0.10 m, BM: 69.5 ± 12.8 kg) and AST (age: 22.2 ± 2.4 yrs, Ht: 1.76 ± 0.10 m, BM: 69.1 ± 9.9 kg). Each group trained 3 day/wk for 6 weeks. The RST group used a combination of weighted sled pulls, uphill sprinting and depth jumps. The AST group combined downhill running, towing, sprint ladders and single leg bounds. Prior to and following the training interventions SL and ST (10 meter sprint time) were recorded at sprint distances of 30m, 60m, and 120m during the last 10 meters of each sprint distance. Pre-post training ST and SL were compared within training groups at each sprint distance using paired t-tests. Additionally, a gain score was calculated by taking the difference between the post and pre test scores. The gain scores for SL and ST were

compared between training groups via independent t-tests at each sprint distance. RESULTS: For the RST 30m, ST (1.18±0.08s vs 1.14±0.08s, p<0.01) and SL (2.06±0.08m vs. 2.09±1.14m, p<0.01) were significantly improved. For the AST, 30m ST (1.19±0.08s vs. 1.18±0.08s, p<0.01) and SL (2.10±0.13m 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±0.07s vs. 1.12±0.08s, p<0.01) was significantly improved. For the AST 120m, ST (1.12±0.07s vs. 1.11±0.07s, p<0.01) and SL (2.30±0.08 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 greatest benefit for improving sprint performance at shorter distances, while AST 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

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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-tsuri-komi-ashi), shoulder throw (seoi-nage), forward leg sweep (deashi-braai), 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 one of the six throws. Minimum threshold for registering acceleration was 16 g. RESULTS: Repeated measures one-way ANOVA and post hoc compared 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⁻²), forward leg sweep (1 impact, 1.4 % incidence rate, 20.58 g, 1.59 krad·s⁻²), and thigh throw (7 impacts, 10% incidence rate, 28.16 ± 4.92 g, 3.94 ± 1.83 krad·s⁻²) had higher frequency of occurrence and magnitude of acceleration than other throws (p<0.01). Thigh throw had highest incidence rate of any throw (p<0.01). CONCLUSION: The judo thigh throw (and break fall) had the highest incidence of sub-concussive head accelerations in the category of 20-40 g. However, none of the judo throws and associated break falls 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

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Researchers and practitioners use the resistance training-specific rating of perceived exertion (RPE) scale for individualization of training 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±4 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 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 pre-testing 1RM both groups 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 and decreased repetitions throughout. Weeks 1-3 consisted of 8, 6, and 4 repetitions on Mon., Wed., and Fri., while weeks 4-5 consisted of 7, 5, and 3 repetitions during the week, with 6, 4, and 2 repetitions being performed during weeks 6-7. Week 8 served as a taper with 4 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 to 82.5-92.5% of 1RM 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 5-7RPE in week 1 and progressing to an 8-10RPE 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 to 153.75±20.40kg; +9.46%), bench press (109.08±15.89 to 116.67±14.61kg; +7.22%), and total strength-TS (250.08±32.30 to 270.42±29.62kg; +8.39%) in PBT, and for 1RM squat (152.20±21.65 to 171.30±24.97kg; +12.52%), bench press (123.00±11.31 to 133.70±14.82kg; +8.58%), and TS (275.20±30.24kg to 305.00±37.61kg; +10.71%) 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.

3706 Board #153 June 3 9:30 AM - 11:00 AM
Greater Ankle Strength and Anaerobic Capacity in Female Marines Who Completed Military Occupational Specialty School

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 (No relationships reported)

Female Marines can now serve in all military occupational specialty (MOS). A cohort of female Marines participated in ground combat MOS schools as part of the Ground Combat Element Integrated Task Force (GCE ITF), 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 school. METHODS: Female GCE ITF 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)/ lactate threshold (LT) during an incremental ramped protocol to exhaustion, and anaerobic power (AP)/capacity (AC) during a 30-second cycling protocol. 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 a priori at 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 invertor 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

	Graduated (n=45)	Not Graduated (n=16)	Group comparison p-value
Age (yrs)	23.0±3.7	21.3±1.4	0.292*
Height (cm)	164.2±5.3	163.1±4.7	0.424*
Weight (kg)	63.5±6.7	63.0±10.1	0.969*
Body Fat (%)	24.2±4.5	26.2±5.3	0.183*
Right Knee Flexion Strength (%BW)	109.9±18.9	103.4±17.4	0.800*
Left Knee Flexion Strength (%BW)	105.5±18.3	97.6±15.7	0.395*
Right Knee Extension Strength (%BW)	198.4±37.7	188.6±25.2	0.996*
Left Knee Extension Strength (%BW)	198.7±34.9	180.1±26.1	0.218*
Right Shoulder Internal Rotation Strength (%BW)	40.4±8.6	37.0±8.3	0.450*
Left Shoulder Internal Rotation Strength (%BW)	38.1±7.9	34.4±7.5	0.884*
Right Shoulder External Rotation Strength (%BW)	30.5±5.6	29.6±3.6	0.520*
Left Shoulder External Rotation Strength (%BW)	28.6±4.9	26.6±3.4	0.639*
Trunk Flexion Strength (%BW)	172.8±29.8	172.0±37.9	0.882*
Trunk Extension Strength (%BW)	263.1±60.7	269.0±76.8	0.995*
Right Ankle Eversion Strength (%BW)	35.1±17.2	32.2±6.3	0.029*
Left Ankle Eversion Strength (%BW)	36.3±9.7	31.6±7.9	0.027*
Right Ankle Inversion Strength (%BW)	35.5±7.6	32.7±8.9	0.047*
Left Ankle Inversion Strength (%BW)	33.9±7.2	31.8±7.2	0.195*
Anaerobic Power (W/kg)	11.0±2.2	10.9±0.7	0.177*
Anaerobic Capacity (W/kg)	6.8±1.5	6.3±0.9	0.035*
Maximal VO ₂ uptake (ml/kg/min)	44.9±3.2	43.2±3.4	0.016*
VO ₂ @ Lactate Threshold (ml/kg/min)	36.9±2.6	29.9±14.2	0.003*

mean±sd significant difference at p<0.05

* T-test †Mann Whitney U

3707 Board #154 June 3 9:30 AM - 11:00 AM
Effects Of Speed- And Circuit-based High-intensity Interval Training Excess Post-exercise Oxygen Consumption
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 (No relationships reported)

In the United States, there remains interest in developing efficient, effective 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 (VO_2) was measured during and after two HIIT sessions and was used to estimate caloric expenditure. Mean VO_2 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 ($p > .05$) in caloric expenditure during exercise between active (83.52 ± 26.1) and sedentary (83.84 ± 31.9) individuals. There was also no significant difference ($p > .05$) 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 ($p < .05$) 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 78.1 ± 30.1 CT). **CONCLUSION:** Regarding maximizing EPOC, individuals 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.

3708 Board #155 June 3 9:30 AM - 11:00 AM
The Effect Of Morning Or Evening Exercise On Cardiovascular Fitness And Body Weight
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 (No relationships reported)

PURPOSE: To compare the effect of 8 weeks of morning exercise or evening exercise on cardiovascular fitness and body composition in healthy women. **METHODS:** Fifty-five participants were randomized to either a morning exercise group (AM) (25.3 ± 4.1 yrs; 25.2 ± 4.7 kg/m²; 37.9 ± 7.6 %BF) or an evening exercise group (PM) (25.4 ± 6.7 yrs; 23.5 ± 3.9 kg/m²; 34.1 ± 6.1 %BF). The AM group completed exercise between 6:30-9:30am and the PM group between 6:30-9:30pm, both for 4 days per week (3 days supervised), 45 minutes per session, and for 8 weeks. All participants followed an exercise program of moderate-intensity treadmill walking (40-59% heart rate reserve [HRR]) and progressed to include vigorous-intensity exercise (60-89% HRR). Cardiovascular fitness was determined using a maximal treadmill protocol and indirect calorimetry. Body weight/composition was determined using a digital scale and dual-energy x-ray absorptiometry (DXA). **RESULTS:** Eighty-two percent of participants completed the study; 21 (78%) from the AM group and 25 (86%) from the PM group, with 94.75% of the prescribed exercise sessions completed. Using intent-to-treat analysis, there was not a group*period interaction for $\text{VO}_{2\text{peak}}$ or time-to-completion during the treadmill test ($ps > .05$); however, with groups combined, time-to-completion during the fitness test significantly improved ($F = 6.66$; $p = 0.013$). For completers in the AM group, 76% gained weight while 36% gained weight in the PM group. For completers, body weight increased by 0.79 ± 1.16 kg in the AM group ($F = 5.05$; $p = 0.0361$) and decreased by 0.21 ± 1.46 kg in the PM group. Intent-to-treat analysis showed a significant group*period interaction ($F = 5.12$; $p = 0.029$). This trend persisted with control of baseline body weight ($F = 5.02$; $p = 0.0301$). However, there was not a significant group*period interaction for total body fat (g) or fat-free mass (g) ($ps > 0.05$). **CONCLUSIONS:** Eight weeks of exercise may improve exercise performance but does not appear to be a function of time of day of exercise. However, these results suggest the possibility that evening exercise may be slightly superior for body weight maintenance. As these differences are small and body composition did not differ between groups, caution should be used when interpreting these data; however, additional research may be warranted.

3709 Board #156 June 3 9:30 AM - 11:00 AM
Improvements In Recruit Fitness During A 6-week Firefighter Training Academy
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Firefighting is a unique and dangerous career in that, unlike some sports and careers that primarily focus on one training goal, firefighters (FFs) must train both aerobic and anaerobic systems. The leading cause for death of on-duty FFs is sudden cardiac events. Emphasizing physical training early in a firefighters career (academy training) has the potential to impact fitness and perceptions of the importance of fitness, and hence to decrease the risk of sudden cardiac events. **PURPOSE:** Examine physical fitness parameters, assessed during the first and last week of a 6-wk firefighter (FF) training academy, in male recruit FFs from 2004 through 2016 to establish the effectiveness of the training regimen employed by the Illinois Fire Service Institute (IFSI). **METHODS:** Participants were male FF recruits ($N = 383$; 26.2 ± 4.2 yrs, $M \pm SD$) from the IFSI who completed baseline fitness measures including measures of weight, estimated $\text{VO}_{2\text{max}}$ (1.5-mi run), muscular endurance (60-s sit-ups, 60-s push-ups, bench press), and flexibility (sit and reach). Following the 6-wk fire academy, which included daily physical training, recruit FFs repeated the fitness test battery. **RESULTS:** Results indicated significant improvements ($M_{\text{diff}} \pm SE$; all $P_s < 0.001$) for weight (1.12 ± 0.14 kg, Cohen's $d = 0.08$), 1.5-mile run (0.92 ± 0.04 min, $d = 0.57$), 60-s sit-ups (5.11 ± 0.25 reps, $d = 0.60$), 60-s push-ups (13.21 ± 0.38 reps, $d = 1.08$), bench press [i.e., 38.6 kg; 2.56 ± 0.26 reps, $d = 0.23$], and flexibility (2.15 ± 0.19 cm, $d = 0.28$). **CONCLUSIONS:** Following a 6-wk training academy, including daily physical training, recruit FFs made significant improvements in weight, BMI, estimated $\text{VO}_{2\text{max}}$, three measures of muscular endurance, and flexibility. Since the majority of on-duty deaths can be attributed to stress or overexertion-related cardiac events, it is important to recognize the importance of a varied fitness regimen for FFs' health as well as performance. All areas of fitness need to be examined with training modalities and performance goals that are consistent with the physical demands of firefighting.

3710 Board #157 June 3 9:30 AM - 11:00 AM
The Effect of Time of Day of Training on Health and Fitness Outcomes in Men
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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 ($\text{BMI} = 26 \pm 3$ kg/m²; 44 ± 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 multimodal 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), power (jump squats and bench throws), 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 ± 2.05 v. 1.75 ± 1.48 Amg/dL), LDL-C (6.50 ± 5.78 v. -3.57 ± 2.80 Amg/dL), and total cholesterol (4.17 ± 0.88 v. -3.26 ± 2.86 Amg/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

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(No relationships reported)

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 cardiorespiratory 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 13wk. 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 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 \pm 0.47) when compared to the standardized treatment group (2.86 \pm 0.66). 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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(No relationships reported)

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 \pm sd; age 22.4 \pm 2.0 yrs; BMI 26.9 \pm 4.2 kg m⁻²) foam rolled prior to testing each day (FR), while 19 (mean \pm sd; age 23.2 \pm 3.2 yrs; BMI 26.3 \pm 4.0 kg m⁻²) 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 \pm 2.45) than FR (0.33 \pm 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.

3713 Board #160 June 3 9:30 AM - 11:00 AM
Cold-water Immersion During Halftime Does Not Affect Second-half Physical Performance In A Football Match

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(No relationships reported)

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 \pm 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) to complete 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 \times 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: $F_{5,209}=0.44$, $p=0.82$; 20-m sprint: $F_{5,209}=0.6$, $p=0.7$; arrowhead agility test: $F_{5,209}=0.26$, $p=0.93$; short-pass: $F_{5,209}=1.75$, $p=0.12$; long-kick: $F_{5,209}=1.19$, $p=0.31$). **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.

3714 Board #161 June 3 9:30 AM - 11:00 AM
Effects of External Counter Pulsation (ECP) on Physical Recovery after Strenuous Exercise

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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 \pm 11.6 years, participated in three two-hour study visits over three consecutive days. During each study 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, measured using a force plate. Jump explosiveness was ground time between consecutive jumps, measured using a contact mat. Subjects who were randomly assigned 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 2 (74.8 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.

- 3715 Board #162 June 3 9:30 AM - 11:00 AM
Does Foam Rolling Increase Pressure Pain Threshold Of Ipsilateral Lower Extremity Antagonist And Contralateral Muscles?
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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 to posttest measures for the ipsilateral hamstrings ($t(20) = -6.2$, $p < 0.001$) and contralateral quadriceps ($t(20) = -9.1$, $p < 0.001$) suggesting an increase in PPT. **CONCLUSIONS:** These findings suggest that foam rolling of the quadriceps musculature 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 inhibition and agonist pain perception from rolling on the left quadriceps. The cross-over effect of decreased right quadriceps PPT may have been from a more global neurophysiological response. Clinicians must consider these results to be exploratory and future investigations examining this intervention on PPT is warranted.

- 3716 Board #163 June 3 9:30 AM - 11:00 AM
Downhill Running Followed by Foam Rolling Has No Effect on the Cost of Running
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Purpose: Downhill running (DHR) causes muscle soreness that may affect running performance. Foam rolling (FR) is a potential recovery tool for reducing soreness and attenuating performance decrements. Running economy (RE), which quantifies the efficiency of running, is a key factor in distance running ability. It is unclear whether DHR affects RE in trained runners and whether FR is an effective recovery method for DHR-induced soreness. Furthermore, RE may be assessed in several ways, including O_2 cost (VO_2) and energy cost (EC, $\text{kcal} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$). These measures may be more accurate with allometric scaling of body weight ($\text{allo}VO_2$ and $\text{allo}EC$; body weight in $\text{kg}^{0.66}$). Thus, our purpose was to evaluate changes in RE with DHR and FR or placebo using 4 definitions of RE.

Methods: Subjects did submaximal running to assess RE 2-4 days before (SUBMAX1) and 48 hours after (SUBMAX2) DHR. Immediately after DHR, they performed FR or placebo (sham compression tights [T]). In a randomized crossover design, subjects repeated these tests 2-4 weeks later. RE during SUBMAX was calculated as VO_2 , $\text{allo}VO_2$, EC, and $\text{allo}EC$. Muscle soreness was measured on a 0-10 verbal scale before DHR and SUBMAX2.

Results: Eight trained runners completed the study ($VO_{2\text{max}}$ $57 \pm 7 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, age 30.6 ± 7 years, 4 females). Soreness at SUBMAX2 was greater than at SUBMAX1, showing that DHR induced soreness in all subjects ($p = 0.012$). Subjects had lower soreness at SUBMAX2 with FR than T ($p = 0.025$). However, there were no significant effects of time or treatment on VO_2 , $\text{allo}VO_2$, EC, or $\text{allo}EC$ ($p > 0.05$ for all comparisons).

Conclusion: Downhill running causes muscle soreness but does not affect running performance as evaluated through RE. FR reduces DHR-induced soreness compared to a placebo. While allometric scaling and energy cost definitions of RE may be better indicators of running performance than the traditional VO_2 , none of the measures of RE are affected by DHR-induced muscle soreness.

- 3717 Board #164 June 3 9:30 AM - 11:00 AM
An Examination of Self-Myofascial Release vs. Instrument Assisted Soft Tissue Mobilization Techniques on Vertical and Horizontal Power in Recreational Athletes
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Self-Myofascial Release (SMR) and Instrument Assisted Soft Tissue Mobilization (IASTM) both relieve adhesions and restrictions in muscle tissue. These tools are popular however there is limited research as to their efficacy on improving athletic performance.

PURPOSE: The objective of this study was to determine if using pre-exercise SMR or IASTM would improve performance on measures of vertical and horizontal power. The researchers also examined if any differences in perceived pain existed between the two manual therapy interventions. **METHODS:** A total of 29 male and 22 female college students volunteered to participate in the study. Subjects were required to meet the American College of Sports Medicine recommendations for physical activity. Subjects were randomly assigned to receive either IASTM via Tecnica Gavilan or SMR via The Stick. Vertical power was assessed by a vertical jump test and horizontal power was measured by a 40 yd sprint. In the first session, body fat percentage and baseline measurements for the vertical jump and 40 yd sprint were collected. During the second session, the subjects received either SMR or IASTM prior to their vertical jump test and 40 yd sprint. Subjects were asked to rate the level of pain they perceived after the massage intervention using a visual analog scale. Subjects then repeated the vertical jump and 40 yd sprint tests. A dependent *t*-test was used to determine differences in pain between the two massage interventions. A 2 x 2 ANCOVA was used to determine if differences existed between genders and the two types of manual therapy. **RESULTS:** There was no interaction ($p > .05$) between the massage intervention and gender for both the vertical jump and 40 yd sprint tests. There was a significant main effect for vertical jump and SMR ($p = .04$). Gender also had a significant main effect 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.

