While data have demonstrated that resistance exercise without blood flow restriction (BFR) decreases vagal tone up to 30 minutes, the effects of upper- versus lower-body resistance exercise with BFR on autonomic modulation are unknown. PURPOSE: To evaluate autonomic modulation in response to upper- and lower-body resistance exercise with BFR. METHODS: Autonomic modulation was assessed in twenty resistance-trained individuals at rest, 30 (R30), and 60 (R60) minutes after either upper- or lower-body resistance exercise with or without BFR. The upper- and lower-body resistance exercise consisted of the lat pulldown and chest press, and knee extension and knee flexion, respectively. The BFR (40% of arterial occlusion pressure) decreased vagal tone up to 30 minutes. The effects of upper- versus lower-body resistance exercise with and without BFR were evaluated. An ANOVA was used to evaluate groups (upper- or lower-body) across conditions (BFR or without BFR) across time (rest, R30, and R60) on autonomic modulation. RESULTS: There were no significant 3-way interactions for any variables. There were no changes for LnTP. There were significant main effects of time for LnHF (upper-body with BFR): Rest: 7.3±1.5ms, R30: 6.6±1.3ms, R60: 6.7±1.5ms; Upper-body without BFR: Rest: 7.1±1.4ms, R30: 6.1±1.5ms, R60: 6.5±1.3ms; Lower-body with BFR (LBFR): Rest: 6.9±1.3ms, R30: 6.2±1.6ms, R60: 7.1±1.4ms; Lower-body without BFR (LW): Rest: 7.3±1.5ms, R30: 6.3±1.8ms, R60: 7.1±1.4ms) and the LnHF/LnLF ratio (UBFR: Rest: 3.9±0.9ms, R30: 5.1±0.9ms, R60: 4.8±0.7ms; UBFR: Rest: 4.1±0.7ms, R30: 4.8±1.1ms, R60: 4.5±1.0ms; LW: Rest: 3.9±1.0ms, R30: 5.0±0.9ms, R60: 4.6±0.84ms) such that LnHF and LnLF/Ratio were significantly reduced, and augmented, after upper- and lower-body resistance exercise with and without BFR. CONCLUSIONS: These data suggest that either upper- or lower-body resistance exercise with or without BFR significantly alters autonomic modulation up to 60 minutes after an acute bout of exercise.

Purpose: The aim of this study was to evaluate the influence of CVD on cerebrovascular regulation at rest and during exercise. A secondary aim was to explore the relationship between cerebrovascular regulation and 1) the presence of white matter lesions and 2) cognitive function.

Methods: We recruited individuals who were cognitively normal older adults. CVD risk was assessed by the Pooled Cohort atherosclerotic cardiovascular disease (ASCVD) risk score. Transcranial Doppler ultrasound measured middle cerebral artery at rest and during a bout of moderate intensity exercise. We quantified white matter lesions from MRI and cognitive function outcomes included executive function, language, processing speed, and attention.

Summary of Results: Seventy-two participants 70.1 ± 4.7 years of age completed the study protocol. ASCVD risk score was significantly associated with both resting and exercise cerebral blood flow velocity (p<0.01). Cerebrovascular regulation parameters were not associated with white matter lesions (p=0.468). We observed a significant association between cerebrovascular regulation parameters and language processing (p=0.010) but not other cognitive domains.

Conclusion: In cognitively normal older adults, higher ASCVD risk score was associated with blunted cerebrovascular regulation and with lower language processing performance. These results highlight the need for CVD risk management to maintain optimal brain health.
The changes in autonomic modulation after high-intensity heavy rope exercise (HI-HRE) are unknown. **PURPOSE:** To examine the effects of HI-HRE on autonomic modulation in resistance-trained (RT) individuals. **METHODS:** Twenty-two young, RT individuals (mean±SD: age 23±3yrs; height 1.71±0.01m; weight: 74.3±14.9kg) had their heart rate (HR), mean arterial pressure (MAP), and measures of autonomic modulation collected at rest, and 15 (Rec1), 30 (Rec2) and 60 (Rec3) minutes following HI-HRE. Heart rate variability measurements included the root mean square of successive differences between normal heartbeats (RMSSD) in the time domain, high-frequency power (lnHF) and the ratio of low-frequency to high-frequency power (lnLF/lnHF ratio) in the frequency domain. RMSSD and lnHF are indicative of vagal modulation collected at rest, and 15 (Rec1), 30 (Rec2) and 60 (Rec3) minutes following HI-HRE. Heart rate variability measurements included the root mean square of successive differences between normal heartbeats (RMSSD) in the time domain, high-frequency power (lnHF) and the ratio of low-frequency to high-frequency power (lnLF/lnHF ratio) in the frequency domain. RMSSD and lnHF are indicative of vagal modulation while the lnLF/lnHF ratio is a measure of sympathovagal balance. The HI-HRE consisted of six, 15-second exercise bouts, using a double wave pattern, separated by 30-seconds of passive recovery; the pace of the exercise was set at 180bpm. A one-way repeated measures analysis of variance was used to analyze the presence of limb dominance, it is possible that the dominant leg may achieve greater peak O$_2$ uptake (VO$_2$peak) and be able to sustain greater power outputs during prolonged dynamic exercise compared to the non-dominant leg.

**RESULTS:** There were trivial differences between the changes in concentration of each biomarker after workload-matched intermittent and continuous exercise in such runners. Given, however, the presence of limb dominance, it is possible that the dominant leg may achieve greater peak O$_2$ uptake (VO$_2$peak) and be able to sustain greater power outputs during prolonged dynamic exercise compared to the non-dominant leg. **CONCLUSIONS:** Prolonged intermittent exercise is potentially more damaging to heart muscle than continuous exercise of the same average running speed at higher average heart rates.
Official Journal of the American College of Sports Medicine

**Thematic Poster - Exercise and Cancer**

**A-18**

**Thematic Poster - Exercise and Cancer**

**Wednesday, May 29, 2019, 9:30 AM - 11:30 AM**

**Room: CC-101A**

**Chair: Claudio Battaglini, FACS.M. University of North Carolina at Chapel Hill, Chapel Hill, NC.**

(No relevant relationships reported)

**INTRODUCTION:** Overweight and obese breast cancer survivors (BCS) are at greater risk of developing type II diabetes (T2D) than non-cancer populations due, in part, from adipose tissue-induced modulations to the adipokines, leptin and adiponectin. Leptin upregulates inflammatory cytokines associated with insulin resistance (IR) while adiponectin inhibits inflammation and regulates glucose uptake. The Leptin/Adiponectin Ratio (LAR) has been used as an indicator for the diagnosis of T2D, due to its ability to measure both inflammatory and glucose abnormalities. In overweight and obese BCS, an elevated LAR induces IR, which contributes to the development of T2D. Exercise may be an effective strategy to reduce the LAR to target the risk of T2D in BCS OBJECTIVES: The purpose of this study was to determine whether a 16-week aerobic and resistance exercise intervention reduces the LAR in overweight and obese BCS.

**METHODS:** Sedentary, overweight/obese (BMI ≥ 25 kg/m²) BCS (Stage I-III) were randomized to the Exercise (EX; n=50) or Control (CON; n=50) groups. The EX group underwent supervised moderate-vigorous intensity aerobic and resistance exercise sessions 3 times per week for 16 weeks. Leptin and adiponectin were measured from fasting blood samples using enzyme-linked immunosorbent assays. Paired t-tests and mixed-model repeated measures ANOVA were used to examine the within and between group differences in mean changes in LAR.

**RESULTS:** On average, women were 53.5±10.4 years old, postmenopausal (60%), Hispanic (55%) with a BMI 33.5±5.5 kg/m² before, and 1.4-h and 24-h after the Hong Kong 100 and Ultra Trail Mont Blanc ultramarathons. Cardiac biomarkers (cTnl, BNP) were assessed from whole blood (I-stat), while stroke volume (SV) & cardiac output (Q) were quantified via echocardiography. Lung diffusing capacity for carbon monoxide and nitric oxide (DLco & DLno) and its components, alveolar membrane conductance (Dm) and capillary blood volume (Vc), were determined via a single-breath DLco/DLno method. **Conclusions:** The data suggests a transient decrease in lung diffusion at rest following ultra-endurance exercise is related to a reduced capillary blood volume and potential pulmonary de-recruitment; however, pulmonary capillary recruitment during low-intensity exercise remains mostly preserved. On the contrary, alveolar membrane conductance was preserved at rest but decreased during light exercise and may contribute to the exertional decrease in lung diffusion after an ultramarathon.

**A-18**

**Effect Of A 16-week Aerobic And Resistance Exercise Intervention On Leptin/adiponectin Ratio In Overweight And Obese Breast Cancer Survivors**

Kaylie Zapanta, Kyuwan Lee, Nathalie Sami, Christina M. Dieli-Conwright, FACS.M. University of Southern California, Los Angeles, CA.

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(No relevant relationships reported)
Chemotherapy for breast cancer may result in fatigue and reduced quality of life (QOL). While exercise can attenuate adverse chemotherapy effects, improvements relative to baseline may be more likely with exercise performed post-treatment. PURPOSE: To compare the effect of exercise during versus after taxane chemotherapy for breast cancer on fatigue and QOL. METHODS: Women were randomized to supervised aerobic and resistance exercise 3x/wk for 8-12 wk starting pre-chemotherapy (Immediate Exercise=IE) or 2-3 wk post-chemotherapy (Delayed Exercise=DE). Fatigue and overall QOL functional subscales were evaluated using the Piper Fatigue Scale (0–none, 10–severe) and European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (scored: 0–100), respectively, at: 1) baseline; 2) 2-3 wk post-chemotherapy (post-chemo); and 3) 10-15 wk post-chemotherapy (follow-up). RESULTS: Overall, n=27 women enrolled and n=26 (IE n=12, DE n=14) completed the intervention (attended >1 session). Attendance was 79±23% for IE and 81±20% for DE. Fatigue did not differ between groups across time, so change within groups was assessed individually. Fatigue increased in DE from baseline to post-chemo (mean diff: +1.7±0.47, p<0.01) and did not decrease with exercise between post-chemo and follow-up (mean diff: -1.1±0.65, p<0.13). Fatigue did not change over time in IE. Overall QOL differed between groups over time (p<0.01), where it was higher in IE versus DE post-chemo (mean diff: +6±3.3, p<0.05). No other group differences were found for QOL functional subscales. The overall deterioration in QOL in DE during chemotherapy was a result of reductions in physical function (mean diff: -16.4±5.6, p<0.01), role function (mean diff: -20.0±6.3; p<0.01), and emotional function (mean diff: -17.4±4.7, p<0.04). Relative to post-chemo, the DE intervention significantly improved QOL by follow-up (mean diff: +20.2±15.4, p<0.01), such that DE and IE QOL did not differ at follow-up (mean diff: 4.6±6.7, p=0.22). CONCLUSIONS: Exercise during taxane chemotherapy may mitigate treatment-related fatigue and reductions in QOL in women with breast cancer. While exercise after chemotherapy increased overall QOL, fatigue experienced during chemotherapy persisted.

Exercise is a potential mechanism for mitigating some side effects caused by adrenocortical deprivation therapy (ADT) for metastatic castration-resistant prostate cancer (mCRPC). To evaluate equivalence between groups for lymphoedema outcomes (equivalence margins for L-Dex, % difference and symptoms scale: ±5, ±1% and ±1, respectively), superiority analysis was conducted for muscle strength and quality of life domains.

RESULTS: Post-intervention equivalence between groups was found for extracellular fluid (0.4; 90% CI -2.5 to 3.2) and symptoms of heaviness (-0.2; 0.6 to 0.2), tightness (-0.1; 0.8 to 0.6) and swelling (0.2; -0.4 to 0.8). Non-equivalence was found for inter-arm volume % difference (-3.5%; -17.3 to 10.3) and pain (4.7; -1.3 to 0), favoring the HIGH group. Strength gains were superior in the HIGH versus LOW group (3 kg; 1 to 5, p<0.05). Further, clinically relevant reductions in breast (-11; -15 to -7) and arm (-6; -10 to -1) symptoms were found in the HIGH group.

CONCLUSION: Findings suggest that pre-diagnosis physically inactive women can benefit from supervised heavy-load resistance exercise during adjuvant chemotherapy for breast cancer without increasing lymphoedema risk. Supported by funding from the Danish Cancer Society, the Novo Nordic Foundation and Trygfonden (7-12-0401).
and home-based interventions may help eliminate barriers to physical activity. PURPOSE: To assess feasibility, adherence, and physiological changes following a home-based exercise intervention in men with mCRPC receiving ADT and androgen receptor targeting agents. METHODS: Men with mCRPC (age=71±10, BMI=29.64 kg/m² ± 3.4) completed body composition (DXA), muscular strength, physical function, and cardiopulmonary exercise testing (CPET) before and after a 12-week home-based exercise intervention (with weekly phone contact) using resistance band and wearable technology for tracking walking. Patient reported outcomes were used for the assessment of fatigue (FACT-Fatigue), quality of life (FACT-P) and depression (Hospital Anxiety and Depression Scale). Feasibility (target: 67%) was determined as the % of patients who completed the intervention. Adherence (target: 75%) to the overall program and specific activities was determined as the number completed relative to prescribed. Physiological changes were assessed using paired samples t-tests and adherence rates with a single sample t-test. RESULTS: Fourteen men completed baseline testing and eight completed the intervention (57%), which was lower than the target value. Adherence was reached but did not statistically exceed the target value of 75% for overall (82.7% ± 9.5; p=0.076), walking (80.7% ± 14.2; p=0.326), or resistance training (85.3% ± 12.5; p=0.072). Core focused exercises had significantly lower adherence (58% ± 35.7, p<0.001). Training significantly increased leg press maximal strength (10.7% ± 6.7, p=0.023) and peak oxygen consumption (9.7% ± 22.4%, p=0.013). No significant difference occurred in any other variable tested. CONCLUSIONS: Feasibility estimates were lower than expected but the high adherence promoted improvements in strength and cardiorespiratory function during mCRPC treatment but did not translate into functional improvements. These preliminary findings suggest home-based interventions are promising, but limited supervision or advanced disease may limit completion of training protocol.

### A-19 Thematic Poster - UCL Injuries in Overhead Athletes

**Wednesday, May 29, 2019, 9:30 AM - 11:30 AM**

**Room: CC-102B**

**Chair:** Jason L. Zaremski, FACSM, University of Florida, Gainesville, FL.

**No relevant relationships reported**

UCL injuries among baseball athletes are an extremely common pathology. It is well documented that baseball athletes typically exhibit an increase in shoulder external rotation range of motion (ERRM) and a decrease in internal rotation range of motion (IRM) while maintaining total rotational range of motion (TROM). Loss of TROM and ERRM may be associated with increased risk for UCL injury. Ultrasound imaging allows clinicians to evaluate UCL thickness and medial joint space (MJS) opening with precision. PURPOSE: To examine if shoulder joint motion (ERRM, IRRM, TROM), or the thickness of the UCL at the mid substance and apex of trochlea provides meaningful elbow joint space (MJS) in asymptomatic catchers. METHODS: Twenty-nine NCAA Division I pitchers participated in this follow-up study. Ultrasound images were obtained of the MJS and UCL on the participant’s...
throwing arm using a GE LOGIQ e ultrasound unit. Participants were placed supine with a wedge placed underneath their pitching hand to maintain elbow position at 30 degrees. A 3 kg valve was forced, as measured by a hand-held dynamometer, was applied 20 cm distal to the medial epicondyle. Ligament thickness measurements were performed at the mid-substance of UCL and at the apex of the trochlea. Imaging evaluations to measure MJS opening were performed from the apex of the trochlea to the apex of the ulna. Standard goniometric procedures were performed with the athlete in a supine position to obtain ER, F-ROM, and T-ROM values. Three stepwise linear regression analyses were performed to determine if shoulder ROM or UCL thickness measures of the mid-substance and apex of the trochlea could predict MJS. RESULTS: Shoulder joint range of motion were not able to significantly predict MJS (R2 = 0.05, F (2,25) = 0.03, p=0.96), UCL thickness at the mid-substance (R2 = 0.04, F (1,25) = 0.10, p=0.76), and at apex of the trochlea (R2 = 0.03, F (1, 25) = 0.04, p=0.85). Further supported prior research that shoulder ROM did not predict MJS, and to this study, UCL thickness measured at two points were unable to predict MJS in asymptomatic baseball pitchers. Further research is recommended to perform multiple imaging sessions throughout the competitive season to further determine predictors of UCL injuries.

PURPOSE: Ulnar collateral ligament reconstruction (UCLR) is a successful procedure in professional baseball players. It is unclear if results differ based on graft choice. The purpose was to determine the performance and return to sport (RTS) rates in professional baseball players following UCLR and compare performance and RTS rate, as well as injury rates, between players who underwent UCLR with hamstring vs. palmaris autograft. The authors hypothesized that there is a high RTS rate in professional baseball players following UCLR with no significant difference in injury rates, RTS rate, or performance, specifically related to primary outcome performance variables: WHIP ((walks + hits)/innings pitched), fielding independent pitching (FIP), and wins above replacement (WAR)) between those who had UCLR with a palmaris vs. hamstring autograft. METHODS: All professional baseball players between 2010-2015 who underwent UCLR using hamstring autograft were included. Surgical details of their procedure were recorded using operative reports. Players with a hamstring UCLR were compared to a matched control group of players who underwent UCLR with palmaris autograft. Results: Overall, 191 players underwent UCLR using hamstring autograft. All differences in RTS rates or times to RTS existed between the hamstring vs. palmaris groups. Significantly more subsequent lower extremity injuries were seen in the hamstring group (p=0.040). More subsequent upper extremity injuries existed in the palmaris group, although this difference was not significant (p=0.052). No consistent differences in performance metrics upon RTS existed between hamstring and palmaris groups. Although both groups significantly declined in many performance metrics following surgery. Both groups showed a decline in post-operatively in WAR and WHIP; FIP did not decline. No significant difference in WAR, WHIP, or FIP existed between groups post-operatively. Conclusion: Baseball players who undergo UCLR with hamstring autograft are more likely to sustain a subsequent lower extremity injury while those who undergo UCLR with a palmaris are more likely to sustain an upper extremity injury. No difference in performance or RTS rates existed between groups. Both groups significantly declined in WAR and WHIP after UCLR.

Quantity Time: Identifying The Benefit Of Ulnar Collateral Ligament Reconstruction In Major League Baseball

Board #3 May 29 9:30 AM - 11:30 AM

Performance and Return to Sport Following Ulnar Nerve Decompression/Transposition in Professional Baseball Players
John D’Angelo1, Brandon Erickson2, Peter Chalmers1, Kevin Ma3, Anthony Romeo1. Rothman Orthopaedic Institute, Tarrytown, NY. 1University of Utah, Salt Lake City, UT. 2MLB, New York, NY. 3HSS, New York, NY.

Purpose: Determine the rate of return to sport (RTS) and performance upon RTS in professional baseball pitchers following ORIF of the medial epicondyle, and see if there is a difference in RTS rate and performance between players who underwent ORIF and matched controls. The authors hypothesized that there is a difference in RTS rate and performance, specifically related to the primary outcome performance variables of win-loss percentage (W-L%), strikeout rate (K%), earned run average (ERA), and wins above replacement (WAR) between cases and matched controls (no history of UCLR or ORIF). METHODS: All professional baseball pitchers who underwent medial epicondyle ORIF between 2010-2016 were included. Demographic and performance data (pre and post surgery) for each player was recorded. Performance metrics were then compared between cases and matched controls (no history of UCLR or ORIF). RESULTS: Overall, 15 pitchers (80% starters, 73.3% right-handed) underwent ORIF of the medial epicondyle following 6.2 ± 3.4 years of professional baseball experience. There was no significant difference in rate of RTS or performance, specifically related to the primary outcome performance variables of win-loss percentage (W-L%), WHIP ((walks + hits)/innings pitched), fielding independent pitching (FIP), and wins above replacement (WAR) between cases and controls. CONCLUSION: UCL reconstruction does not appear to compromise the quality of pitching performance, but does prolong the quantity of pitches in a player’s career.
Conclusion: No difference in overall upper or lower extremity injury rates existed respectively). No difference in return to sport (RTS) rates, or the ipsilateral/drive leg or contralateral/landing leg was seen (p=1.000; p=0.460). Timing of RTS between groups. No differences in subsequent ipsilateral or contralateral landing leg group (p<0.001). No difference existed in return to sport (RTS) rates, performance compared to matched controls remained the same in most performance metrics. Post-operatively, pitchers with a UCLR prior to ulnar nerve transposition/decompression that had a successful RTS performed the same as matched controls prior with UCLR.

Methods: All professional baseball players who underwent isolated ulnar nerve decompression/transposition between 2010-2016 were included. Demographic and performance data (pre and post surgery) for each player was recorded. Performance metrics were then compared between cases and a group of matched controls. Results: Overall 52 players, 83% pitchers (14 underwent prior UCLR) were included. Most surgeries (92%) were anterior subcutaneous transpositions. Overall, 62% of players were able to successfully RTS and 56% returned to the same or a higher level. There was no significant difference between cases allowed more walks per 9 innings (4.4 vs. 2.8; p=0.011). Conclusion: Anterior subcutaneous transposition is the most common surgery in professional baseball players to address ulnar neuropathy at the elbow. Players have a 62% rate of RTS, which is lower than expected for this non-reconstruction or repair procedure. For players who successfully RTS, performance compared to matched controls remained the same in most performance metrics. Post-operatively, pitchers with a UCLR prior to ulnar nerve transposition/decompression were compared to controls with a history of a UCLR but who did not go on to have an ulnar nerve transposition/decompression, the only performance difference of all the recorded metrics was cases allowed more walks per 9 innings (4.4 vs. 2.8; p=0.011). Conclusion: Anterior subcutaneous transposition is the most common surgery in professional baseball players to address ulnar neuropathy at the elbow. Players have a 62% rate of RTS, which is lower than expected for this non-reconstruction or repair procedure. For players who successfully RTS, performance compared to matched controls remained the same in most performance metrics. Post-operatively, pitchers with a UCLR prior to ulnar nerve transposition/decompression that had a successful RTS performed the same as matched controls prior with UCLR.

Purpose: To examine the effect of heavy carried loads on pelvic and trunk range of motion (ROM) between anthropometrically matched male and female soldiers. Methods: Four male and 4 female Soldiers were matched on height and body weight (differences < 2.54 cm and 4.54 kg). All participants walked unloaded (BW), and with vest-borne loads of 15, 35 and 55 kg. Each load was carried for 10 min while walking on a level treadmill at 1.3 m/s, with pelvis and trunk segmental angles collected after 5 min. Four mixed model ANOVAs (sex x load) compared trunk and pelvis frontal and transverse plane ROM. Results: There were sex x load interactions for trunk transverse and frontal plane motion (Table 1). Specifically, as load increased: (A) trunk axial rotation decreased more in females than males (p=0.037), and (B) trunk frontal plane motion increased for males and remained relatively constant for females (p=0.034). Pelvis frontal plane ROM also increased at 55 kg in both sexes relative to carrying no additional load. Conclusions: Despite anthropometric matching, preliminary results suggest sex-related differences in trunk frontal plane motion while carrying loads > 35 kg and no sex-related differences in pelvis motion. Disclaimer: The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government.

Table 1. Pelvis and Trunk Frontal (Y) and Transverse (Z) plane ranges of motion for different loads among male and female Soldiers.

<table>
<thead>
<tr>
<th>Sex</th>
<th>BW</th>
<th>15 kg</th>
<th>35 kg</th>
<th>55 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelvis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frontal</td>
<td>M</td>
<td>6.9 ± 0.3</td>
<td>8.4 ± 0.2</td>
<td>8.7 ± 1.5</td>
</tr>
<tr>
<td>F</td>
<td>8.8 ± 2.2</td>
<td>9.7 ± 3.0</td>
<td>10.5 ± 3.1</td>
<td>11.1 ± 1.9 *</td>
</tr>
<tr>
<td>Transverse</td>
<td>M</td>
<td>6.3 ± 2.1</td>
<td>6.5 ± 2.2</td>
<td>7.3 ± 2.6</td>
</tr>
<tr>
<td>F</td>
<td>10.0 ± 2.9</td>
<td>8.6 ± 1.6</td>
<td>6.0 ± 1.8</td>
<td>8.1 ± 1.8</td>
</tr>
<tr>
<td>Trunk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frontal</td>
<td>M #</td>
<td>4.9 ± 1.4</td>
<td>5.3 ± 0.5</td>
<td>6.7 ± 1.0</td>
</tr>
<tr>
<td>F</td>
<td>4.3 ± 2.2</td>
<td>4.6 ± 1.7</td>
<td>5.1 ± 2.2</td>
<td>5.7 ± 2.7 *</td>
</tr>
<tr>
<td>Transverse</td>
<td>M #</td>
<td>8.4 ± 2.1</td>
<td>6.2 ± 0.9</td>
<td>7.9 ± 2.7</td>
</tr>
<tr>
<td>F</td>
<td>9.0 ± 1.4</td>
<td>6.6 ± 1.1</td>
<td>5.0 ± 0.8 *</td>
<td>4.4 ± 0.7 *</td>
</tr>
</tbody>
</table>

BW = Bodyweight only; # = sig sex x load interaction * Sig different from BW; + sig different from male

Current research on patient satisfaction after a total knee replacement (TKR) lacks an examination of objective assessments with respect to gait biomechanics, strength, and balance abilities. Purpose: To examine associations between patient satisfaction and the gait biomechanics, strength, balance, functional capacities, and survey data.