- 3718 Board #165 June 3 9:30 AM - 11:00 AM
The Impact of a 30 vs. 60 Second Passive Recovery Period on Vertical Jump Performance
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The vertical jump (VJ) test is commonly utilized to determine how high a person can jump and what their resulting power will be. Thus, it is important that the VJ test is administered correctly for a person to jump as high as possible. The standard time between subsequent jumps is usually 30 seconds (secs) with a completion of 3-6 jumps. But, if an individual is not fully recovered before their next jump, it is possible that jump may be lower vs. the first or earlier jumps. If a longer recovery period is granted between each jump, the individual may potentially jump as high as or even higher than their previous attempts. However, to the best of the researchers' knowledge, the impact of a 30 vs. 60 secs passive recovery period on VJ performance has not been assessed. **PURPOSE:** To investigate the potential differences between a 30 vs. 60 secs passive recovery period on VJ performance in no less than averagely fit college-age males. **METHODS:** After having descriptive data (ie. Ht., Wt., BF%, age) recorded, 31 averagely fit college-age males had their reach height measured and then participated in an 8 min dynamic warm-up. Subjects were then given a 4 minute passive recovery (PR) period after the warmup and then completed 4 familiarization jumps (ie. trials) using a VJ measurement device. After another 4 min PR period, subjects completed 2 series of jumps (ie. 4 trials apiece) in a counterbalanced order with either 30 (THIR) or 60 (SIXT) secs of PR between each jump. The THIR and SIXT jump series were separated by 4 min of PR. Excluding the first jump/trial for each series, the highest jump for THIR vs SIXT were compared using Paired-Samples *t*-Tests with significant differences occurring at $p < 0.05$. **RESULTS:** No significant differences ($p = 0.44$) occurred between SIXT ($70.01 + 10.36 \text{ cm}$) and THIR ($69.97 + 9.86 \text{ cm}$). **CONCLUSION:** The current results suggest that 30 or 60 secs of passive recovery between jumps is optimal recovery for peak performance to occur during the vertical jump test using averagely fit college-age males. However, further research may

be necessary to assess the impact of 30 vs. 60 sec passive recovery on vertical jump performance using averagely 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.

3719 Board #166 June 3 9:30 AM - 11:00 AM
Effects Of Manual Inter-structural Release For Posterior Shoulder Tightness On The Humeral Head Position

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PURPOSE: The aims of this study were to determine if inter-structural release for posterior shoulder tightness on the position of 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, was performed to achieve 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 adduction, 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 level of significance was set at $\alpha=.05$. **RESULTS:** The R group showed significant improvements in flexion by 17.2 ± 9.5 ($P=0.043$) and in total arc by 16.4 ± 9.5 ($P=0.038$). The R group (10.1 ± 7.7) showed significant improvements than the C group (0.1 ± 5.0) 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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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 were familiarized with the Rating of Perceived Exertion (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 throwing 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.

3721 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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Human skeletal muscle expresses significant plasticity of phenotype 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. Diametrically opposed to these anabolic signaling pathways are the cellular survival and homeostatic 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: 10 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, pmTOR, 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 pmTOR ($p=0.385$), AMPK ($p=0.159$), and pAMPK ($p=0.430$). No statistical difference was found pre and post for gene expression of myosin heavy chain 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.

3722 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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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 (mmol/L) at 5 min ($P=16.52\pm 2.10$; $A=13.2\pm 2.29$; $WBC=16.78\pm 2.72$). BLA for A recovery was significantly less than P or WBC ($p=0.003$). At 10 min ($P=16.76\pm 0.68$; $A=11.74\pm 2.72$; $WBC=11.62\pm 1.48$) and 15 min ($P=16.34\pm 4.0$; $A=11.62\pm 1.48$; $WBC=8.98\pm 2.73$) 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

for 10 and 15 min. **Conclusion:** The results of this study indicate that initially, 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 P at 10 and 15 min of recovery.

3723 Board #170 June 3 9:30 AM - 11:00 AM

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

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Foam rolling is a common technique among fitness professionals and athletes. However, the effect of this technique on performance and short-term recovery remains unclear. **PURPOSE:** To examine the effects of acute foam rolling on quadriceps performance and short-term recovery from exercise-induced fatigue. **METHODS:** 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 that was 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: 219.250 ± 11.18, CON: 220.90 ± 11.18, p=0.918) and eccentric (FR: 238.40 ± 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=0.307) and eccentric (Pre: 249.05 ± 12.00, CON: 243.35 ± 12.20, p=0.337). No significant interaction was found between conditions and time for MVC performances (concentric: p=0.987; eccentric: p=0.646). Post-test 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 muscle soreness (MS), fatigue, and rate of perceived exertion (RPE) during MVC pre-test (MS: FR: 17.3 ± 11.53, CON: 22.8 ± 14.41, p=0.358; Fatigue: FR: 2.8 ± 1.55, CON: 2.6 ± 1.07, p=0.741; RPE: FR: 3.0 ± 1.41, CON: 3.2 ± 1.62, p=0.772), after fatigue protocol (MS: FR: 75.3 ± 23.51, CON: 78.7 ± 21.55, p=0.945; 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 significantly affect isokinetic MVC performance or improve short-term recovery of fatigue-induced quadriceps.

3724 Board #171 June 3 9:30 AM - 11:00 AM

The Effectiveness of Compression Socks on Recovery from Maximal Aerobic Exercise

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PURPOSE: The purpose of the present investigation was to determine the effect of compression socks on recovery from maximal aerobic running for college aged subjects. **METHODS:** Moderately fit college aged student subjects (N=16) were recruited to participate in the present study. Specific anthropometric measurements were first recorded, including appropriate fitting for compression socks. Subjects completed two sets of maximal graded treadmill exercise tests to exhaustion using the McConnell Treadmill Protocol including a control phase and a compression phase. During the control phase, two treadmill maximal tests were conducted with 24 hours of recovery separating them. During the compression phase, subjects completed two treadmill maximal tests, wearing compression socks during their 24 hours of recovery. At least 7 days separated the compression and control phases, and a cross over design was utilized. During each treadmill test, heart rate, RPE, and Vo2 were recorded at baseline and every three minutes. Blood lactate values were measured before and after each exercise session. **RESULTS:** Blood lactate levels measured 24 hours following a maximal exercise bout were significantly lower (p < .05) when compression socks were worn for the 24 hours when compared to a control phase (2.31 mmol/L; 3.59 mmol/L, respectively). Blood lactate levels 20 minutes following the maximal exercise bout were not significantly different (p > .05) when wearing the compression socks compared to the control phase (5.51 mmol/L; 5.77 mmol/L, respectively).

CONCLUSIONS: Pre-exercise lactate levels were significantly lower while wearing compression socks, which indicated an improvement in short-term (24 hour) aerobic exercise recovery. Compression socks have a positive effect on short term recovery from maximal aerobic exercise for moderately fit college aged individuals.

3725 Board #172 June 3 9:30 AM - 11:00 AM

Pilot Study: The Influence Of Menthol On Recovery From Exercise-induced Muscle Damage.

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PURPOSE: Menthol is a cold receptor agonist found in various products claiming to relieve muscle soreness, but menthol's influence on recovery from exercise-induced muscle damage requires clarification. The purpose of this study was to compare serial measures of muscle soreness and performance following exercise-induced muscle damage between a Menthol (M), Placebo (P) and Control (CON) condition. It was hypothesized dependent variables would not differ between conditions (null hypothesis). **METHODS:** 38 males with a mean (SD) age, weight and height of 24.0 (4.0) yrs, 79.5 (16.1) kg and 1.74 (0.12) m were randomized to M (n=11), P (n=8), and CON (n=19). Participants were familiarized with a testing battery (TB) including: perception of lower body muscle soreness; 0-10 pain response to 30N of pressure applied to right quadriceps/hamstrings/calf; hip flexion/abduction range of motion; vertical jump; Agility T-test. Muscle damage was induced on Monday using 40x15m sprints with a 5m deceleration zone. Participants in M applied Biofreeze™ (4% menthol gel) twice daily to the lower body, whilst P applied a gel that smelled like Biofreeze™ but contained no menthol. CON did not undergo any intervention. Participants completed TB daily from Monday to Friday. Dependent variables were calculated as they changed from baseline and the area under the curve was then calculated by summing Monday to Friday scores. The area under the curve values were then compared by condition using the Kruskal Wallis test (alpha level = 0.05). **RESULTS:** A significant difference in agility time (s) was observed by condition (p=0.0044) and Dunn's post-hoc test indicated that menthol caused less decrement in agility performance following exercise-induced muscle damage compared to both CON and P (p<0.05). No other significant differences were observed between conditions. **CONCLUSIONS:** Menthol application may help to preserve agility performance after exercise-induced muscle damage, however the mechanism of action is not clear. Further data collection is required to strengthen Monday to Friday comparisons and observe the time-course of recovery by condition. *Performance Health (Hygienic Corporation, Akron, Ohio) supported this project with donations of Biofreeze and Placebo gel.*

3726 Board #173 June 3 9:30 AM - 11:00 AM

Comparison Of Recovery Measures Following Cardiorespiratory Fitness Testing In Young Children

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Post exercise heart rate recovery measures have been used as a predictor of fitness and mortality in adult populations. Less is known about the predictive value of oxygen consumption and heart recovery responses to clinical and field cardiorespiratory fitness testing in young children. **PURPOSE:** To compare oxygen uptake (VO₂; ml·kg⁻¹·min⁻¹) and heart rate (HR; beats·min⁻¹) recovery responses (mean ± SD) from the FitnessGram Progressive Aerobic Cardiovascular Endurance Run (PACER) test to recovery measures from a progressive maximal graded exercise test (GXT; treadmill) in 17 (9 boys) young (10-11 yr old) children. **METHODS:** Subjects completed the PACER and GXT in a randomized order 1 week apart while wearing a HR monitor and portable oxygen analyzer. VO₂ and HR recovery measures were determined at 1, 3 and 5 mins post completion of the PACER and GXT. **RESULTS:** There were no significant mean VO₂ measures between the PACER and GXT VO₂ at 1 min (14.5 ± 3.1 vs 16.1 ± 3.6), 3 min (8.0 ± 1.4 vs 7.9 ± 1.3), or 5 min (7.3 ± 1.4 vs 7.2 ± 1.6) of recovery. The GXT recovery HR (149.0 ± 31.0) recovery was significantly (p < 0.05) greater at 1 minute than the PACER recovery HR (136.0 ± 17.0), however there was no significance between the GXT and PACER HR at 3 min (115.2 ± 9.1 vs 110.8 ± 11.7) or at 5 min (108.5 ± 7.7 vs 107.1 ± 10.0) of recovery. **CONCLUSIONS:** The PACER resulted in similar absolute cardiorespiratory recovery responses in young children when compared with a criterion fitness test. Supported by the University of Kentucky Pediatric Exercise Physiology Laboratory Endowment

3727 Board #174 June 3 9:30 AM - 11:00 AM
Chronic Effects of Cupping Therapy on Balance, Flexibility and Muscular Power
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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 Biodex 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: SI: .89, .99, .74, & .86 and 1.07, .78, .84 & 1.01; HE(degrees): 13.4, 14.3, 13.6, & 13.3, and 12.7, 14, 13.8 & 13.6; HF(degrees): 66.6, 62, 61, & 62.4 and 65.1, 62, 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 alteration 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.

3728 Board #175 June 3 9:30 AM - 11:00 AM
The Effects of Acute Cupping Therapy on Balance, Flexibility and Muscular Power
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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♀) volunteered. **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. Hamstring/quadriceps unilateral muscle power (MP) testing was conducted with a Biodex Isokinetic dynamometer (Watts = W) including five repetitions @ 60°/sec warm-up and 10 maximal repetitions at 120°/sec for the trial. Assessments were conducted within 15 minutes of CUP (PreC), as well as within 15 minutes post (Post15) and 60 minutes post (Post 60) CUP. 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 differences among matched variables including: MP(W): 64, 62, & 59.4, and 63.8, 58.7, & 56.3; HED(degrees): 13.3, 13.4 & 13.8, and 12.3, 13.2, & 12; HF(degrees): 67.4, 65.8, & 63.8, and 66.5, 63.8, & 64.3 and SI: .94, .83, & .95 and 1.17, .96, & .76, for CUP and No CUP treatments, respectively. **CONCLUSION:** A single application of CUP did not yield changes in muscular power, flexibility or balance when assessed within 60 minutes of the treatment. These data fail to support the practice of cupping for improved strength, flexibility or balance.

3729 Board #176 June 3 9:30 AM - 11:00 AM
The Effect Of Foam Rolling On Exercise induced Muscle Fatigue
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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 below table for all results. 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 Change of PT, PT/BW, And APT TW Between Control Group And FR Group

Variables	Before	0.5h After	24h After	48h After
Control PT (Nm)	207.38±43.36	156.52±42.80*	155.85±46.37 *	157.66±47.44 *
FR PT (Nm)	214.16±20.35	159.83±29.70*	166.16±36.19 *	192.78±41.95#
Control PT/BW (Nm/kg)	2.96± 0.4	2.30± 0.48*	2.27± 0.50 *	2.30± 0.59*
FR PT/BW (Nm/kg)	3.14± 0.58	2.39± 0.43*	2.46± 0.52 *	2.72± 0.54#
Control Average PT (Nm)	207.38±43.36	148.1±46.58*	153.97±47.50*	155.15±48.00 *
FR Average PT (Nm)	214.16±42.00	165.56±32.23*	172.36±40.62*	193.28±38.67#
Control Total Work (J)	1271.93±256.64	952.41±274.03*	945.56±251.82*	968.84±283.00*
FR Total Work (J)	1283.64±240.76	967.45±170.57*	1060.57±261.46*	1163.50±261.39#

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

3730 Board #177 June 3 9:30 AM - 11:00 AM
Stretching Techniques and Their Effects on Sprint Speed for Wheelchair Athletes
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(No relationships reported)

Flexibility is an important health- and motor-fitness 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 effect of stretching mode on sprint speed among competitive wheelchair athletes. **Method:** Wheelchair rugby players with tetraplegia (N = 32.4±9.8 yrs, 76.78±13.8 kg, 161.2±17.2 cm, 13.1±9.5 yrs post injury) were randomly assigned to one of three different stretching techniques [proprioceptive neuromuscular facilitation stretching (PNF), static stretching, (SS) or dynamic stretching (DS)] on three testing dates. Timing gates (Brower TC Motion Start, Knoxville, TN) were used to assess sprint speed before warm-up, after warm-up (which included the assigned stretching mode, and after 75 minutes of rugby play. The best of the two sprint times was used to compare pre- and post- warm-up speeds as well as pre- and post-practice speeds. **Results:** Sprint speed improved from pre- to post-warm-up across each stretch condition. PNF yielded the greatest improvement (-0.10±0.22 s). As expected, sprint scores declined from pre- to post-practice with DS yielding the least change (0.02±0.19 s). **Conclusion** Regardless of stretch mode, short term performance can be improved

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
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Adequate 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 (BCAA), β -hydroxy- β -methylbutyrate (HMB), and glutamine on recovery from weightlifting. **METHODS:** Fourteen trained participants (mean \pm SD: age = 21 \pm 2 y) completed two protocols (treatment and placebo), each consisting of two resistance bouts separated by 24 h rest. 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 (RPR) 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 \pm 1 vs. 10 \pm 3; p = .03), latissimus pull-down (11 \pm 2 vs. 10 \pm 1; p = .02), and total repetitions (62 \pm 5 vs. 59 \pm 7; p = .03). Reduced residual pain (29 \pm 19 vs. 40 \pm 23; p = .01) and pain during the leg press (37 \pm 14 vs. 45 \pm 21; p = .04) and shoulder press (39 \pm 17 vs. 47 \pm 24; p = .04) were observed with treatment. RPE on the second day was reduced under the treatment for the leg press (55 \pm 20 vs. 62 \pm 16; p = .02) and leg extension (53 \pm 20 vs. 61 \pm 19; p = .03) exercises. RPR 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 attributed 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
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 (No relationships reported)

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 VO_2 , 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]) (CON) 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 maximal heart rate alternated with 1-minute recovery bouts at ~50-60% of HRR. **METHODS:** Nine healthy adults (5 females, 4 males, 23.8 \pm 2.8 years, 75.0 \pm 9.9 kg) underwent a submaximal exercise test to determine estimated VO_2 max. Exercise sessions were then completed in random sequence at least one week apart. **RESULTS:** Exercise VO_2 was 66.0 \pm 12.2 L for CON, 17.0 \pm 2.9 L for I-4, 30.4 \pm 6.9 L for I-7, and 44.3 \pm 10.4 L for I-10. EE for each exercise session was 323.5 \pm 60.1 kcal for CON, 84.2 \pm 19.5 kcal for I-4, 151.0 \pm 33.7 kcal for I-7, and 219.5 \pm 51.4 kcal for I-10. Average exercise HR was 133.8 \pm 4.1 for CON, 142.2 \pm 8.2 for I-4, 152.4 \pm 5.8 for I-7, and 152.4 \pm 5.7 for I-10. Recovery HR in first hour after exercise was higher after I-10 (82.3 \pm 6.4 beats/min) than after CON (75.4 \pm 8.4 beats \cdot min⁻¹) and I-4 (76.8 \pm 7.3 beats \cdot min⁻¹). Recovery HR in 2nd hour after exercise was higher after I-10 (70.8 \pm 8.1 beats \cdot min⁻¹) than after CON (66.7 \pm 6.7 beats \cdot min⁻¹) or I-4 (67.7 \pm 6.9 beats \cdot min⁻¹). Rate of EE was lower in 2nd hour after exercise for CON (1.04 \pm 0.15 kcal \cdot min⁻¹) than after I-10 (1.10 \pm 0.15 kcal \cdot min⁻¹) or I-4 (1.11 \pm 0.18 kcal \cdot min⁻¹). **CONCLUSIONS:** Though exercise VO_2 and EE associated with CON were significantly higher than those associated with any of the interval training sessions,

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
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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 \pm 4.4 yr., ht: 176.6 \pm 9.1 cm, body mass: 83.1 \pm 13.1 kg, 13 ♂) 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 \pm 8.3, 54.8 \pm 8.8, 55.3 \pm 8.6, and 54.3 \pm 10.4; Broad(cm): 215.9 \pm 29.9, 218.4 \pm 28.7, 221.7 \pm 28.9, and 218.9 \pm 28.4; LBR(cm): 176.5 \pm 21, 176.7 \pm 18, 178.3 \pm 18.7, and 176.5 \pm 17.2; LBL(cm): 173.4 \pm 12.1, 175.7 \pm 13.2, 177.2 \pm 14.4, and 177.2 \pm 16.5, and S(sec): 2.8 \pm .17, 2.8 \pm .12, 2.8 \pm .16, and 2.8 \pm .14 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
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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 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 \pm 0.7 years, body mass: 58.44 \pm 7.8 kg, Height: 161 \pm 7.1 cm, fat %: 21.5 \pm 3) were involved in a "cross-over" experimental design. After three game training sessions (Avg Heart Rate 183 \pm 9, 180 \pm 8 and 180 \pm 8 bpm respectively), participants were enrolled into either a CnCWI protocol (n=12), (12 min water temperature 14 \pm 0.5°C), InCWI protocol (n=11), (4x 2 min water temperature 14 \pm 0.5°C+1min out of water) or a control group (CG) with passive recovery (n=9) (sit in the room). Counter-movement Jump test (CMJ), Visual Analog Scale (VAS-Pain) and thigh volume were measured pre- and post-training, post-immersion, as well as 24 hours and 48 hours after training + recovery protocol. **RESULTS:** Statistically significant differences were found in DOMS (F (4,116) = 6.84, P < 0.001, ω^2 : 0.32) in post-immersion CnCWI vs. CG (5.08 \pm 0.8 vs. 6.6 \pm 0.86, P < 0.001) and InCWI vs. CG (5 \pm 0.76 vs. 6.66 \pm 0.86, P < 0.001). In the post 24h CnCWI vs. CG (5.08 \pm 0.81 vs. 7.22 \pm 0.97, P < 0.001) and InCWI vs. CG (4.72 \pm 0.81 vs. 7.22 \pm 0.97, P < 0.001). In post 48h CnCWI vs. CG (3.83 \pm 0.7 vs. 7.22 \pm 0.83, P <

0.001) and InCWI vs. CG (3.90 ± 0.92 vs. 7.22 ± 0.83 , $P < 0.001$). With regards to the percentage of change in CMJ and thigh volume, no statistically significant changes were seen in any of the times 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 players' 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 pain.

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

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(No relationships reported)

(No relationships reported)
Both Proprioceptive Neuromuscular Facilitation (PNF) and Active Isolated Stretching (AIS) are widely used stretching techniques, but their difference in improving shoulder flexibility has not been evaluated.

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 (21.46 ± 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 ± 0.003 ; $P < 0.001$).

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

		Before	After	Difference	ES	P-value
AIS	flexion	$157.42 \pm 2.83^\circ$	$164.51 \pm 2.24^\circ$	$9.77 \pm 1.96^\circ$	2.78	<0.001
	Stretch	$34.37 \pm 1.44^\circ$	$37.91 \pm 0.92^\circ$	$5.72 \pm 0.56^\circ$	2.93	<0.001
PNF	flexion	$156.28 \pm 2.49^\circ$	$159.85 \pm 2.24^\circ$	$5.67 \pm 2.36^\circ$	1.51	0.003
	Stretch	$34.17 \pm 0.73^\circ$	$36.22 \pm 0.77^\circ$	$3.78 \pm 0.56^\circ$	2.73	<0.001

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

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3736 Board #183 June 3 9:30 AM - 11:00 AM

The Influence of Post-Exercise Cryotherapy on Circulating Testosterone

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Cryotherapy is commonly used to improve muscle recovery from exercised induced damage. Recent studies have shown that use of post exercise cryotherapy can blunt adaptations in muscle hypertrophy and strength but the mechanism as to why is unclear. **PURPOSE:** To examine the effects of post-exercise cold water immersion (CWI) on free circulating testosterone (T). **METHODS:** Ten well-trained men [one repetition maximum (1RM) to body mass ratio: 1.65 ± 0.15], completed two resistance training sessions (6 sets of 10 repetitions at 80% of their 1RM for a smith machine squat) separated by 72 hrs. After each session subjects were given one of two recovery interventions prescribed in a randomized and counterbalanced order. These interventions were 1) 60 min of seated passive recovery (CON) or 2) 15 min of lower body cold water immersion (15°C) followed by 45 min of seated passive recovery (CWI). Venous blood samples were taken pre (PR) and immediately post (IP) and at 15, 30, and 60 min post exercise and an ELISA was used to measure T. Hormone levels were compared between interventions across all time points using a mixed model MANOVA with Bonferroni post hoc test ($p < 0.05$). **RESULTS:** No significant differences in T were found between the CWI or CON at any time point: PR (15.24 ± 7.64 ; 14.25 ± 8.95 ; $p = 0.374$), IP (CWI = 20.45 ± 13.11 ; CON = 22.75 ± 22.22 ; $p = 0.514$), 15 min (CWI = 18.03 ± 9.33 ; CON = 20.21 ± 18.20 ; $p = 0.556$), 30 min

(CWI = 17.10 ± 11.75 ; CON = 16.42 ± 11.34 ; $p = 0.662$) and 60 min (CWI = 13.70 ± 7.82 ; CON = 16.55 ± 15.16 ; $p = 0.321$). Additionally, no significant differences were found between recovery interventions in T area under the curve (CWI = 1014; CON = 1091 $p = 0.588$). **CONCLUSIONS:** Post exercise T showed no significant differences after CWI, suggesting that diminished T response from CWI is not responsible for the mitigation of hypertrophy observed from chronic use of cryotherapy previously observed. Rather, changes in inflammatory markers or immune response post CWI may be the cause of this reduced hypertrophic responses. Future research exploring the relationship between cryotherapy and testosterone may benefit from investigating colder water temperatures or other forms of cryotherapy.

3737 Board #184 June 3 9:30 AM - 11:00 AM

Pneumatic Compression Device Speeds Recovery from DOMS in Comparison to Compression Sleeve

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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; flexion 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 elbow 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 minimized 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.

3738 Board #185 June 3 9:30 AM - 11:00 AM

Effects of Compression Socks on Muscle Recovery in Competitive Masters Endurance Athletes

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(No relationships reported)

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 ± 8 yr; height: 176 ± 14 cm; mass: 83.0 ± 13.3 kg; body fat: $23 \pm 7\%$; ≥ 18 mo 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 fatiguing protocol (6 sets, weighted calf raises to failure) and were randomly assigned to wear either COM or PLA socks for 48-h. Visit 2 (48-h post) consisted of CIR/ROM measures, surveys, and 1-mile run. Participants were assigned the sock type not previously given and completed the same protocols during Visits 3-4. T-tests determined differences 48-h after fatigue with COM and PLA socks ($p \leq 0.05$).

Results: Perception of muscle fatigue and soreness [scores: 1 (least)-10 (most); taken pre-, 24-h, and 48-h post] tended to increase 24-h [vs pre (fatigue: PLA: $+1.00$; COM: $+1.75$ points)(soreness: PLA: $+1.00$; COM: $+2.25$ points)] and 48-h [vs pre (fatigue: PLA: $+2.50$; COM: $+2.75$ points)(soreness: PLA: $+2.75$; COM: $+2.75$ points)] after the fatiguing protocol, but no significant differences existed between sock types ($p > 0.05$). Compared to pre-fatigue, calf CIR was similar (48-h post) with both socks

($p > 0.05$). 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: $p = 0.19$)]. Additionally, 1-mile run time was not affected by COM (pre: 8.5 ± 1.9 min; 48-h: 8.5 ± 2.0 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.

3739 Board #186 June 3 9:30 AM - 11:00 AM
Acute Effects of Two Different Foam Rollers on Range of Motion

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(No relationships reported)

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 chronic benefits. **PURPOSE:** Therefore, the aim of this study was to determine if differences existed between the acute effects 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 taking pre ROM measurements followed by 10 minutes 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 followed by protected dependent t tests revealed that significant ($p < .05$) differences existed between control and SN, control and grid, but not between SN and grid ($p > .05$). Effect sizes revealed that when comparing mean differences from pre to post for SN and grid: a large effect was seen for shoulder extension ($d = -.80$) in favor of SN, moderate effects were observed for shoulder flexion ($d = -.50$) in favor of SN, hip flexion ($d = -.62$) in favor of SN, and hip abduction ($d = .57$) 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.

Supported by UCO Student Research, Creative, and Scholarly Activities (RCSA) Grant

3740 Board #187 June 3 9:30 AM - 11:00 AM
Effect of Cooling on Postmatch Recovery in Elite Volleyball Players in Warm Conditions

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(No relationships reported)

PURPOSE: The purpose of this study was to determine the effect of a single 14 min of contrast water therapy (CWT) or cold shower (CS) on recovery postmatch in elite volleyball players performed in warm conditions

METHODS: Ten volleyball players completed a 60 min simulated match play in the heat followed randomly by 1 of 3 recovery modalities: (a) CWT consisted of alternating cold (12°C) and hot (38°C) water immersion, (b) CS (20°C), and (c) Passive recovery (PAS; ambient temperature). Blood plasma markers levels (Lactate, Glucose, Fatty acids, Triglycerides, Total cholesterol, Urea, Apolipoproteins: apoB, apoA-I), inflammatory proteins (C-reactive protein, Orosomucoid, Albumin and Haptoglobin) were collected pre-match and immediately after recovery. Vertical jump, agility and speed performances, body temperature and perceived fatigue were also measured pre-match, and immediately after each recovery modality

RESULTS: Plasma concentrations of physiological biomarkers showed a significant changes after all recovery modalities, while concentration of Albumin remained unchanged in passive recovery compared to CWT and CS. After CWT, a significant improvement in lower-limbs power was observed during squat jump and agility performance ($p < 0.05$). Conversely, the CS resulted in a decrease of the lower-limbs power during counter-movement jump but improved start sprint speed. There was 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 modalities

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

3741 Board #188 June 3 9:30 AM - 11:00 AM
Effectiveness of Cross Taping as a Therapy for Delayed Muscle Soreness

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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 applied the 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 (1 day per week) 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

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(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 ($60^\circ/\text{s}$) 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 ($60^\circ/\text{s}$) strength for knee extension, score of muscle soreness, muscle thickness of quadriceps femoris were evaluated before exercise and post-exercise period. Blood sample was drawn to investigate blood glucose and lactate, serum creatine kinase (CK) and myoglobin (Mb) concentrations before exercise, 3 h and 24 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.

3743 Board #190 June 3 9:30 AM - 11:00 AM
Use Of Compression Garments For Recovery From Plyometric Exercise
 Tylor Bennett, Jennifer Talaski, Kara A. Stone, Allison M. Barry, Kyle J. Hackney, Donna J. Terbizan, FACSM, FACSM. *North Dakota State University, Fargo, ND.* (Sponsor: Donna J. Terbizan, FACSM)
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 (No relationships reported)

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 18-25 were recruited for participation (height 1.81 ± 0.078 m; body mass 79.28 ± 12.59 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 pretest-posttest design. Thirty healthy males aged 18-25 were recruited for participation (height 1.81 ± 0.078 m; body mass 79.28 ± 12.59 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 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 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

G-35 Free Communication/Poster - Youth Sports

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

3744 Board #191 June 3 8:00 AM - 9:30 AM
Validity And Prediction Of VO₂Peak from the Progressive Aerobic Cardiovascular Endurance Run (PACER) in Children
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 (No relationships reported)

PURPOSE: The primary purpose of this study was to evaluate the variance in predicted VO₂peak from previously published Progressive Aerobic Cardiovascular Endurance Run (PACER) equations in children. The secondary goal was to develop an equation to reduce the variability in the prediction of VO₂peak from the PACER. **METHODS:** Forty-four participants (19 females, 25 males) aged 7-14 years completed a maximal treadmill test and the PACER on non-consecutive days. A portable indirect calorimeter was used to assess VO₂ continuously during both exercise bouts. T-tests were used to identify differences between biometric variables and exercise outcomes (VO₂peak, heart rate, rating of perceived exertion, PACER laps, and maximal shuttle run speed). Repeated measures ANOVA, Bland-Altman plots, and folded empirical cumulative distribution plots were used to compare treadmill VO₂peak and VO₂peak predicted from PACER equations. The SDState Junior Jacks Equation was created to predict VO₂peak from the PACER using backwards stepwise linear regression. **RESULTS:** PACER VO₂peak prediction equations including a weight-related variable provided a high degree of variability evidenced in mean bias (-0.8 - 1.1), wide range of limits of agreement ($16.8 - 22.9$ ml·kg⁻¹·min⁻¹), and typical error of estimate (4.2 - 6.0). The SDState Junior Jacks Equation [VO₂peak = $-4.34(\text{wc}) - 3.982(\text{sex}) + 0.234(\text{max laps}) + 70.544$] includes sex (0=males, 1=females), maximum PACER laps, and waist circumference (centimeters) to predict VO₂peak from the PACER and provides the lowest typical error of estimate (3.7), small mean difference (-0.6),

narrowest range of agreement (15.9 ml·kg⁻¹·min⁻¹), and most favorable Bland-Altman and mountain plots compared to other PACER equations containing a weight-related variable. **CONCLUSIONS:** Comparison of predicted VO₂peak from PACER equations including a weight-related variable indicates VO₂peak 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 VO₂peak. The SDState Junior Jacks PACER equation utilizes sex, PACER laps, and waist circumference to provide a valid, less variable prediction of VO₂peak in children.

3745 Board #192 June 3 8:00 AM - 9:30 AM
Directly Measured Free Living Energy Expenditure and Anaerobic Performance in Children and Adolescents
 Lorena Correas-Gómez¹, José Ramón Alvero-Cruz¹, Manuel Dorado-Guzmán², Jesús Barrera-Expósito³, Norma T. Martín-Sanz⁴, Sabrina Álvarez Carnero⁵, José Míguez Amil⁶, Iván López-Fernández⁷, Javier Castro-Gacio⁷, Manuel Avelino Giráldez García⁸, Catarina N. Matias⁸, Luis B. Sardinha⁸, Elvis A. Carnero¹. ¹*University of Málaga, Málaga, Spain.* ²*Fernando de los Ríos High School, Ronda, Spain.* ³*Nuestra Señora de la Victoria "Martiricos" High School, Málaga, Spain.* ⁴*Miguel Romero Esteo High School, Málaga, Spain.* ⁵*Julio Gurriarán Primary School, O Barco, Spain.* ⁶*Maceda High School, A Coruña, Spain.* ⁷*University of A Coruña, A Coruña, Spain.* ⁸*University of Lisbon, Lisbon, Portugal.*
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 (No relationships reported)

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 y, BMI= 20.5 ± 3.8 kg/m², TDEE= 2390.9 ± 531.9 kcal). TDEE was determined over 15 days by the doubly labelled water technique. Physical activity (PA, min/day and steps/day) was measured by accelerometry. 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 (PAEE/kg) 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 PAEE/kg 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 (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 should be cross-validated in other scholar communities. Funded by Spanish Ministry of Economy and Competitiveness (Grant: DEP2011-30565)

3746 Board #193 June 3 8:00 AM - 9:30 AM
Adolescent Female Ball Players Oxygen Consumption and the Association to Playing Ability and Fitness Estimation
 Dalya Navot Mintzer, Eyal Shargal, Idit Shub, Levana Zigel, Rotem Kislav-Cohen. *Wingate Institute, Netanya, Israel.*
 (Sponsor: Naama Constantini, FACSM)
 (No relationships reported)

Peak oxygen consumption (VO₂peak) is used to estimate aerobic capacity. Data regarding adolescence female ball players is limited. Furthermore, the association to coaches' estimation of playing ability and aerobic fitness is scarce and can be of interest for players selection. **Purpose:** This study evaluates VO₂peak of soccer and basketball elite adolescent female players from the Israeli Academy for Sport Excellence. The purpose of the current investigation was to evaluate VO₂peak based on playing position and to compare VO₂peak to coaches' estimation of individual general playing ability and aerobic fitness. **Methods:** Results of treadmill VO₂peak testing were collected from medical records and were analyzed. Head coaches (national level) were asked to estimate general playing ability and aerobic fitness of each player on a

scale of 5 (best) to 1 (worst). **Results:** Twenty eight female soccer players (14.3-17.9 years) and 23 female basketball players (12.6-16.0 years) were included. Average VO_{2peak} was 48 and 47.9 ml/kg/min, respectively. Forward soccer players had a better VO_{2peak} comparing to other positions (goalkeepers=42.2, defenders=48.4, midfield=47.3, forwards=54.7ml/kg/min). Soccer coach playing ability (average=4.21) and fitness estimation (average=3.96) did not correlate with VO_{2peak} results (Correlation Coefficient= 0.292, $p=0.13$ and 0.257, $p=0.18$ respectively). Center basketball players had the lowest and point guards the highest average VO_{2peak} (centers=34.2, forwards=44.6, guards=50.5 and point guard=53.1 ml/kg/min). Basketball coach playing ability (average=3.14) and fitness estimation (average=2.86) correlate with VO_{2peak} results (Correlation Coefficient= 0.464, $p=0.03$ and 0.547, $p=0.008$ respectively). **Conclusions:** Adolescent female soccer and basketball players at different playing positions exhibited different VO_{2peak} values as reported in the literature. Basketball coaches' estimation of aerobic fitness and general playing ability were associated with VO_{2peak} results whereas soccer coaches' estimation did not. VO_{2peak} may be considered as a parameter for team selection of ball game players game players, however in light of the inconclusive results, further research is required.