Abstracts were prepared by the authors and printed as submitted.
Prader-Willi syndrome (PWS) is a form of congenital obesity that occurs 1 in 25,000 births. Progressive obesity and reduced lean mass contribute to muscle weakness, which may alter knee mechanics during gait. Purpose: To compare quadriceps strength between individuals with and without PWS, and to examine the relationship between quadriceps strength and knee mechanics during gait in adults with PWS.

Methods: 10 individuals with PWS participated in this study (1.70±0.09m, 71.9±16.1kg), and were matched on sex to 10 obese controls (1.74±0.08m, 76.9±19.1kg). Participants completed three maximal isometric knee extensor contractions using a dynamometer (71.9±16.1kg), and were matched on sex to 10 obese controls (1.74±0.08m, 76.9±19.1kg). The functional model was inclusive of WOMAC total scores, stair ascent and chair rise times, and peak isokinetic knee extension torque (R=0.87, AIC=19.51, p=0.0002).

Conclusions: The biomechanical models included both VGRF and knee extension extensions, indicating their relevance to patient satisfaction. Additionally, preferred gait speed was significant to both stair ascent and descent models. Pain was not included in any models due to a complete separation of data points.

Acknowledgements Supported by Matching Dissertation Grant of International Society of Biomechanics.
Medial contact force (MCF) is a measure of the internal loads contributing to knee cartilage loss. Including both knee adductor moment (KAM) and knee flexor moment (KFM) peaks in regression equations significantly improves the prediction of MCF. The objective of gait modification is to reduce KAM by lateralizing the resultant vector of the ground reaction force of the targeted limb. Yet, scant research currently exists investigating consequential changes in MCF of the non-modified limb. PURPOSE: To compare changes in MCF of the non-modified limb as a result of implementing medial knee thrust (MKT) strategy. METHODS: 19 healthy participants (age 26.7±4.8 years; height 1.69±0.17 m; mass 72.3±1.8 kg) volunteered for this study. All analyses were performed at 0.05 alpha level. RESULTS: A total of 1848 participants had knee OA only and 274 had knee OA+diabetes. A total of 245 individuals had a walking speed <1.0 m/s with 26.5% of these individuals having diabetes. A total of 1877 participants had a walking speed ≥1.0 m/s with 11.1% of these individuals having diabetes. Logistic regression analyses showed that diabetes was significantly associated with slow walking speed (<1.0 m/s), (odds ratio 1.62, 95% confidence interval [1.11, 2.36], p=0.013) after controlling for age, sex, race, body mass index, depression and pain while walking. CONCLUSION: This study found an association between diabetes and slow walking speed in people with knee OA, independent of knee pain. People with diabetes and knee OA are about 1.6 times more likely to have a slow walking speed (<1.0 m/s) than those with OA alone. Previous research has linked slow walking speed to adverse health outcomes. Further research should explore the complex relationships between walking speed, functional ability, and health outcomes in this population.

Mechanical stimuli are necessary for the maintenance of articular cartilage. Individuals with obesity have large joint loads during gait yet are at high risk for knee osteoarthritis. As such, the association between joint loading and cartilage thickness in individuals with obesity is unclear. PURPOSE: To examine the moderating effect of obesity on the association between knee adduction characteristics during gait and femoral cartilage thickness. METHODS: 48 young adults with and 48 without obesity matched on age and sex completed assessments of gait biomechanics and ultrasound imaging. Ultrasound imaging was completed in 140° of knee flexion, and outcome variables included cartilage thickness of the medial and lateral femoral condyles, and the medial to lateral (M:L) thickness ratio. 3-dimensional gait analyses were conducted over 5 trials on a 10m runway at a self-selected speed. Biomechanical outcomes included the peak knee adduction angle (KAA), first (KAM1) and second (KAM2) peaks of the knee adduction moment, and the knee adduction angular impulse (KAI). Kinetics were normalized to a product of height and weight. Multiple linear regression was used to examine the association between biomechanical and cartilage outcomes after accounting for sex, gait speed, and step width. The moderating effect of body mass index (BMI) on the association between biomechanical and cartilage outcomes was assessed via the addition of the interaction term (BMI x biomechanical variable). Significant interactions were assessed via post hoc probing of the conditional slopes at each level of BMI group (α=0.05). RESULTS: There was a significant interaction between BMI group and KAA (p<0.02, p<0.03), KAM1 (p<0.05, p<0.01), and KAI (p<0.34, p>0.04) on the M:L ratio. Post hoc probing indicated that KAA (Effect=-0.02, p<0.05), KAM1 (Effect=-1.63, p<0.01), and KAI (Effect=-29.40, p<0.02) were only associated with M:L ratio in individuals without obesity. No associations were found between biomechanical outcomes and medial or lateral femoral condyle cartilage thickness. CONCLUSIONS: Results suggest that obesity influences the ability of cartilage to positively adapt to ambulatory joint loads. Obesity is associated with proinflammatory cytokines, which may impair cartilage repair in response to mechanical stimuli.

Walking speed is often considered a sixth vital sign and an important predictor for disability and mortality in older adults. Previous research has shown that a decline in walking speed is associated with diabetes (DM) or osteoarthritis (OA), independently. Slow walking speed may interfere with daily living and basic mobility needs. PURPOSE: The aim of this study was to investigate the impact of diabetes on walking speed in people with knee OA. METHODS: A cross sectional analysis of Osteoarthritis Initiative (OAI) data at 96 months follow up was performed for 2122 individuals aged between 53-87 years with knee pain over 30 days. Participants were grouped into knee OA+diabetes or knee OA only. Walking speed was measured using the average speed of 2 trials of 20 meter walk test. Diabetes and knee pain over 30 days were assessed via a self-reported questionnaire. Walking speed was categorized as either slow walking speed (<1.0 m/s) or normal walking speed (≥1.0 m/s). Knee pain while walking was assessed immediately after each walk test using a numeric rating scale from 0 to 10. Knee pain while walking was categorized as follows: no pain (0), mild pain (1-3), moderate pain (4-6) and severe pain (7-10). Logistic regression analyses were performed at 0.05 alpha level. RESULTS: A total of 1848 participants had knee OA only and 274 had knee OA+diabetes. A total of 245 individuals had a walking speed <1.0 m/s with 26.5% of these individuals having diabetes. A total of 1877 participants had a walking speed ≥1.0 m/s with 11.1% of these individuals having diabetes. Logistic regression analyses showed that diabetes was significantly associated with slow walking speed (<1.0 m/s), (odds ratio 1.62, 95% confidence interval [1.11, 2.36], p=0.013) after controlling for age, sex, race, body mass index, depression and pain while walking. CONCLUSION: This study found an association between diabetes and slow walking speed in people with knee OA, independent of knee pain. People with diabetes and knee OA are about 1.6 times more likely to have a slow walking speed (<1.0 m/s) than those with OA alone. Previous research has linked slow walking speed to adverse health outcomes. Further research should explore the complex relationships between walking speed, functional ability, and health outcomes in this population.
Exercising in the warm environments increases thermoregulatory demand for skin blood flow, influencing oxygen delivery and oxygen consumption (VO$_2$) systematically and to active muscle. Near infrared spectroscopy (NIRS) is a non-invasive technique that indirectly assesses local tissue oxygen delivery and VO$_2$, and accounts for systemic oxygen uptake. Limited evidence exists on the relationship between muscle oxygenation and systemic oxygen uptake during combined heat stress and exercise. PURPOSE: To examine the relationship between muscle oxygenation and VO$_2$ at different exercise intensities in the heat. METHODS: Six participants (4 males, 2 females, age:21±1.0 years, height: 173.41±15.84 cm, weight: 73.14±17.28 kg, mean VO$_2$max: 46.41±3.53 ml kg$^{-1}$ min$^{-1}$) performed a treadmill exercise protocol (30°C, 60% relative humidity) with 10 minutes each at 30%, 40%, 60%, 70%, and 80% of VO$_2$ at VO$_2$max. NIRS (Moxxy, Fortiori Design LLC, Minnesota, USA) was used to assess muscle oxygen saturation (SmO$_2$) of the vastus lateralis muscle and systemic VO$_2$ was measured using expiratory gas analysis. Pearson correlations coefficients were calculated to evaluate the relationship between average SmO$_2$, relative changes from baseline (Δ) in SmO$_2$, mean VO$_2$ at percent of peak velocity, and percent of VO$_2$max. RESULTS: There was a positive correlation between ΔSmO$_2$ and SmO$_2$ at 80% of peak velocity (r=0.857, p=0.029). There were no significant correlations between SmO$_2$, SmO$_2$, and VO$_2$, at 30%, 40%, 60%, or 70% of peak VO$_2$ (r=0.483, p=0.332;40%; r=0.554, p=0.254; 60%: r=0.653, p=0.160; 70%: r=0.620, p=0.189). There were no significant correlations between mean SmO$_2$, VO$_2$, and percent of peak velocity, or percent of VO$_2$max. CONCLUSION: At 80% of peak velocity, SmO$_2$, VO$_2$, and SmO$_2$, are positively correlated and may suggest this relationship exists while running at high intensities. Therefore, the relationship between NIRS measured SmO$_2$ and oxygen uptake during exercise in the heat must be further explored in order to use NIRS as an assessment for energy efficiency and substrate utilization.

The thermal-circulatory ratio (TCR) is a supportive measure for the assessment of heat tolerance (HT) that was developed for use in military-age males with a history of exertional heat illness (EHI). Examining the heat tolerance test (HTT) and the TCR in a healthy population would give evidence for the application of this as functional measures of heat tolerance in this population. PURPOSE: To assess the sensitivity and specificity of the TCR threshold value during a HTT in a subset of individuals without a history of EHI. METHODS: 12 participants (8 males, 4 females; age: 20±2 years; height: 171±11 cm; weight: 68.7±12.9 kg, VO$_2$max: 46.8±3.49 ml kg$^{-1}$ min$^{-1}$) completed a HTT composed of two hours of treadmill walking at a speed of 5 km hour$^{-1}$ at a 2% grade in 40°C and 40% relative humidity. Rectal temperature (T$_r$) was assessed and heart rate (HR) was assessed. The Israeli Defense Force (IDF) criteria for heat intolerance was utilized and determined when T$_r$ exceeded 38.5°C, HR exceeded 150 bpm, or when either did not reach a plateau. The TCR was calculated by dividing T$_r$ by HR. The TCR threshold value to determine heat tolerance at the end of the HTT (TCR$_{final}$) was 0.279°C/bpm. Independent t-tests were performed to compare ending T$_r$ and HR between HT and heat intolerant (HI) groups. Data are presented as mean±SD and significance level (p<0.05) was set a priori. Diagnostic accuracy of the TCR in comparison to IDF HTT criterion was assessed using sensitivity and specificity. RESULTS: The mean T$_r$, HR, and TCR$_{final}$ were 38.02±0.97°C, 119±13 bpm, and 42.3±2.1 ml/min/m$^2$ respectively. There were no differences in the mean T$_r$ at the end of the HTT between HT and HI, though HR was observed to be lower in HT versus HI (p=0.006). Sensitivity and specificity of the TCR in healthy individuals was 50% and 100%, respectively. The positive likelihood ratio was unable to be calculated due to a lack of false positives. The negative likelihood ratio (–LR) was 0.5. CONCLUSIONS: The specificity of the TCR in this study is similar to findings in previous research. The TCR threshold identified all healthy participants who were HI (n=8) based on IDF criteria but lacked the ability to determine HI participants. Further research is needed to determine the application of the TCR to varying groups of individuals and if it may be a potential predictor for future EHI risk.

Given the increased female presence in military populations and the extreme environmental stress of many military operations, it is important to fully elucidate possible differences in response to environmental stresses between the sexes. PURPOSE: To investigate the sex differences in temperature responses to prolonged, dynamic exercise in the heat. METHODS: Six individuals (3 males, 3 females, age: 20 ± 2 years; height: 166 ± 9.5 cm weight: 69.58 ± 13.6 kg VO$_2$max: 43.2 ± 2.1 ml/min/m$^2$) completed nine-hour trials with three 80-minute blocks of exercise that consisted of bouts of walking at 30% and 40% VO$_2$ at running and at 70% and 80% of velocity at VO$_2$max, followed by 50 minutes of rest. Exercise was completed in two hot environmental conditions (dry: 35°C, 30% relative humidity (RH); and humid 30°C, 60% RH) and two clothing conditions (shirt and shorts, and Army Combat Uniform). Internal temperature (T$i$) was assessed continuously via rectal probe. Independent samples t-tests were utilized to assess differences between the sexes. Data are presented as mean ± SD, significance was set a priori at p<0.05. RESULTS: The only differences in this data set were present in the maximum T$_i$ in the third block of exercise (male: 39.23 ± 0.40, female: 38.82 ± 0.15°C, p<0.021). Environmental and clothing condition data was pooled for this preliminary analysis. No differences were observed in mean temperatures for any blocks of exercise (Block 1 – male: 38.06 ± 0.30°C, female: 38.08 ± 0.39°C, p=0.542; Block 2 – male: 38.46 ± 0.31°C, female: 38.19 ± 0.31°C, p=0.941; Block 3 – male: 38.66 ± 0.35°C, female: 38.27 ± 0.19°C, p=0.157). Additionally, there were no differences in sweat rate between sexes across any blocks of exercise throughout the trials (Block 1 – male: 1.20 ± 0.39L/hr, female: 0.58 ± 0.33L/hr, p=0.693; Block 2 – male: 1.05 ± 0.20L/hr, female: 0.88 ± 0.31L/hr, p=0.373; Block 3 – male: 1.14 ± 0.47L/hr, female: 0.65 ± 0.35L/hr, p=0.410). CONCLUSION: While these preliminary data show only maximum temperature difference in the final block of exercise, additional data is needed to fully elucidate the impact of prolonged exercise heat exposure on both males and females. This investigation aims to help to answer any questions about special military considerations for males and females during prolonged missions or training in the heat.

High radiant heat load reduces endurance exercise performance in the heat indoors, but this remains unconfirmed in outdoor exercise. PURPOSE: The present study examined the effects of variations in solar radiation exposure on self-regulated exercise intensity and thermoregulatory responses in the heat outdoors as a fixed rating of perceived exertion (RPE). METHODS: Ten male participants completed 45-minute cycling exercise in hot outdoor environments (about 31°C) at a freely chosen resistance and pedal cadence at an RPE of 13 (somewhat hard). Participants were blinded to resistance, pedal cadence, distance and elapsed time and exercised at three sunlight exposure conditions: clear sky (mean±SD: 1072±91 W m$^{-2}$; HIGH); thin cloud (592±32 W m$^{-2}$; MID); and thick cloud (306±52 W m$^{-2}$; LOW). Rectal and skin (chest, upper arm, thigh and calf) temperatures, heart rate, skin blood flow and blood pressure were recorded at rest and during exercise. RESULTS: Power output (HIGH 96±22 W;
Heat stress reduces physical work capacity (PWC), which can incur major economic deficits. In the context of climate change, an accurate prediction model for PWC as a function of heat stress severity is urgently required, allowing accurate forecasting of its expected future economic impacts. PURPOSE: Evidence shows that physical work at self-selected intensities is characterised by a largely stable working heart rate (HR) indicating a constant cardiovascular strain. Given that both heat stress and work load affect HR, we developed a constant cardiovascular strain methodology to quantify heat-induced reductions in PWC at a workload moderate and heavy based on WHO definitions. METHOD: Sixteen young adult male participants (heterogeneous in fitness and body characteristics) performed ten experimental trials each consisting of 1-hour of treadmill walking exercise at a HR clamped at 125 b·min⁻¹. The first experimental trial was conducted in a reference environment (15°C, 50% rh). The remaining nine trials were conducted at the same fixed heart rate for a maximum of 1 hour at 30-50°C at various humidities. RESULTS: The core-to-skin temperature gradient was narrower, body heat gain from the sun (SHG) was greater and thermal sensation was higher with increasing solar radiation and all variables were different between all trials (p<0.001). Mean skin temperature was lower at a WBGT than MID and LOW (p<0.01) and was similar between trials (p=0.485). CONCLUSIONS: We conclude that self-regulated exercise intensity in the heat outdoors at a fixed RPE of somewhat hard is reduced with increasing solar radiation because of greater thermoregulatory strain, perceived thermal stress and SHG. Moreover, solar radiation below 600 W m⁻² might be of benefit to maintain endurance physical performance in the heat.

In trained endurance athletes, the ability to defend arterial oxy-hemoglobin saturation (SaO₂) during high intensity constant-workload exercise in moderate hypoxia depends in part on the ability to increase minute ventilation (V̇E). Previous data have shown, however, that despite the existence of a substantial amount of ventilatory reserve (V̇Eres) in some cyclists, V̇E surprisingly does not increase during 5km time trials (5kTT) in hypoxia, despite a significant decrease in both SaO₂ and mean power output (ṖM) from normoxia. PURPOSE: To determine the effect of reducing the work of breathing (Ẇ↑) on V̇E, breathlessness (RPB), and PTT during a 5kTT in highly trained cyclists. We hypothesized no change in RPB, while V̇E would increase with an attenuated decrement in SaO₂ and ṖM from normoxia. METHODS: Fourteen trained male cyclists (V̇O₂peak = 58.7 ± 4.7 ml kg⁻¹ min⁻¹) performed a 5kTT under 3 conditions at sea level: ‘CON’ (FiO₂ = 0.21), ‘HYP’ (FiO₂ = 0.16), and ‘HYP+He’ (FiO₂ = 0.16, with balance helium). Esophageal balloons were used to assess Ẇ↑ in each condition. Inspiratory capacity maneuvers were performed at each km, and flow-volume loop analyses were used to assess the %EFL and V̇Eres. The modified Borg scale (0-10) was used to assess RPB at each km. RESULTS: Ẇ↑ decreased from HYP to HYP+He by 30 ± 18% (p = 0.01). Despite a substantial V̇Eres throughout CON (52 ± 44 L min⁻¹) and HYP (124.8 ± 17.9 L min⁻¹) but increased during HYP+He (139.5 ± 22.0 L min⁻¹; p < 0.05). While SaO₂ decreased from CON to HYP by 10 ± 1% (p < 0.01), SaO₂ increased by 4 ± 1% from HYP to HYP+He (p < 0.01). ṖM decreased from CON to HYP (+14.2%; p < 0.01) and increased from HYP to HYP+He (+5.5%; p < 0.01). When comparing HYP to HYP+He, a significant correlation was observed between SaO₂ and ṖM (r = 0.69; p < 0.05) ṘṖM decreased from CON (6.0 ± 2.0) to HYP (7.0 ± 2.0; p < 0.05) and was unchanged from HYP to HYP+He (6.6 ± 2.0). CONCLUSIONS: In moderate hypoxia, a low ventilatory reserve does not limit 5km time trial performance, where by design, individuals are free to adjust power output. The ability to utilize ventilatory reserve while remaining below a critical threshold of perceived breathlessness appears conducive to maintaining aerobic exercise performance in moderate hypoxia.
POSSIBLE: To investigate whether the dysanapsis ratio (DR) predicts expiratory flow limitation in highly trained athletes, as has been shown in healthy, active men and women. METHODS: Data from 124 highly trained men (age 21.9 ± 3.6 yrs) who performed maximal incremental tests to exhaustion were analyzed. The maximum expiratory flow-volume curve, along with inspiratory capacity maneuvers, were used to determine lung volumes, determine expiratory flows, and to quantify flow limitation. The subjects were partitioned into ‘flow-limited’ (EFL) and ‘non-flow-limited’ (NEFL) groups, where tidal v.s. maximal flow-volume overlap >5% qualifies as EFL. Group differences were evaluated using independent T-tests, while logistic regression was used to assess the predictive ability of DR, forced vital capacity (FVC), and VO2max on EFL. RESULTS: 63% of subjects (n = 78) displayed EFL with an average severity of 43.3 ± 21.0%. EFL showed significantly lower FEV1 (63% of subjects (<p = .001), FEV1/FVC (86.3 ± 7.8 vs. 91.3 ± 5.7% (<p = .001), and FEF25-75 (61.2 ± 20.7 vs. 74.1 ± 14.1 L/s <p < .001). However, no significant differences were found in FVC (5.2 ± 0.7 vs. 5.3 ± 0.8 <p = .191) between groups. EFL showed a significantly smaller DR (0.2 ± 0.1 vs. 0.3 ± 0.1 <p = .001) compared to NEFL. There were no differences between EFL and NEFL at peak exercise with respect to VO2max (67.1 ± 8.1 vs. 65.4 ± 4.5 ml min^-1 kg^-1, <p = .246), VE (155.9 ± 20.6 vs. 156.8 ± 26.6 ml min^-1, <p = .59), or frequency of breathing (56.8 ± 8.6 vs. 55.4 ± 10.3 br·min^-1, <p = .262). A significant predictive relationship was observed between DR on EFL (Odds Ratio (OR): 0.55, 95% CI 0.36 to 0.81, <p < .001). A multivariate analysis indicated that DR (OR 0.35, 95% CI 0.21 to 0.58, <p < .001), FVC (OR 0.49, 95% CI 0.31 to 0.78, <p < .003), and VO2max (OR 1.63, 95% CI 0.51 to 2.53, <p = .282) were significant predictors of EFL. CONCLUSIONS: Consistent with previous findings in active subjects, an increase in DR or FVC significantly decreases the likelihood of EFL in highly trained athletes. However, results from this analysis show that when controlling for DR and FVC, an increase in VO2max significantly increases the likelihood of EFL. This relationship was previously found to be non-significant in healthy active individuals and may highlight potential differences that exist within endurance trained populations.

PURPOSE: To examine sex differences in DF when matched for absolute diaphragmatic pressure during inspiratory PTL. METHODS: Healthy subjects were recruited and matched for absolute diaphragmatic work results in randomized order, 7+ days apart. Women demonstrated an attenuated inspiratory muscle metaboreflex. Sponsor: Natural Sciences and Engineering Research Council of Canada, UBC Physical Activity and Precision Health Cluster

It has recently been demonstrated that women experience an attenuated cardiovascular response to inspiratory pressure-threshold loading (PTL). Furthermore, due to a significantly longer time to task failure, the rate of development of diaphragmatic fatigue (DF) is slower in women compared to men. It is unclear if the abovementioned differences are due to discrepancies in absolute diaphragmatic force output. PURPOSE: To examine sex differences in DF when matched for absolute diaphragmatic pressure during inspiratory PTL. METHODS: Fourteen healthy men (n = 8) and women (n = 6) performed a single bout of PTL for five minutes. Subjects were required to breathe in a square-wave fashion whilst targeting a transdiaphragmatic pressure (Pdi) of 92 cm H2O. Fatigue of the diaphragm was assessed via twitch P0 (P0,P0) using cervical magnetic stimulation. Cardiovascular responses, including heart rate (HR) and mean arterial blood pressure (MAP) were monitored beat-by-beat throughout PTL. RESULTS: Following inspiratory PTL, the total work done by the diaphragm (-13,500 cm H2O s, <p = .50) and the reduction in P0,P0 was not different between sexes (M = 26 ± 8%, W = 25 ± 9%, <p = .82). When scaled to body mass, women produced more diaphragmatic pressure (187 cm H2O · min^-1 kg^-1 vs. 65 ± 18 cm H2O · min^-1 kg^-1, <p = .01). There was no effect of sex on HR (M = 114 ± 12 bpm, W = 115 ± 9 bpm, <p = .50) during PTL; however, ΔMAP was lower in women compared to men (M = 131 ± 16 mmHg, W = 211 ± 13 mmHg, <p = .03). CONCLUSION: Inspiratory PTL matched for absolute diaphragmatic work results in a similar degree of DF between sexes. Despite performing the same level of absolute diaphragmatic work and developing the same degree of DF, women demonstrated an attenuated inspiratory muscle metaboreflex. Sponsor: Natural Sciences and Engineering Research Council of Canada, UBC Physical Activity and Precision Health Cluster

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

AFTER spinal cord injury (SCI), respiratory complications are a leading cause of morbidity and mortality. A novel technique, acute intermittent hypoxia (AIH) triggers spinal motor plasticity, and can increase tidal volume at rest in humans with SCI. Only sparse, inconclusive literature exists about the effects of AIH on maximal effort respiratory maneuvers after SCI. To investigate whether the effects of AIH on maximal effort respiratory ability in adults with SCI. METHODS: 4 community-dwelling, adult males with SCI completed a single AIH or sham treatment in randomized order, 7+ days apart. AIH consisted of 15, 1 minute periods breathing a hypoxic gas mixture (9-13% oxygen), interspersed with 1.5 minute periods breathing room air. Sham treatments replicated AIH, but used air (21% oxygen) versus hypoxic episodes. Blood oxygen saturation was monitored. Maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP) were recorded prior to and 30 minutes after AIH and sham. Pre and post scores for each condition were compared using non-parametric Friedman’s two-way ANOVA by ranks. RESULTS: Baseline blood oxygen saturation averaged 97.1 ± 2.2%. During AIH, saturation decreased to an average of 82 ± 3%, then returned to baseline. Blood oxygen saturation remained stable during sham treatments. MIP did not differ at any point on either day (pre-AIH, 90.4 cmH2O +/- 34.3; post-AIH, 99.3 cmH2O +/- 17.6; pre-sham, 98.8 cmH2O +/- 21.3; post-sham, 85.2 cmH2O +/- 17.3; X~6.231, p=1.01). MEP did not differ at any point on either day (pre-AIH, 91.2 cmH2O +/- 23.1; post-AIH 93.4 cmH2O +/- 26.8; pre-sham 80 cmH2O +/-25.6; post-sham 85.4 +/- 21.1; X = -2.4, p = .494) Individually, 3 participants increased MIP after AIH, but decreased after sham; the fourth participant increased MEP after AIH, but decreased after sham. CONCLUSION: These pilot study results suggest AIH may affect maximal effort respiratory ability in adults with SCI. Although group means did not differ, individual outcomes varied with AIH improving one outcome in each participant versus sham. Further research is warranted to examine response variations and to determine the therapeutic potential of AIH after SCI. Support: Brooks-PHP Research Collaboration; Center for Respiratory Research and Rehabilitation at the University of Florida.

Effects of Acid Intermittent Hypoxia on Maximal Respiratory Ability after Spinal Cord Injury
Thomas E. Wutor1, Kathryn Cavka2, Shaked Almehd1, David D. Fuller1, Gordon S. Mitchell1, Emily J. Fox1. (University of Florida, Gainesville, FL. Brooks Rehabilitation, Jacksonville, FL. Email: tsutor@ufl.edu (No relevant relationships reported)

Academic Poster Session

In Vivo MRI Study of the Relationship Between Iliac Artery Atherosclerosis and Cardiac Functionality

Combined Influences of Inspiratory Loading and Subsystolic Circulatory Occlusion on Blood Pressure Responses
Joshua R. Smith, Eric J. Bruhn, Jessica D. Berg, Thomas P. Olson, FACSMM. Mayo Clinic, Rochester, MN. (Sponsor: Thomas Olson, FACSMM. Email: smith.joshua1@mayo.edu (No relevant relationships reported)

No relevant relationships reported

Effects of Acute Intermittent Hypoxia on Maximal Respiratory Ability after Spinal Cord Injury
Tommy E. Wutor1, Kathryn Cavka2, Shaked Almehd1, David D. Fuller1, Gordon S. Mitchell1, Emily J. Fox1. (University of Florida, Gainesville, FL. Brooks Rehabilitation, Jacksonville, FL. Email: tsutor@ufl.edu (No relevant relationships reported)
and locomotor muscle afferent feedback results in a greater blood pressure response than either alone. These findings have important implications for populations that exhibit exaggerated locomotor and respiratory muscle reflexes (e.g., heart failure).

### PURPOSE:
To test the hypothesis that reactive oxygen species (ROS) and protein kinase B (Akt) are signaling molecules involved in the protective effect of PO2 cycling during reoxygenation in smoking-induced COPD mice.

### METHODS:
To develop COPD symptoms, male C57BL6 mice were exposed to cigarette smoking for 2 months, and then, they were divided into two groups: control and smoking-induced COPD. The smoking-induced COPD group was exposed to cigarette smoke for 3 months. All mice were then exposed to either 1% O2 cycling or with the respective inhibitors for ROS (Tiron, 1 mM; N-acetyl cysteine, NAC, 1 mM; n = 7) or Akt (MK-2206, 50 μM; n = 5) for 30 min before PO2 cycling. Muscle was then switched to hypoxia for 30 min, followed by 15 min of reoxygenation. In the middle of reoxygenation (5-10 min), each muscle strip was exercised at a heart rate of 65% VO2 max, followed by 15 min of cycling. Muscle force was recorded and end contractile force was measured. The experiment was repeated with a 5-min warm-up period to ensure muscle fatigue.

### RESULTS:
Our data indicate that PO2 cycling significantly improved diaphragm function during reoxygenation in smoking-induced COPD mice (18 ± 1.3% for PO2 cycling vs. 8 ± 1.5% for control, p < 0.05). However, inhibition of either ROS or Akt abolished such protective effects on diaphragm (11 ± 2.5% for Tiron + NAC + PO2 cycling; 6 ± 2.1% for Akt inhibitor + PO2 cycling; 18 ± 1.3% for PO2 cycling, p < 0.05). CONCLUSIONS: In smoking-induced COPD mice, we suggest that PO2 cycling can improve the diaphragmatic function during reoxygenation potentially through the intracellular signaling of ROS and Akt.

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### RESULTS

Even a single high-fat meal (HFM) is associated with increased airway inflammation. While exercise may modify postprandial airway inflammation, the protective effect may be diminished by age. **Purpose:** To determine whether an acute bout of preprandial exercise attenuates postprandial airway inflammation in active younger and older adults.

### METHODS

8 younger active (YA; 23.5 ± 4.5 y/o) and 5 older active (OA; 64.8 ± 2.6 y/o) athletes that habitually exceed physical activity (PA) guidelines completed two HFM sessions in a randomized order. In exercise + HFM (EX+HFM), subjects performed exercise at a heart rate of 65% VO2peak to exceed 75% of the cardiac content of the HFM. In both sessions, subjects refrained from exercise for 48 hours prior to the HFM challenge (except for the exercise session in EX+HFM), and visited the lab after a 12-hour fast to consume the HFM (12 kcal/kg BW: 57% fat, 39% CHO, 4% protein). Triglycerides (TG) and exhaled nitric oxide (eNO) were measured at baseline, 2- and 4-hours post-HFM. **Results:** The mean eNO at baseline for the YA and OA was not significantly different (p = 0.17). The increase in eNO from baseline to 2 hours in the HFM condition was 13.1 ± 26.9% and during the EX+HFM was 2.5 ± 11.6% in the YA adults, and was -1.2 ± 11.3% in the HFM alone and 10.8 ± 15.0% in the EX+HFM. However, when analyzing all subjects together, the airway inflammatory response was not significantly different across time (p = 0.08), by age (p = 0.23), or by condition (p = 0.80). There was a significantly greater TG response in the HFM condition compared to the EX+HFM condition in OA (p < 0.05), which was also lower in the YA (p = 0.05).

### CONCLUSIONS:
With these preliminary analyses, airway inflammation does not appear to be altered by age or preprandial exercise, however, the triglyceride response is modified by acute exercise and age. Supported by 4-VA grant

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### RESULTS

17-year-old high school football player presented for sideline evaluation with right wrist pain. The injury occurred when he was tackled and had his wrist twisted and caught under another player. His coach kept him in the game and after one more play, his teammates called out for medical attention. He had diffuse swelling and pain along the ulnar aspect of the distal forearm and wrist. He was placed in a volar splint and sent to the emergency department where x-ray imaging of the wrist was read by radiologist as normal. The athlete followed up in clinic 4 days later. He continued to have pain, restricted range of motion, and decreased strength. Review of systems was otherwise normal. Past medical history was unremarkable.

### PHYSICAL EXAMINATION

Wrist examination showed moderate diffuse swelling but no ecchymosis or deformity. He had tenderness along the ulnar aspect of the distal wrist. There was no tenderness at the anatomic snuff box or scaphoid tubercle. Range of motion was limited in all directions, especially in supination. Strength was 4+/5 in all motions except for supination, which was 3+/5. Special tests including triangular-fibrocartilage complex grind, Watcher’s, and Finkelstein’s were equivocal. Sensation to light touch was intact. Radiial pulses were equally palpable bilaterally.

### DIFFERENTIAL DIAGNOSIS

1) Ulnar styloid or hook of hamate fracture. 2) Distal radioulnar joint injury. 3) TFCC injury. 4) Scapholunate or lunotriquetral dissociation.

### TESTS AND RESULTS

Initial x-rays at ED were read as normal. Repeat x-rays were concerning for volar ulna dislocation. MRI without contrast showed volar dislocation of the ulna.

### FINAL WORKING DIAGNOSIS

Radioulnar joint dislocation with volar displacement of ulna.

### TREATMENT AND OUTCOMES

1. Orthopedic hand surgery referral. Given the length of time since initial injury, closed reduction was performed under general anesthesia.
2. Long arm cast with the forearm in supination position for 4 weeks. Repeat x-rays demonstrated maintenance of reduction. After cast removal, the patient returned to football with a removal wrist splint.

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### RESULTS

A 17-year-old left-handed high school senior baseball player with a history of Langerhans cell histiocytosis presented to the outpatient clinic with pain on the ulnar aspect of his proximal right forearm. The pain had developed over the course of 2 months after he had increased the intensity of his offseason weight training regimen. He first noticed the pain while performing a high volume of upper body lifting, specifically bicep curls; pain was most severe during weightlifting but now occurred even during non-lifting activities. The patient denied any constitutional or neurologic symptoms.

### PHYSICAL EXAMINATION

Inspection was unremarkable. Examination revealed extension of ulna. The athlete followed up in clinic 4 days later. He continued to have pain, restricted range of motion, and decreased strength. Review of systems was otherwise normal. Past medical history was unremarkable.

### DIFFERENTIAL DIAGNOSIS

1. Muscle strain
2. Extensor tendinopathy
3. Bone tumor
4. Posterior interosseous nerve entrapment
5. Ulnar fracture
6. Exertional compartment syndrome

TEST AND RESULTS:
Right forearm AP and lateral x-rays: negative for fracture or bony abnormality
MRI right forearm without contrast: Incomplete intrarticular stress fracture of the mid ulnar diaphysis

FINAL WORKING DIAGNOSIS:
Ulnar stress fracture

TREATMENT AND OUTCOMES:
1. Rest and avoidance of weightlifting or loading of the right upper extremity until follow up
2. Due to patient reluctance to rest, right wrist/forearm brace while awake to remind him to rest the limb
3. At 4-5 week follow-up, pain was completely resolved
4. RT & C evaluated his elbow for a re-introduce weight-bearing exercises of the right upper limb as tolerated, beginning with isometric wrist strengthening followed by low intensity flexion/extension exercise before progressing to heavier lifts involving larger muscles groups and multi-joint movements
Patient was able to return to all activities and declined physical therapy.

13 May 29 10:10 AM - 10:30 AM
Elbow Pain in an Adolescent Pitcher
Nicholas C. Czananello, Brittany J. Moore, Karen L. Newcomer, FACSM. Mayo Clinic, Rochester, MN. (Sponsor: Dr. Karen Newcomer, FACSM) (No relevant relationships reported)

HPI
Patient is a 16 year old right-hand dominant male baseball pitcher with past medical history of partial tear of the right UCL and OCD of the right lateral trochlea managed with casting 9 months prior. He presented to our clinic with insidious onset right posterolateral elbow and arm pain 2 months after returning to pitching in summer baseball in May.
He described sharp pain in the right lateral elbow with radiation into the posterolateral arm exacerbated with push-ups and bench press. He noticed a painless popping sensation with elbow extension, but denied weakness or sensory changes. The pain was not specifically associated with baseball or pitching and was different from his previous pain.

PHYSICAL EXAM
Mild tenderness at right common extensor tendon origin worsened with 5 push-ups and improved with rest. Mild tenderness at right posterolateral triceps border. Slight weakness of the right triceps with pain. Varus and valgus stress caused no pain, but there was asymmetry with minimally increased laxity during valgus stress on the right. Negative extensor wad stress tests including Cozens, middle finger extension and Mills. No pain with flexor-pronator stretching. No pain with resisted pronation or supination.

DIFFERENTIAL DIAGNOSIS
1. Triceps tendinitis
2. Lateral epicondylitis
3. Radial nerve irritation
4. OCD radio-capitellar joint
5. Intraarticular loose body
6. Stress reaction/stress fracture distal humerus
7. Bony tumor/infection

TEST AND RESULTS
11 May 29 10:30 AM - 10:50 AM
Acute Bilateral Elbow Pain In a College Volleyball Player
Jonathan Smith, Dennis Khalili-Borna, FACSM. Kaiser Permanente Fontana Medical Center, Fontana, CA. (No relevant relationships reported)

HISTORY: A 19 year old college volleyball player presents to the athletic training room with chief complaint of bilateral elbow stiffness and swelling for one day. Her evaluation in the training room revealed mild decrease in elbow extension bilaterally with pain at terminal elbow extension. She was observed and treated conservatively with NSAIDS, compression wraps, over a two day period. Elbow swelling improved initially then began to track down the forearm. After day 2 of observation she continued to have muscle soreness and swelling. She denied abdominal pain, changes in urine color or decreased urine output. She was sent the Urgent Care for further evaluation of her symptoms.

Physical Exam: Vital's were normal during training room visits. Initial exam revealed tenderness to palpation over the flexor and extensor masses of the elbow as well as mild swelling. She had a slight decrease in active and passive elbow extension bilaterally and she exhibited pain at terminal elbow extension bilaterally. Flexion was preserved.

DIFFERENTIAL DIAGNOSIS:
1. Delayed Onset Muscle Soreness
2. Epicondylitis
3. Valgus Extension Overload
4. Olecranon Stress Fracture
5. Rhabdomyolysis
6. Exertional Compartment Syndrome
7. Olecranon Fossitis

Tests: CBC was within normal limits. Electrolytes were within normal limits.
Creatinine showed mild elevation. CPK was significantly elevated at 40,000 U/L

Final Working Diagnosis: Rhabdomyolysis

TREATMENT AND OUTCOMES: The patient was admitted the hospital for a 4 day period for IV fluids and observation. Over the course of her hospitalization her CK levels were trended and she was released after CK levels were below 5,000 U/L. Her PCP continued to treat Creatinine levels after she was discharged and they continued to trend downwards. Two weeks after discharge she started on a 3 week gradual return protocol and she remained symptom-free. Follow up labs were drawn prior to her first match and showed only mildly elevated CK (230 U/L) with normal creatinine and GFR. She has been participating in matches at full capacity and remains asymptomatic.
While other factors may have contributed, it appears releasing seemingly unrelated forces for evaluation of a two month history of left mid-thigh tightness, discomfort and bulge. MI, Mark F. Riederer, C.S. Mott Children’s Hospital/University of Michigan, Ann Arbor, MI. Atraumatic left thigh mass in an adolescent multisport athlete

& thoracic mobility and core stability were also addressed to prevent future injury. Little has been published regarding the role of fascial lines in diagnosis or treatment secondary to fascial restriction along Myers Functional & Arm Lines DISCUSSION:

CLINICAL EXAMINATION: Patient had mild tenderness over the left lateral epicondyle, as well as moderate tenderness and increased tone in extensor group muscles. Gripping increased left elbow pain. No strength or neurological deficits were noted. MRI’s Test was negative. Cozen’s Test was positive for pain over the lateral epicondyle. DIFFERENTIAL DIAGNOSES: 1. Lateral Epicondylitis 2. Radial Tunnel Syndrome TREATMENT & RESULTS: Manual therapy to the forearm extensor group decreased local muscle tension, but had to little to no effect on elbow pain following three visits. Stretching, contrast, and rest did not positively impact pain. Reviewing the Myers Functional and Arm Lines, treatment of the thoracolumbar junction and right hip region by cupping, dry needling, and spinal adjustment were performed with noticeable improvement noted after the fourth visit. Following another similar treatment, the patient’s condition resolved. FINAL DIAGNOSIS: Elbow pain secondary to fascial restriction along Myers Functional & Arm Lines DISCUSSION: Little has been published regarding the role of fascial lines in diagnosis or treatment of orthopedic injuries. Since local treatment appeared ineffective, looking elsewhere in the biomechanical chain was necessary. Both provocational movements increase lumbar extension if done improperly, creating compensatory dysfunction. Therefore, shoulder & thoracic mobility and core stability were also addressed to prevent future injury. While other factors may have contributed, it appears releasing seemingly unrelated fascial restrictions noticeably impacted the results.

ARM & THIGH II

Clinical Case Slide - Hip and Thigh II

Wednesday, May 29, 2019, 9:30 AM - 11:30 AM
Room: CC-306

Management of a 58-Year Old CrossFit Athlete with Elbow Pain by Treating the Contralateral Hip Region

Megan L. Pfieffer, DACBSP, DC, ATC. Voodoo Chiropractic, Nashville, TN.

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(No relevant relationships reported)

MANAGEMENT OF A 58-YEAR OLD CROSSFIT ATHLETE WITH ELBOW PAIN USING MYERS FASCIAL LINES

M. L. Pfieffer, DC, CCSP, ATC. Voodoo Chiropractic, Nashville, TN

ABSTRACT

HISTORY: 58 y/o male recreational CrossFit athlete presented with insidious left lateral elbow pain, progressing over several weeks and exacerbated by pull-ups and overhead barbell movements.

PHYSICAL EXAMINATION: He has a normal gait without limp. There is no visible swelling, bruising or deformities of the left thigh. Approximately over the mid to superior quadriceps there is an area of approximately 4 cm x 3 cm that is slightly indurated, non-tender but the patient reports it is uncomfortable to palpate. There is no fluctuance. There is no limitation or pain with active and passive range of motion at the knee or hip. Hip flexion and knee extension strength are a 4/5 without pain with resistance. The remainder of the physical examination is non-contributory.

DIFFERENTIAL DIAGNOSIS:

1. Quadriceps strain
2. Myositis ossificans
3. Quadriceps hematoma
4. Lipoma
5. Osteocartilaginous lesion

TEST AND RESULTS:

Initial imaging included plain radiographs, which did not show any acute or chronic osseous abnormalities. The soft tissues appear normal. Musculoskeletal ultrasound demonstrated a large hypoechoic defect within the rectus femoris muscle. An MRI showed a full-thickness tear of the indirect muscle of the rectus femoris, with a 1.5 cm craniocaudal gap/retraction of the indirect muscle at the myotendinous unit.

FINAL/WORKING DIAGNOSIS:

Full-thickness tear of the indirect head of the left rectus femoris tendon with retraction of the myotendinous unit

TREATMENT AND OUTCOMES:

Due to the fact that the patient was not very symptomatic, we recommended a trial of non-operative management. This included rest from sports and physical therapy to work on strengthening. Displeased with this plan, the family sought a second opinion from the team physician for a local Division I college volleyball team. In a telephone follow up conversation with the patient’s mother, the team physician also recommended non-operative management.

A-24

Thigh Pain In A Multi-sport Youth Athlete

Aloiya E. Earl, Brett C. Bentley, Earl R. Stewart. The University of Alabama, Tuscaloosa, AL.

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(No relevant relationships reported)

HISTORY: A healthy 10-year-old male multi-sport athlete experienced insidious onset of right thigh pain associated with limp for about one week prior to office presentation. The pain started during his school day and had progressively worsened over the week, which caused him to be unable to complete his baseball practices. The pain was worse with running and jumping. He did not have nocturnal pain, weight loss, or night sweats. Of note, he had an identical presentation about 8 months prior in his contralateral thigh which was diagnosed as a compression-sided stress fracture of his left femoral neck and treated conservatively. EXAM: Afebrile. Well-appearing. Limping gait. Lumbar spine exam WNL. Bilateral knee exam WNL. Left hip exam WNL. On exam of his right hip, he had tenderness diffusely in his proximal anterior and lateral thigh and over his AHS. He had full hip ROM but with pain at the extremes of flexion, IR, and ER. Strength of LLE WNL. Strength of RLE limited to 4/5 with hip abduction and hip flexion due to pain. Seated and supine log roll positive for pain. Unable to perform a single-leg hop on his right side. He had pain with bowing of his femur. Neuromuscular examination of bilateral LE WNL. DDx: Acute synovitis, stress fracture, Legg-Calve-Perthes disease, SCFE, pathologic fracture: RFL pelvis 10/10/18: No apparent osseous abnormality. MRI right hip 10/11/18: Edema within the medial femoral neck, most likely stress-related. 10/15/18 CMP, PTH, TSH, Vit D: WNL. FINAL WORKING DIAGNOSIS: Compression-sided stress reaction of the right femoral neck, which was his second stress injury within 8 months, the first being in his left femoral neck. TREATMENT/OUSTCOME: The patient was treated for his second stress injury with conservative management again. He was instructed to be NWB with crutches for 6 weeks, after which he would have a follow up visit and if doing well clinically and radiographically, would progress to partial protected weight bearing and formal PT to transition back to sport. Given his normal lab workup, he was also referred to an orthopedic hip specialist to evaluate for possible biomechanical contributions to abnormal stress through the femoral neck or connective tissue disorders. His sports schedule was reviewed. Multi-sport participation was encouraged, but with a 3-month consecutive break during the year.

A-102

Atraumatic Left Thigh Mass In An Adolescent Multi-sport Athlete

Mark Riederer. C.S. Mott Children’s Hospital, Ann Arbor, MI.

Email: mrriedere@med.umich.edu

(No relevant relationships reported)
**HISTORY:** A 78-year-old female triathlete presented to clinic to follow-up on injuries sustained during a cycling accident. Evaluation in the ED on the day of injury showed facial bone fractures and small peripheral parenchymal hematomas in the right frontal and temporal lobes for which she had follow-up scheduled. In clinic two days later, she complained of pain and bruising over her right hip. She was diagnosed with an abrasion and contusion of the right hip and treated with ice and NSAIDs. She returned four weeks later with worsening right hip pain, described as constant, throbbing, non-radiating, and worse with weight-bearing. It was associated with swelling and a tender mass that had developed over the right hip. She denied fevers or chills.

**PHYSICAL EXAMINATION:** Vitals were normal at both visits. Initial exam of the right hip showed a large abrasion, mild ecchymosis, and tenderness. She had full range of motion without pain or edema. She also had normal balance and gait. Four weeks later, the right hip had a 15 x 17 cm, warm, tender mass over the lateral aspect of the thigh, without erythema. FABER and FADIR were negative, and muscle strength, pulses, and sensation were normal. The abrasion was well-healed. **DIFFERENTIAL DIAGNOSIS** 1. Hematoma 2. Contusion 3. Bursitis 4. Abscess 5. Neoplasms **TEST AND RESULTS:** CBC was normal. Radiographs of right hip were negative for fracture or soft tissue abnormalities. MRI of the right lower extremity showed a heterogeneous fluid collection measuring 22 x 4 x 6 cm (H x W x D, 528 cc) overlying the right hip with small internal foci of hemorrhage/debris, and peripheral rim enhancement with no areas of internal enhancement. **FINAL WORKING DIAGNOSIS:** Morel-Lavallée lesion. **TREATMENT AND OUTCOMES:** The patient underwent aspiration, doxycycline sclerotherapy, and percutaneous drainage. Post-procedure US was negative for any significant fluid collection. Repeat MRI three weeks after the procedure showed incomplete resolution/recurrence of the lesion measuring 20 x 1.5 x 2.8 cm (84 cc). The patient had follow-up with orthopedics and elected for conservative treatment with compression dressings. She returned to triathlon training and has subsequently completed a 100-km bike race at 6 months post injury.

**HISTORY:** A 53-year-old male reports to physical therapy with left posterolateral thigh pain. Three years prior, pr’s spring ligament popped and required surgical reconstruction. During the patient’s surgery, he had a nerve block to the lateral hamstring. Patient completed necessary therapy and attempted to return to exercise. Following attempts at exercising, patient reported sporadic symptoms of leg weakness. Patient has had two normal nerve conduction tests as well as a normal MRI of the back, knee, and hip. At initial evaluation, patient is unable to bike or run, and describes symptoms of localized weakness and achiness post-exercise.

**PHYSICAL EXAMINATION:** Posture normal, no apparent gait deviations. Pain localized to the distal lateral hamstring. Full, pain-free lumbar spine, hip, and knee AROM and overpressure. Gross LE strength testing within normal limits except for L hamstrings (3+/5). Dynamometer reading R: 38lbs, L: 25lbs. Contraction did not reproduce patient’s pain. Symptoms present with elongation of L hamstring muscle. Deep squat limited by “tightness” in L calf. **DIFFERENTIAL DIAGNOSIS:** 1. Distal Peripheral Nerve Entrapment 2. Hamstring Tendinopathy 3. Mechanical Dysfunction **TEST AND RESULTS:** 1. Neural Tissue Testing: - Positive slump test - Painful arc of motion: Patient had symptoms at 40 degrees short of vertical that dissipate once patient’s leg was lifted to 35 degrees - Positive straight leg test - Reflexes were within normal limits **FINAL WORKING DIAGNOSIS:** Distal peripheral nerve entrapment of mechanical nature. **TREATMENT AND OUTCOMES:** - 5 physical therapy sessions over 5 weeks - Ergonomic desk set up - Sciatic nerve sliders from slump position - Progressive hamstring strengthening

**HISTORY:** Patient is a 14 year old male who presented to sports medicine clinic for evaluation of three weeks of right quadriceps pain that began while running during baseball practice. He was initially prescribed physical therapy for a presumed right quadriceps strain but on follow up two months later he continued to have pain with activities as well as a deformity in his right thigh that was growing in size.