3747 Board #194 June 3 8:00 AM - 9:30 AM
Association Between Genu Valgus And Physical Activity, Adjusted To Chronological Age In Brazilian Males Adolescent

Andrea Cassimiro de Oliveira, Rafael Benito Mancini, João Pedro da Silva Junior, Luis Carlos de Oliveira, Timoteo Leandro de Araujo, Victor Matsudo. *CELAFISCS, SÃO CAETANO DO SUL, Brazil.*

(No relationships reported)

PURPOSE: Genu valgus interferes negatively in physical activities of moderate and moderate to vigorous intensity among Brazilian females adolescent students, which may be a negative factor for an active lifestyle. **Objective:** To analyze the association between genu valgus and physical activity level (PAL), categorized in: total, light, moderate, vigorous and moderate to vigorous intensity, adjusted to chronological age in male adolescent students.

METHODS: sample comprised 270 male students, 30 boys in each age group, aged 10-18 years (14.0 ± 2.6), and living in the city of Ilhabela, Brazil. Genu valgus was evaluated using a goniometer, measuring the intermalleolar distance (cm). Physical activity behavior in different intensities (minutes per week) was assessed by the International Physical Activity Questionnaire (IPAQ). Statistical analysis has used multiple linear regression adjusted to chronological age.

RESULTS: There was no association ($p>.05$) between intermalleolar distance and total ($\beta=.475$), light ($\beta=4.843$), moderate ($\beta=2.012$), vigorous ($\beta=.412$) and moderate to vigorous ($\beta=2.423$) physical activity level.

CONCLUSIONS: Genu valgus does not interfere in different levels of physical activity (total, light, moderate, vigorous and moderate to vigorous) among males adolescent students.

The association between genu valgus and physical activity level, adjusted to the chronological age in Brazilian males adolescent students

Variables	Males (n=270)			
	B	p ^a	R ²	IC 95%
Total PA (min/w)	.475	.917	.014	-8.542; 9.493
Light PA (min/w)	4.843	.223	.05	-2.964; 12.65
Moderate PA (min/w)	2.012	.577	-.005	-5.078; 9.101
Vigorous PA (min/w)	.412	.73	-.007	-1.932; 2.755
MV PA (min/w)	2.423	.52	-.005	-4.989; 9.836

a $p<.05$; association between genu valgus and level of physical activity (PAL). IM: intermalleolar distance; PAL: physical activity level; min/w: minutes per week; MV: moderate to vigorous.

3748 Board #195 June 3 8:00 AM - 9:30 AM
Association Between Waist-to-Height Ratio And Fitnessgram® BMI Classification In Sixth-grade Children

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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 (WHtR) 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 WHtR and FITNESSGRAM BMI classification in sixth-grade children. **METHODS:** Subjects were 528 sixth-grade boys and girls, ages 11-13,

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 WHtR and BMI was .92, and the correlation between BMI and AC was -.75. The correlation between WHtR and AC was -.70. Receiver Operating Characteristic (ROC) analysis indicated that a WHtR 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 WHtR 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 WHtR 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 WHtR 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:** WHtR is strongly associated with classification according to FITNESSGRAM BMI standards in sixth-grade children. These data suggest that a WHtR of .451 for girls and .475 for boys are the best criteria for HFZ classification for FITNESSGRAM BMI. Also, a WHtR of .476 for girls and .484 for boys are the best criteria for High Risk classification for FITNESSGRAM BMI. Reduction of WHtR may provide important benefits since children in the High Risk category are most likely to develop problems related to metabolic syndrome as adults.

3749 Board #196 June 3 8:00 AM - 9:30 AM
Correlation Between Varying Back Squat Depths On Speed And Vertical Jump Performance In North American High School Football Players

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(No relationships reported)

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 three 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. A 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 cms, 90° 3RM squat: 116.1 ± 21.0 kgs, and 45° 3RM squat: 132.1 ± 22.2 kgs. Low correlations were found at both knee flexion angles: 90° 3RM squat ($36.6M r = -0.32$, $VJ r = 0.33$, $p < 0.01$), and 45° 3RM squat ($36.6M r = -0.31$, $VJ r = 0.33$, $p < 0.01$). However, moderate correlations were revealed when comparing the 3RM back squat/body mass ratio with the participant's 36.6M sprint times ($90 r = -0.46$, $45 r = -0.46$, $p < 0.01$). **CONCLUSIONS:** Within the parameters of this study, low to moderate correlations were determined between back squat strength and sprint speed as well as VJ at both 90 and 45 degrees of knee flexion.

3750 Board #197 June 3 8:00 AM - 9:30 AM
Metabolic Cost of Battling Rope Exercise in Children

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(No relationships reported)

Battling ropes (BR) are an effective mode of conditioning for adults, but the efficacy of BR exercise for children is unknown. **PURPOSE:** To examine the acute metabolic cost of BR exercise in children. **METHODS:** 15 boys (10.6 ± 1.4 yr) were tested for peak oxygen uptake (VO_{2peak}) on a treadmill and subsequently (≥ 48 hours later) performed a progressive 10 min BR protocol of 5 exercises (EX#: repetitions): standing side to side wave (EX1; 30), seated alternating wave (EX2; 60), standing alternating wave (EX3; 60), jumping jacks (EX4; 20) and double arm slams (EX5; 20). Each BR exercise was performed twice for 30 sec with a 30 sec rest interval between sets and exercises while connected to a metabolic system. A metronome was used to standardize cadence

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 VO_2 and HR during the treadmill test were 47.4 ± 8.8 ml/kg/min and 195.1 ± 6.6 bpm, respectively. Mean HR and VO_2 values for both sets of each exercise during the BR protocol were 52.7% to 84.1% and 21.5% to 60.1% of HR_{peak} and $\text{VO}_{2\text{peak}}$, respectively. During the BR protocol, there were progressive increases in VO_2 and HR from EX1 to EX5. Results of pairwise comparisons of VO_2 and HR among five BR exercises are below (mean \pm SD):

	EX1	EX2	EX3	EX4	EX5
HR (bpm)	103.3 \pm 11	124.1 \pm 15 ¹	148 \pm 16 ^{1,2}	147 \pm 14 ^{1,2}	164 \pm 11 ^{1,2,3,4}
VO_2 (ml/kg/min)	10.2 \pm 2	12.7 \pm 3 ¹	18.1 \pm 3 ^{1,2}	23.1 \pm 3 ^{1,2,3}	28.5 \pm 3 ^{1,2,3,4}

$p < 0.05$ ¹vs EX1; ²vs EX2; ³vs EX3; ⁴vs 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 $\text{VO}_{2\text{max}}$ are Not Associated with Ventricular Morphology or Function in Female Youth Athletes
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(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 ($\text{VO}_{2\text{max}}$), 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 $\text{VO}_{2\text{max}}$ using changes in echocardiographic variables as predictors.

RESULTS: During the study period, no significant change in $\text{VO}_{2\text{max}}$ was identified ($2.61 \pm 32\%$ v $2.62 \pm 32\%$, $p = 0.75$, $d = 0.05$). A significant decrease was identified in RVFAC ($44 \pm 10\%$ v $36 \pm 5\%$, $p = 0.02$, $d = -0.61$). 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 $\text{VO}_{2\text{max}}$ ($\beta = -0.33$ to 0.50 , $p > 0.05$ for all)

CONCLUSION: During the 7 month study period, no changes were identified in $\text{VO}_{2\text{max}}$ or ventricular size. The reason for the significant decrease of RVFAC is unclear but could be due to increased afterload or decreased RV contractility. Also, none of the echocardiographic variables were significant predictors of change in $\text{VO}_{2\text{max}}$ 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
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PURPOSE: Evidence shows an association between muscular strength (MS) and health among youth, however low muscular strength cut-points for the detection of

high metabolic risk in Latin-American populations are scarce. The aim of this 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: 0.74-0.94), $p < 0.001$; adolescents girls AUC=0.79 (95%CI: 0.70-0.89), $p < 0.001$; boys AUC= 0.88 (95%CI: 0.68-0.92), $p < 0.001$). In children (9 to 12.9 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
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PURPOSE: Associations between maximal rate of oxygen uptake ($\text{VO}_{2\text{max}}$) 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 $\text{VO}_{2\text{max}}$ 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: 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 (MetScore) as the sum of the age-sex standardized scores of waist circumference, triglycerides, HDL-c, glucose, systolic and diastolic blood pressure.

RESULTS: Linear regression analyses showed that the Barnett et al. (b) and Mahar equations were negatively associated to MetScore showing the highest discriminatory accuracy for identifying the low/high cardiometabolic risk in both sexes and age group (9-12 and 13-17 years old). Therefore, we are proposing to use Barnett et al. (b) equation [Boys and girls: $\text{VO}_{2\text{max}} = 25.8 \times 6 \times G + 1 \times 0.2 \times \text{body mass} + 3.2 \times \text{final speed}$] in Colombian youths to classify youths at metabolic risk.

CONCLUSIONS: The CRF cutoffs can be used as a quantitative marker of healthier cardiovascular profile Colombian in children and adolescents.

3754 Board #201 June 3 8:00 AM - 9:30 AM
Maturational Timing and Adolescent Swim Performance
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Beunen et al. (1978) found that the early maturers in their sample of non-athletic girls performed better on simple motor tasks than the late maturers early in adolescence, but that the late maturers performed better than the early maturers late in adolescence. Purpose: To determine if the same relationship between maturational timing and

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 equates 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 all three adolescent phases. We detected a significant two-way interaction ($F_{4,334} = 5.8, P < 0.001$), which indicated that the effect of maturational timing on swim performance differed by adolescent phase. Mean PPS for the early, average, and late maturers during early adolescence was 496.4, 494.8, and 480.0, whereas mean PPS during middle adolescence was 664.4, 683.1, and 721.3. Thus, the late maturers improved more (62.6%) from early to middle adolescence than the average (47.0%) and early (45.2%) maturers. In contrast, swim performance improved to a similar extent for the three groups from middle to late adolescence. Conclusion: Our results extend Beunen et al.'s findings by showing that early-maturing swimmers have a performance advantage over late-maturing swimmers during early adolescence. But by middle adolescence, the late maturers have a performance advantage that is maintained into late adolescence.

3755 Board #202 June 3 8:00 AM - 9:30 AM

Which One Is The Decisive Factor To Cognition Performance In Preschool Children Aged 3.5 To 4.5 Years Old, Aerobic Fitness Or Agility?: A Cross-sectional Study In Shanghai, China

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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 from eight preschools in Yangpu, Shanghai, China. After enrolled in this study (Trial Registration: clinicaltrials.gov NCT00674544), the young children were asked to perform a comprehensive package of tests including physical fitness and cognitive function. Children's scores on the tests of 10-m Shuttle Run (time; this test can be used to determine speed and agility performance, and elite players will use less time than the subelite participants) and 20-m Shuttle Run (laps; this test can be used to determine aerobic fitness performance, and elite players will have more laps than the subelite participants), Verbal Intelligence Quotient (VIQ), Performance Intelligence Quotient (PIQ), and Full Intelligence Quotient (FIQ) were assessed. Correlation coefficients were determined by conducting Pearson product-moment and Spearman's rho analyses. Linear regression analyses were used to examine the associations of cognitive performance with aerobic fitness and agility in a sequential manner. Descriptive data were reported as mean±SD. Statistical significance was set at a p-value < 0.05. **Results:** After adjustment for age, gender, BMI, physical activity, nutrition status, sleep habits, and education, a negative relationship ($P < 0.001$) was found between the change in the 10-m Shuttle Run Test (times) and the change in PIQ, VIQ and FIQ, whereas a positive association ($P < 0.01$) was observed between the change in the 20-m Shuttle Run Test and the change in PIQ, VIQ and FIQ. However, after the 10m and 20-m Shuttle Run Tests were mutually adjusted with covariates to control the confound variables, only the negative association still remained in the changes between the 10m Shuttle Run Test and PIQ, VIQ and FIQ ($P < 0.001$), respectively. **Conclusions:** Compared with aerobic fitness, a high level of the agility fitness may be associated more with a high cognition performance (performance of the PIQ, VIQ, and FIQ). Further research is needed to examine the effect of the aerobic and agility fitness related interventions on the cognitive parameters in this population.

3756 Board #203 June 3 8:00 AM - 9:30 AM
Effects of Self-Regulation at Ventilatory Breakpoint on Children's Running Fitness during Physical Education Pedagogical Strategies

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Introduction: Exercising at ventilatory breakpoint (Vpt) with the use of Rate of Perceived Exertion (RPE) scale has been used widely in children but its effect on running fitness during Games Concept Approach (GCA) or Skill-based Approach (SA) pedagogical strategies during physical education lesson is unknown. **Purpose:** To investigate the effects of running fitness of exercising within the range of Vpt (RPE 4-6) via self-regulation by children during GCA and SA pedagogical strategies. **Methods:** 18 healthy children, 9 boys (age: 10years old, height: 138 ± 5.94cm, weight: 34.56 ± 7.3kg) and 9 girls (age: 10 ± 0.5years old, height: 135 ± 8cm, weight: 33 ± 10.45kg) 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 1.6km before and after the intervention. **Results:** Paired-t test showed significant difference between pre and post 1.6km run test for GCA (pre: 693.67 ± 98.03 seconds, post: 614.89 ± 74.18 seconds, $p = 0.001$) and SA (pre: 817.11 ± 92.98 seconds, post: 712 ± 68.51 seconds, $p < 0.0005$). Independent-t test showed significant difference between GCA and SA in the 1.6km post run ($p = 0.011$) and HR (GCA: 159.03 ± 12.22, SA: 129.99 ± 17.23, $p = 0.001$) but not in RPE (GCA: 4.30 ± 1.16, SA: 3.73 ± 1.72, $p = 0.426$). Maximum HR (HR_{max}) percentage was higher in GCA (75.73% of HR_{max}) than SA (61.9% of HR_{max}). **Conclusion:** Faster timings in the 1.6km post run test results showed improvement in cardiovascular fitness for both pedagogical approaches, which may have been attained with sustained exercise intensity 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.

3757 Board #204 June 3 8:00 AM - 9:30 AM
Nine-year Longitudinal Study Of Obesity In Japanese Young Children

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PURPOSE: Childhood obesity is increasing worldwide. Tracking, or the tendency for an individual to maintain his/her disease risk factor rank level relative to his/her peers through time, leading to adolescence and adult obesity is observed even in early childhood. Childhood obesity is associated with increased risk of mortality due to cardiovascular diseases in adulthood, independent of adult weight. Therefore, intervention, and prevention of obesity in young children is important in reducing the risks of obesity and cardiovascular disease in adulthood. However, little is known about the process and tracking of obesity during the years of young childhood because of a lack of longitudinal studies. Consequently, prevention and treatment of obesity in the young childhood has made little progress. The purpose of this study is to investigate the trends in degree and tracking of obesity in young children over nine years. **METHODS:** The subjects were 58 young children (22 boys and 36 girls). They were followed up for height, weight, and obesity index from 3 to 11 years old. Obesity index ((actual weight - standard weight) / standard weight × 100) was calculated using the standard weight for Japanese children, which was determined according to the formula: Male $y = 1.83 \times 10^{-3}x^2 - 0.071x + 4.43$, female $y = 2.34 \times 10^{-3}x^2 - 0.157x + 7.71$ (y: standard weight, x: height). Obese was defined as having an obesity index of more than +15%. Pearson's correlation coefficients and χ^2 test were used to estimate the effects of age on frequency trend and tracking of obesity. Statistical significance was $p < 0.05$. **RESULTS:** The prevalence of obesity was 17.2% (n=10) in 3-year-old children and 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

($r=0.630$), 9-years-old ($r=0.548$), 10-years-old ($r=0.559$), 11-years-old ($r=0.512$). Among 10 young children who were obese at 3-years-old, 3 showed tracking of obesity from 11-years-old.

CONCLUSIONS: The status of many obese young children is likely to track, but the chance of a decrease in obesity over nine years is not small in young childhood.

3758 Board #205 June 3 8:00 AM - 9:30 AM
Relationships Between Young Children's Physical Activity And Guardians' Consciousness Regarding It
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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 is 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, 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.

3759 Board #206 June 3 8:00 AM - 9:30 AM
Vertical Jump Performance Predicts Selection Of Young Talented Volleyball Players For the Junior National Team
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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. 34.4±3.6 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 (Wilk's lambda= 0.69, $\chi^2= 15.12$, $p=0.001$, $\eta^2=0.12$). 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 discriminate between selected and non-selected junior volleyball players.