**PHYSICAL EXAMINATION:** On exam patient was well appearing, his right quad had no erythema or ecchymosis. He had a palpable mobile mass in the mid-thigh that was not tender to palpation but protruded with resisted knee extension. The remainder of the quadriceps muscle belly was non-tender. His lower extremity strength and sensation were preserved. **DIFFERENTIAL DIAGNOSIS:** 1. Quadriceps tear with retraction 2. Normal anatomic variant 3. Fascial herniation 4. Soft tissue mass **TEST AND RESULTS:** 1. MRI Right Femur w/o Contrast: Grade 1 strain of rectus femoris muscle at the myotendinous junction, suggesting intramuscular degloving mechanism. **FINAL WORKING DIAGNOSIS:** Rectus Femoris intramuscular degloving injury **TREATMENT AND OUTCOMES:** The patient continued to work with physical therapy and was able to slowly reintroduce sport specific activities over the next month without recurrence of pain. His deformity has reduced significantly in size.
HISTORY: A 14-year-old male football player presented to our sports medicine clinic complaining of left knee pain and swelling. Onset of knee pain was 2 months prior and he began to complain of intermittent swelling over the last 3–4 weeks prior to this initial visit. There was no reported history of trauma or injury. Pain worsened with activity and was localized to his anterior knee and medial joint line. NSAIDs and a knee brace did not alleviate his symptoms. He denied any associated knee instability, popping, locking or patellar instability. Neurological signs and symptoms were absent. Review of systems was otherwise negative. PHYSICAL EXAMINATION: Examination revealed a moderate sized left knee effusion with tenderness to palpation around the patella and medial joint line. There was no ecchymosis or erythema. Strength exam was normal. Knee range of motion was decreased in both flexion and extension secondary to swelling. There was pain on patellofemoral grind test with a negative patellar apprehension test. He had a negative Lachman and McMurray test. Anterior and posterior drawer tests were also negative. No ligament laxity was appreciated with varus or valgus stress testing. Examination of the contralateral knee was normal. He was otherwise well appearing with a normal gait. DIFFERENTIAL DIAGNOSIS 1. ACL tear 2. Meniscus tear 3. Fracture 4. Juvenile idiopathic arthritis 5. Osteochondritis dissecans TESTS AND RESULTS 3 view x-rays of left knee were obtained and normal. MRI revealed distal femoral osteomyelitis with associated intraosseous and subperiosteal abscess with deep posterior knee soft tissue abscesses. CBC showed WBC 11.7, Hgb 10.5, Hct 32.2, Platelets 576. CRP 9.45 mg/dL, ESR 57mm/hr. FINAL WORKING DIAGNOSIS Osteomyelitis of the left distal femur with intraosseous and subperiosteal abscess TREATMENT AND OUTCOMES 1. Emergent vascular surgery with ligation of L popliteal artery and repair of transected LLE 2. Orthopaedic surgery with internal fixation and fasciotomies with skin closure 3. Pedorthic surgery with fibular head osteotomy and soft tissue reconstruction 4. Rehabilitation and bracing 5. Ongoing physical therapy and pain management. 

Knee Injury - Trampoline
Sabrina P. Sawlani, Brian McCall, Brian J. Donohue. Presence Resurrection Medical Center, Chicago, IL. (Sponsor: Poonam Thaker, FACSM)

HISTORY: 21-year-old male presents to ER for left knee injury after mis-landing a flip while jumping on a trampoline. He hyperextended his left leg, felt a pop and severe pain with numbness of left foot. Notable deformity which self-reduced.

PHYSICAL EXAMINATION: LLE: Ecchymoses and edema of distal thigh, knee and proximal leg. ROM- active and passive knee flexion and extension limited due to pain. DP/PT pulses nonpalpable, capillary refill mildly delayed, and cooler to touch distally. Diminished sensation of dorsomedial foot and lateral leg. Unable to extend toes or dorsiflex ankle. Exam under anesthesia with positive Lachman, anterior drawer, posterior drawer and varus stress tests. 

DIFFERENTIAL DIAGNOSIS:
1. Knee dislocation with vascular compromise and peroneal nerve injury
2. Anterior cruciate ligament tear
3. Posterior cruciate ligament tear and posterolateral corner injury
4. Lateral collateral ligament rupture
5. Meniscus tear
6. Tibial plateau fracture
7. Distal femur fracture

TEST AND RESULTS:
- XR L. Knee 4+ Views: Medial tibial condyle possible fracture.
- CT Angiogram LLE: Popliteal artery severe stenosis at level of tibial plateau. Comminuted medial tibial plateau fracture.
- Diagnostic angiogram: Cut-off of popliteal artery at level of knee, unable to cross with stents.

FINAL WORKING DIAGNOSIS: Left knee dislocation with popliteal artery rupture and left medial tibial plateau fracture

TREATMENT AND OUTCOMES:
1. Emergent vascular surgery with ligation of L popliteal artery and repair of transected L popliteal artery with reverse saphenous vein interposition graft.
2. Orthopaedic Surgery external fixator placement and fasciectomy with skin closure to prevent possible reperfusion injury/compartment syndrome.
3. 2 weeks post-injury, ORIF medial tibial plateau and replaced ex-fix. Delayed ligament reconstructions unnecessary due to ligaments remain stable.
4. 6 weeks post-injury, removal of L leg external fixator. Nonweightbearing in physical therapy.
5. 3 months post-injury, EMG for persistent foot drop with severe L peroneal neuropathy at knee.
6. 4 months post-injury, ambulating.
7. 8 months post-injury, referred to peripheral nerve surgery specialist for decompression of L common peroneal nerve at fibular head, and excision of posterior and anterior cutaneous interosseus septae.

132 May 29 10:30 AM - 10:50 AM Postoperative Knee Complication - Soccer
Kathleen Maguire, Lyle Micheli, FACSM. Boston Children’s Hospital, Boston, MA. (Sponsor: Lyle Micheli, FACSM)
(No relevant relationships reported)

History:
17 year old female status post left ACL reconstruction with hamstring autograft presents one week after surgery with pain and swelling over posterior medial knee. A blood blister was noted and drained. She started on Keflex to prevent superficial wound infection. The following day she returned in exquisite pain with skin discoloration and formation of a collection over the posterior medial knee. This was presumed to be an infected hematoma and she was taken to the operating room for a postsurgical knee washout.

Physical Examination:
Examination noted an abscess at the popliteal fossa medially with surrounding erythema. The area over this collection was warm and tender to touch. The patient had no calf pain or swelling.

Differential Diagnosis:
1. Hematoma
2. Knee infection, bacterial or fungal
3. DVT
4. Contact dermatitis
5. Hemophagocytic lymphohistiocytosis (HLH)
6. Still’s disease
7. Pyoderma gangrenosum
8. Behcet’s

Tests and Results:
1. Single OR tissue culture positive for S. hominis and P. acnes early in hospital course, subsequent OR cultures negative for growth
2. Multiple blood cultures negative for growth
3. OR tissue biopsy shows marked neutrophilic infiltrate and abscess formation, clinically consistent with pyoderma gangrenosum (PG)

Final Working Diagnosis: Pyoderma gangrenosum

Treatment and Outcomes:
1. Surgery: 19 combined orthopedic and plastic surgery procedures including irrigation and debridement, wound VAC changes, and skin grafting of left knee
2. Infectious Disease (ID): Multiple courses of antibiotics for presumed left knee postoperative infection. Antibiotics discontinued once PG diagnosis was established
3. Hematology: PICC related DVT treated with anticoagulation, anemia managed with transfusions
4. Rheumatology/Dermatology: Due to the patient’s highly elevated inflammatory markers, coagulopathy, anemia, and repeated procedures without significant detectable pathogenic organism, there was concern for an immune-mediated systemic inflammatory response. OR tissue biopsy supported this diagnosis. The patient was started on prednisone and Anakinra and the antibiotics were discontinued
5. She completed her course of anticoagulation, weaned off steroids and immunosuppressive medication and had had no recurrent symptoms

A-26 Rapid Fire Platform - Biomarkers in Sport, Performance and Health
Wednesday, May 29, 2019, 9:30 AM - 10:50 AM
Room: CC-Hall WA2

134 Chair: William Byrnes, FACSM. University of Colorado Boulder, Boulder, CO.
(No relevant relationships reported)

Iron deficiency, which can be assessed by the iron storage protein ferritin (fer) can negatively affect athletic performance. We have previously observed that Division 1 cross country (XC) runners have fer levels that are at the low end of normal ranges despite being iron supplemented. The hormone hepcidin and the cytokine/myokine interleukin-6 (IL6) can both influence iron regulation but have not been evaluated in this population.

Purpose:
The purpose of this study was to determine how hepcidin and IL6 change over a season in DI XC runners and determine whether changes in these parameters were related to changes in fer, hemoglobin concentration (Hb) or hematocrit (Hct).

Methods:
45 athletes (25 female, 20 male) were recruited from the University of Colorado Di XC team in the fall of 2017. Fasted blood samples were collected in October (before NCAA XC championships), January, and March (during the outdoor track season). Blood samples were analyzed for Hb, Hct, fer, IL6 and hepcidin. All runners were provided with oral iron supplements from a certified nutritionist during this period.

Results:
All biomarkers remained stable across the season except Hb, which was significantly higher in March. In males vs. females, there were no differences in hepcidin (24 ± 11 vs. 21 ± 11 ng/mL; p > 0.05) or IL6 (16 ± 21 vs. 12 ± 24 pg/mL; p > 0.05). When compared to females, males had higher fer (64 ± 33 vs 47 ± 24 pg/mL; p < 0.05) (50 ± 48 vs 44 ± 3 pg/mL; p < 0.01), and Hb (16.3 ± 0.7 vs 14.8 ± 0.8 g/dL; p < 0.01). After controlling for sex, there was a positive relationship between hepcidin and fer (r = 0.47; p < 0.01); 20% of the variability in fer was explained by hepcidin and 51% was explained by individual variability. There were no relationships between IL6 and hepcidin or IL6 and fer.

Conclusion:
Despite a consistent iron supplementation regime, hepcidin, IL6 and fer do not seem to systematically change across a season in collegiate runners. As expected, hepcidin and fer were positively related, but there were no relationships between IL6 and other measured parameters. Although fer was at the low end of
normal for both men and women, all other parameters were normal at all time points, suggesting that the normal range of fer for endurance athletes may be lower than the normal for both men and women, all other parameters were normal at all time points, suggesting that the normal range of fer for endurance athletes may be lower than the }

138 May 29 10:00 AM - 10:10 AM
Are Molecular Deficits Relevant to Concussion Present in Collegiate Football Players Entering the NFL Draft?
Laura J. Kunce1, John Keenan2, Amanda Carlson-Phillips3, Michael A. Schmidt4, Caleb M. Schmidt5, Zung V. Tran6.

Email: LKunce@thorne.com

(Purpose: Factors that influence individual susceptibility to brain acceleration forces or poor outcomes in brain injury are not well understood. Characterization of molecular markers in athletes entering a highly competitive contact environment may provide additional insight into factors that influence the longitudinal follow-up of concussion incidence and its trajectory. We examined the metabolic phenotype of collegiate football players entering the 2016 National Football League (NFL) draft. The principal aims were to observe and characterize the molecular status of individual athletes and to quantify the prevalence of athletes with multiple concurrent molecular deficits. These will serve as baseline measures, as concussion incidence and trajectory of these athletes will be followed in their NFL careers. METHODS: Blood samples were taken from 30 elite American collegiate football players seven weeks before the NFL scouting combine, and 15 weeks before entering the NFL draft. RESULTS: Of 74 analytes, results revealed four undesirable values in Omega-3 Index (4.66%), AA: EPA fatty acid ratio (29.12%), homocysteine (11.4 µmol/L), vitamin D (30 ng/mL), and magnesium (4.1 mg/dL). Using reference ranges optimized for athletic performance, no athlete had 0, 1 or 2 abnormalities in blood values; 10% had 3, 40% had 4, and 50% of athletes had 5 undesirable values. CONCLUSIONS: Molecular deficits in this cohort entering the NFL draft appear to be common. Historical evidence exists showing that the molecular deficits observed in this study have mechanistic correlations with concussion trajectory and outcome. A more thorough examination of protein expression data that contribute to poor outcomes in concussion may open the door to precision nutrition and clinical countermeasures, not only in football, but in any sport in which acceleration forces to the brain may be present. Supported by WellnessFX.

139 May 29 10:10 AM - 10:20 AM
Associations Between Circulating Basal BDNF, IGF-1 and Physical Fitness
Heikki Kyröläinen, FACSM1, Matti Santtila2, Kai Plihaisten3, Jani Vaara4. 1University of Jyväskylä, Jyväskylä, Finland. 2National Defence University, Helsinki, Finland. 3Finnish Defence Forces, Helsinki, Finland.

(No relevant relationships reported)

Exercise-induced increase in circulating insulin-like growth factor 1 (IGF-1) levels might stimulate brain-derived neurotrophic factor (BDNF) expression. Thus, circulating IGF-1 can travel from the periphery to the brain and stimulate the expression of BDNF and facilitate long-lasting changes in neural activity. It has been shown that chronic training leads to upregulation of basal levels of both BDNF and IGF-1. Several longitudinal studies have also shown that aerobic exercise acutely elevates circulating BDNF levels in humans. PURPOSE: To investigate associations of peripheral BDNF and IGF-1 with several physical fitness components at rest. METHODS: 792 adults (26±16 yr) men participated. BDNF and IGF-1 concentrations were analyzed from venous blood samples using an ELISA Assay (Human BDNF ELISA kit, ScienCell Research laboratories, San Diego, California) and Dynex DS 2 ELISA processing system (Dynex Technologies, Chantilly, Virginia). Cardiorespiratory fitness (VO2max) was determined using an indirect graded cycle ergometer test until exhaustion. Bilateral maximal isometric leg (VCyleg) and arm extension forces (MVcarm) were measured using dynamometers. Muscular endurance tests consisted of repeated 1-min push-ups and sit-ups, while standing long jump assessed muscular power. RESULTS: The mean±SD BDNF and IGF-1 concentrations were 15.2±10.36 ng/ml, 25.0±9.69nmol/l, respectively, while VO2 max was 41.1±8.8 ml/kg/min, MVcleg 33941±933n, MV Carm 871±216N, push-ups 28±14 reps/min, sit-ups 35±12 reps/ min, standing long jump 227±26cm. BDNF and IGF-1 correlated weakly with each
Cyclists often block periodize their training in micro and meso periods with high training volumes to prepare for competition. The effect of such periods on surrogate markers for Relative Energy Deficiency in Sport (RED-S) have not yet been properly investigated. PURPOSE: To determine how a mesocycle of four weeks of interval training affects RED-S associated surrogate markers and performance variables in well-trained male cyclists. METHODS: Twenty-two participants (age: 33.5 ± 6.6 years, height: 181.4 ± 5.2 cm, weight: 76.5 ± 7.4 kg, VO2max: 63.5 ± 6.6 mL·kg⁻¹·min⁻¹) were recruited for a four-week interval training protocol, consisting of three high-intensity interval training sessions per week with an accumulated work duration of 32 minutes per session. Unlimited low-intensity training was permitted. Protocol included pre- and post-intervention assessment of resting metabolic rate (RMR) (ventilated hood), body composition by dual x-ray absorptiometry, blood samples, energy intake and exercise energy expenditure to calculate energy availability (EA), and aerobic- and anaerobic performance. RESULTS: Four weeks of interval training increased aerobic performance (mean ± SD of difference); peak power output: 18.5 ± 12.4 W, (p < 0.001), VO2peak: 1.5 ± 0.2 mL·kg⁻¹·min⁻¹ (p < 0.005), and functional threshold power: 170.7 ± 11.8 W, (p < 0.001) as well as testosterone levels [1.35 ± 2.13 nmol·L⁻¹, (p = 0.011)]. However, triiodothyronine (T3 [0.12 ± 0.18 nmol·L⁻¹, (p = 0.008)] absolute RMR [-52.2 ± 81.4 kcal per day⁻¹, (p = 0.01)], relative RMR [-0.8 ± 1.2 kcal per kg FFM, (p > 0.01)], and RMR [-0.03 ± 0.04, (p = 0.01)] decreased, and cortisol levels increased (49.3 ± 87.3 nmol·L⁻¹, p < 0.02) indicating energy deficiency, while no changes were observed in body weight or -composition, EA, or insulin and insulin-like growth factor 1 (IGF-1). CONCLUSION: A successive four weeks of intensified training increased performance and testosterone levels in this group of well-trained male endurance athletes, although surrogate markers of RED-S such as decreased RMR, T3, and increased cortisol levels were observed. These results indicate the complexity, and the methodological challenges of assessing and evaluating RED-S in male athletes.

May 29 10:30 AM - 10:40 AM
Salivary Biomarkers in College Female Basketball Players during the Late Competition Season
Kevin J. Finn, FACSM, Jack Ransone, FACSM, Michaela Martinez,1 University of Central Missouri, Warrensburg, MO. 1College of William and Mary, Williamsburg, VA. Email: klm2@umw.edu
(No relevant relationships reported)

The college basketball season involves multiple competitions and strenuous practice that have been linked to signs of overtraining. During the late competition period, evaluation of stress and recovery can assist coaches in determining player loads to ensure optimal performance. PURPOSE: To assess factors that reflect on stress and recovery through the study of salivary biomarkers. METHODS: Fifteen members of the college women’s basketball team volunteered to participate. Saliva samples (0.75mL) was collected 24 hours before (pre) and 24 hours after (post) a competition during the last three weeks of the regular season. Salivary samples were stored frozen and then sent to a laboratory for analyses at the end of the study period. Biomarker concentrations were determined using indirect ELIZA for testosterone, cortisol, and secretory immunoglobulin A. In addition, at the time of the saliva collection, subjects were asked to report their perception of overall health, anxiety, mood, and salivary biomarkers were conducted. RESULTS: The means (SD) of the biomarkers and subjective measures are reported below.

None of the salivary biomarkers were significantly different in pre-post comparisons nor across the three weeks. Changes in health scores, anxiety, or mood were not significantly different. Overall the testosterone showed significant correlations with cortisol (r=0.51), sigA (p=0.46), and health score (r=-0.31). In addition, cortisol was significantly related to health score (p=0.24). Health score showed a negative relationship with anxiety ranking (r=-0.30) while no other relationships were evident. Conclusion: The lack of significance between these variables might indicate that these players did not show indication of stress or lack of recovery during this period of competition.

May 29 10:40 AM - 10:50 AM
Salivary IgA as a Predictor of Upper Respiratory Tract Infections in Elite Rugby Union Players
Caoimhe Tiernan, Tom Comyns, Mark Lyons, Alan M. Nevill, Giles Warrington, FACSM, University of Limerick, Limerick, Ireland. 1University of Wolverhampton, Wolverhampton, United Kingdom. Email: caoimhe.tiernan@ul.ie
(No relevant relationships reported)

For athletes to optimise their performance, minimising the risk of injuries and illness is essential to reduce the number of training days missed. Upper Respiratory Tract Infections (URTI) are amongst the most common illnesses reported in athletes. An URTI can result in missed training days, which in turn may lead to performance decrements. PURPOSE: The purpose of this study was to investigate if salivary Immunoglobulin A (sIgA) is a predictor of URTI in elite Rugby Union players. METHODS: Nineteen male elite Rugby Union players provided morning saliva swabs and completed an illness log documenting symptoms of URTI, bi-weekly (Monday and Friday), over a 10-week training period. Test re-test reliability of sIgA was completed under controlled conditions prior to the study. Multi-level logistic regression was used to analyse the relationship between sIgA and the binary outcome of presence or absence of an URTI. RESULTS: The results found that a significant decrease in sIgA ((-0.00537 (0.00268) (beta (SE)), increased the odds of a player contracting an URTI. A player was at a greater risk of contracting an URTI, within the subsequent 2-week period, if sIgA decreased by 65% or more. Conclusion: The results show that sIgA is a useful predictor for determining the likelihood of players contracting an URTI. This results provide coaches with an objective monitoring marker, to help reduce the risk of players contracting an URTI and missed training days, which may lead to performance decrements. These results may assist the coaches and support staff in making evidenced based decisions, where sIgA decreases by 65% or more, by adjusting individual player training load and implementing appropriate recovery strategies to ensure optimisation of training.
Synchronizing cardiac diastole with foot strike during running may maximize the efficiency with which skeletal muscle promotes venous return of blood to the heart. Recent research has found that diastolic stepping results in a lower heart rate (HR) compared to systolic stepping in elite endurance runners. **PURPOSE:** To assess HR, metabolic responses, and perceived exertion to running when foot strike occurs during either cardiac systole (CS) or cardiac diastole (CD) in non-endurance trained individuals. **METHODS:** Eight non-endurance trained participants (7 males; Age: 25.3 ± 8 yr; BMI: 23.6 ± 3.2 kg/m²) performed 2, 5-min bouts of treadmill running at a comfortable pace (5.4 ± 0.5 mph) with foot strike occurring during either CD or CS. Participants wore a chest strap that transmitted accelerometer and HR data to a tablet computer with proprietary software. The software generated an auditory beep that was synched with either 45% (CD) or 100% (CS) of each cardiac cycle. Participants were instructed to match their steps to the beats during both conditions (CD or CS) which was determined between trials and blinded to the participants. **RESULTS:** During relative short, steady-state running conditions, synchronization of foot strike with CD results in a significantly lower HR when compared to CS. This may lead to enhanced cardiac filling, which may be beneficial to running performance in non-endurance trained individuals.

**HEART RATE RESPONSE DURING A COLLEGIATE ESPORTS TOURNAMENT**


During the last decade, electronic sports (esports), or competitive video gaming, has rapidly increased, generating nearly $1 billion per year and is now comprised of millions of gamers around the globe (online and live). However, the physiological effects of these gaming competitions have not been thoroughly examined yet. A myriad of literature focuses on heart rate (HR) and traditional athletic competition but very little research has addressed the heart rate responses of individuals playing competitive esports and none to date have examined heart rate during collegiate competition. **PURPOSE:** To determine the HR response during a competitive live esports tournament in collegiate club esports competitors. **METHODS:** Male members of the University of Mississippi esports team (n=14; age ~ 19.8±1.0 years; BMI = 24.1±5.5; export mean hours per week ~ 18.9±11.6) participated in the study during the Egg Bowl esports tournament. A 5-minute ambient (seated) heart rate was collected using a Polar H10 HR monitor prior to esports competition. Upon sitting on stage, recordings for HR began immediately prior and ended immediately post to their esport match. **RESULTS:** Mean HR conditions during 5-minute ambient was 166±21 bpm. Mean HR conditions during 5-minute ambient was 166±21 bpm. Mean HR conditions during 5-minute ambient was 166±21 bpm. Upon sitting on stage recordings for HR began immediately prior and ended immediately post to their esport match. **CONCLUSION:** Given the elevated HR observed in the study, further understanding of the physiological response to competitive esports in the tournament setting is critical for developing interventions to potentially mitigate the physiological stress experienced by esports athletes.
Heart rate variability (HRV) is used to guide endurance training prescription but the optimal body position for daily recordings is unclear. PURPOSE: To assess supine and standing HRV associations with aerobic fitness and submaximal exercise heart rate (HRex) responses to an aerobic interval session.

METHODS: Healthy women (n = 8, age = 23 ± 3 years) performed a graded treadmill test to determine maximal oxygen consumption (VO$_{2}$max). The exercise intensity at HRV threshold (HRV$_{T}$) under a controlled treadmill incremental exercise test (IET) is considered a practical strategy for cardiac parasympathetic depression and anaerobic threshold assessment. However, the prognostic value of HRV$_{T}$ for outdoor running performance is unknown. PURPOSE: To correlate the exercise intensity at the HRV$_{T}$ assessed during a treadmill incremental test and the 5-km outdoor running time in young men. METHODS: 14 beginner runners (23.5±4.4 yrs, BMI: 23.2±2.7 kg/m$^2$) underwent a treadmill IET. The R-R intervals were collected continuously during exercise testing using a heart rate monitor (Polar® v800) and heart rate variability was analyzed by the SD1 index of Poincaré Scatterplot map. HRV$_{T}$ was considered the load (km/h) corresponding to the point of stabilization at which there was no further significant decline in the values of the SD1 index even with increasing intensity. After a 48h period, the participants individually performed a 5-km running trial on an outdoor 250-m track. The participants were encouraged to conclude the 5-km running test as quickly as possible. Due to non-normality of the data and the sample size, we used the Spearman’s correlation test with p-value set at 5%.

RESULTS: The exercise intensity at HRV$_{T}$ was 7 (7.8-7.6) km/h and the time to complete the 5-km trial was 25.2 (23.2-25.8) minutes. A strong correlation was observed between the treadmill speed at the HRV$_{T}$ and the time expended to cover the 5-km running test (Figure 1).

CONCLUSION: HRV$_{T}$ evaluated during an IET under controlled conditions was negatively correlated with the outdoor 5-km running performance in young non-athlete men. Our results may open a new application to the HRV$_{T}$ as a practical tool for the prognostic evaluation of a 5-km running performance.

Heart rate variability (HRV) responses to an aerobic interval session.

METHODS: Healthy women (n = 8, age = 23 ± 3 years) performed a graded treadmill test for the determination of maximal oxygen consumption (VO$_{2}$max). Over the subsequent 5 days, post-walking measures of supine and standing natural logarithm of the root mean square of successive RR intervals (LnRMSSD) were averaged to establish baseline. Subjects then performed an interval training session consisting of 7 x 3 min of treadmill running at 90% of the velocity attained at VO$_{2}$max (vVO$_{2}$max), with two minutes of walking at 4 km·h$^{-1}$ between sets. Immediately before and 24 h post-interval session, a submaximal test consisting of 3 min of running at 60, 70, 80, and 90% of vVO$_{2}$max was performed with HRex recorded at the end of each stage. HRV measures were recorded the morning after the interval session for comparison to baseline and changes in HRex. RESULTS: VO$_{2}$max ranged from 32.5 - 54.4 ml·kg$^{-1}$·min$^{-1}$. Baseline supine LnRMSSD was significantly associated with VO$_{2}$max (r = 0.77, p = 0.03). No differences in supine (4.26 ± 0.57 vs. 4.30 ± 0.70, p = 0.81) or standing (3.62 ± 0.67 vs. 3.26 ± 0.87, p = 0.98) LnRMSSD were observed between baseline and day 1 post-interval session. However, individual changes in standing LnRMSSD were significantly associated with their changes in HRex at 60% vVO$_{2}$max (r = -0.71, p < 0.05) where those with a decrease in LnRMSSD relative to baseline demonstrated increases in HRex and vice versa. Additionally, we observed a large, non-significant relationship between VO$_{2}$max and changes in standing LnRMSSD (r = 0.69, p = 0.056) where those with reduced standing LnRMSSD relative to baseline at 24 h post-interval session tended to have lower VO$_{2}$max and vice versa.

CONCLUSIONS: These results indicate that standing HRV may provide a better indication of individual exercise responses whereas supine HRV provides a better indication of aerobic fitness level among healthy women.
OBSERVATION OF HEART RATE VARIABILITY RESPONSE TO COLLEGIATE ESPORTS TOURNAMENT

G.B. Rhoden, S. Valladao, T.L. Andre, D. Cox. The University of Mississippi, Oxford, MS

OBSERVATION OF HEART RATE VARIABILITY RESPONSE TO COLLEGIATE ESPORTS TOURNAMENT

Gunter B. Rhoden, Silvio P. Valladao, Thomas Andre, Damon Cox. University of Mississippi, University, MS

(No relevant relationships reported)
active muscle mass, therefore, isometric leg exercise (ILX) (large muscle mass) may have greater potential than isometric handgrip exercise (HGX) (small muscle mass) to evoke PEH. PURPOSE: To determine the impact of a bout of large (ILX) and small (HGX) muscle mass isometric exercise on post-exercise blood pressure. METHODS: Twelve healthy males (23.7 ± 3.5yrs) completed 3 experimental visits (1 HGX, 1 ILX, 1 control (rest no exercise)). Blood pressure (systolic and diastolic; SBP and DBP) was assessed at baseline and at 15, 30, 45 and 60 min post-exercise or control with an automated sphygmomanometer. Isometric exercise consisted of 4 alternating 2 min isometric contractions (quadriiceps (ILX) or handgrip (HGX)) at 30% maximum voluntary contraction. Contractions were separated by 1min of rest. Participants completed each condition on a separate day (order counterbalanced). RESULTS: SBP was lower than baseline at 15 and 45 min post (p=0.013 and p=0.014 respectively); but this did not differ between the control, HGX and ILX conditions (p=0.256; Control: baseline 110 ± 7.3 mmHg, average post 106.7 ± 8.6mmHg; HGX: baseline 110 ± 10.3mmHg, average post 107.4 ± 8.3mmHg; ILX: baseline 113.25 ± 11.7mmHg, average post 111.8 ± 11.2mmHg). DBP did not differ from baseline (Baseline DBP: control 69.17 ± 4.4mmHg, HGX 68.6 ± 7.9mmHg, ILX 72.3 ± 7.4mmHg) at any time point in any condition except peak HR. However, DBP 15 min post was higher in the ILX (73.4 ± 8.9mmHg) vs. the HGX (68.3 ± 7.9mmHg) and Control (68.3 ± 8.6mmHg) conditions. CONCLUSION: PEH did not occur following a single session of either HGX or ILX suggesting that this type of exercise may not be a potent stimulus for PEH in this population, even when engaging the larger quadriiceps muscle mass. Further research is required to identify the importance of the duration and intensity of isometric exercise on post-exercise blood pressure. Funded by NSERC

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Board #13
May 29 9:30 AM - 11:00 AM
The Effects Of Long-term Functional Training On VO2max
Adrian Aron, Heather Cumbela, Emily Hiatt, Ross Copeland, Amanda Slaughter. Radford University, Radford, VA. (Sponsor: Trent Hargens, FACSM)
Email: aaron@radford.edu
(No relevant relationships reported)

High intensity functional training (HIIT) programs have been gaining popularity as an alternative to enhance many fitness domains in a more efficient time period. These programs are characterized by alternation of short periods of intense multimodal exercises with low paced activities or rest. Recent analysis demonstrated inconclusive evidence for beneficial adaptations following short term HIIT participation (Claudino et al., 2018). The current study examined following 5-12 weeks of HIIT training, highlighting the limited evidence for longitudinal aerobic adaptations of HIIT participants. PURPOSE: The aim of this study was to investigate the VO2max changes of long-term participation in HIIT on subjects with previous training experience. METHODS: The subjects were 11 male, 34.7 years ± 8.3, with at least five months of long-term participation in HIIT on subjects with previous training experience. Participants. RESULTS: The subjects were 11 male, 34.7 years ± 8.3, with at least five months of long-term participation in HIIT on subjects with previous training experience. Participants. PURPOSE: To determine if PRIME, improves hemodynamic and vascular profiles in subjects >70y who are at risk for losing functional independence. METHODS: Seventy-five subjects (52 F, Age: 76±5y) were tested at baseline and after 4 wk (Phase I) of either PRIME or AT. All subjects were then enrolled in an 8-wk of combined AT and resistance training (RT) (Phase II). The change scores for (1) Blood pressure (Brachial-B and Aortic-A), (2) Vascular Stiffness (Pulse Wave Reflection-PWR, and velocity-PWV and Augmentation Index AIX) and (3) Vascular function (Brachial artery flow-mediated dilation - BAFMD), were analyzed. RESULTS: At the end of Phase II, there was a significant time effect for B and A blood pressures (SBP= -3.4 ± 11.95, bSBP= -2.77 ± 8.69, dSBP= -2.64 ± 8.66, aSBP= -4.13 ± 11.31, aMAP= -2.42 ± 8.31, and dABP= -1.97 ± 7.40 mmHg, all p<0.05). Additionally, there was a significant effect for time for BAFMD from baseline (4.35 ± 2.90%) for both interventions after Phase I and Phase II (5.25 ± 3.12 and 6.68 ± 2.76% respectively, p<0.01). There was a group effect in favor of PRIME at Phase I for bMAP (4.66 ± 10.08 vs. -0.35 ± 9.11 mmHg), bDBP (4.08 ± 8.27 vs. -0.49 ± 7.56 mmHg), aMAP (4.70 ± 10.08 vs. -0.76 ± 8.60 mmHg), and dABP (-4.32± 7.93 vs. -0.89 ± 6.86 mmHg) (all p<0.05). No significant changes were noted in PWR, PWV or AIX. CONCLUSIONS: These findings confirm that exercise training improves hemodynamic profile and vascular reactivity in individuals >70y. Interestingly, individuals who followed PRIME showed greater hemodynamic benefits at 4 wks. PRIME may represent a novel approach to achieve hemodynamics benefits in individuals with limited cardiovascular function.

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Board #14
May 29 9:30 AM - 11:00 AM
Prime: Hemodynamic/vascular Changes Following Peripheral Focused Low-mass, High-repetition Training In Older Adults
Joaquin Ortiz de Zevallas1, Michael A. Welsch, FACSM2, Mary N. Woesner1, Neil M. Johannsen3, Daniel P. Credeur1, Conrad P. Earnest, FACSM, William E. Kraus, FACSM, Jason D. Allen, FACSM1. 1University of Virginia, Charlottesville, VA. 2University of Mississippi Medical Center, Jackson, MS, USA. 3University of Southern Mississippi, Hattiesburg, MS. 4Texas A&M University, College Station, TX. (Sponsor: Professor Jason D. Allen, FACSM)
(No relevant relationships reported)

Advancing age is associated with changes in arterial structure and function that contribute to increased blood pressure, pulse pressure and cardiovascular disease risk. Exercise training beneficially moderates these risks. Peripheral Remodeling through Intermittent Muscular Exercise (PRIME) is a novel training approach, involving peripheral focused low-mass high-repetition exercises that imposes a low cardiorespiratory strain. Initiation of structured exercise with PRIME rather than aerobic training (AT) yields superior benefits in functional ability/capacity, in elderly subjects. PURPOSE: To determine if PRIME, improves hemodynamic and vascular profiles in subjects >70y who are at risk for losing functional independence. METHODS: Seventy-five subjects (52 F, Age: 76±5y) were tested at baseline and after 4 wk (Phase I) of either PRIME or AT. All subjects were then enrolled in an 8-wk of combined AT and resistance training (RT) (Phase II). The change scores for (1) Blood pressure (Brachial-B and Aortic-A), (2) Vascular Stiffness (Pulse Wave Reflection-PWR, and velocity-PWV and Augmentation Index AIX) and (3) Vascular function (Brachial artery flow-mediated dilation - BAFMD), were analyzed. RESULTS: At the end of Phase II, there was a significant time effect for B and A blood pressures (SBP= -3.4 ± 11.95, bSBP= -2.77 ± 8.69, dSBP= -2.64 ± 8.66, aSBP= -4.13 ± 11.31, aMAP= -2.42 ± 8.31, and dABP= -1.97 ± 7.40 mmHg, all p<0.05). Additionally, there was a significant effect for time for BAFMD from baseline (4.35 ± 2.90%) for both interventions after Phase I and Phase II (5.25 ± 3.12 and 6.68 ± 2.76% respectively, p<0.01). There was a group effect in favor of PRIME at Phase I for bMAP (4.66 ± 10.08 vs. -0.35 ± 9.11 mmHg), bDBP (4.08 ± 8.27 vs. -0.49 ± 7.56 mmHg), aMAP (4.70 ± 10.08 vs. -0.76 ± 8.60 mmHg), and dABP (-4.32± 7.93 vs. -0.89 ± 6.86 mmHg) (all p<0.05). No significant changes were noted in PWR, PWV or AIX. CONCLUSIONS: These findings confirm that exercise training improves hemodynamic profile and vascular reactivity in individuals >70y. Interestingly, individuals who followed PRIME showed greater hemodynamic benefits at 4 wks. PRIME may represent a novel approach to achieve hemodynamics benefits in individuals with limited cardiovascular function.
which negatively affected ratings of LnSleep (2.09 ± 0.06 vs. 1.82 ± 0.35, p<0.05) and LnEnergy (2.04 ± 0.08 vs. 1.73 ± 0.23, p<0.05). No differences in TD (3662 ± 967 vs. 4018 ± 973 mm), HS (641 ± 251 vs. 611 ± 191 mm) or DRPE (602 ± 241 vs. 658 ± 277 au) were observed between tournaments (p>0.05). CONCLUSIONS: Decrements in LnRMSSD were observed in response to the internal, but not domestic tournament, despite no differences in match-physical demands. Thus, factors separate from competition alone (e.g., travel-related stress) may impact players’ physiological response to a tournament.

178  Board #16  May 29 9:30 AM - 11:00 AM  The Effects of an Intensive Endurance Training Period on Nocturnal HRV and Endurance Performance  Piia Kaikkonen1, Juhu Alhmaini1, Tampere Research Center of Sports Medicine, Tampere, Finland. 2Neuromuscular Research Center, Faculty of Sport and Health Sciences, University of Jyväskylä, Jyväskylä, Finland.  (No relevant relationships reported)

PURPOSE: The optimal balance between training load and recovery is essential for the development of physical performance. In the athletic population, relatively good knowledge usually exists of individual tolerance for training. In recreationally training individuals with less training background, the optimal balance may be more difficult to estimate. The main aim of this study was to find out whether a ten-day intensive endurance training period of the non-athletic population is overreaching, and whether the changes in endurance performance can be detected in nocturnal HRV.

METHODS: 13 recreationally endurance trained healthy men (25 ± 3 y, 179 ± 6 cm, 79 ± 14 kg, VO

2max

2 43 ± 6 ml/kg/min) participated in a two-week baseline training period with two exercises in a week (PRE, 30 min at 70 % of P

max

2) and a 10-day intensive training period with nine exercises (INT, 30 min at 70 % of P

max

2). All the exercises on were performed on a bicycle ergometer. Each exercise included a 5-minute warm-up and cool-down (50% P

max

). Maximal aerobic performance test on a bicycle was carried out before and at the end of both training periods. Nocturnal RR-intervals were measured during three consequent nights at the end of PRE and INT. A mean of all three nights was used in the analysis.

RESULTS: Endurance performance improved during the INT (from 294 ± 41 W to 306 ± 41 W, P = 0.006). No change occurred in VO

2max

2 (PRE 45 ± 6, INT 46 ± 4 ml/kg/min). Nocturnal HR (PRE 71 ± 9 bpm, INT 69 ± 9 bpm) or RMSSD (PRE 50 ± 14 ms², INT 54 ± 21 ms²) did not change. Participants were retrospectively divided to higher (Resp+), and lower responders (Resp-), according to the change (%) in Pmax during the INT. Resp+ had lower RMSSD at PRE (38 ± 4 ms² vs. 31 ± 9 ms², P=0.019) and INT (40 ± 4 ms² vs. 33 ± 11 ms², P=0.043) compared to Resp-. No difference in nocturnal HR or Pmax at PRE was detected between groups.

CONCLUSIONS: A ten-day intensive training period was not overreaching for the recreationally trained young men, as the improvement in endurance performance indicates. Despite the rather high training intensity, no change in nocturnal cardiac autonomic function was detected. The results of the present study suggest that in order to improve endurance performance of recreationally trained individuals, relatively high training intensities may be well tolerated.

A-38  Free Communication/Poster - Monitoring  Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  Room: CC-Hall WA2  The Consumer Technology Association (CTA) has guidelines for heart rate that wearable devices should be evaluated second-by-second. However, many investigations in the literature have reported minute-by-minute evaluations.

PURPOSE: To determine whether the interpretation of validity and reliability of three heart rate sensing bra devices during exercise would be similar if data were evaluated second-by-second versus minute-by-minute. METHODS: Nine females completed 14-min protocols while wearing the Sensoria Fitness biometric sports bra, the Adidas Smart sports bra, or the Berlei sports bra concurrently with the Polar H7 heart rate monitor (commercial measure). The protocol involved 1-min standing rest on the treadmill, 3-min walking warm up, 5-min run, 5-min walk. Participants rested between bouts until heart rate was within 10 bpm of resting. Validity was determined through three methods: Mean Absolute Percent Error (MAPE), Bland-Altman bias and Limits of Agreement (LOA), and Intraclass Correlations (ICC). Reliability was determined through ICC analysis, and significance was accepted at p < 0.05. RESULTS: MAPE, bias and LOA, and ICC for second-by-second and minute-by-minute evaluations are shown in table 1. The reliability ICC values are shown in table 2.

Table 1. Validity of heart rate sensing bras evaluated each second versus each minute.

<table>
<thead>
<tr>
<th>Device</th>
<th>MAPE (Sec)</th>
<th>Bias (Sec)</th>
<th>LOA (Sec)</th>
<th>ICC (Sec)</th>
<th>ICC (Min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensoria</td>
<td>1.08</td>
<td>0.98</td>
<td>0.017</td>
<td>-0.07</td>
<td>4.78 to -4.43</td>
</tr>
<tr>
<td>Adidas</td>
<td>3.11</td>
<td>3.04</td>
<td>0.44</td>
<td>-0.10</td>
<td>22.63 to -21.76</td>
</tr>
<tr>
<td>Berlei</td>
<td>1.08</td>
<td>4.81</td>
<td>-0.34</td>
<td>0.40</td>
<td>6.93 to -7.62</td>
</tr>
</tbody>
</table>

Table 2. Reliability of heart rate sensing bras evaluated second-by-second versus minute-by-minute.

<table>
<thead>
<tr>
<th>Device</th>
<th>Reliability ICC (Sec)</th>
<th>Reliability ICC (Min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensoria</td>
<td>0.965</td>
<td>0.956</td>
</tr>
<tr>
<td>Adidas</td>
<td>0.864</td>
<td>0.842</td>
</tr>
<tr>
<td>Berlei</td>
<td>0.961</td>
<td>0.955</td>
</tr>
</tbody>
</table>

CONCLUSIONS: The validity measures of MAPE, Bland-Altman bias and LOA, and ICC appear to be minimally influenced by sampling rate. Reliability measures are consistent regardless of rate. While further investigation is necessary, this data provides evidence that CTA guidelines for heart rate sampling are minimally influenced if taken at longer periods.

180  Board #18  May 29 9:30 AM - 11:00 AM  Validity In Step Counting Of Wearable Devices During Uphill Trail Running  Robert W. Salatto1, James W. Navalta, FACSM, Jeffrey Montes1, Nathaniel G. Bodell1, Jacob W. Manning2, Mark DeBeliso1, FACSM,1 University of Nevada, Las Vegas, Las Vegas, NV. 2Southern Utah University, Cedar City, UT. (Sponsor: James W Navalta, FACSM)  (No relevant relationships reported)

In today’s technological society, there are many options for wearable exercise tracking technology. With a growing emphasis for outdoor recreation, there is a need to validate these devices in a natural setting. PURPOSE: The purpose of this study was to examine the reliability of wearable step tracking devices during uphill trail running. METHODS: Participants (n=12) completed a self-paced one-mile uphill run, wearing step tracking devices including: Stryd Power Meter (criterion) Garmin Fenix 5 watch (wrist), Suunto Sport watch (wrist), Motiv ring (finger), Fitbit Surge 2 (ankle), Polar A360 (ankle), Garmin VivoSmart (ankle), and Samsung Gear 2 (ankle). Validity was determined via Bland-Altman analysis (bias and limits of agreement, LoA), a mean absolute percentage error (MAPE) lower than 10%, and Intraclass Correlation (ICC) greater than 0.70. Significance was accepted at the p < .05 level. RESULTS: The wrist and finger-worn devices were all valid compared to the criterion measure (see table 1). Of the devices secured around the ankle, only the Polar A360 was considered valid for step count (see table 1).

Table 1. Validity measurements for wearable devices during an uphill run compared to the Stryd Power

<table>
<thead>
<tr>
<th>Number</th>
<th>Device</th>
<th>MAPE (%)</th>
<th>ICC, p-value</th>
<th>Bias, LoA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Garmin Fenix*</td>
<td>5.1</td>
<td>0.962, &lt;0.001</td>
<td>-59.87, -229 to 112</td>
</tr>
<tr>
<td>2</td>
<td>Suunto Sport*</td>
<td>8.5</td>
<td>0.971, &lt;0.001</td>
<td>-14.52, -306 to 15</td>
</tr>
<tr>
<td>3</td>
<td>Motiv Ring*</td>
<td>5.1</td>
<td>0.907, &lt;0.001</td>
<td>-29.14, -252 to 31</td>
</tr>
<tr>
<td>4</td>
<td>Fitbit Surge 2</td>
<td>16.1</td>
<td>0.741, &lt;0.001</td>
<td>-254.27, -293 to 783</td>
</tr>
<tr>
<td>5</td>
<td>Polar A360*</td>
<td>9.1</td>
<td>0.774, &lt;0.001</td>
<td>-70.29, -444 to 505</td>
</tr>
<tr>
<td>6</td>
<td>Garmin VivoSmart</td>
<td>11.0</td>
<td>0.506, 0.033</td>
<td>-240.65, -152 to 1041</td>
</tr>
<tr>
<td>7</td>
<td>Samsung Gear 2</td>
<td>12.5</td>
<td>0.785, &lt;0.001</td>
<td>-149.24, -320 to 618</td>
</tr>
</tbody>
</table>

Conclusion: Several devices (1, 2, 3, 5) demonstrated reliable step counting during uphill trail running. The devices that were not valid (4, 6, 7) were attached around the ankle. Results indicate that several valid devices are available for tracking steps in a trail running situation, however caution should be used for choice of wearable and where it is positioned on the body.
The myriad of beneficial effects of strength training are well-known in humans. However, most previous studies have relatively small sample sizes (n<50) and a brief duration of training (<3 months). Furthermore, they lack ecological validity.

**PURPOSE:** In this study, we leverage the widespread usage of smartphones and a mobile app-based strength training program to investigate the development of muscular strength in 5676 free-living humans from 4 months to 4 years. **METHODS:** We studied a dataset consisting of 5676 people with 24,471 total observations over a period of 4 months to 4 years (mean duration 463±271 days). Lower body muscular strength was taken as the estimated 1-repetition maximum (1RM) using the Epley equation for the barbell back squat exercise. Participants must have had more than one estimated 1RM to be included in the analysis during the period in which they participated in a progressive, periodized strength training program consisting mainly of compound exercises 1-3 times per week. A multi-level growth model with random effects was used to describe strength gains. Variables of baseline strength, gender, training experience, training frequency, volume and intensity were also included in the modeling. **RESULTS:** Lower body strength increased significantly over time (L-Ratio = 91985, p < .0001). The mean SE baseline 1RM squat was 98.2±12.1 kg and the largest gains occurred within the first 6 months of initiating the training program (e.g. 3.9±0.1 kg/month from baseline to 6 months; 24% increase) with improvements continuing through year 1 (9.5±1.5 kg/month from 6-12 months; 36% increase from baseline), 2 years (0.9±0.08 kg/month from year 1 to 2; 46% increase from baseline), 3 years (0.5±0.19 kg/month between years 2-3), and 4 years (0.3±0.65 kg/month in years 3-4). **CONCLUSIONS:** This study showed that an app-based strength training program results in substantial and continual increase in lower body strength in a large free-living sample up to 4 years. Subsequent analyses will examine the influence of several demographic and acute training variables and their interactions to confirm and expand upon existing meta-analyses. This study has implications for the application of mobile technology, Big Data, and the Living Lab concept to the field of exercise science.

**Board #20**
May 29 9:30 AM - 11:00 AM
**Validity of the Adidas Smart Bra in Measuring Heart Rate during Exercise Transitions**
Gabriela Guzman, Crystal Maxwell, James W. Navalta PhD., FACSM. University of Nevada, Las Vegas, Las Vegas, NV. (Sponsor: James W. Navalta, FACSM)
Email: gabby10rmz@gmail.com

Wearable technology is becoming very popular, offering a variety of applications for it. **PURPOSE:** The current investigation was designed to evaluate the validity of a heart rate sensing bra during transitions from rest to self-paced running and walking. **METHODS:** Nine females completed a 14-min protocol while simultaneously wearing the Adidas Heart Rate Monitoring Smart Braand Polar H7 heart rate monitor (criterion measure). The protocol involved 1-min standing rest on the treadmill (to determine resting heart rate), 3-min walking warm up, 5-min run, and 5-min walk. The validity of the sports bra was determined by three methods: mean absolute percent error (MAPE), Bland-Altman bias and limits of agreement (LOA), and intraclass correlations (ICC) with a value greater than 0.7 and significance <0.05. Those three methods were used to compare second to second data. **RESULTS:** When all conditions were considered (7596 datapoints), MAPE = 3.11%, bias = 0.44±11.34 and LOA range = -21.75 to 52.23 (ICC=0.902<0.001). For the resting condition (549 datapoints), MAPE = 2.07%, bias = -0.08±3.64 and LOA range = -6.69 to 6.68, and ICC=0.977 (p<0.001). The transition from rest to a walking warm up (1621 datapoints) yielded MAPE = 0.047%, bias = 94.38±13.38 and LOA range = -67.16 to 121.59, and ICC = 0.923 (p<0.001). With respect to the transition from warm up to running (270 datapoints), MAPE = 5.60%, bias = 0.78±18.38 and LOA range = -35.55 to 36.49, and ICC = 0.706 (p<0.001). When the transition from running to walking was considered (2700 datapoints), MAPE = 1.99%, bias = 0.11±1.97 and LOA range = -3.74 to 3.96, and ICC = 0.995 (p<0.001). **CONCLUSION:** These pilot results indicate that the Adidas Heart Rate Monitoring Smart Bra is valid for most conditions (rest, warm-up, walking). Progressing from active warm-up to rest should be viewed with caution, as heart rate measurements were not all valid in this condition.

**Board #21**
May 29 9:30 AM - 11:00 AM
**Impact Identification With Machine Learning From Low Frequency Wearable Sensor Data Among National Ice-hockey Players**
Aaron M. Pilotti-Riley1, Davor Stojanov1, Mohammad Sohaib Arif1, Erik M. Bollt2, Stephen J. McGregor1,1Eastern Michigan University, Ypsilanti, MI. 2Clarkson University, Potsdam, NY. (Sponsor: Dr. Andrew R. Coggan, FACSM)

Purpose
To determine if machine learning approaches could be used to improve impact identification from low frequency data collected from wearable sensors (WS) among national ice-hockey team members.