3760 Board #207 June 3 8:00 AM - 9:30 AM
Comparison Of Cardiorespiratory Fitness Testing Measures In Young Children
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 (No relationships reported)

Laboratory and field methods of assessing cardiorespiratory fitness in young children provides valuable information to assess the effectiveness of intervention strategies designed to improve overall health outcomes. **PURPOSE:** To compare peak oxygen uptake (VO_{2peak}; ml·kg⁻¹·min⁻¹) and maximal heart rate (MHR; beats·min⁻¹), from the FitnessGram Progressive Aerobic Cardiovascular Endurance Run (PACER) test to a maximal graded exercise test (GXT; treadmill) in 17 (9 boys) young (10-11 yr old) children. In addition, VO_{2peak} from the PACER test was compared (mean ± SD) to the estimated VO_{2peak} using the Topend Sports Beep Test Score Calculator (Topend) equation. **METHODS:** Subjects completed the PACER and GXT in a randomized order 1 week apart while wearing a heart rate monitor and a portable oxygen analyzer. **RESULTS:** The PACER test VO_{2peak} (30.4 ± 4.6) was not significantly different from the GXT VO_{2peak} (32.1 ± 5.5) however, MHR GXT (194.8 ± 9.4) and MHR PACER (173.7 ± 20.9) were significantly ($p < 0.05$) different. Topend VO_{2peak} (23.8 ± 2.9) was significantly ($p < 0.05$) lower than the PACER VO_{2peak}. Both the GXT and the Topend VO_{2peak} were significantly ($p < 0.05$) correlated with the PACER ($r=0.75$ and 0.62, respectively). There was no significant correlation between the PACER and GXT MHR ($r=0.40$). **CONCLUSIONS:** The PACER elicits a similar VO_{2peak} response, however the Topend estimation equation should be used with great caution to estimate the cardiorespiratory fitness of young children. Supported by the University of Kentucky Pediatric Exercise Physiology Laboratory Endowment

3761 Board #208 June 3 8:00 AM - 9:30 AM
Comparison of Health Related Fitness Variables between Male and Female Youths in Singapore
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Physical fitness encompasses health-related fitness (HRF) variables such as cardiovascular fitness (CF), lumbar and lower limb flexibility (LLLF), muscular strength (MS) and body fat percentage (BF%). To date, no large study has been conducted on HRF variables among Singaporean youths. **PURPOSE:** To compare HRF variables between 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 %) from Singapore schools participated in this study. Body Mass Index (BMI) was calculated using standard methods and BF% was measured with a Tanita BC-581 FitPlus Innerscan Scale and Body Composition Monitor. CF, LLLF, and MS were tested using the 15m youth Progressive Aerobic Cardiovascular Endurance Run test (PACER), one-legged sit-and-reach test (SRT), handgrip strength test (HS), and 1-minute sit-up test (SUT) respectively. **RESULTS:** 76.65% of the youths (males: 77.82%, females: 82.56%) were in the healthy BMI range according to the Health Promotion Board of Singapore. Significant differences were found between males and females for all variables (BF %: Males: 17.64 ± 10.73 %, Females: 25.74 ± 7.87 %, $p < 0.005$; SRT: Males: 52.97 ± 10.04 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.

Abstracts were prepared by the authors and printed as submitted.

3762 Board #209 June 3 8:00 AM - 9:30 AM
Effects of Backward Walking on Balance in Children
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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 (0.69±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±1.74m/s, p<0.01).

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

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3763 Board #210 June 3 8:00 AM - 9:30 AM
Test-retest Reliability Of The 40-yd Dash And Vertical Jump Assessments In Youth Athletes
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Introduction: Limited data exist on the reliability and sensitivity of the 40-yard dash (40-yd) and vertical jump (VJ) tests in youth athletes, which are popular combine performance assessments. **Purpose:** To examine the test-retest reliability for the 40-yd and VJ in youth athletes. **Methods:** Seventy-seven 5-15 year-old athletes (mean height ± SD = 153.0 cm ± 14.9; weight = 45.8 kg ± 16.3) volunteered for the performance assessments during two visits separated by 24-72 hours. Athletes were divided into three age groups (5 - 9, 10 - 11, and 12 - 15 years old). The 40-yd was assessed in seconds (s) with a digital timing gate, and the VJ was assessed in centimeters (cm) with a vertec, both performed on indoor field turf. Intra-class correlation coefficients (ICC) with corresponding 95% confidence intervals, standard errors of measurement (SEM), coefficients of variation (CV), and minimum detectable changes (MDC) were calculated from the repeated measures analysis of variance (ANOVA) from test 1 to test 2 for both assessments. **Results:** There were systematic decreases in 40-yd times from test 1 to test 2 for the 12 - 15 year-old group, but there was no other detectable systematic variability for any other variable. The ICCs ranged from 0.78 to 0.96, which were greater than zero. MDCs (calculated from SEMs) for the 5 - 9, 10 - 11, and 12 - 15 age groups were 0.49, 0.70, and 0.38 s for the 40-yd, and 6.7, 4.3, and 13.7 cm for the VJ, respectively. **Conclusions:** Twelve to fifteen year olds may need a familiarization trial (i.e., test run) for the 40-yd. Based on the age of the athlete, 0.4 - 0.7 s and 4 - 14 cm changes in the 40-yd and VJ, respectively, may be necessary for individual youth athletes to consider their improvements real beyond the errors of the measurements.

3764 Board #211 June 3 8:00 AM - 9:30 AM
Research On The Influence Of Exercise On Brain Structure And Brain Function In The Resting State Of Children With Febrile Convulsion
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PURPOSE: Using the complex brain function and brain structure as an entry point in the resting-state, the research explored the central mechanisms of febrile convulsion, aiming to improve the condition of impaired brain function and the level of physical ability of FC children. **METHODS:** We chose 10 children (group A) and 10 FC children (group B). The group B was intervened by the sensory integration training, which was based on balance and flexibility and coordination. The intervention lasted for 6 months. Adopting BOLD-fMRI technology, regional homogeneity was observed. Based on VBM measurement technology, Cerebral gray matter concentration was measured. The dynamic change of regional homogeneity and gray matter concentration of the whole brain for both A and B group has been observed before and after exercise intervene. **RESULTS:** 1. Compared with group A, the abnormality of regional homogeneity occurred in many encephalic regions for group B. 2. After intervene, group B's regional homogeneity signal changed obviously in SG (P<0.05; P<0.01) and cerebellum (P<0.05; P<0.01), MI (P<0.05; P<0.05), PMA (P<0.05; P<0.05), SMA (P<0.05; P<0.01) and IPL (P<0.05; P<0.05). 3. The gray matter of group B occurred in such encephalic regions as precentral gyrus (BA 4), inferior parietal lobule (BA 40), cuneus (BA 18), precuneus (BA 7), cingulate gyrus (BA 24, 32) encephalic regions improved. 4. Sit and reach (flexibility, P<0.01), walking balance beam (balance ability, P<0.01), cross jump (coordination ability, P<0.05), two feet continuous jump (jump ability, P<0.01) significantly increased for group B. **CONCLUSIONS:** 1. SG was the main encephalic region which resulted in FC children motor function injuries. So it was the main intervene target. 2. MI, PMA, SMA and IPL were the critical regions for FC children to accomplish reorganization and compensation of the brain function in the resting-state. They were the important focus for exercise intervene. 3. the abnormal alteration of ray matter concentration was the main difference among group A and B children' brain structure. It became the material basis of the abnormality of brain function. 4. Sensory integration training and exercise intervene based on the development of balance and coordination ability had the significant effect on improving FC children's physical ability .

3765 Board #212 June 3 8:00 AM - 9:30 AM
Activity and Fitness in Recreational and Competitive Youth Rock Climbers.
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In the search to find activities youth enjoy and to which they will adhere, rock climbing has become increasingly popular; youth climbing teams/programs exist all over the United States (US) and United Kingdom (UK). The US has over 800 climbing gyms, with almost 400 in the UK. From a health-related fitness perspective, climbing appears to be a good option for decreasing sedentary behavior and keeping youth active.

PURPOSE: 1) To determine if recreational (REC) and elite/competitive (EC) youth climbers meet US DHHS (2008) physical activity guidelines during their climbing gym sessions, and 2) to determine if REC and EC youth climbers differ in estimated energy expenditure (EE), fitness, and body composition. **METHODS:** Data were collected between 2009-2013 in the US and UK. Thirteen REC (mean age: 10.7 ± 3.3 yrs) and 18 EC (13.8 ± 2.3 yrs) female climbers were assessed; 17 REC (10.6 ± 1.7 yrs) and 22 EC (13.9 ± 1.9 yrs) males were assessed. Heart rate (HR) monitors were used to collect time of activity (mins), average heart rate (AHR), and peak heart rate (PHR) in beats per minute (bpm) during climbing. Energy expended (kcal) during climbing was estimated from the HR data. Health-related fitness was measured via sit and reach (flexibility), pushups (muscular endurance), and right and left grip strength (muscular strength). Body composition (%fat) was calculated from skinfolds using standardized equations. Differences between groups were tested using ANCOVAs, controlling for age. **RESULTS:** In the REC and EC groups, climbers spent between 73 and 85 mins being active during climbing sessions; the groups did not significantly differ. However, female and male EC climbers, respectively, had higher estimated EE (5.4 ± 1.3 and 6.7 ± 1.7 kcal/min) than female and male REC climbers (3.5 ± 1.4 and 4.3 ± 1.4 kcal/min; p<0.05). Female EC climbers were also stronger than female REC climbers in both right and left grip strength (p<0.01). Once adjusted for age, few other differences existed between REC and EC. **CONCLUSION:** For all groups, AHR ranged between 120-158 bpm, and the exercise intensity approached moderate levels. REC and EC climbers did not differ on most physical or fitness parameters. Additionally, climbers met US DHSS recommendations for duration of cardiorespiratory activity, but intensity did not consistently meet moderate levels.

3766 Board #213 June 3 8:00 AM - 9:30 AM

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

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PURPOSE: The physical function of high school students has been declined in the last decade. The purpose of this study was to investigate the effect of a modified Tai Chi intervention on physical function among high school students.

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). 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 (SLSECB) 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 ($p < .05$) between four groups, and repeated ANOVA was employed to examine the differences within the groups over the course of the intervention ($p < .05$).

RESULTS: The results demonstrated that by the end of 20th week, the BEG had a significantly lower RHR than the BCG did (62.06 ± 0.75 vs 69.97 ± 2.89 beats/min), and the similar trend of the RHR was discovered between the GEG and GCG; the BEG had significantly greater improvement in VC than the BCG did ($4,230 \pm 224$ vs $2,865 \pm 143$ ml), and the similar trend was found between the GEG and the GCG. On the SLSECB, 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.

3767 Board #214 June 3 8:00 AM - 9:30 AM

Longitudinal Changes in Physical Fitness and Physical Activity in Childhood

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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 ($r = -0.48$).

CONCLUSIONS: Our study suggests that there are distinctive characteristics pertaining to every factor in the improvements observed in physical fitness in childhood.

3768 Board #215 June 3 8:00 AM - 9:30 AM

Salivary Cortisol Responses After A Tennis Match In Adolescent Athletes

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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 60.0 ± 8.2 kg, BMI 19.9 ± 1.2) 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 resulted 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. $976.1 \pm 143.143.7$ pg/ml; $p < 0.001$). No significant differences were found between the mean cortisol responses in males and females ($p > 0.05$). **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.

3769 Board #216 June 3 8:00 AM - 9:30 AM

Physical Exercise Program To Improve The Sport Performance On Speed Skating In Children

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PURPOSE: To investigate the effects of physical exercise program on sport performance of children speed skaters. **METHODS:** A total of 52 children speed skaters (aged 9.09 ± 0.27 ; 69.2% girls) from Ecuador participated in the study. The ALPHA-Fitness battery was used to analyze the body composition and physical fitness: muscular fitness (hand-grip strength and standing long jump test), speed-agility (4x10-m shuttle run test), and cardiovascular fitness (20-m shuttle run test). Sport performance was measured by the time-marks of the different modalities of the speed skating (combined test, time trial, sprint and hare test). All participants were evaluated before and after 10-weeks of intervention based on a physical exercise program (90-min/ session, 4-days/week). A mixed factorial ANOVA was used to analyze effects and interactions of the study factors age (<10 -y and >10 -y), sex (boys and girls), and measure moments (baseline and post-intervention) on body composition, physical fitness, and sport performance. **RESULTS:** Post-intervention compared with baseline, weight was lower in girls <10 -yr (MD = 0.66 ± 0.30 Kg, $p = 0.033$), fat mass was lower in girls <10 -yr and >10 -yr (MD = 7.37 ± 1.21 Kg, $p < 0.001$; MD = 7.71 ± 1.71 Kg, $p < 0.001$), muscle mass was lower in boys >10 -yr (MD = 0.13 ± 0.06 Kg, $p < 0.035$) and bone mass was higher in girls <10 -yr (MD = 0.28 ± 0.09 , $p = 0.03$). The muscular fitness of upper limbs was higher post-intervention compared with baseline in boys <10 -yr (DM = 1.55 ± 0.57 , $p = 0.010$) and girls <10 -yr (MD = 1.58 ± 0.35 , $p < 0.01$). For lower limbs, muscular fitness post-intervention was higher in girls <10 -yr (MD = 5.20 ± 2.28 , $p = 0.02$). The cardiovascular fitness was higher post-intervention in girls <10 -yr (MD = 0.65 ± 0.20 , $p = 0.002$) compared with baseline. The time marks of the combined test post-intervention was lower in boys >10 -yr (MD = 6.06 ± 2.00 , $p = 0.004$, in time

trial the time-mark was lower in boys <10-yr (MD=0.71±0.19, p=0.001), girls <10-yr (MD=0.52±0.12, p<0.001) and in girls >10-yr (MD=0.38±0.17 p=0.027) compared with baseline. The time-mark in sprint was lower for girls <10-yr (MD=2.39±1.02, p=0.023) post-intervention. **CONCLUSION:** A 10-weeks physical exercise intervention improves sport performance in children speed skaters, what are directly related with sex and age.

3770 Board #217 June 3 8:00 AM - 9:30 AM

Reliability of the Neuromuscular Fatigue Threshold Measurement across Maturity Status in Boys

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Several studies in adult men and women have demonstrated excellent reliability and sensitivity when measuring neuromuscular fatigue threshold (NFT) during an incremental cycle ergometer test. Recently, the ability to estimate NFT in young boys (11.1±1.1yrs) was demonstrated, which may provide a new noninvasive method to examine training interventions as well as the effect of maturation on changes in motor unit recruitment strategies. However, to date, no one has examined the reliability of estimating NFT in boys. **PURPOSE:** To determine the reliability of estimating the onset of neuromuscular fatigue in boys across maturity status. **METHODS:** Twenty-four boys (age 11 to 17yrs) volunteered with parental consent to complete two graded exercise test (GXT) on a cycle ergometer separated by at least 48 hours. The NFT was estimated during the GXT by way of the maximal distance method using electromyographic amplitude values from the right vastus lateralis vs power output (W). All participants were separated according to their number of years from peak height velocity (PHV), an estimation of somatic maturity status, into PRE- (-1yr), PERI- (between -1 to +1yr) and POST- (+1yr) PHV groups. Test-retest reliability was calculated for PRE-, PERI-, POST-PHV as well as the combined group. Intraclass correlation coefficient (ICC_{2,1}), standard error of the measurement (SEM) and minimum detectable change (MDC) were calculated using a custom written Excel spreadsheet. **RESULTS:** Table 1 summarizes the results. Every group independently and combined demonstrated excellent reliability (ICC>0.75) **CONCLUSIONS:** The current results described in Table 1 are similar to other studies that have reported ICC (0.85 to 0.95), SEM (6W to 14.6W) and MDC (17W to 34W) in adult men. The estimation of NFT, therefore, is reliable in boys regardless of maturity status.

Table 1. Summary of the reliability data

Group	NFT-Trial 1 (w)	NFT-Trial 2 (w)	ICC	SEM (w)	MDC (w)
All (n=24)	161.7+38.0	163.1+39.0	0.96	10.4	23.3
PRE (11.6+0.7yrs; n=6)	123.7+46.0	122.0+48.2	0.99	6.1	14.5
PERI (14.2+1.0yrs; n=7)	157.7+18.4	157.1+12.7	0.80	10.0	23.3
POST (17.0+0.8yrs; n=11)	185.1+24.2	189.4+21.1	0.85	12.5	29.2

3771 Board #218 June 3 8:00 AM - 9:30 AM

Effect Of A Trampoline Training Program In The Power Of Lower Limbs In Children's Gymnasts

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PURPOSE: The recreational and competitive practice of acrobatic sports, that is, trampoline, is growing rapidly around the world. The trampoline is a gymnastic implement used for learning acrobatic skills in children's gymnastics. However, few studies investigating its application for the development of the power of lower limbs. Thus, the aim of this study was to analyze the effect of an intervention program based on trampoline training on lower limbs in children's gymnasts.

METHODS: A total of 20 gymnasts children (age: 8.00±1.71 years) participated in the study. The power of lower limbs was evaluated before and after an intervention of 8 weeks (3 days/week, 1 h/session) based on training trampoline. Leg power was assessed by Bosco test with the battery Squat Jump (SJ) and Countermovement jump (CMJ) by jumping platform (Axon Jump, software 4.0). The jump time, jump height and speed takeoff were evaluated for both batteries jump. The technical implementation of vertical jump in trampoline was evaluated by scoring code of the International Federation of Trampoline (range of score from 0 to 10). The weight, height and the attendance during the intervention were also analyzed. Paired-samples

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 value of significance was p<0.05.

RESULTS: Post-intervention, SJ 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.

3772 Board #219 June 3 8:00 AM - 9:30 AM

A Comparison Of Aerobic And Anaerobic Power In High School Individual Sports Athletes

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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) 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 Wrestling (56.9 ml·kg⁻¹·min⁻¹), 2) Golfer (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=.293; 0.52, p=0.513). **CONCLUSIONS:** The comparisons between sports that reached statistical significance evidenced differences was observed in several groups on VO_{2max}: 1) Wrestling and Golf (p=.001), 2) Wrestling and Shooting (p=.005), 3) Swimming and Golf (p=.001), 4) Shooting & Track & field (p=.001), 5) Track & field and Golf (p=.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.

3773 Board #220 June 3 8:00 AM - 9:30 AM

Effect of Modified Tai Chi Exercise on Lower Extremity Muscle Strength and Proprioception among Chinese High School Students

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PURPOSE: The effect of Tai Chi exercise on muscle strength and proprioception among high school students has been well documented. The purpose of this study was to investigate the effect of a modified Tai Chi intervention on lower extremity muscle strength and proprioception among high school students.