Methods
23 members of the U.S. National (NTDP) U18 team consented to procedures approved by EMU Human Subjects Committee. Using previously validated impact events identified from data collected at 100 Hz (Impact Processor, Zephyr MD), we used two neural network approaches, autocoder (AE), neural network that can reconstruct inputs of large data sets and multi-layer perceptron (MLP), a neural network that uses non-linear activation of multiple layers of interconnecting nodes as well as support vector machine (SVM) to attempt to improve the identification of impacts from summary data recorded at 1 Hz. A dataset, selected from 8 players with the highest ice time in one game, was comprised of 86 impacts and 8802 samples were used to train the AE. Variables from 1 Hz data used to train the AE included Activity and Peak resultant acceleration as well as Peak and Min accelerations in the Vertical, Lateral and Sagittal planes. The trained AE was then applied to the validated test set from 8 players for 3 games consisting of 409 impacts and 462138 datapoints. Accuracy was determined by F1 score (F1 = 2 * (precision * recall) / (precision + recall)), where precision = true positives / (true positives + false positives) and recall = true positives / (true positives + false negatives).

Results
Using only trained AE, 187 true positives, 3299 false positives and 222 false negatives were identified with an F1 score of 0.96. To improve accuracy, AE was used as filter with MLP for classification, which identified 184 true positives, 225 false negatives and only 26 false negatives resulting in an F1 score of 0.594. Finally, using AE filter and the SVM classifier with class weights produced the best results with 272 true positives, 137 false negatives and only 50 false positives and an F1 score of 0.744.

Conclusion
These data show that using autocoder programming with additional classification (MLP or SVM) impacts can be identified at 1 Hz with relatively high F1 scores in ice hockey using trunk-worn wearable sensors. Finally, using sensor fusion techniques, it is likely impact identification in ice-hockey could be entirely automated.

**Board #22**
May 29 9:30 AM - 11:00 AM
**Monitoring External Training Loads and Neuromuscular Performance For Division I Basketball Players Over the Pre-Season**
Aaron Heishman, Ryan M. Miller, Eduardo D.S. Freitas, Brady S. Brown, Bryce D. Daub, Michael G. Bemben, FACSM. University of Oklahoma, Norman, OK. (Sponsor: Michael G. Bemben, FACSM)
Email: aaronheishman@ou.edu

External training load (TLε) is used to quantify the biomechanical load accrued during training. The countermovement (CMJ) jump is used to evaluate neuromuscular fatigue and recovery in response to TLε. However, limited research has coupled TLε parameters with changes in neuromuscular performance variables from the CMJ.

**PURPOSE:** The purpose of this investigation was twofold: 1) to characterize TLε across the pre-season and 2) examine the differences in TLε per session and CMJ performance across the 5 weeks of pre-season training in NCAA DI basketball athletes. Additional analyses examined the influence of position and scholarship standings.

**METHODS:** TLε was monitored in 14 male athletes during 22 basketball practice sessions over the course of the pre-season. In addition, weekly CMJ scores were used as an indicator of neuromuscular fatigue and performance. A-3-way (2 X 2 X 5) Repeated Measures Analysis of Variance with Bonferroni post hoc analysis was used to examine differences in the average TLε per session each week and differences in the CMJ variables of Flight Time (FT) and Jump Time (JT) and Jump Height (JH) across time and between position (Guard vs. Forward/Center) and academics (Scholarship vs. Walk-on).

Statistical significance was set at p ≤ 0.05. **RESULTS:** Player load per minute (PL; PL/min) was significantly higher during Week 1 and Week 2 compared to Week 3 (p < 0.05). No significant differences were observed for average PL, high inertial moment analysis (IMA), or Total Jumps per session across the 5 weeks of pre-season (p > 0.05). A significant group X time interaction indicated Scholarship athletes had greater PL, PL/min, 2 Dimensional PL, High IMA, and Total Jumps compared to the Walk-on athletes. Player position did not influence TLε. No significant
POURPOSE: Two wrist-worn monitors (FBS and GV) and an armband (SWA) were evaluated in measuring energy expenditure (EE) and heart rate (HR) during a gym-based routine. METHODS: Men (n = 21) and women (n = 16) completed a gym-based routine comprised of 15-min stationary cycling (SC), 15-min treadmill running (TR), and 35-min resistance training (RTR) at self-selected intensities while wearing the monitors. All monitors were compared to a portable metabolic analyzer (OM) for EE. The FBS and GV were compared to a chest HR monitor (PM) for maximal HR (HRmax) and average HR (HRavg). RESULTS: Compared to the OM, the FBS and GV produced higher EE estimates, while the SWA underestimated EE during TR and underestimated EE for the rest (Table 1). Equivalence testing determined that no monitor was equivalent to the OM, although the SWA yielded the most favorable agreement for whole session as the 90% CI (410.9–500.1 kcal) overlapped the higher end of the equivalence zone (423.6–517.7 kcal) by only 12.7 kcal. Acceptable measurement error (≤20%) for whole session was produced by the SWA and for TR by the SWA and GV, while for RTR the GV had the highest measurement error (Table 1). Significant bias was observed for the FBS and GV during SC (10.1 ± 39.2 kcal and 18.6 ± 33.7 kcal), TR (47.4 ± 52.7 kcal and 82.0 ± 79.2 kcal), and whole session (83.2 ± 93.7 kcal and 104.4 ± 131.9 kcal). In regards to HRavg and HRmax, both monitors 90% CIs fell in the equivalence zones with the exception of HRmax measured by the FBS for TR. The GV had an improved accuracy over the FBS as indicated by lower error rates for HRavg (SC: 2.0% vs. 5.9%; TR: 2.4% vs. 3.1%; and RTR: 2.4% vs. 9.5%) and HRmax (SC: 0.8% vs. 1.4%; TR: 0.9% vs. 1.5%; and RTR: 0.9% vs. 7.0%). CONCLUSION: The study protocol simulated real-world conditions to facilitate naturalistic application of the findings. No monitor accurately estimated EE, however, the SWA had the most favorable estimates. The FBS and GV demonstrated comparable performance for both EE and HR estimates.

2

PURPOSE: To test the absolute validity and test-retest reliability in two kinds of pram walking settings and help researchers and postural women to choose suitable tools for monitoring physical activity levels. METHODS: 12 participants who were adult women (23.2 ± 0.7 years old) wore Fitbit Flex 2 on both wrists to perform the outdoor protocol: Two sets of round state distance pram walking of two settings (one round for each setting): (1) Both hands pushing setting; (2) One hand pushing setting. The step counts from Fitbit Flex 2 were compared to video recording to assess the absolute validity and test-retest reliability. RESULTS: The average Mean Absolute Percentage Error (MAPE) of step counts for left and right wrists in both hands pushing setting were -43.1% and -39.9%. In one hand pushing setting, the average MAPE of step counts for wrist of dominant hand was -52.6%, and -51.5% for wrist of non-dominant hand. In both hands pushing setting, the Fitbit Flex 2 had a low correlation (ICC=0.40) for wrist of dominant hands while the correlation of wrist of non-dominant hand was good (ICC=0.85). In one hand pushing setting, the correlations are excellent (ICC=0.99) for wrist of non-dominant hand and moderate for wrist of dominant hand (ICC=0.68). CONCLUSIONS: The absolute validity of step counts for Fitbit Flex 2 was poor when device applied on the wrists of both hands in both hands pushing setting and dominant hand in one hand pushing setting while the absolute validity was high when the device applied on the wrist of non-dominant hand in one hand pushing setting. The test-retest reliability is excellent to good when the device were worn on the wrist of non-dominant hand and moderate to poor on the wrist of dominant hand.

2

PURPOSE: Wearable technology has increased in prevalence and in the ability to monitor health related data. Additionally, the ability to record training data through various sensors has become essential in developing highly personalized training programs. Metabolic measurements have typically been confined to laboratory settings, but portable metabolic carts make the collection of these metrics in real world conditions possible. PURPOSE. The purpose of this study was to compare measurements of VO2 from two different portable metabolic carts, a new consumer focused cart (A) and a research grade cart (B), in outdoor cycling under steady state conditions. METHODS: A total of 10 participants were included in the study. All participants were recreationally trained cyclists who had track racing experience. Participants completed a ramped VO2 max test with lactate sampling from capillary blood at one minute intervals. Lactate threshold (LT) was estimated as the first stage prior to an increase of >1 mmol in lactate concentration. Participants later completed six 10-minute intervals in a pairwise manner at 50, 70, and 85% of their power at LT on an outdoor velodrome. Expressed gasses during these intervals were analyzed by two different portable metabolic carts (A&B). Data from approximately 9-9 min of each interval were averaged. Comparisons between the two devices were made using paired t-tests. RESULTS: Average age of participants was 44.3 ± 3.01 years and VO2max was 51.56 ± 2.74 ml/kg/min. Cart A was unable to capture enough data when cycling at 50% of LT and therefore no comparisons were possible. There were significant differences (p<0.001) in absolute VO2 (1890.0 ± 245.1 ml/min vs. 2627.3 ± 262.0 ml/min) between carts A&B respectively when cycling at 70% of LT. Additionally, there were significant differences (p<0.001) in absolute VO2 (2269.9 ml/min vs. 3609.3 ± 317.5 ml/min) between carts A&B respectively when cycling at 85% of power at LT. Conclusions: Measurements of VO2 while cycling in an outdoor environment may not be consistent across devices. Supported by FAST Grant from Sam Houston State University

WEDNESDAY, MAY 29, 2019
Activity monitors have demonstrated success at facilitating positive physical activity behavior changes in diverse populations by providing self-monitoring, motivation, and timely feedback, yet questions loom due to a paucity of data on the accuracy of arm band heart rate monitors (ABM). Purpose: The purpose of this investigation was to assess the accuracy of the ABM under aerobic exercise conditions. Methods: 15 male and 5 female college students (age 20 ± 1.2 years, body mass 72.8 ± 13.4 kg) engaged in steady state aerobic exercise on a treadmill while wearing the ABM and a hard wire electrocardiograph (ECG). PAR-Q+ and a brief medical screening preceded participation. Resting measures were obtained pre (sitting & standing) and post (sitting) aerobic exercise. The treadmill protocol included 3 minute stages at 1% grade with speeds of 53.6 meters/min, 80.4 meters/min, 107.2 meters/min, 160.8 meters/min, 187.6 meters/min, and a cool-down at 53.6 meters/min. Results: Statistical analysis by paired t-tests revealed NSD between HR of 74 ± 14 & 74 ± 14, 94 ± 14 & 98 ± 14, 120 ± 16 & 121 ± 19, 156 ± 17 & 156 ± 19, 175 ± 17 & 176 ± 17, and 187 ± 16 & 187 ± 16 at min speeds of 80.4, 107.2, 160.8, 187.6, and 214.4 m/min, for ABM & EKG, respectively. Only the 53.6 m/min speed revealed a significant difference in HR of 90 ± 13 vs 92 ± 13 for ABM and EKG, respectively. In addition, there was a high correlation and low standard error between the ABM and ECG measures (r = .998, SE = 2). At speeds of 80.4 (r = .991, SE = .59), 120.7 (r = .992, SE = 1.31), 160.8 (r = .99, SE = .77), and 214.4 meters/min (r = .965, SE = .38), the ABM was also a high correlation and low standard error. Contrary to all other trials, the 53.6 meters/min trial (r = .992, SE = .38) showed a significant difference at the p<.01 level (.004). Conclusion: At all workloads in excess of 53.6 m/min, the ABM provides accurate HR measures, however for the novice exercise enthusiast or the slow paced walker, ABM may be insufficient for accurate HR monitoring.

Purpose: As fitness trackers become more available, the need for independent validation has become more important to drive accuracy in training decisions and physiologic research. Therefore, the purpose of this study was to find the reliability and accuracy of the data collected from the Garmin fenix 3 HR fitness tracker. Methods: 17 healthy, recreational runners (9 male, 8 female, 28.11 ± 7.38 yrs, 70.26 ± 10.76 kg, 173.77 ± 5.96 cm) performed three running conditions (flat, incline 5%), and decline 5%) on an instrumented treadmill used to collect ground reaction force data. Infrared markers were placed on the foot and trunk and tracked with a 16 camera motion capture system. The data was processed using Visual 3D software (5.0, C-Motion, Inc., Germantown, MD,USA) and variables extracted were compared to data collected by the Garmin fenix 3 HR (Garmin Ltd., Olathe KS). Results: Statistical analysis was done via a 2-tailed paired t-test comparing the data taken from the motion capture system and instrumented treadmill to the data collected by the Garmin watch. There were no differences between the Garmin and the treadmill for flat stride length, declined stride length, inclined run cadence, declined run cadence, and inclined ground contact time. Differences (p < 0.05) were observed in inclined stride length, flat run cadence, flat vertical oscillation, inclined vertical oscillation, declined vertical oscillation, flat ground contact time, and declined ground contact time. Conclusion: Overall the Garmin fenix 3 HR fitness tracker was found to be reasonably reliable for certain variables, such as stride length and run cadence, but not reliable for vertical oscillation and ground contact time. Certain considerations should be taken as to the accuracy of the variables when using this data to drive training adaptations.

Purpose: As fitness trackers become more available, the need for independent validation has become more important to drive accuracy in training decisions and physiologic research. Therefore, the purpose of this study was to determine the accuracy of predicted maximal aerobic fitness assessment (VO2max) from the Garmin fenix 3 HR fitness tracker when compared to a lab based VO2max test. Methods: 6 healthy recreational runners (4 male, 2 female, 25.4 ± 2.5 yrs, 69.0 ± 6.9 kg, 174 ± 5.7 inches, 35.4s ± 29.9 km/h) participated in two testing sessions; a graded exercise test to exhaustion (GXT) on a treadmill and a 15-minute submaximal outdoor track session. During the treadmill GXT expired gases were collected and analyzed using a metabolic cart, with the highest value being considered VO2max. Heart rate was measured continuously via telemetry, with the highest value recorded as the maximal heart rate (HRmax). Participants then completed a submaximal outdoor run on a track between 48 hrs and 7 days after the lab test. The outdoor run involved maintaining at least 70% of HRmax for 15 minutes while wearing a Garmin fenix 3 HR watch and Garmin HR monitor chest strap. The watch was reset to default settings prior to inserting participant into data for each test. Statistical analysis was done via a 2-tailed paired t-test, comparing the lab and field measures. Results: There was no difference between the treadmill (51.6 ± 7.8 ml/kg/min) and the Garmin estimated value from the outdoor run (53.2 ± 4.1 ml/kg/min) for VO2max. Conclusion: Overall the Garmin fenix 3 HR fitness tracker was found to provide an accurate estimate of VO2max when compared to an actual GXT. Based on these data it would appear that the Garmin fenix 3 HR watch with chest strap may provide individuals an accurate assessment of their aerobic capacity for simple self-monitoring.

Purpose: The development in sports performance wearable technology has allowed for the monitoring of an athlete’s internal load via surface electromyography (sEMG) based garments. These garments have been shown to be a valid tool for measuring sEMG in sports settings. However, to conduct valid comparisons of sEMG, current methods often involve referencing data from a particular movement to a maximal voluntary contraction (MVC). MVCs are typically measured using an isokinetic dynamometer (ISO); however, with the application of sEMG in a sports environment utilizing an ISO can be impractical. An alternative is the use of manual muscle testing (MMT), in which manual resistance is applied by a trained practitioner to invoke a MVC. The purpose of this study was to compare sEMG-based garment measurement of MVCs elicited using ISO versus MMT in lower extremity muscles. Methods: Twelve healthy, physically active participants (7 males, 5 females) were recruited for this study. Participants were fitted with a sEMG-based compression short or legging embedded with sEMG sensors. Following a dynamic warm-up, participants performed, in a randomized order, either ISO or MMT normalization protocols to measure the MVC of the vastus medialis (VM), vastus lateralis (VL), biceps femoris (BF) and gluteus maximus (GM). Data were sampled at 1KHz and band pass filtered, with the peak amplitude of the MVC used for analysis. Paired samples t-tests (p < .05) were used to compare the mean peak amplitudes from each muscle between ISO and MMT protocols. Pearson’s correlations (p < .05) were conducted to evaluate the degree of the relationship of peak amplitudes obtained by the two protocols for each muscle. Results: No significant difference (r = .47 - .88) were found between any of the muscles when comparing mean peak amplitudes for the ISO and MMT protocols. Significant correlations indicated a positive association between peak amplitudes obtained through ISO and MMT for the VM, BF, and GM were recorded for the ISO and MMT. This suggests that the use of MMT, when administered by a trained member of staff, could be a practical method for normalizing each of the measured muscles to the MVC in a field environment.

Scientific Abstract
Clinical experience highlights the dangers of the sport of mountain biking, with a high volume of collisions, laceration, fractures and concussions. Scientific literature to date has been sparse with regards to injuries in this population. While participation in this sport can transform the lives of the racers with its emphasis on fitness and fun, injuries can significantly limit the student-athlete’s ability to exercise. However, this project has strong potential to make high school mountain bike racing a safer sport.
The increased risk of falling with aging leads to a recurrent problem in elderly in need of long-term care and may become a major social problem. A reduction in the increased risk of falling with aging leads to a recurrent problem in elderly in need of long-term care and may become a major social problem. A reduction in the increased risk of falling with aging leads to a recurrent problem in elderly in need of long-term care and may become a major social problem. A reduction in the increased risk of falling with aging leads to a recurrent problem in elderly in need of long-term care and may become a major social problem. A reduction in the increased risk of falling with aging leads to a recurrent problem in elderly in need of long-term care and may become a major social problem. A reduction in

**CONCLUSION:**

Conclusions account for the most injuries with regard to competitive mountain biking. The variance keeps account for the least amount of concussions, which suggests injury prevention needs to be taught early on to less experienced riders. Safety guidelines on courses, with equipment, and with skills training should be implemented to lower the amount of concussions (and total injuries) for athletes in the coming years.

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**Board #33**

**May 29 9:30 AM - 11:00 AM**

**Does Squat Depth and Width Influence Quadriceps Muscle Activation?**

Matt Denning1, Brad Gardiner2, Tyler Standifird3, Lauren Williams1, 2 Brigham Young University - Idaho, Rexburg, ID. 3 Weber State University, Ogden, UT. (Utah Valley University, Orem, UT. (Sponsor: Doug Powell, FACSM)

(No relevant relationships reported)

Squats are a popular closed-chain exercise that benefit strength, power, and balance. Squats are often performed with varying depths and widths. Squat variation may elicit different demands on the neuromuscular system. PURPOSE: This study investigated muscle activation of the vastus lateralis (VL) and vastus medialis (VM) during 9 different squat variations. METHODS: 13 healthy, college-aged adults (6 female, 7 male, mass = 73.5 ± 15.0 kg, height = 1.7 ± 0.09 m) performed body-weight squats at 3 widths (standard (shoulder width), mid (150% of shoulder width), and wide (200% of shoulder width)) and 3 squat depths (shallow (55 degree knee flexion), parallel (90 degree knee flexion), and deep (125 degree knee flexion)). Electromyography (EMG) and marker data were used to determine peak EMG amplitudes during the eccentric and concentric phases of the squat. 2x3 ANOVAs were used to evaluate the simultaneous effect of squat depth and width on peak EMG amplitude. EMG data were filtered using a root mean square approach and normalized to a 30-degree squat reference position.

**RESULTS:** Generally, muscle activation increased with greater squat depth, but did not change with greater squat width. Specifically, VL amplitude during the concentric phase was 61% and 19% greater during the parallel (232.7 ± 81.5% reference value; p < 0.01) and deep squat (315.2 ± 133.3% reference value; p < 0.01) when compared to the shallow squat (144.2 ± 52.4% reference value). Similarly, VM amplitude during the concentric phase was 70% and 88% greater during the parallel (262.9 ± 207.6% reference value; p > 0.05) and deep squat (292.2 ± 171.4% reference value; p < 0.01) when compared to the shallow squat (144.2 ± 99.8% reference value). Surprisingly, there was no statistical difference in EMG amplitude during the eccentric phase for or by depth interactions (p > 0.05).

**CONCLUSIONS:** These data support the idea that deep squats can be used to generate increased muscle activity of the lower-extremities. Our data also indicate that increased squat width does not increase muscle activity, although our study only examined muscles primarily used for sagittal-plane movement. Further research is needed to investigate the intertwined relationship between squat depth and width on muscle activation for additional lower-extremity muscles.
In muscle fatigue studies, repetitive muscle contractions at a submaximal force level (e.g., 50% of maximum voluntary contraction [MVC]) are frequently used as a fatiguing task such as isometric knee extensions. Contrary to submaximal fatiguing contractions, when MVC is used to induce muscle fatigue, muscle force will decrease despite maximal effort and amplitude and/or frequency of electromyographic (EMG) signals will also change with the development of muscle fatigue. However, it is unclear the effect angle of knee joint on the neuromuscular activation of individual muscles of quadriceps femoris during repetitive knee extension tasks. PURPOSE: We sought of this study was to assess the effect of knee joint angle on the neuromuscular activation pattern of the four individual muscles in the quadriceps femoris during repetitive fatiguing MVCs. METHODS: Fifteen healthy men and women (age, 25 ± 3 years; height, 165 ± 11 cm; weight, 57 ± 10 kg) performed two fatiguing tasks consisting of 40 MVCs at knee joint angles of 90° (flexed) and 140° (extended). Neuromuscular activation of the vastus intermedius (VI), vastus lateralis, (VL), vastus medialis (VM) and rectus femoris (RF) was recorded using surface electrodes, and median frequency (MF) and root mean square (RMS) of EMG signals (normalized by pre-test MVCs) were recorded using surface electrodes, and median frequency (MF) and root mean square (RMS) of EMG signals (normalized by pre-test MVCs) were calculated. RESULTS: MVCs significantly decreased from the 10th to the 40th repetition at both knee joint angles. The MFs of VI and VM in the flexed knee joint angle and that of RF at the flexed knee joint angles were significantly decreased after the 10th repetition. There were no significant changes in normalized EMG amplitude in any muscles specific to knee angle. Stepwise regression analysis revealed predictive synergistic action may take place in RF, VM, and VI in the flexed joint angle and between RF and VM at the extended joint angle. CONCLUSION: These results suggest that neuromuscular activation of RF and VM is independent, but activation of VI and VL is dependent, upon knee joint angle, which may, in part, explain joint angle-specific muscle fatigue.
It has been proposed in the literature that muscle damage may temporarily and negatively affect proprioceptive capacity, which can be tested through the ability to replicate angles, while muscle damage can be verified by quantifying creatine kinase (CK) in the bloodstream.

**Purpose:** To verify the relationship between muscle damage and sense of position in the isokinetic dynamometer, in knee extensions, after an eccentric exercise protocol.

**Methods:** Ten male college students (age: 20.6 ± 1.8 years, body mass: 75.0 ± 11.7 kg, height: 177.4 ± 6.9 cm), with no prior experience with resistance exercises, were submitted to an eccentric exercise protocol, in the isokinetic dynamometer, for induction of muscle damage composed of two phases: 1st phase: 10 sets of 10 repetitions with 30 seconds of rest (100 eccentric contractions) — Speed = 30°/s. There was a 5 minute break between the phases. 2nd phase: 11 sets of 10 repetitions and 30 seconds of rest (110 eccentric contractions) — Speed = 180°/s. To evaluate the muscle damage was used the values of CK peak found in the post-tests shortly after exercise, 24h, 48h, 72h and 96h. To verify the sense of position, the subjects, blindfolded, should find the angle of 60° in the right knee on the isokinetic dynamometer. Was used a subtraction of the target value (60°) by the angle performed by the subjects on the day of CK peak.

**Results:** There was a significant correlation (r = 0.014) between CK and knee position sense, with r = 0.742 classified as strong (Devore, 2006).

**Conclusions:** The induction of muscle damage caused by eccentric exercise significantly influences the subjects' proprioception, since the higher the CK values, the greater the angular discrepancies between the expected value and the one performed by the subjects.

**In a triathlon event, people use various strategies and equipment for enhancing their triathlon performance in each exercise mode (i.e., swim, bike, run). During the swimming portion of a race, triathletes will typically wear a wetsuit that is categorized as either full sleeve or sleeveless. Anecdotally, triathletes may select a sleeveless wetsuit because the full sleeve may increase shoulder movement resistance.**

**Purpose:** To investigate shoulder muscle activity influenced by wetsuit design.

**Methods:** Seven subjects (5 male and 2 female, age: 45.7 ± 8.0 yrs, height: 174.8 ± 10.5cm, mass: 70.1 ± 9.4 kg) participated in the experiment. Muscle activity of the Anterior Deltoid (AD) and Posterior Deltoid (PD) was measured (2000 Hz) using a water proofed electromyography (EMG) system (Mini-Wave, Cometa, Italy). After a self-directed warm-up, participants were asked to swim 50m at a 'somewhat hard' pace that they could maintain the pace for a sprint triathlon distance (750m) for each condition: No wetsuit (NWS), sleeveless wetsuit (SLW), and full wetsuit (FWW). EMG data were smoothed using a 4th order Butterworth filter (cutoff frequency = 4 Hz). The smoothed data were used to identify the beginning and ending points of a stroke cycle. Five consecutive stroke cycles were then extracted for analysis based on maximum strength. The strength balance between dominant (D) and non-dominant (ND) upper limbs is fundamental to develop a good lift and joint safety. The shoulder joint is naturally instable because of anatomic structure, and depends of passive and active elements, ligaments and muscle, respectively, for proper stability.

**Results:** For the ER movements between the dominant (47.8±5.8 Nm.kg−1) and non-dominant (44.3±6.1 Nm.kg−1) sides at the velocity of 60°/s, there was no significant difference between sides in IR (p=0.15; D=71.7±16.3Nm.kg−1, ND=66.1±12Nm.kg−1); and at 180°/s for ER (p=0.24; D=48±5.3 Nm.kg−1, ND=45.7±18.6 Nm.kg−1) and IR (p=0.24; D=68.7±15.5 Nm.kg−1, ND=64.6±8.6 Nm.kg−1).