METHODS: Sixth male and sixty female healthy high school students aged 16-18 years participated in the Tai Chi intervention. The participants were randomly assigned to four groups with 30 per group: the male experimental group (MEG); female experimental group (FEG); male control group (MCG) and female control group (FCG). 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. Lower extremity muscle strength (LEMS) of squat, proprioception of ankle inversion (PAI), 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 ($p < .05$) between four groups, and repeated ANOVA was employed to examine the differences within the groups over the course of the intervention ($p < .05$).

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, $p < .05$), and the similar trend was found between the FEG and the FCG on LEMS; the MEG had a significantly better proprioception (PAI & PAE) than the MCG did (PAI: 2.93 ± 0.92 vs 5.81 ± 0.99 deg, $p < .05$; PAE: 2.98 ± 1.04 vs 5.70 ± 1.01 deg, $p < .05$), 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 MCG did (PKF: 0.99 ± 0.49 vs 2.69 ± 0.51 deg, $p < .01$; PKE: 0.75 ± 0.51 vs 2.05 ± 0.51 deg, $p < .05$), and the similar trend was discovered between the FEG and FCG on PKF and PKE.

CONCLUSIONS: The modified Tai Chi exercises may improve high school students' lower extremity muscle strength and proprioception at 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 Diets 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, Muscular Strength and Anaerobic Power in Young, Healthy Women.

Collin Popp¹, Michelle Bohan Brown¹, William C 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 (MP) 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 ($\text{abs}\dot{V}O_{2p}$ and $\text{rel}\dot{V}O_{2p}$) and Wingate test were used to determine peak power (PP) and relative peak power (RPP). Leg press and chest press machines were used to estimate upper body (CP1RM), and lower body (LP1RM) 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)*exercise (Ex) for $\text{abs}\dot{V}O_{2p}$ ($p = 0.093$), strength (CP1RM ($p = 0.753$), LP1RM ($p = 0.427$), PP ($p = 0.732$), RPP ($p = 0.498$)). Based on the ANOVA there was a significant three-way interaction of TP*D*Ex for $\Delta\text{rel}\dot{V}O_{2p}$ ($p = 0.016$) as the MP + Ex group ($\Delta + 4.4 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) had a greater change from baseline compared to the MP group ($\Delta - 2.7 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, ($p = 0.002$)), and PD + Ex group ($\Delta - 0.3 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, ($p = 0.03$)).

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.

3775 Board #222 June 3 9:30 AM - 11:00 AM

Asymmetries In Slowed On-transient \dot{V}_{E-} and $\dot{V}O_{2-}$ Kinetics Are Not A Consequence Of Age In HFpEF

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(No relationships reported)

PURPOSE: Aging, increased ventilation (\dot{V}_{E-}), and reduced pulmonary oxygen uptake ($\dot{V}O_{2-}$) during exercise are hallmark features of heart failure with preserved ejection fraction (HFpEF). The pathophysiology of increased \dot{V}_{E-} and reduced $\dot{V}O_{2-}$ linked to exercise intolerance remains unclear in HFpEF. Aging is associated with prolonged exercise on-transient \dot{V}_{E-} and $\dot{V}O_{2-}$ -kinetics suggesting abnormal integrated cardiopulmonary and skeletal muscle function. This study aimed to test whether the continuous effect of age explains on-transient \dot{V}_{E-} and $\dot{V}O_{2-}$ -kinetics in HFpEF during submaximal ergometry.

METHODS: Sixteen HFpEF (age: mean = 69 ± 7 , range = 55-83 years; BMI = 30 ± 4 kg/m²) performed 2 transients of 6 min fixed-load (20 W) square-wave ergometry at 65 rpm transitioning from rest. Breath-by-breath \dot{V}_{E-} and $\dot{V}O_{2-}$ were measured via open-circuit metabolic system. Raw data were linear interpolated to 1 s intervals and time-aligned for ensemble averaging across transients into 10 s bins for analyses. Excluding the cardiodynamic phase (35 s), Phase II on-transient \dot{V}_{E-} and $\dot{V}O_{2-}$ -kinetics were assessed via single exponential models as, $Y_B + A_1[1 - e^{-(t-TD)/\tau}]$, where, Y_B = rest; A_1 = steady-state increase in \dot{V}_{E-} or $\dot{V}O_{2-}$ above rest; TD = time delay; τ = time constant.

RESULTS: Resting \dot{V}_{E-} and $\dot{V}O_{2-}$ were 12 ± 1 and 0.36 ± 0.06 L/min, respectively. Phase II $\tau\dot{V}_{E-}$ and $\tau\dot{V}O_{2-}$ were 81 ± 40 and 49 ± 23 s, respectively, whereas TD were -4 ± 23 and 23 ± 6 s, respectively. A_1 for \dot{V}_{E-} and $\dot{V}O_{2-}$ were 13 ± 2 and 0.46 ± 0.08 L/min, respectively. Linear regressions (R^2) between age and $\tau\dot{V}_{E-}$ or $\tau\dot{V}O_{2-}$ were 0.01 and 0.12, respectively (both $P > 0.05$). In contrast, R^2 between $\tau\dot{V}_{E-}$ or $\tau\dot{V}O_{2-}$ with A_1 for \dot{V}_{E-} or $\dot{V}O_{2-}$ were 0.38 ($P = 0.02$) or 0.02 ($P = 0.66$), respectively. Lastly, R^2 between $\tau\dot{V}_{E-}$ and $\tau\dot{V}O_{2-}$ was 0.28 ($P = 0.04$).

CONCLUSIONS: These data suggest that the continuous effects of aging cannot explain prolonged on-transient \dot{V}_{E-} and $\dot{V}O_{2-}$ -kinetics in HFpEF. However, unique to on-transient \dot{V}_{E-} kinetics, prolonged $\tau\dot{V}_{E-}$ explained the variance in slowed $\tau\dot{V}O_{2-}$ and the increased rise in A_1 for \dot{V}_{E-} . These interactions between on-transient \dot{V}_{E-} and $\dot{V}O_{2-}$ kinetics suggest calibration between pathophysiology at both skeletal muscle and cardiopulmonary levels contributing to exercise intolerance in HFpEF.
Funding: AHA 16POST30260021 (EHV), NIH RO1-HL126638 (TPO).

3776 Board #223 June 3 9:30 AM - 11:00 AM

Effect Of Ankle Plantar Flexion On ACL Strain During Landing From A Jump

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(No relationships reported)

Injuries to the Anterior Cruciate Ligament (ACL) are one of the most common injuries in athletic activities. Landing from a jump is one of the leading athletic activities associated with ACL injuries. Researchers have postulated that landing flat footed (hill contact) is a more detrimental landing posture to ACL health than landing on toes (or ball of foot). In this research, a novel hybrid robotic system utilizing cadaveric legs (six inches above the knee joint to the toes) was designed to simulate lower extremity biomechanics. The robotic system has the ability to raise a cadaveric leg with pre-applied muscle forces and instrumented ACL to a desired height and drop it onto a force plate. Because we have full access to the foot and ankle joint, tests were performed to determine the impact of flat footed versus plantar flexed landing at various hip and knee flexion angles. **PURPOSE:** To compare the strain of the ACL during a one inch jump landing with foot in a toe down, plantar flexion position versus flat footed, with foot parallel to contact surface. **METHODS:** Four cadaveric knees were tested using a hybrid biomechanical device designed to simulate athletic activities such as landing from a jump, or a plant and cut movement. The cadaveric knees were attached to the device by insertion of a threaded rod implanted into the femur. Quadriceps and Hamstring (Q/H) forces were applied by the use of linear pull cables attached to the associated muscle group. Hip flexion angle was controlled allowing comparison of ACL strain at different degrees of hip flexion during flat-footed and plantar flexed landing scenarios. ACL deformation, Ground Reaction Force (GRF), Q/H forces, and Hip Flexion/Extension were measured across all tests. Data was post-processed using MATLAB to find maximum GRF, ACL deformation during impact, and associated muscle forces. T tests were performed comparing ACL strain of flat-footed vs. plantar-flexed landings. **RESULTS:** ACL strain of flat footed landings at all hip flexion angles were significantly higher than the plantar flexed tests ($p = 0.0019$). **CONCLUSION:** Our results indicate that landing from a jump with the foot plantar flexed lowers the strain on the ACL compared to a flat footed jump landing. The main reason for this could be the shock absorbing role of the ankle and foot ligaments during the plantar flexed landings.

3777 Board #224 June 3 9:30 AM - 11:00 AM
Acute Aerobic Exercise Stimulates ATP Production Rate Similarly in Subsarcolemmal and Intermembranar Muscle Mitochondria in Humans

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 (No relationships reported)

Purpose: Mitochondria (MITO) in skeletal muscle are organized in reticulum extending from the subsarcolemmal region (SS MITO) to the intermembranar 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/mg protein) and IMF MITO (MPG substrate: 259±44 vs 427±61; nmol ATP/min/mg 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 MITO ($P > 0.05$). 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.

3778 Board #225 June 3 9:30 AM - 11:00 AM
Acute Exercise Increases STARS mRNA in Human Skeletal Muscle

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 (No relationships reported)

Striated Activator of Rho Signaling (STARS) has recently been proposed as link between external stimuli and cellular responses in the adaptation to physical activity. This actin-binding protein is localized in the sarcomere and has been previously shown to modulate Serum Response Factor (SRF) activity which activates transcription of factors important in muscle growth and metabolism. STARS has also been linked to PGC-1 α and ERR α gene expression changes and protein interactions. However, the context and regulation of STARS is still unclear. **Purpose:** To determine how a single bout of physical activity influences STARS mRNA expression over a 24-hour time course. **Methods:** 20 untrained subjects (male and female; aged 20-35) were randomized to either 60 minutes of endurance exercise on a cycle ergometer (20 min at 50% VO₂max + 40 minutes at 65% VO₂max) or no exercise. Muscle biopsies were taken from *M. vastus lateralis* at rest and 30 minutes, 2h, 6h and 24hrs after the end of exercise. cDNA was extracted and gene expression analysed. Fold induction was statistically analysed by ANOVA. **Results:** Exercise induced a significantly higher STARS gene expression increase compared to control ($p=0.048$). Furthermore, after an initial upregulation at 30 minutes (2,8-fold $\pm 0,5$), a time-dependent decrease in expression could be observed at 2h (2,1-fold $\pm 0,34$), 6h (1,4-fold $\pm 0,38$) until baseline was reached after 24hrs. **Conclusion:** Acute endurance exercise upregulates STARS mRNA expression in a time- dependent manner. These data strengthen the possible role of STARS as an important player in the regulation of muscle growth and metabolism.

3779 Board #226 June 3 9:30 AM - 11:00 AM
Occupational And Leisure-time Physical Activity And Risk Of Disability Pension: Prospective Data From The Hunt Study, Norway

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 (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 walking 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 walking 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). Several 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.

3780 Board #227 June 3 9:30 AM - 11:00 AM
Physical Activity Level and Androgen Concentrations are Independently and Additively Associated with Cardiovascular Disease Risk in Men.

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 (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/H 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.

3781 Board #228 June 3 9:30 AM - 11:00 AM
Building Healthy Communities: A Comprehensive School Health Program to Prevent Chronic Disease
 Erin E. Centeio¹, Nate McCaughtry¹, Whitney Moore¹, Alex Garn², Mariane Fahlman, FACSM¹, Jeffrey Martin¹, Noel Kulik¹. ¹Wayne State University, Detroit, MI. ²Louisiana State University, Baton Rouge, LA.
 (No relationships reported)

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 socioecological 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 (WtHR) 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 ($m = 100$) 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 WtHR among treatment and control groups at time two (T2) $F_{M1}(24.61, 63.08) = 4.59, p < .001, R^2_{\text{treatment}} = 0.01$. There were no significant differences in T2 WtHR based on age $F_{M1}(0.02, 63.08) = 0.44, p > .05$, gender $F_{M1}(0.03, 63.08) = 0.001, p > .05$, and race $F_{M1}(0.15, 63.08) = 0.02, p > .05$. A total of 64% of T2 WtHR 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.

3782 Board #229 June 3 9:30 AM - 11:00 AM
Effects Of Exercise Training And Increasing Non-exercise Physical Activity On Cardiometabolic Risk Factors: Results From The I-can Study
 Damon L. Swift¹, Lesley D. Lutes², Tyara R. Nevels¹, Patricia M. Brophy¹, Chelsey A. Solar¹, Joeseeph D. Houmard, FACSM¹. ¹East Carolina University, Greenville, NC. ²University of British Columbia Okanagan, Kelowna, BC, Canada.
 (No relationships reported)

PURPOSE: Exercise training has known cardiovascular benefits, however little data exists on the potential additive effects of exercise training combined with increasing non-exercise physical activity on cardiometabolic risk factors, especially in a long duration intervention. **METHODS:** We randomized obese adults ($N=45$) to one of 3 groups: 1) aerobic training (AERO); 2) aerobic training and increasing non-exercise physical activity (AERO-PA) or; 3) a control group for 6 months. Both the AERO and AERO-PA groups participated in aerobic training at 50-75% $\dot{V}O_2$ max at a dose of 12 kcal/kg/week. In addition to exercise training, the AERO-PA group participated in behavioral coaching sessions to determine strategies to increase non-exercise physical activity levels (measured via accelerometer) by 3,000 steps/day. The main outcome of the trial was waist circumference. Secondary outcomes included fitness ($\dot{V}O_2$ max), body composition (dual-energy X-ray absorptiometry), and insulin action (oral glucose tolerance test). **RESULTS:** The study population had a mean (SD) age of 52.6 (7.6) yrs., body mass index of 36.0 kg/m² (4.8) and a physical activity level of 4635.6 (1242.7) steps/day at baseline. A significant higher steps/day was observed in the AERO-PA group (7216.6) compared to the AERO (5662.3, $p=0.007$) or CON (5330.3, $p=0.029$). Intent to treat analyses revealed significant changes in absolute $\dot{V}O_2$ max (0.28 vs. 0.09 L/min), relative $\dot{V}O_2$ max (3.8 vs. 0.91 ml/kg/min) and estimated maximal METs (Est METs) (1.2 vs. 0.52 METs) in the AERO-PA compared to the AERO group (all $p < 0.05$). No effects were observed for waist circumference, body mass, body composition, or insulin action variables. Person correlations showed that change in steps during the intervention in exercisers were associated with improvements in Est METs ($r=0.54, p=0.007$), body weight ($r=-0.43, p=0.03$), waist circumference ($r=-0.54, p=0.005$) and approached significance for body fat ($r=-0.40, p=0.054$). **CONCLUSIONS:** Exercise training and increasing non-exercise physical activity resulted in a greater improvement in fitness compared to aerobic training alone

($\Delta 0.71$ METs), which may be clinically important based on epidemiological data. In addition, higher step levels outside of exercise are supportive for improvements in body composition.

3783 Board #230 June 3 9:30 AM - 11:00 AM
Winning off the Field: The Role of High School Sports Participation in College Physical Activity
 Fiona M. Asigbee¹, LaShaune P. Johnson², Jaimie N. Davis¹. ¹University of Texas at Austin, Austin, TX. ²Creighton University, Omaha, NE.
 (No relationships reported)

PURPOSE: To examine the role of High School (HS) sport participation and specific HS sport involvement on college physical activity (PA) levels.

METHODS: A cross-sectional cohort of 1,339 traditional, full-time degree seeking undergraduate students completed *The High School Physical Activity and College Health Behaviors Survey* (HSPA & CB) survey, consisting of 80-items, to assess health behaviors, including PA levels and HS sport participation. The relationship between HS sport participation (grouped as quintiles) and the likelihood of meeting the Centers for Disease Control and Prevention (CDC) recommendations for PA—number of days of aerobic activity and strength activity—was accessed using logistic regression. ANCOVAs were used to determine if the number of HS sport (in quintiles) was related to the number of days involved in aerobic and strengthening activities.

RESULTS: Results showed that the sum of all sports for all four years of HS was a significant predictor of the likelihood of meeting the CDC recommendations for number of days involved in aerobic (OR=1.08; 95%CI 1.04-1.13; $p < 0.001$), and strength (OR=1.11; 95%CI 1.07-1.16; $p < 0.001$) activities as college adults. Findings were also significant for the number of days involved in aerobic and strength activities for specific HS sports. When compared to other HS sports (competitive dance: 3.04 \pm 0.20 days, cross country: 3.49 \pm 0.31 days, football: 3.06 \pm 0.22 days, soccer: 2.90 \pm 0.17 days, and group "other": 3.48 \pm 0.40 days), HS cheerleaders (1.83 \pm 0.22 days) had lower aerobic and strength activity in college. HS volleyball and softball players (0.88 \pm 0.8 days; 0.86 \pm 0.11 days) had less strength activity in college, compared to other HS sports (baseball: 1.44 \pm 0.11 days, hockey and field hockey: 1.51 \pm 0.14 days, football: 1.52 \pm 0.09 days, and the group "other": 1.59 \pm 0.17 days).

CONCLUSION: Current findings support a strong connection between HS sport involvement and its lasting effects on college PA levels.

3784 Board #231 June 3 9:30 AM - 11:00 AM
Does The Aging Process Influence The Agility Performance In Old People?

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Biomedical Research Centre in Physiopathology of Obesity and Nutrition (CIBEROBn)-AgriFood Institute of Aragon (IA2)-Faculty of Health and Sport Sciences (FCSD), Zaragoza, Spain. (No relationships reported)

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.