**Conclusions:** These results indicate that there may be sex-based differences in the physiological underpinnings of impulse generation in trained athletes, particularly in relation to both muscle size and fascicle length of the vastus laterals. Further research should investigate changes in these relationships over time and consider contributions from neuromuscular components.

**Background:** Previous investigations have identified moderate to strong relationships between skeletal muscle architecture (SMA) and performance measures in athletes, however differences between males and females in this regard are not well known. A better understanding of relationships between task-specific impulse windows and SMA in males and females may allow coaches to direct training stimuli toward improving specific morphological underpinnings of sport performance for the athletes under their care. **Purpose:** The purpose of this analysis was to determine relationships between components of SMA and isometric impulse in male and female athletes. **Methods:** Penum angle (PA), fascicle length (FL), and anatomical cross-sectional area (ACSA) were determined for the vastus laterals muscle via β-mode ultrasonography in a group of male (n = 94) and female (n = 61) collegiate, club, and international athletes. Net isometric impulse at 50, 90, 200, and 250 ms was measured during an isometric mid-thigh pull (IMP) test administered pre-season as part of an ongoing athlete monitoring program. **Results:** Pearson product-moment correlation revealed strong correlations between FL and impulse in males (r = 0.33 → 0.36, p < 0.05) but not in females, weak correlations between CSA and impulse in males (r = 0.39 to 0.48, p < 0.05), and weak to moderate correlations between CSA and impulse in females (r = 0.55 to 0.62, p < 0.05). **Conclusions:** These results indicate that there may be sex-based differences in the physiological underpinnings of impulse generation in trained athletes, particularly in relation to both muscle size and fascicle length of the vastus laterals. Further research should investigate changes in these relationships over time and consider contributions from neuromuscular components.

**Background:** Previous investigations have identified moderate to strong relationships between shoulder muscle activity influenced by wetsuit design.**

**Purpose:** To verify the relationship between muscle damage and sense of position in the isokinetic dynamometer, in knee extensions, after an eccentric exercise protocol.

**Methods:** Ten male college students (age: 20.6 ± 1.8 years, body mass: 75.0 ± 11.7 kg, height: 177.4 ± 6.9 cm), with no prior experience with resistance exercises, were submitted to an eccentric exercise protocol, in the isokinetic dynamometer, for induction of muscle damage composed of two phases: 1st phase: 10 sets of 10 repetitions with 30 seconds of rest (100 eccentric contractions) — Speed = 30°/s. There was a 5 minute break between the phases. 2nd phase: 11 sets of 10 repetitions and 30 seconds of rest (110 eccentric contractions) — Speed = 180°/s. To evaluate the muscle damage was used the values of CK peak found in the post-tests shortly after exercise, 24h, 48h, 72h and 96h. To verify the sense of position, the subjects, blindfolded, should find the angle of 60° in the right knee on the isokinetic dynamometer. Was used a subtraction of the target value (60°) by the angle performed by the subjects on the day of CK peak.

**Results:** There was a significant correlation (r = 0.014) between CK and knee position sense, with r = 0.742 classified as strong (Devore, 2006).

**Conclusions:** The induction of muscle damage caused by eccentric exercise significantly influences the subjects' proprioception, since the higher the CK values, the greater the angular discrepancies between the expected value and the one performed by the subjects.
Previous studies have reported that decreases in muscle size and quality of the vastus lateralis (VL) may contribute to the lower vertical jump power observed in old compared to young males. However, we are aware of no previous studies that have examined the contribution of VL muscle size and quality to age-related power differences in females, nor have there been any studies that examined these differences between young, middle, and older age groups. PURPOSE: To determine the effects of age on vertical jump power and muscle size (cross-sectional area (CSA)) and quality (echo intensity [EI]) of the VL in young, middle-aged, and old females.

METHODS: Twenty-six young (age = 22 ± 2 yr; height = 163 ± 7 cm; mass = 61 ± 8 kg), 30 middle-aged (36 ± 5 yr; 164 ± 7 cm; 62 ± 11 kg), and 23 old (71 ± 5 yr; 161 ± 7 cm; 59 ± 10 kg) females underwent two diagnostic ultrasound assessments followed by three countermovement vertical jumps (CMJs). Peak power output (Pmax; W) was measured during the CMJs using a portable force plate. VL CSA (cm²), and EI (AU) were measured on the right leg using a portable B-mode ultrasound imaging device and linear-array probes. One-way ANOVA and post-hoc analyses were used to compare Pmax, CSA, and EI between age groups. Pearson product-moment correlation coefficients (r) were used to examine the relationships between Pmax and CSA and EI.

RESULTS: Higher Pmax and CSA values were observed for the young (Pmax = 2257.40 ± 438.42 W; CSA = 20.59 ± 4.23 cm²) compared to the old (Pmax = 1908.55 ± 242.10 W; CSA = 17.74 ± 1.47 cm²) and middle-aged (Pmax = 1958.20 ± 341.87 W; CSA = 20.04 ± 1.94 cm²) and the middle-aged compared to the old (Pmax = 0.001; CSA = 0.039). EI values for the young (104.29 ± 16.86 AU) and middle-aged (107.71 ± 17.30 AU) were lower than the old (128.35 ± 14.99 AU) (P < 0.001), but they were not different from each other (P = 0.720). There was a significant positive relationship between Pmax and CSA and EI (r = 0.830; P < 0.001) and a significant negative relationship between Pmax and EI (r = -0.442; P = 0.001). CONCLUSIONS: These findings demonstrated that vertical jump power and muscle size and quality decrease with age. The significant relationships observed between Pmax and CSA and EI suggest that these age-related declines in VL muscle size and quality may play an important role in the lower vertical jump power observed in middle-aged and older adults.

CONCLUSIONS: The forward lunge is a common exercise used in strength training and rehabilitation to improve lower extremity strength1,2. In other lower extremity exercises, fatigue from high repetitions has been shown to alter biomechanics and increase injury risk3. Moreover, fatigue responses appear to be gender specific4,5. Therefore, the purpose of this study was to determine the effects of fatigue and gender on lower extremity biomechanics during the forward lunge. METHODS: 29 young adults (13 males) participated in the study. Subjects repeatedly completed a set of 7 walking lunges across a ~8 m walkway and 4 stationary lunges on force plates until fatigued. A fatigued state was identified as two consecutive sets that scored a 9 on a modified Borg RPE scale, or a single set that scored a 10. Vicon motion capture system (Vicon Motion Systems, Oxford, UK) was used to collect the data. Average peak lower limb angles and internal moments of the forward limb were calculated for the baseline set of stationary lunges and the last set (i.e. fatigued set) of stationary lunges. Main effects of gender and fatigue and their interaction were evaluated using a repeated-measures MANOVA. Results: Neither a significant gender × fatigue interaction nor gender main effect at the multivariate level were found. A significant multivariate omnibus main effect of fatigue, however, was detected. Variables that changed with fatigue are outlined in Table 1. CONCLUSION: The increase in hip adduction angle, knee adduction angle, and knee adduction moment with fatigue may stress internal stabilizers of the knee. As such, individuals should exercise caution when performing the forward lunge to fatigue.


Table 2. Average peak lower extremity angles and moments for baseline and fatigued sets (mean ± SE).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline</th>
<th>Fatigued</th>
<th>p</th>
<th>Change from Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip Adduction Angle (°)</td>
<td>3.1 ± 0.9</td>
<td>7.1 ± 0.9</td>
<td>&lt; 0.001</td>
<td>Increase</td>
</tr>
<tr>
<td>Hip Adduction Moment (Nm/kg)</td>
<td>0.3 ± 0.02</td>
<td>0.2 ± 0.02</td>
<td>&lt; 0.001</td>
<td>Decrease</td>
</tr>
<tr>
<td>Knee Adduction Angle (°)</td>
<td>9.8 ± 2.0</td>
<td>28.9 ± 2.0</td>
<td>0.037</td>
<td>Increase</td>
</tr>
<tr>
<td>Knee External Rotation Angle (°)</td>
<td>11.8 ± 1.0</td>
<td>13.5 ± 1.2</td>
<td>0.001</td>
<td>Increase</td>
</tr>
<tr>
<td>Knee Flexion Moment (Nm/kg)</td>
<td>0.3 ± 0.03</td>
<td>0.4 ± 0.024</td>
<td>&lt; 0.001</td>
<td>Increase</td>
</tr>
<tr>
<td>Knee Adduction Moment (Nm/kg)</td>
<td>1.2 ± 0.05</td>
<td>0.9 ± 0.05</td>
<td>&lt; 0.001</td>
<td>Decrease</td>
</tr>
<tr>
<td>Knee Adduction Moment (Nm/kg)</td>
<td>0.8 ± 0.01</td>
<td>1.1 ± 0.01</td>
<td>0.048</td>
<td>Increase</td>
</tr>
<tr>
<td>Ankle Planarflexion Angles (°)</td>
<td>6.9 ± 1.4</td>
<td>11.8 ± 1.6</td>
<td>0.001</td>
<td>Increase</td>
</tr>
<tr>
<td>Ankle Planarflexion Moment (Nm/kg)</td>
<td>0.9 ± 0.03</td>
<td>1.1 ± 0.03</td>
<td>&lt; 0.001</td>
<td>Increase</td>
</tr>
</tbody>
</table>
METHODS: Nine male elite Brazilian handball athletes [21.4 ± 2.1 years; 90.3 ± 10 kg; 187.5 ± 5 cm; 10.5 ± 4.2 body fat; 9.7 ± 1.8 years of training experience; 1.81 ± 0.23 of Relative 1RM back squat (kg/kg); 15 hours of weekly training volume] were recruited into the study. The experimental sessions were performed seven days apart in a counterbalanced order. The athletes were required to complete either a CR protocol or a control protocol (CMJ only). Athletes completed a standardized warm-up consisting of 5 min of light-intensity cycling, static stretching exercises, and three consecutive CMJs. After a 3 min rest period, athletes performed baseline CMJs test. The CR protocol was consisted of three sets of 5 repetitions at 85% of 1RM with 3 minutes of rest between sets. Back squat was loaded with 85% of IRM combining 55% of IRM using weight-plate and 29.7 ± 2.04% of the athlete’s 1RM in full squat exercise (starting position) with elastic band resistance. During control session, the same warm-up routine was included so that the only difference between the PAP and control protocol was the absence of a potentiating stimulus.

RESULTS: One-way repeated measures ANOVA indicated a significant effect of time in CMJ performance within CR condition (p<0.01, n² = 0.39). The vertical jump height was significantly greater (6.5%, ES = 0.85) at 2-min as compared to baseline. No significant differences in jump height were detected when compared with baseline at 4-, 6-, and 8-minute post-exercise. Two-way repeated-measures ANOVA revealed an interaction effect (p=0.05, n² = 0.40) in PAP response. At 2-min, PAP response was significantly larger (4.9%, ES=1.38) in CR condition than control (p<0.05).

CONCLUSIONS: The combination of free weight and elastic bands during heavy squat exercise seems to be effective to create a post-activation potentiation effect to enhance acute neuromuscular performance at 2-min after preconditioning stimulus.

INTRODUCTION: Improvements in immunosenescence have been reported to be associated with regular exercise and physical activity. Multiple investigations have elucidated the effectiveness of aerobic exercise on the attenuation of biological markers of systemic inflammation. However, few studies have evaluated the impacts of resistance training on inflammation, and even fewer have examined the effects of resistance training on salivary biomarkers of inflammation. PURPOSE: To evaluate the impacts of 5 weeks of bench press-only training on salivary biomarkers of inflammation in trained college-age males (N = 23). Pre and post analyses of salivary biomarkers (IL-1β, IL-6, TNFα, CRP, and Testosterone) were conducted. Five weeks of either standard bench press (n = 12) or leg drive focused bench press (n = 11) was completed. RESULTS: No significant (p>0.05) main effects between groups were observed. Within groups measures did reveal that testosterone significantly decreased by 17.0% in the standard bench press group from pre to post (p = 0.02). CONCLUSIONS: Five weeks of bench press training did not alter pre-training levels of inflammation measured in saliva. Subjects were required to be currently training and have completed a minimum of 6 months of resistance training (including bench press) prior to starting this study. Since the bench press was the only training exercise, the intensity of training administered may not have been sufficient to elicit notable alterations in overall inflammatory status in this sample.
The maximal strength training implies the greatest possible activation of the central nervous system, improving inter and intramuscular coordination and causing considerable benefits recognized by the international scientific community. It is well known that the pyramidal training can give powerful performance results thanks to a progressive increase in the load. However, there are different traditional methods to strength training and all have already been successfully tested. PURPOSE: This randomized controlled trial study design with experimenter blinding aimed to compare the effect of different volumes of training. METHODS: Study participants (20 men, age: 23.9 ± 2.05 years, body mass: 75.6 ± 9.45 kg, height: 1.77 ± 0.05 m, body mass index: 24.09 ± 2.46 kg/m²) were assigned to the MST group (n = 10) performed strength training with maximal loads (80-95% of 1RM, 3-min rest) for two sessions per week interspersed with a pyramidal training session (90-sec rest), and PT group (n = 10) performed pyramid training alone (90-sec rest) for three sessions per week. Both groups were assigned to different volumes of training, with the MST group performing 5 sets (MST-5, n = 5), 10 sets (MST-10, n = 5), or 20 sets (MST-20, n = 5) per muscle group per week. Ten repetition maximum (10RM) tests were performed on the chest press, lat pull-down, 45° leg press, and stiff legged deadlift. Muscle thickness (MT) was measured using ultrasound at biceps brachii, triceps brachii, pectoralis major, quadriceps femoris and gluteus maximus. All measurements were performed at the beginning (pre) and after 12 and 24 weeks (post) of training.

**RESULTS:** All groups showed significant increases in all 10RM tests and MT measures after 12 and 24 weeks of TR (p < 0.05). There were no differences in any 10RM test between G5 and G10 (p = 0.05) after 12 and 24 weeks. G5 and G10 showed significantly greater increases of 10RM than G15 and G20 for bench press, lat pull-down and stiff legged deadlift, both at 12 and 24 weeks. There were no group by time interaction for any MT measure.

**Conclusions:** Five to 10 sets per week might be sufficient for bringing about optimal gains in muscle size and strength in trained men over a 24-week period. There appears to be a deleterious effect for higher volumes (≥15 sets per week), especially after 12 weeks of training. These results bring evidence of an inverted “U shaped” curve for the dose response curve for muscle strength, with a possible deleterious effect after exceeding a certain training volume. Whilst the same trend was noted for muscle hypertrophy, the results did not reach significance. Therefore, using low volume RT programs might be an interesting alternative for personal trainers, strength coaches and medical practitioners to increase muscle size and strength in trained men.
Effect of a 2-Week Strength Training Learning Intervention on Self-selected Weight Training Intensity
Sabrina Ahmad, Steve Glass, FACSM, Taylor Gabler. Grand Valley State University, Allendale, MI. (Sponsor: Jeff Potteger, FACSM)

PURPOSE: Research has found that novice clients, fail to self-select weight that is heavy enough to promote strength gain. The purpose of this study was to determine the effectiveness of a 2-week strength training learning intervention with regards to self-selected weight training intensity.

METHODS: Subjects between 18-40 y were placed in a control (CON = n=7) or experimental (EXP = n=8) group. Each subject was provided practice training on 5 resistance training machines (chest press, leg press, triceps extension, bicep curl, shoulder press). On 6 different training days, separated by at least 48h, subjects completed 2 sets on each machine while blinded to the load. CON were instructed to self-select a load to build strength without feedback. Load, repetitions and ratings of perceived exertion (RPE) were recorded. Starting with a self-selected load, EXP were encouraged to lift to fatigue. If EXP exceeded 12 repetitions, the load was increased (Goal- attain 70%1RM). RPE was assessed each set. Post training days, CON and EXP completed self-selection trials for all lifts, plus 3 novel lifts (pec fly, leg extension, shoulder raise). One repetition maximum (1RM) was assessed last. All loads were converted to % 1RM. Comparisons between groups were made using 2Way ANOVA.

RESULTS: For % 1RM there were significant main effects for both condition and day (Day 1 EXP=57.2±12.0%; CON=47.2±13.7%; Day 6 EXP=74.7±10.8%; CON=66.2±13.4%). For repetitions there were significant effects across days (Day 1 EXP=10.8±4.8; CON=12.3±4.6; Day 6 EXP=9.3±3.6; CON=10.1±3.0) with significant interaction effects indicating CON did not change repetition number as load increased. There were significant main effects across days for RPE (Day 1=15.4±2.0; Day 6=16.5±1.9). All loads selected exceeded 60% 1RM indicating that both EXP and CON treatment achieved adequate training loads. However, among the novel lifts only the pec fly was greater than 60% 1RM (pec fly 63.0±11.0%; leg extension 38.9±12.5%; shoulder raise 53.1±11.8%).

CONCLUSION: Two weeks of supervised resistance training resulted in EXP and CON self-selecting loads greater than 60% 1RM. Repeated training exposure resulted in higher self-selected training loads suggesting that repeated exposure to resistance training sessions is an important factor to attain loads that promote strength gain.

Acute Resistance Training Does Not Impair Cognitive Function in Costa Rican Older Adults

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Aging imposes a gradual deterioration of brain function and cognitive abilities, which hinder older adults’ capacity to train and limit their independence and safety at home. The lack of evidence on the acute effects of resistance training (RT) on cognition in older adults. PURPOSE: To determine the acute effect of RT on cognitive performance in older adults.

METHODS: Twenty healthy young men (23.8 ± 0.7 years; mean ± SEM) who have not experienced resistance exercises, were recruited for this study. A variety of intensity (resting, 30%, 50%, and 70% of their predetermined one-repetition maximum (1-RM)) of arm-curl exercise was used to reveal physiological tremor. Total work was held equally by varying the number of repetitions with 5 sets during each of the intensities. The session of intensities was performed in random order with at least a week of wash-out period. The physiological tremor responses were recorded during exercise using accelerometers (3-axis) attached at the dominated wrist and left ear. Also, electromyography (EMG) data were collected from the biceps brachii muscle during the exercise. Physiological tremor and EMG data were shown as average root mean square index.

RESULTS: As we expected, EMG amplitude increased significantly (0.01 ± 0.001 mV, 0.40 ± 0.02 mV, 0.70 ± 0.04 mV, and 1.03 ± 0.05 mV in resting, 30%, 50%, and 70% of RM, respectively, P=0.01) as the intensity of exercise increased. Physiological tremor amplitude significantly increased as the intensity of exercise increased (wrist; 0.08 ± 0.001 m², 0.08 ± 0.002 m², 0.09 ± 0.002 m², and 0.09 ± 0.004 m² in resting, 30%, 50%, and 70% of RM, respectively, P=0.01, ear; 0.01 ± 0.001 m², 0.03 ± 0.001 m², 0.05 ± 0.002 m², and 0.07 ± 0.004 m² in resting, 30%, 50%, and 70% of RM, respectively, P=0.01). EMG amplitude was significantly related to physiological tremor (r=−0.632 and r=−0.649 in wrist and ear, respectively, P=0.01).

CONCLUSION: To our knowledge, this is the first study to suggest the physiological tremor could be an index of the intensity of resistance exercise.

Does the Physiological Tremor Identify the Intensity of Resistance Exercise?
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Although the various methods are commonly used to predict the intensity of aerobic exercise, there is a lack of information on resistance exercise intensity.

PURPOSE: Accordingly, the primary purpose of this study was to determine whether the physiological tremor assessed by accelerometer could recognize the intensity of resistance exercise. METHODS: Twenty healthy young men (23.8 ± 0.7 years; mean ± SEM) who have not experienced resistance exercises, were recruited for this study. A variety of intensity (resting, 30%, 50%, and 70% of their predetermined one-repetition maximum (1-RM)) of arm-curl exercise was used to reveal physiological tremor. Total work was held equally by varying the number of repetitions with 5 sets during each of the intensities. The session of intensities was performed in random order with at least a week of wash-out period. The physiological tremor responses were recorded during exercise using accelerometers (3-axis) attached at the dominated wrist and left ear. Also, electromyography (EMG) data were collected from the biceps brachii muscle during the exercise. Physiological tremor and EMG data were shown as average root mean square index.

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CONCLUSION: To our knowledge, this is the first study to suggest the physiological tremor could be an index of the intensity of resistance exercise.

Average concentric velocity (ACV) during barbell exercises varies inversely as a function of load and can be used for determining training loads. It is unclear if ACV differs between variations of similar lifts such as the conventional deadlift (CD) and sumo deadlift (SD) or between the front squat (FS) and back squat (BS).

PURPOSE: To compare ACV, peak concentric velocity (PCV), and range of motion (ROM) between the FS and BS and between the CD and SD. METHODS: In a randomized order, nine participants (N=9; age: 22±4) underwent one-repetition maximum (1RM) testing for the FS, BS, CD, and SD. The open barbell system was used to measure ACV PCV, and ROM during the 1RM protocol. During the first testing session, height, body mass, femur and humerus length were measured; training age, frequency of training, and estimated 1RM were obtained via questionnaire. Paired samples t-tests were used to determine differences in ACV, PCV, and ROM between the between the FS and BS and between the CD and SD. RESULTS: Paired samples t-tests indicated no differences between the 1RM FS and BS for: ACV (0.24 ± 0.06 vs 0.25 ± 0.06 m/s; p=0.930), PCV (0.66 ± 0.11 vs 0.66 ± 0.16 m/s; p=0.969), or ROM (0.49 ± 0.06 vs 0.51 ± 0.11 m; p=0.819). For the SD and CD there were no differences in ACV (0.27 ± 0.11 vs 0.26 ± 0.08 m/s; p=0.691) or PCV (0.55 ± 0.19 vs 0.51 ± 0.13 m/s; p=0.445) but significant differences were observed in ROM (0.48 ± 0.06 vs 0.53 ± 0.05 m; p=0.015).

CONCLUSIONS: Despite a lower ROM for the SD compared to the CD, bar velocity is similar at maximal loads (e.g. IRM). If using velocity to determine training loads, these data suggest that the same velocity range for regulating training loads could be used for the SD and CD as well as for the FS and BS.
Many resistance training exercises incorporate both eccentric and concentric phases of muscle contraction. Through the stretch shortening cycle, the velocity and magnitude in which the eccentric phase is completed directly affects performance during the concentric phase. PURPOSE: Therefore, the purpose of this research was to investigate the effects of eccentric phase duration on concentric outcomes at 60% and 80% of one-repetition maximum (1RM) in the back squat and bench press. METHODS: Sixteen resistance-trained males (Age: 23.25 ± 2.57 yrs; Height: 171.82 ± 7.48 cm; Body Mass: 81.96 ± 12.16 kg) completed four laboratory visits as follows: Day 1: 1RM testing; Day 2: establishment of normative eccentric durations; Days 3 and 4: randomized fast (0.75 times) or slow (2.0 times) eccentric duration conditions, which were controlled by visual and auditory metronomes. Outcome measures assessed during the concentric phase were: average concentric velocity (ACV), peak concentric velocity (PCV), rating of perceived exertion (RPE), range of motion (ROM), and barbell path. A one-way ANOVA and Pearson’s Product Moment correlations were used for analysis with significance set at p ≤ 0.05. RESULTS: Eccentric duration was significantly and inversely correlated with average concentric velocity (ACV) at 60% (r = −0.408) and 80% (r = −0.477) of 1RM squat and at 100% (r = −0.604) of 1RM bench press. At 60% of 1RM squat, both fast and slow eccentric conditions produced greater (p = 0.001) peak concentric velocity (PCV) than normative duration with fast also producing greater PCV than slow (p = 0.044). Eccentric duration had no impact on RPE, ROM, or barbell path. CONCLUSIONS: Therefore, our results show that well-trained athletes performing a moderately faster eccentric phase may enhance squat and bench press performance. However, caution should be used when interpreting these results as athletes who already perform a fast eccentric duration may not benefit from deliberately increasing eccentric velocity.