PURPOSE: To test the evolution of agility capability across the aging process in seniors aged over 65 years. **METHODS:** In this longitudinal study 152 participants (32 men and 120 women; 70.9 ± 4.5 years) were evaluated in Aragon (Spain) within the framework of the *elderly EXERNET* multi-center study. Agility was measured in all participants using the 8-foot up-and-go test (Senior Fitness Test Battery). The time (seconds) required to get up from a seated position, walk 2.45 m, turn and return to a seated position was registered. 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 was divided into three groups (group 1: ≤ 74 years old; group 2: 75-84 years old; group 3: ≥ 85 years old) to observe if there were differences between ages. As no sex-by-time interactions were found, analyses were performed including men and women as a whole group. **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 during the follow-up was 24%. However, the oldest group showed a larger increase in agility in the 8-year follow-up than the younger groups (12%, 23%, 50%, 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.

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3785 Board #232 June 3 9:30 AM - 11:00 AM
Physical Activity among Navajo Cancer Survivors: A Qualitative Study

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(No relationships reported)

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 homestead 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.

3786 Board #233 June 3 9:30 AM - 11:00 AM
The Association Of Leptin With Unique Measures Of Body Composition Distribution In Exercising Women
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(No relationships reported)

Women with functional hypothalamic amenorrhea (FHA) present with suppressed systemic leptin, a signal of nutritional status. Unique measures of regional body composition that reflect subcutaneous (leg and gynoid) versus visceral (trunk and android) fat have varying impacts on leptin. The relationship between leptin and these unique measures has not yet been explored in exercising women with varying menstrual status.
 ACSM May 30 – June 3, 2017

Purpose: To examine 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, android, 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: $r = 0.757$, $p < 0.001$), 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 concentration 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.

3787 Board #234 June 3 9:30 AM - 11:00 AM
Dietary Nitrate and Muscle Power with Aging

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(No relationships reported)

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 (NO_3^-), 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 NO_3^- 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 NO_3^- . On another, they were tested 2 h after ingesting BRJ depleted of NO_3^- (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 NO_3^- 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 NO_3^- 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 NO_3^- in some subjects, as the relative increase in maximal power was correlated (i.e., $r = 0.78$; $P < 0.05$) with the amount of NO_3^- ingested per kilogram of body mass. In keeping with this conclusion, maximal power increased ($P < 0.05$) by $6.4 \pm 3.9\%$ in the four subjects who ingested > 125 mmol/kg of NO_3^- , but did not improve in the two subjects who ingested less. **CONCLUSION:** Acute dietary NO_3^- supplementation appears to improve muscle contractile function in healthy elderly individuals, but only when provided at a dose of > 125 mmol/kg of NO_3^- . The optimal dose of dietary NO_3^- for improving muscle speed and power in older (or younger) persons remains to be determined.

3788 Board #235 June 3 9:30 AM - 11:00 AM
Effect Of Dietary Nitrate Supplementation On The Development Of Neuromuscular Fatigue During Whole Body Exercise

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(No relationships reported)

PURPOSE: To investigate the effect of dietary nitrate supplementation on the development of neuromuscular fatigue during whole body exercise. **METHODS:**

Denver, Colorado

Three healthy, recreationally active males (30 ± 1 yrs) performed fatiguing, constant-load cycling exercise ($80\% W_{peak}$, 243 ± 12 W) following three days of dietary nitrate supplementation (DNS) or a nitrate-stripped placebo (PLA). PLA exercise was performed to task failure, with DNS exercise time matched to that which was achieved during PLA exercise. General quadriceps fatigue was quantified as the pre- to post-exercise decrement in maximal voluntary contraction torque (ΔMVC). Peripheral and central fatigue were quantified as the pre- to post-exercise changes in quadriceps twitch torque (ΔQ_{tw} ; supramaximal electrical femoral nerve stimulation) and voluntary activation (ΔVA), respectively. Prior to each trial, femoral arterial blood flow (Doppler ultrasound, common femoral artery) was quantified during cycling exercise at 50, 75, and 100 W (4 min each). Heart rate, ventilation, and pulmonary gas exchange were recorded throughout exercise. **RESULTS:** Femoral arterial blood flow was similar between conditions at baseline (~ 0.3 L \cdot min $^{-1}$) and all 3 workloads (~ 1.9 , ~ 2.4 , ~ 2.8 L \cdot min $^{-1}$ during cycling exercise at 50, 75, and 100 W, respectively). Furthermore, heart rate (~ 185 BPM), minute ventilation (~ 146 L \cdot min $^{-1}$), O_2 consumption (~ 3.1 L \cdot min $^{-1}$), and CO_2 production (~ 3.4 L \cdot min $^{-1}$) during the final minute of exercise were similar between trials. While nitrate supplementation had no effect on ΔMVC ($\sim 14\%$) and ΔVA ($\sim 4\%$), ΔQ_{tw} was significantly lower in DNS compared to PLA ($-35 \pm 2\%$ vs $-41 \pm 7\%$, respectively). **CONCLUSION:** Dietary nitrate supplementation attenuates the development of peripheral fatigue during whole body exercise. As the treatment did not alter the cardiopulmonary response and bulk locomotor muscle blood flow during cycling exercise, this ergogenic effect is likely determined by intramuscular and/or intracellular mechanisms. Finally, the observed attenuation of peripheral fatigue during endurance exercise might contribute to the documented performance enhancement previously reported with DNS.

3789 Board #236 June 3 9:30 AM - 11:00 AM
Efficacy of a Personalized Hydration Plan on Repeated Countermovement Jump Performance after Exercise-Heat Stress

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 (No relationships reported)

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.

Purpose: To evaluate the effect of exercise-induced hyperthermia, dehydration, and fatigue on anaerobic power during a 20-second repeated countermovement jump (CMJ). Secondly, to assess the efficacy of a personalized hydration plan 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; VO_{2max} : 60.1 ± 6.1 mL \cdot kg $^{-1}\cdot$ min $^{-1}$) completed 50-90 min of exercise in warm conditions (wet bulb globe temperature: $27.0 \pm 2.24^\circ C$) with (EXP) and without (CON) fluid replacement equal to sweat rate in a counterbalanced, randomized, cross-over fashion. Gastrointestinal temperature (T_{gi}) and fatigue (scale of 0-10) were measured throughout exercise. Dehydration was determined by percent body mass loss (BML). Peak power (PP), mean peak power (MPP), and heart rate (HR) were measured during CMJ pre- and post-exercise using dual force plates and a HR strap. Dependent t-tests evaluated post-exercise T_{gi} , fatigue, and BML between groups. Separate two-way repeated measures ANOVA evaluated differences in PP, MPP, and HR with $\alpha=0.05$. **Results:** Subjects achieved $2.59 \pm 0.52\%$ BML in CON and $0.92 \pm 0.41\%$ in EXP ($p<0.001$). Post-exercise T_{gi} (39.29 ± 0.31 , 39.03 ± 0.61 °C, $p=0.425$) and fatigue (9 ± 1 , 9 ± 2 ; $p=0.424$) were similar between CON and EXP, respectively. HR response during post-exercise CMJ was greater in CON than EXP (174 ± 7 , 161 ± 11 , $p=0.040$). No differences ($p>0.05$) were seen in PP or MPP pre-exercise (PP: 53.80 ± 10.78 , 55.80 ± 11.63 ; MPP: 45.20 ± 8.26 , 45.80 ± 8.14) to post-exercise (PP: 52.80 ± 12.05 , 52.20 ± 8.17 ; MPP: 46.40 ± 7.83 ; 44.20 ± 7.29) for EXP and CON, respectively. **Conclusion:** Exercise-induced hyperthermia, dehydration, and fatigue to the levels achieved in this study did not affect anaerobic power. Fluid replacement reduced cardiovascular strain but did not affect anaerobic power during CMJ, likely due to the mild hyperthermia and $<3\%$ dehydration in CON.

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3790 Board #237 June 3 9:30 AM - 11:00 AM
Alaska Mountain Wilderness Ski Classic: Alterations in Body Composition

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 (No relationships reported)

* **PURPOSE:** The Alaska Mountain Wilderness Ski Classic (AMWSC) is considered to be one of the most challenging endurance events in the world. It has endured for more than 2 decades and various courses have traversed the Wrangell St. Elias, Chugach, Brooks and Alaska mountain ranges. There are no food drops, rest stations,

or marked trails as skiers are free to pick the best route (i.e. 100-150 miles) through the mountainous and remote Alaskan backcountry. Given the combined challenges of chronic activity, mental stress and cold exposure on physiological resilience, the purpose of this study was to evaluate the influence of the 2016 AMWSC that was staged in the Brooks Range on energy expenditure and body composition. A two-tailed paired t-test was used to compare pre- and post-event alterations in lean body mass, fat mass and bone mineral density.

* **METHODS:** 15 male and female skiers (mean \pm SEM; Age = 31.4 ± 0.7 , BMI = 23.7 ± 0.6) were recruited for the study. Lean body mass, total fat mass, and bone mineral density were measured using a General Electric iDXA pre- and post-event. In order to estimate total and daily energy expenditure, all participants wore a Actigraph wGT3X-BT monitor throughout the event.

* **RESULTS:** The first finishing group completed the event in 100 hours and 25 min, and the last individual completed the event at 121 hours and 7 min setting a course record for the closest time range within the finishing groups. Lean body mass and the relative skeletal muscle index (RSMI) increased by 1.7 ± 0.3 kg and 0.22 ± 0.05 kg/m 2 , respectively. While there was a significant reduction (Δ of -1.3 ± 0.2 kg) in total fat mass, there was no change in bone mineral density (Δ of 0.0044 ± 0.0085 g/cm 3). Including a correction for pack weight, daily energy expenditure was 5084 ± 244 , 7314 ± 332 , 7492 ± 422 , 7505 ± 307 , 6538 ± 376 , 3843 ± 592 , 5889 ± 859 kcal, respectively over the course of the event. Total energy expenditure was $37,162 \pm 2174$ kcal.

* **CONCLUSION:** Lean body mass and RSMI increased in all athletes. Previous work using isotopic methodologies during acute exercise showed that urea reincorporation into protein increased during exercise. Future studies are planned with this cohort that will utilize isotopic methodology to measure changes in protein synthesis and skeletal muscle for evaluating the impact of cold exposure on physiological resilience.

3791 Board #238 June 3 9:30 AM - 11:00 AM
Influence of Physical Activity Patterns and Age on Acute Mountain Sickness Incidence during Mt. Kilimanjaro Trek

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 (No relationships reported)

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 (19,341 ft).

METHODS: 27 adults (44 ± 15 yrs; 24.45 ± 3.90 BMI; $n=11/27$ 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 Biovotion 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 yrs, 2: 44 ± 8 yrs, and 3: 58 ± 10 yrs). 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: $65\% \pm 14\%$ vs. $54\% \pm 19\%$ vs. $52\% \pm 14\%$; KPH: 1 ± 0.1 vs. 0.91 ± 0.09 vs. 0.85 ± 0.06 ; Steps/min: 23 ± 5 vs. 22 ± 5 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 ± 8 bpm; SPO2: $85.5 \pm 5.5\%$ vs. $83.2 \pm 9.4\%$ vs. $81.9 \pm 8.0\%$; $p<0.05$ 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 physical 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.

3792 Board #239 June 3 9:30 AM - 11:00 AM
The Response Of Plasma Hypoxia-inducible Factor-1 Alpha, Serum Erythropoietin And Plasma Vascular Endothelial Growth Factor During Acute Exposure To Altitude (4300 M)

Roy Salgado, Beth Beidleman. *United States Army Research Institute of Environmental Medicine, Natick, MA.*
 (No relationships reported)

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 ²Biophysics and Biomedical Modeling Division, US Army Research Institute of Environmental Medicine, Natick, MA Intracellular hypoxia-inducible factor-1 alpha (HIF-1 α) increases in response to hypoxia and regulates erythropoietin (EPO) and vascular endothelial growth factor (VEGF) expression. However, the response of extracellular HIF-1 α (i.e. plasma HIF-1 α) to acute hypobaric hypoxia (HH) exposure is unclear. **PURPOSE:** To determine whether plasma HIF-1 α 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 \pm 7 years, ht: 179 \pm 10 cm, wt: 74 \pm 12 kg, 46 \pm 6 ml/kg/min; mean \pm 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-1 α , serum EPO, and plasma VEGF were measured via ELISA assay. **RESULTS:** From SL to HH, plasma HIF-1 α (SL: 287 \pm 108 pg/mL vs HH: 264 \pm 128 pg/mL, p = 0.51) and plasma VEGF (SL: 74 \pm 55 pg/mL vs HH: 100 \pm 87 pg/mL, p = 0.23) did not change. From SL to HH, serum EPO increased (SL: 14 \pm 15 mIU/mL vs HH: 62 \pm 42 mIU/mL, p < 0.0001). **CONCLUSION:** During the first ~19 hrs of HH exposure plasma HIF-1 α and plasma VEGF do not increase, while serum EPO does increase. While we were the first to measure plasma HIF-1 α during an acute exposure to HH, our results indicate that extracellular HIF-1 α may not represent intracellular HIF-1 α response to HH. Disclaimer: Author's views are not official U.S. Army or DoD policy.

3793 Board #240 June 3 9:30 AM - 11:00 AM
Stress And Well-Being Of Correctional Officers

Kerry S. Kuehl, Diane L. Elliot, FACSM. *Oregon Health & Science University, Portland, OR.*
 (No relationships reported)

Working as a correctional officer (CO) in the U.S. leads to a lower life expectancy than the average U.S. adult, but little research has been done to understand factors leading to these high health risks. **PURPOSE:** To assess mental and physical health characteristics of CO's working in minimum security level prisons as compared to CO's working in maximum security level prisons. **METHODS:** 210 CO's from the Oregon Department of Corrections were assessed by physical measures and survey. Survey included validated measures of stress, diet, physical activity, sleep, pain, disability and injury data, tobacco and alcohol use. Physical measures included fasting lipid and blood glucose, blood pressure, body weight, body composition, waist and hip circumference, flexibility and grip strength. Independent two sample t-tests or chi-square tests were used to assess differences among CO's working in minimum versus maximum security prisons. **RESULTS:** 87% of CO's were overweight or obese and 52% had metabolic syndrome. While years on the job were similar (13 years), CO's working at maximum security prisons reported significantly higher work stress (p=.013) and higher alcohol consumption (p=.040) compared to CO's working at a minimum security level prison. Maximum security level CO's reported greater missed days of work compared to CO's working at a minimum security prison and correlated with increased work stress (p<0.001), less sleep, unhealthy eating habits, and not exercising (p<0.01 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.

3794 Board #241 June 3 9:30 AM - 11:00 AM
Encouraging Exercise In The Palmetto State: A Descriptive Analysis Of Hiit And Its' Associated Injuries

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 (No relationships reported)

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 \pm 8.1), with a mean BMI of 25.6 (\pm 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 \geq 4 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 (38%) 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.

3795 Board #242 June 3 9:30 AM - 11:00 AM
Development Of A Novel Grading Scale Based On The ULNT1 And BPTT

Mark W. Butler¹, Mary Lou Galantino², M. Alysia Mastrangelo, FACSM². ¹Nova Care Rehabilitation, Medford, NJ. ²Stockton University, Galloway, NJ.
 (No relationships reported)

Purpose: Upper Limb Neurodynamic Tests assess for mechanosensitivity, with moderate degrees of reliability and validity. The purpose of this study was to assess inter and intra-rater accuracy of a novel standardized grading scale based on neurodynamic tests demonstrated to bias the median nerve and brachial plexus. **Methods:** Participants attending lectures on neural mobilization were instructed in a novel grading scale based on the Upper Limb Neurodynamic Test 1 and Brachial Plexus Tension Test. At least one hour after instruction, participants were shown 7 different videos of a possible 14 test positions in random order and asked to score the tests on a data collection sheet. To determine accuracy in Phase II, at least one month after participating in Phase I, nine of the 307 clinicians were re-tested by again viewing the 7 videos and scoring the tests. **Results:** In Phase I, SPSS 22.1 was used for descriptive statistics and ANOVA data analysis. Fifty eight percent achieved the correct response for all 7 positions, 23.5% for six positions, and 12.1% for five positions 4.6% for 4 positions and less than 2% accurate for 3 or less test positions. Of note, clinicians with 1 – 5 years of experience scored significantly better than clinicians with 15+ years of experience (p<.002). There were no significant differences in accuracy between groups of clinicians based on area of specialty or location. In Phase II a similar analysis included 9 participants, 89% achieved the correct response for all 7 positions, with 100% achieving a correct response to 6 or more positions. **Conclusion:** Previous authors have identified the value of neural mobility testing but have not utilized a specific grading scale. This study is the first step to identifying and testing a clinical scale that may have utility in the clinic. Our results demonstrate good accuracy of responses among all clinicians in their ability to correctly identify test positions in this grading scale. However, there was a significant difference in accuracy between clinicians with 1 – 5 years of experience vs. clinicians with 15+ years of experience. This grading system may provide quantified outcome in neural mobility scoring for clinical utility. Further testing is needed to ascertain why differences exist in two levels of years of experience.

3796 Board #243 June 3 9:30 AM - 11:00 AM
Impact of Attention Deficit Hyperactivity Disorder on Athletes
 Timothy M. Dekker. *Mayo Clinic, Jacksonville, FL.*
(No relationships reported)

Impact of Attention Deficit Hyperactivity Disorder on Athletes
 Timothy Dekker, George G.A. Pujalte, 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 occurring 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 been 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 ($t=-9.32$, $p<.001$) with Bruininks-Oseretsky 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($p=.04$) 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, MI, 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.

3797 Board #244 June 3 9:30 AM - 11:00 AM
Understanding Injury and Injury Prevention in Paralympic Sport
 Marcus Fearing¹, Shana Harrington². ¹*Creighton University School of Medicine, Omaha, NE.* ²*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 athletes revealed they have current pain, and 34% had missed a competition because of injury. Sixty-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.

3798 Board #245 June 3 9:30 AM - 11:00 AM
Minute Porosity of 3D Printed Splints and Casts May Allow Water Entry
 Diana Hall¹, Frank Roquemore¹, Jay Townsend², Bill Bentley³, David Atkins⁴, Lex Schultheis³. ¹*ActivArmor, Pueblo, CO.* ²*Department of Corrections, State of Colorado, Canon City, CO.* ³*Robert E. Fischell Medical Device Institute, College Park, MD.* ⁴*Dept. of Aerospace Engineering, Clarke School of Engineering, University of Maryland, College Park, MD.*
Reported Relationships: D. Hall: *Intellectual Property; Patent holder for ActivArmor technology. Ownership Interest (Stocks, Bonds); Owner of ActivArmor.*

MINUTE POROSITY OF 3D PRINTED SPLINTS/CASTS MAY ALLOW WATER ENTRY
 Acknowledgements: Jorge Hernandez, James Coburn, FDA, Center for Devices and Radiation Health, Office of Science and Engineering Laboratories
PURPOSE: Optical scanning and additive manufacturing of immobilizing devices allow for custom fit without padding, allowing patients to return to wet/athletic activity during recovery. However, no studies have evaluated waterproofing of 3D printed immobilization devices. We hypothesized that water may enter the interior of these devices unless strict manufacturing process controls are followed and claims of waterproofing are verified. **METHODS:** Patient specific ABS polymer casts manufactured using fused filament methods by ActivArmor were evaluated for water penetration and retention. Manufacturing parameters were evaluated. Finished devices with visually smooth unbroken surfaces were immersed in fresh water in depths from 1 to 25 feet for periods ranging from 5 to 30 minutes. Change in gross weight was used to determine the quantity of water retained. Examination of surface features was evaluated by digital optical microscopy and internal structure by micro computed tomography. **RESULTS:** Some casts that appeared completely sealed admitted water at depths as little as one foot, increasing up to 16% of dry weight at depths of 25 feet. Small changes in manufacturing reduced water entry to 3% of dry weight, while increasing extrusion diameter completely waterproofed prints. Optical microscopy revealed fenestrations in lamination at acute angles in geometry of prints in prints that retained water. Micro computed tomography was notable for 17 micron gaps in smooth straight sections of water absorbing prints. **CONCLUSIONS:** Visual inspection of 3D printed devices is not sufficient to verify watertight integrity. Retained water inside devices may support bacterial colonization. However, enablement of appropriate manufacturing process controls and verification procedures enable custom 3D printed devices support claims of improved hygiene and waterproofing. Supported by FDA, Office of Regulatory Science and Innovation, University of Maryland Center for Regulatory Science Initiative

3799 Board #246 June 3 9:30 AM - 11:00 AM
Creatine Kinase, Glomerular Filtration Rate and Military Physical Activity during 2012 Comandos Course
 NILTON G. ROLIM FILHO. *EB/CNPq/FADEUP, Porto, Portugal.*
(No relationships reported)

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 estimate 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 ($M=18.37\pm 2.18$) at the 4th week ($M=19.53, \pm 2.4$), this huge effect also occurs with skeletal muscle mass $t(18)=-12.67$, $ES=4.22$ from baseline ($M=38.42, \pm 4.13$) to $M=40.65 \pm 4.61$. The results demonstrated a huge decrease in visceral fat area $t(18)=12.26$, $ES=4.09$ / baseline ($M=47.61\pm 13.18$) to the 5th week ($M=25.53\pm 9.7$), as well as eGFR $t(18)=4.51$, $ES=1.5$ with baseline ($M=128.18\pm 15.07$) to $M=111.16\pm 20.54$. The eGFR $t(17)=-4.59$, $ES=1.58$ were significant increase from baseline ($M=129.62\pm 14.12$) to 11th week ($M=138.77\pm 10.87$). What concerns creatinine different trends were found with a very large increase $t(18)=-4.05$, $ES=1.35$ from baseline ($M=0.93\pm 0.12$) to 5th week ($M=1.06\pm 0.18$), otherwise creatinine $t(17)=4.99$, $ES=1.71$ had a huge decrease at the 11th week ($M=0.82\pm 0.9$). Significant increase occurs in urea $t(18)=-10.99$, $ES=3.66$ from baseline ($M=32.75\pm 4.37$) to the 5th week ($MD=63.89\pm 13.08$), even as were found a huge effect on CK $t(14)=-6.33$,

ES=2.39 concerning baseline (M=123.13±36.05) to 5th week (M=777.87±408.41).

CONCLUSION: Our results support a significant effect of military physical intervention in muscular protein, eGFR and body composition markers.

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, Øyvind Salvesen, Marius S. Fimland. *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 non-specific 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 change, fear-avoidance beliefs and back-extension strength were secondary outcomes. **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=0.033). 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 slightly 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, FACSM, Rosa María Cruz Castruita. *Universidad Autónoma de Nuevo León, Monterrey, Mexico.*
(No relationships reported)

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Universidad Autónoma de Nuevo León, San Nicolás de los Garza, Nuevo León, México.

At present, the prevention of disability in the elderly is a priority in research topic because it affects the functionality and consequently the quality of life. Determine which process is toward disability a person is crucial to prevent the advanced stage of the loss of functionality; this loss can be detected clinically by the decline or lack of autonomy and emergence of dependence.

PURPOSE: To determine the features and functionality of the free-living older adults of 60 years and over in the metropolitan area of Nuevo León. **METHODS:** In this study, descriptive and cross-sectional study of 367 adults aged 60 years and over different club houses in the metropolitan area of Nuevo León, was applied an anamnesis, anthropometric measurements such as weight and height and the battery short of physical activity (SPPB) that consists in the realization of three tests of balance (feet together, semitandem and tandem), speed (4 meters, up and sit in a chair five times, the battery allows you to assess the risk of disability, with a total score that ranges between 0 and 12, a score below 10 can determine a high risk of disability. For the statistical analysis we used the SPSS version 21.0, using descriptive statistics mean, median and standard deviation. **RESULTS:** In older adults the average age is 72 ±7.28 years of age, with an average schooling of 5 years, 98% with cognitive ability to answer your interviews, 50.8% are widowed, 55.7% is devoted to the home, 24.2% are pensioners, who are economically dependent on someone are 53.9% situation related to the 70.1% who referred to live together, the most outstanding is the hypertension with 51.3%, according to diabetes mellitus in 31.5% and high cholesterol in a 29.2 %;

the SPPB showed a 12.1% with low performance of physical capacity, 47.3% risk of disability. **CONCLUSION:** In the characterization predominantly female, in a state of widowhood with household activities, presenting an economic dependence, the main pathology is hypertension and there is a significant percentage of risk of disability in this population.

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 Matsuo¹, Sena Wakano¹, Mayu Asakawa¹, Taizan Fukaya², Eiji Yamanaka², Yuji Asai¹. *¹Nihon Fukushi University, Handa, Aichi, Japan. ²Nagoya University, Nagoya, Aichi, Japan.*
(No relationships reported)

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

PURPOSE: 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).

METHODS: 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 knee 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 ΔTOI 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

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(No relationships reported)

Advanced age is a significant risk factor associated with brain structural damage, cognitive impairment, and dementia. Regular aerobic exercise potentially protects the brain from structural and functional damage related to age. Therefore, it is important to investigate whether cognitively impaired individuals adhere and respond to exercise training in a similar manner to their cognitively healthy counterparts.

PURPOSE: To test the hypothesis that cognitively impaired individuals respond to structured, supervised exercise regimentation 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<0.01) 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 (T_c 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 (T_c) 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 T_c max. *Indicators of severity:* Upon admission blood glucose and pulse rate appeared to be indicators of EHI/S severity. Higher T_c 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 T_c max. *Return to duty:* T_c 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 the same amount of rest days as those without (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.
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(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 (1/1/2010-12/31/2015) 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-gymnast athletes 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±1.8; Non-gym-ACL: 14.6±1.2; 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±2.16cm) compared to Non-gym-ACL (+0.02±1.72cm) groups (p=0.047), but no significant differences were

found between the Gym-min (+1.32±2.27cm) 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-gymnast athletes, suggesting that catch-up 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 Polk¹, Douglass Johnson¹, Jordan Murphy¹, Brian McCormick¹, Alex Webb¹, Andrew Horn¹, David Milzman¹. ¹MedStar Georgetown University Hospital, Washington, DC. ²Georgetown 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 defensive player. 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 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)

Purpose: Obesity has become a global public health concern as evidence mounts that it is related to a large variety of life threatening diseases from diabetes to heart disease. The biochemical links between body composition and hypercholesterolemia are a target of ongoing research. The hormone collagen triple helix repeat containing 1 (CTHRC1) has been shown to play an important role in the regulation of body composition in mouse models. This study aimed to compare CTHRC1 and serum lipid panels in human adults. We hypothesized that higher CTHRC1 levels would be associated with both decreased cholesterol and triglycerides (TG).

Methods: This study was done in collaboration with researchers at the University of South Carolina who completed the Energy Balance Study (EBS) on 430 adult subjects age 21-35, with BMI ranging from 20-35. Deidentified baseline plasma samples from the EBS subjects were analyzed with enzymatic calorimetric testing and ELISA to measure lipid panels (total cholesterol, HDL, LDL, triglycerides) and CTHRC1 concentrations respectively. Statistical analysis software was used to compare the data both generally and within clinically accepted subgroups of lipid concentrations.

Results: Of the 430 samples from the EBS subjects, 310 contained sufficient plasma for both CTHRC1 and lipid panel testing. No statistically significant difference in lipid concentrations was found between detectable and undetectable CTHRC1 groups (p=0.17-0.99). Stratification of CTHRC1 into undetectable, middle 75% and top 25% also showed no significant difference in lipid concentrations (p=0.32-0.79), nor did stratification of lipid panel components into clinically relevant subgroups (total

cholesterol $</>200$, HDL $</>40$, LDL $</>100$, TG $</>150$, $p=0.12-0.94$). Lastly, linear regression models showed no correlation between CTHRC1 and lipid concentrations ($p=0.21-0.93$).

Conclusion: This study demonstrates no association between CTHRC1 and lipid concentrations in a sample of relatively healthy human adults. Further research is required to better understand the temporal variation of CTHRC1 levels in vivo and thus, better time the collection of samples from subjects. Furthermore, a broader range of body composition among future subjects will help to better generalize data to the adult population.

3808 Board #255 June 3 9:30 AM - 11:00 AM
Use Of FEV1/FVC For Diagnosis Of Exercise-induced Bronchoconstriction (EIB) in Adolescents
 Rebecca Breslow, Kathryn Ackerman, FACSM, Carter Petty, Katherine Cooper, Dawn Ericson. *Boston Children's Hospital, Boston, MA.* (Sponsor: Kathryn Ackerman, FACSM)
(No relationships reported)

Purpose: Standard asthma therapies must be used judiciously in adolescent athletes to minimize side effects and costs. Current diagnostic criteria for EIB, $\geq 10\%$ 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, body mass index (BMI), gender, 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, $\geq 12\%$ 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 associated with reversibility. The mean % decline in FEV1/FVC in 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.

Conclusions: 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 this condition.

3809 Board #256 June 3 9:30 AM - 11:00 AM
Joint Injection Teaching of Internal Medicine Residents
 Michael Seifert. *Maine Medical Center, Portland, ME.* (Sponsor: Heather Gillespie, FACSM)
(No relationships reported)

Previous studies have shown that Internal Medicine (IM) residents lack confidence in performing joint injections. They report lack of training as the primary cause for low confidence. We developed a teaching session to see if hands-on teaching of IM residents and faculty would help residents make durable confidence gains in performing joint injections of the knee and shoulder. **PURPOSE:** To assess whether a teaching intervention, performed early in the training year for IM residents, would improve resident confidence in their knowledge of and ability to perform joint injections.

METHODS: A 90 minute resident joint injection workshop occurred in September 2016. Residents were given a pre-course questionnaire to measure their confidence with knee and shoulder injection indications, techniques, and risks and benefits as measured in a five-point Likert scale (1 is low, 5 is high). Following a brief lecture reviewing these topics, the residents then practiced on simulation models. A post-course questionnaire given afterwards assessed whether there was an increase in confidence of knowledge in these procedural skills. The IM faculty were given the same lecture and opportunity to practice on models in October 2016. The longer-term effect of the teaching intervention was measured by re-administering the post-course questionnaire four months later via Survey Monkey®.

RESULTS: 18 IM residents completed the workshop. Confidence for performing knee injections increased from a mean of 2.22 to a mean of 3.78; for shoulder injections the mean increased from 1.61 to 3.78. Confidence in knowledge of the risks and benefits,

supplies needed, and indications increased similarly. Statistically paired t-tests of all measured items showed significant increases. Four months post-workshop, confidence levels were sustained above the pre-testing levels for all areas studied (again $p < 0.001$). Finally, residents indicated they were more likely to perform these injections even after four months.

CONCLUSIONS: Based on this study, our workshop-style teaching session for residents and supervising faculty led to significant and durable increases in resident's confidence of their knowledge and ability to perform two common joints injections. Further development of this model may increase clinical performance and practice confidence.

3810 Board #257 June 3 9:30 AM - 11:00 AM
Athlete Risk Correlation Study: Psychosocial Determinants Of Musculoskeletal Injury Risk
 Vicki Nelson¹, Christina Thompson², Christopher Tangen².
¹Greenville Health System, Greenville, SC. ²University Hospitals Cleveland, Cleveland, OH. (Sponsor: Kyle Cassas, FACSM)
(No relationships reported)

PURPOSE: Several modifiable factors are linked to athletic injury including disordered eating, sleep, team climate, anxiety and life stressors. We hypothesize that characterization of psychosocial factors could help identify at-risk athletes and areas for possible intervention.

METHODS: High school student-athletes aged 14-18 participating in school sponsored athletics were provided with a 31-question survey including perception of athletic pressures, diet and weight, family and personal relationships, academics and sleep. 156 athletes were surveyed with 144 athletes participating (92% response rate). Each athlete indicated whether they had sustained a musculoskeletal injury or concussion requiring time away from sport. Athletes who reported musculoskeletal injury were compared to non-injured peers using fisher's exact test for significance.

RESULTS: Significant association was seen between musculoskeletal injury and a perceived competitive athletic environment including playing multiple sports (82% of injured vs 55% of well athletes, $p < 0.001$), belief that the team depends on them to do well (92% v 77%, $p < 0.02$), and deriving most personal friendships from among teammates (85% v 63%, $p < 0.005$). Injured female athletes were additionally more likely to identify feeling pressure to perform well in their sport and plans to pursue collegiate athletics. Self-identified change in school grades was protective (53% vs 71%, $p < 0.03$), with decreased injury in these students. Additionally, feeling tired upon waking (91 v 77%, $p < 0.02$) and occupation with weight (30 v 15%, $p < 0.04$) correlated with increased injury. This association between injury and occupation with weight was enhanced among female athletes. None of the significant associations were seen among athletes reporting concussion.

CONCLUSIONS: In a cohort of high school athletes screened for psychosocial and behavioral determinants, a more competitive athlete environment, fatigue and preoccupation with weight were found to increase the risk of musculoskeletal injury. The significant survey responses support the hypothesis that psychosocial factors contribute to risk of injury and further studies are warranted.

3811 Board #258 June 3 9:30 AM - 11:00 AM
Preliminary Results from a Prospective Study Using the Female Athlete Triad Cumulative Risk Assessment
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(No relationships reported)

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 to moderate risk for amenorrhea/oligomenorrhea decreased from nine to six and number of BSI's 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 risk. 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

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(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 $1,000 \times 10^3$ 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 257.1×10^3 platelets/ μL (95%CI 240-274). Protocol 1 yielded a mean of 648.4×10^3 platelets/ μL (95%CI 581-714) (2.5x WB concentration). Protocol 2 yielded a mean of 464.4×10^3 platelets/ μL (95%CI 424-504) (1.8x WB concentration). Protocol 3 yielded a mean of 974.1×10^3 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

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(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 Maine. Each high school was contacted directly to determine AT status, number of students, number of athletes, and types of sports. We then calculated the rates of each of the three types of ED visits in schools with and without AT. Chi-square tests were used to compare the ED utilization for each type of injury among high schools with and without ATs.

Results:

The 2013 Maine All Claims Data includes injury data for 346 Maine zip codes. There were a total of 1114 fractures, 826 sprains, and 538 concussions. Preliminary results were obtained from 185 (53.5%) zip codes, representing a total of 620 (55.6%) fractures, 427 (51.7%) sprains, and 305 (56.7%) concussions. These 185 zip codes represent 31992 students, 56.2% of the estimated 56,924 public high school student population in 2013-2014.

In HS w/ AT, the cumulative student population was 28270 and there were 536 fractures, 339 ankle sprains, and 266 concussions. In HS w/o AT the cumulative student population was 3722 and there were 84 fractures, 88 ankle sprains, and 39

concussions. Rates were calculated by injury type per student population for schools w/ and w/o AT and reported per 100 person-time units. Fractures had rates of 1.90 and 2.26 for HS w/ AT and HS w/o AT, respectively, with a p value of 0.1423. Sprains had rates of 1.20 and 2.37 for HS w/ AT and HS w/o AT, respectively, with a p value of < 0.0001 . Concussions had rates of 0.94 and 1.05 for HS w/ AT and HS w/o AT, respectively, with a p value of 0.5223.

Conclusion:

Although data analysis is not yet complete, our preliminary investigation reveals a significant difference in the rates of utilization of ED services for sprains when comparing schools with and without ATs. There was no statistically significant difference found for similar comparisons of fractures and concussions.

3814 Board #261 June 3 9:30 AM - 11:00 AM
Opioid Prescription Practices for Pediatric Musculoskeletal Injuries

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(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 and orthopedic providers are 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 (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 7.1, 95% CI 5.8-8.7), and ED visits (ED vs PC OR 10.3, 95% CI 4.6-23.4; ED vs Ortho OR 8.7, 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 (27.0%) 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.