Powerlifters often focus more on physiological stresses of programming and performance than psychological stress. However, total allometric load could influence the capacity to generate force. Understanding this relationship can give coaches and athletes tools to optimize workout-life balance. PURPOSE: To determine the effect of psychological stress on force production in distinct populations. METHODS: Competitive powerlifters (PL) and recreationally active college students (RA) were tested. The RA group consisted of 10 men and 13 who performed knee extension and flexion at 2 time points using a Cybex dynamometer: Once during an academic respite and once during exams. Psychological stress was assessed with a 10-Point Powerlifters Stress Scale Questionnaire. Linear regression measured the effect of psychological stress on peak force. The PL group consisted of 26 men and 8 women competing in the 2018 USAPL Raw Nationals. The day before the competition, participants completed as many reps as possible for 60% and 80% of one-repetition maximum (1RM) or 80% 1RM (load and order was randomized) for 8 cam-mediated variable resistance training exercises. For all 8 exercises, Pearson correlation was used to assess correlations between the two were determined for the RT reps achieved at 60% 1RM and 80% 1RM and correlations between the two were determined for the following 8 exercises: bench press (r = 0.83 ± 0.02 reps; r = 0.51), leg press (17.9 ± 5.0 reps to 37.3 ± 15.9 reps; r = 0.63), shoulder press (7.8 ± 2.5 reps to 13.6 ± 3.5 reps; r = 0.59), pull-down (10.3 ± 2.1 reps to 24.1 ± 8.3 reps; r = 0.50), knee extension (11.4 ± 4.7 reps to 17.3 ± 5.8 reps; r = 0.71), knee flexion (12.4 ± 4.5 reps to 23.4 ± 6.7 reps; r = 0.74), elbow extension (12.5 ± 5.0 reps to 23.0 ± 10.3 reps; r = 0.63), and pull-ups (11.2 ± 3.9 reps to 17.3 ± 5.8 reps; r = 0.57). Capturing a true assessment of power in upper body movements is problematic owing to difficulty reproducing a testing environment that matches kinematic profiles performed in sport. New technology permits more accurate reflections of three-dimensional power in isotonic environments. PURPOSE: To quantify power ratios of single-arm and pull exercises across various loads. METHODS: 64 subjects performed a total of 1,145 sets on Proteus (Boston Biomotion, Inc.): 570 sets of single-arm horizontal presses and 575 sets of single-arm horizontal rows. All subjects performed both exercises. Three-dimensional magnetic resistance was applied at 5, 10, 15, 20, and 25lb. ANOVA tested the subjects’ kinematic profile across loads. RESULTS: On average, across all sets, maximum power per set was 175.2 ± 103.6 for presses and 183.6 ± 108.5 for pulls. For mean power throughout a set, subjects achieved 159.5 ± 96.3 for presses and 168.2 ± 102.5 for pulls. The different loads had significant differences for maximum (p = 0.001) and mean (p = 0.001) power; the higher the load, the higher the value in each measurement. At a 5lb load, maximum power (presses and pulls combined) was 31.7 ± 10.8; at a 25lb load, it was 366.4 ± 91.2. The higher the load, the greater the percentage for mean power, at 5lb, subjects achieved 26.8 ± 10.2 while at 25lb, it was 35.1 ± 92.0. Dominant and non-dominant arms were similar in maximum (p = 0.497) and mean power (p = 0.530) although overall, pulling was stronger than pushing. Across all sets and loads, push-to-pull ratio was 0.95:1 for both maximum and mean power. This ratio changes at different loads. For peak power, at 5lb, the push-to-pull ratio was 1.22:1. At 10lb, it was 0.99:1. At 15lb, it was 0.98:1. At 20lb, it was 0.95:1. At 25lb, it was 0.94:1. For mean power, the same pattern, though slightly more extreme, was found. CONCLUSIONS: Numerous investigations have quantified ideal force ratios of the knee while similar assessments of the upper limbs have received relatively little attention. New technology provides a systematic approach to measure strength ratios of the shoulder and elbow in three-dimensional space. In this context, strength ratios change with load; push power exceeds pull power at low loads whereas the inverse is true at higher loads. These strength ratios may be considered for sport application and recognition of risk for upper limb injury.
elbow flexion (9.9±5.4 reps to 17.3±6.4 reps; r = 0.86). CONCLUSIONS: EPs should understand that correlations between repetitions achieved at different loads tend to be moderate.

**Board #62**
May 29 11:00 AM - 12:30 PM
Prioritization of Resistance Training In NCAA Division I Track and Field Athletes

**PURPOSE:** Resistance training is a powerful systemic stimulus known to improve a multitude of physiological variables. These include but are not limited to muscularkeletal strength, power, muscle mass, bone mass, and connective tissue. The sport of track and field is composed of many different events that focus on strength, power, and muscular endurance. Therefore resistance training is typically a vital part of athletic preparation for track and field athletes. The purpose of this study was to investigate specific manipulations of the acute program variables within the off-season resistance training program. METHODS: 34 NCAA Division I track and field student-athletes men participated in 12 week mesocycle of a non-linear periodized training program between the months of September and December. Groups were separated by needs of their athletic event and thus, performance primary goals (Group 1 (Power) n=12, age: 20±1.1±10.0 body mass: 87.8±13.3 kg; Group 2 (Local Muscular Endurance) n=12, age: 21±1.1±10.10, body mass: 82.9±10.4 kg; Group 3 (General Strength) n=10, age: 18.9±0.8, body mass: 80.4±8.1 kg). The training groups prioritized resistance loads and volume for development of power, local muscular endurance, and general strength, respectively. Performance variables were assessed at the beginning and end of this training program and consisted of counter movement vertical jump with arm swing, 1-repetition-maximum in the barbell bench press, and barbell back squat. RESULTS: The primary findings of this investigation are Group 1 saw significant (p≤0.05) statistical increases in vertical jump (4.1±1.0 cm), and back squat maximum (13.1±3.6 kg); Group 2 saw significant (p≤0.05) statistical increases in bench press maximum (14.2±0.5 kg), and back squat maximum (15.0±0.6 kg). Group 3 saw significant (p≤0.05) statistical increases in vertical jump (4.7±0.7 cm) and maximum back squat (20.0±5.0 kg). CONCLUSIONS: Our results showed similar result it was observed only 60% of the BM, whilst results significantly lower than 60%, 70% 80% and 90% of the BM. For 60% of the BM, lower power output was observed when compared to 70%, 80% and 90% of the BM. Finally, no significant differences were observed between 70% and 80% and 90% of the BM, as well as 80% and 90% of the BM. CONCLUSIONS: The results indicate that the optimal load based on BM for HPC exercise occurs at 70%, 80% and 90% of the BM.

**Board #64**
May 29 11:00 AM - 12:30 PM
Comparing Relative Attempt Progressions Of Elite Male And Female Raw Powerlifters
Spencer K. Travis, Caleb D. Bazyler, Michael C. Zourdos, East Tennessee State University, Johnson City, TN. Florida Atlantic University, Boca Raton, FL. (No relevant relationships reported)

**PURPOSE:** In powerlifting, each lifter is given 3 attempts to contest the back squat (BS), bench press (BP), and deadlift (DL). The summation of the best valid attempt for each discipline constitutes a powerlifting total (PT). However, little information is available regarding attempt selection strategies to maximize PT. Therefore, the purpose of this study was to determine and compare the magnitude of load progression from one attempt to the next for each lift between elite raw male and female powerlifters. METHODS: Data used in this study was retrieved from the International Powerlifting Federation (IPF) online database for all Classic World Championships from 2012-2018. Males (n=65) and females (n=41) from all weight classes who completed 9 out of 9 lifts successfully were included in the analysis. A Welch’s-test was used to compare relative attempt progressions (percent increase from attempt 1 to 2 and 2 to 3) between males and females for all lifts with alpha level set at p≤0.05. RESULTS: Relative attempt progression was similar between females (6.08±2.11%) and males (5.59±1.80%) from attempt 1 and 2 on BS and from attempt 2 to 3 on DL (males: 4.33±2.01%; females: 3.75±1.84%). However, relative attempt progression was greater for females compared to males between attempt 1 and 2 on BP (6.55±2.10% vs 5.35±2.12%, p=0.005) and DL (6.76±4.19% vs 5.40±2.28%, p=0.03), and between attempt 2 and 3 on BP (4.28±1.74% vs 2.85±1.24%, p=0.001) and BS (4.04±1.89% vs 3.31±1.43%, p=0.03), respectively. CONCLUSIONS: These data indicate that successful elite male powerlifters are on average more conservative with their attempt progressions for each lift than females. This may be due to differences in opening attempt selection or perceived effort during subsequent attempts between males and females. Importantly, these findings provide general attempt progression guidelines for coaches working with elite raw (i.e., classic) male and female powerlifters.

A-41 Free Communication/Poster - Biomechanics of Resistance Training
Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

**Board #65**
May 29 11:00 AM - 12:30 PM
Validity of the Two-Point Method for Estimating Squat and Bench Press One Repetition Maximums
Brandon W. Snyder, Dylan S. Zangakis, Gavin L. Moir, Shawn N. Munford, Shala E. Davis, FACSM. East Stroudsburg University, East Stroudsburg, PA. (Sponsor: Shala Davis, FACSM) (No relevant relationships reported)

**PURPOSE:** To assess the validity of the two-point method for estimating one repetition maximums (1RM) in the squat and bench press exercises with varied pairs of loads. METHODS: Thirteen resistance-trained men (age: 21.7±0.4 years; height 1.74±0.07 m; mass: 82.9±9.3 kg; 1-repetition maximum (1RM) back squat: 149.9±20.7 kg; 1RM bench press: 114.8±18.5 kg) performed three trials of squat and bench press using the following percentages of 1RM: 20, 30, 40, 50, 60, 70, 80, 90%. The order of the loads was counterbalanced across the participants. The mean vertical velocity of the barbell during the concentric phase of each repetition was recorded using a 3-D motion analysis system (Vicon; 200 Hz). Varied loading pairs (20% & 80%, 30% & 70%, 40% & 60%, 50% & 50%) were selected and regressions were created to estimate 1RMs. Analysis of variance was used to compare differences between the measured and estimated 1RMs for the squat and bench press. RESULTS: No significant differences were found (p>0.05) between estimated and measured 1RMs despite large range of mean differences in the squat (MD: 0.45 kg-27.47kg) and bench press (MD: 1.09 kg-4.33kg). CONCLUSION: The two-point method represents a useful means of estimating 1RM during the back squat and bench press exercises without inducing the fatigue associated with directly measuring 1RM. However, individualized force-velocity characteristics should be considered when utilizing the two-point method for estimating a 1RM.

Abstracts were prepared by the authors and printed as submitted.
The squat is a common and versatile exercise in both the rehabilitation and sports performance settings. Sagittal plane trunk and shank orientations have been theorized to modulate extensor moments at the hip and knee during squatting. For example, increasing trunk inclination is thought to increase the extensor moment at the hip and decrease the extensor moment at the knee, while increasing shank inclination has been theorized to increase the knee extensor moment and decrease the hip extensor moment. Although the influence of sagittal plane tibia and trunk orientations on hip and knee extensor moments have been established in computational models, experimental validation in human subjects is lacking. **Purpose:** To determine the influence of sagittal plane trunk and shank orientations on hip and knee extensor moments during the lowering phase of a barbell back squat. **Methods:** Kinematic and kinetic data were obtained from 8 male and 8 female participants during the execution of 8 different squat conditions in which the tibia and trunk orientations were manipulated. Foot position, bar position, bar load, and stance width were controlled across subjects. Inverse dynamics equations were used to calculate the hip/knee extensor moment ratio at 60, 90, and 120 degrees of knee flexion. Linear regression was used to evaluate the association between the differences in the sagittal plane trunk and tibia angles and the hip/knee extensor moment ratio at each knee flexion angle of interest. **Results:** The difference between trunk and shank inclination explained 67%, 71%, and 67% of the variance in the hip/knee extensor moment ratio at 60 degrees (p<0.001), 90 degrees (p<0.001), and 120 degrees (p<0.001) of knee flexion, respectively. Across all of the examined depths, the squat was deemed to be hip extensor biased (hip/knee extensor moment ratio > 1.0) when the sagittal plane tibia angle exceeded the sagittal plane shank angle. **Conclusion:** The relationship between sagittal plane trunk and shank orientation can function as an acceptable inference as to whether a particular squat technique is hip extensor biased or knee extensor biased.

**It is suggested that verbal commands influence the ability to produce peak force during maximal voluntary isometric contractions (MVC).** When determining peak force capabilities during MVC it is recommended to use the verbal command, as “hard” as possible. Additionally, when instructing conditions to achieve maximal rate of force development (RFD), using the verbal command as “fast” as possible. **Purpose:** To examine the influence of two different verbal commands on peak force production during MVC with the squat condition (Q) and the knee flexion condition (KE). **Methods:** Twenty-five lower-body resistance trained males (n = 16, mean ± SD; age: 21.7±0.4 years; height 1.74±0.07 m; mass 82.9±9.5 kg; squat 1RM: 149.85±22.68 kg; bench 1RM: 114.77±18.47 kg.) performed three trials of squat and bench press using the following percentages of a one repetition maximum (1RM): 20, 30, 40, 50, 60, 70, 80%. The order of the loads was counterbalanced across the participants. The mean vertical velocity of the barbell during the concentric phase of each repetition was recorded using a 3-D motion analysis system (Vicon, 200 Hz) and the GymAware LTP. Analysis of variance was used to assess the differences in the vertical velocities across the seven load conditions for each of the two exercises. **Results:** Mean velocities were significantly different between devices for both the squat and bench press exercises (p<0.05). Specifically the GymAware LTP provided significantly greater velocities under the 20% IRM and 40% IRM load conditions in the squat exercise (mean differences: 0.05±0.03 m/s; 0.02±0.02 m/s; p<0.05) in addition to the 30%IRM load for the bench press exercise (mean difference: 0.04±0.02 m/s; p<0.05). **Conclusion:** The GymAware LTP had a tendency to overestimate maximal velocities during the squat and bench press exercises when compared to the Vicon 3-D motion analysis system, particularly at the lighter loads. Such differences may bring into question the validity of the force-velocity characteristics derived from the LTP device during these resistance exercises.

**Purpose:** To assess the validity of the GymAware linear position transducer (LTP) during the squat and bench press exercises. **Methods:** Thirty resistance-trained men (age: 21.7±0.4 years; height 1.74±0.07 m; mass: 82.9±9.5 kg; squat IRM: 149.85±22.68 kg; bench IRM: 114.77±18.47 kg.) performed three trials of squat and bench press using the following percentages of a one repetition maximum (1RM): 20, 30, 40, 50, 60, 70, 80%. The order of the loads was counterbalanced across the participants. The mean vertical velocity of the barbell during the concentric phase of each repetition was recorded using a 3-D motion analysis system (Vicon, 200 Hz) and the GymAware LTP. Analysis of variance was used to assess the differences in the vertical velocities across the seven load conditions for each of the two exercises. **Results:** Mean velocities were significantly different between devices for both the squat and bench press exercises (p<0.05). Specifically the GymAware LTP provided significantly greater velocities under the 20% IRM and 40% IRM load conditions in the squat exercise (mean differences: 0.05±0.03 m/s; 0.02±0.02 m/s; p<0.05) in addition to the 30%IRM load for the bench press exercise (mean difference: 0.04±0.02 m/s; p<0.05). **Conclusion:** The GymAware LTP had a tendency to overestimate maximal velocities during the squat and bench press exercises when compared to the Vicon 3-D motion analysis system, particularly at the lighter loads. Such differences may bring into question the validity of the force-velocity characteristics derived from the LTP device during these resistance exercises.

**Purpose:** The aim of this study is to find correlations between HRV variables and TLC variables during a half squat movement in young female soccer players. **Methods:** Thirteen professional female soccer players were tested (Age 20.7 years, height 1.72±0.04 m, weight 60.9 kg ± 4.4 kg). We analyzed HRV during standing, we also evaluated the velocity of a half squat movement with a LTP, during a maximal strength test, statistical analyses were performed to determine associations. **Results:** Associations were found between Stress index during standing position and Mean acceleration to Maximal velocity (m/s²) (R²=0.3115, P=0.0381), Mean velocity (R²=0.3284, P=0.0322), Propulsive mean velocity (R²=0.3189, P=0.0334). **Conclusions:** Stress Index (SI) is a variable that reflects sympathetic activation and suggest autonomic reactivity to stress situations indicating an adequate response to confront the demands presented by the sport. Thus, an abnormal sympathetic predominance could result in chronic fatigue which would evolve a SI higher elevation, giving the index greater value. According to our findings the SI during standing position correlated with velocity and acceleration variables during half squat; this suggests that adequate sympathetic reactivity could contribute to the improvement of neuromuscular variables. We hypothesized that SI could be a simple non-invasive way to measure sympathetic reactivity in sports, being part in assessment and monitoring of performance. We also suggest that interventions aimed to improve sympathetic reactivity could improve neuromuscular performance.
PRE-STRETCH AUGMENTATION (PA) AND REACTIVE STRENGTH (RS) INDICES HAVE BEEN USED TO ASSESS THE STRESS-LENGTH CYCLE CONTRIBUTION TO CYCLICAL JOINT STRESS IN THE SPINAL COLUMN. THE MAIN GOAL OF THIS STUDY WAS TO ASSESS THE RELIABILITY OF THE MEASUREMENTS OF THE SPIRAL COLUMN STRESS IN HEALTHY YOUNG ADULTS USING A 3-D MOTION ANALYSIS SYSTEM (VICON; 200 Hz) AND THE GYMWARE ATM. RELIABILITY OF THE GYMWARE ATM WAS DETERMINED USING THE INTRACLASS CORRELATIONS (ICC) AND COEFFICIENTS OF VARIANCE (CV%).

RESULTS: THE GYMWARE ATM SHOWED HIGH INTERSESSION RELIABILITY FOR BOTH EXERCISES WITH ICCs RANGING FROM GOOD TO EXCELLENT (SQUAT: 0.71-0.91; BENCH PRESS: 0.83-0.91). CV% SHOWED PRECISION IN THE RECORDED VELOCITIES DURING BOTH EXERCISES (SQUAT: 0.71-0.91; BENCH PRESS: 0.83-0.91).

underwent the stretching routine and post-tests as previously described. The following measures were made during each test: ROM, thermal sensation (TS), thermal comfort (TC), electromyography (EMG), and the Hoffman reflex (HR). A two-way RM ANOVA detected differences between time (Pre vs. Post), condition (CONTROL vs. M/H vs. P), and any interaction, with post-hoc testing used to indicate directionality (alpha=0.05).

RESULTS: Menthol significantly improved AADF ROM by 2.67 degrees compared to P (p<0.001), coinciding with significantly cooler sensations (p<0.01) and a loss of thermal comfort (p<0.05) with menthol. Similarly, menthol improved WBLT ROM by 2.98 degrees compared to P (p<0.01), coinciding with a significant loss of thermal comfort (p<0.05) with menthol.

CONCLUSION: Menthol appears to improve active joint range of motion during stretches that are held to a maximal tolerable tension. This suggests that one’s perception of tension per se, rather than actual muscle tension, may be more important in determining maximal active joint ROM. It is not clear whether menthol achieves this by specifically reducing one’s perception of muscle tension during a maximal stretch, or whether other sensory inputs arising from menthol i.e. TS, TC, divert attention from it.

Previous research on the link between saddle pressure, rider comfort and urological disorders have focused predominantly on saddle design, bicycle setup and workload. Yet, the effect of chamois design on saddle pressure and perceived comfort during cycling in both men and women remains unresolved.

PURPOSE: In this study we investigated the effects of chamois design on perceived comfort and peak saddle pressure during seated-maximal cycling in men and women.

METHODS: Eighteen subjects (9 M; 9 F) participated in two separate protocols, one laboratory- and one field-based. The laboratory protocol required subjects to ride at 2.5 W/kg for 5 minutes using either a new (A) or old (B) chamois design. Saddle pressure was captured for 30 seconds during each trial. At the conclusion of each trial, subjects were asked to rate the chamois on seven different scales: ‘Overall Comfort’, ‘Saddle Comfort’, ‘Overall Sensation’, ‘Genital Sensation’, ‘Genital Comfort’, ‘Overall Quality’, and ‘Overall Satisfaction’. The field protocol required subjects to complete one week of regular cycling training with a field-based chamois. Subjects were given an opportunity to use each chamois design for one week and were asked to complete the same comfort assessments at the end of each week. A repeated measures, two-way ANOVA was performed to test for main and interaction effects (Chamois x Sex) on saddle pressure and comfort condition for each of the laboratory and field study.

RESULTS: The laboratory protocol resulted in a significant main effect of chamois design on ‘Overall Comfort’ (A>B, p<0.05). The field protocol also resulted in a significant main effect of chamois design on ‘Overall Comfort’ (A>B, p<0.05) as well as ‘Buttocks Comfort’ (A>B, p<0.05). Peak saddle pressures were significantly higher in Chamois B than Chamois A (24.5±3.54 vs. 23.06±3.53 psi, p<0.05). There was a significant main effect of Sex on Genital Sensation and Genital Comfort (Males>Females, p<0.05) under both laboratory and field conditions.

CONCLUSIONS: Chamois design is an important factor that affects both peak saddle pressure and perceived comfort for males and females during cycling. Innovation of future chamois designs should focus on providing individualized comfort for males and females. Further research is needed to investigate the possible link between chamois design and the development of urological disorders.

PURPOSE: To determine the effects of six different crank lengths (150, 165, 170, 172.5, 175, and 180 mm) on gross efficiency, maximum power, optimal pedaling rate (cadence at maximum power), and joint kinematics of the hip and knee.

METHODS: Elite level cyclists (n = 18) participated in two visits to the Cal Poly Cycling Lab. The purpose of the first lab session was to measure VO2 peak (60.6 ± 7.6 mL·min⁻¹·kg⁻¹), participant characteristics (28.2 ± 5.3 years; 175.6 ± 7.4 cm; 70.5 ± 5.3 kg; 255 ± 105 km/week), and complete familiarization trials with four different crank lengths. These practice trials consisted of 4 second seated maximal sprints on the participant’s original crank length (170, 172.5, or 175 mm) and three other crank lengths (150, 165, and 180 mm). The second test session was a single-blind randomized crossover design with the six different crank lengths. After a 5 minute warm up, participants performed a 3 minute steady state effort at 65% VO2 peak and 90 rpm. This was followed by two maximum effort 4 second seated sprints with 90 seconds rest prior to each sprint. Participants rested for 5 minutes before the next crank length test. RESULTS: During steady state cycling, shorter cranks had a higher gross efficiency (150 mm: 22.1% compared to longer cranks (180 mm: 21.6%), (p < 0.001). No significant differences were found between crank lengths for maximum power output during the 4 second sprints. There was an increase in optimal pedaling rate between 150 mm cranks (130 rpm) and all other lengths (180 mm: 120 rpm) (p < 0.001). 150 mm cranks have a significantly smaller hip (45°) and knee (67°) range of motion than all other cranks measured (180 mm: hip 51°, knee 75°) (p < 0.001).

CONCLUSIONS: Shorter cranks resulted in a significantly higher gross efficiency, smaller knee and hip range of motion, and a higher optimal pedaling rate.

PURPOSE: The cyclist’s accommodation on the bicycle is essential to avoid injuries and improve performance. The adjustment of the handlebar range of the bicycle can have similar or contrary effects to the horizontal adjustment of the saddle. The backward position generates pelvic anteversion, decreased hip angle, greater activation of the hamstring muscles, plantar flexors and greater tibio-femoral shearing force. On the other hand, the forward position of the saddle generates retroversion of the hip, increase in the angle of the knee, decrease in the activation of the hamstrings and increase of the strength in the quadriceps and can generate patello-femoral pain.

PROPOSITION: Evaluate the variations in muscular activity and joint ranges of the lower extremities in the cycle of pedaling, by changing the length of the handlebar reach in amateur cyclists.

METHODS: Eight male cyclists (Age: 41.75 ± 10.08 years; Weight: 72.56 ± 5.53 Kg) of right predominance were measured. The hip, knee and ankle joint angles (three-dimensional kinematics) and muscle activity of the Biceps Femoral, Lateral and Medial Gastrocnemius, Lateral and Medial muscles (surface electromyography) and the adjustment of their bicycles in three handlebar lengths were recorded: a) preferred, b) advanced (preferred + 3 centimeters) and c) delayed (preferred - 3 centimeters). It was carried out two stress tests one of incremental load of maximum power and another of constant load to 57% of the maximum power at 90 rpm.

RESULTS: A variance analysis (ANOVA) finding differences in the activation units of the left lateral gastrocnemius muscle in the preferred position vs. back (0.34 vs. 0.18, p = 0.042) and between the position of the left hip at 150° between the forward vs. back position (0.64 vs. 1.01, P = 0.05).

CONCLUSIONS: The modification of the handlebar ranges of the bicycle from the preferred position to the backward one, produces an increase in the angle of the hip generating pelvic anteversion. This variation is presented at 150 degrees of the cycle of pedaling in the transition from maximum power to that of the bottom dead center, with the decrease in the activation of the left lateral gastrocnemius muscle.
Cycling is one of the most popular exercises for knee osteoarthritis (OA) or total knee replacement (TKR) rehabilitation. It is known for reducing load on lower extremity joints compared to walking. One way to fit a bicycle to an individual is adjusting saddle height. There have been limited studies on effects of saddle height on frontal-plane knee joint loading.

**Purpose:** To determine the effects of saddle height and workrate on the knee joint biomechanics.

**Methods:** Fourteen experienced cyclists (age 50-70 years) were recruited from bicycle shops and clubs. Subjects participated in a single testing session that included six test conditions of three saddle heights at two workrates.

Saddle heights were set at 20°, 30°, and 40° of knee flexion while the crank was at the bottom position. Workrate was electronically controlled at 80 and 120 watts. Three-dimensional kinematic (240 Hz, Vicon) and pedal reaction force (1200 Hz, Customized instrumented pedal) data were recorded for five successful cycles in each condition.

Joint kinematics and kinetics were calculated and compared using a 3x2 ANOVA and paired t-tests with a Bonferroni correction. **Results:** There were no significant interactions or saddle height main effect for peak knee abduction moment. There was a significant effect of saddle height on knee extension ROM, peak knee extension moment, and peak knee flexion moment (all p < 0.012). The post hoc comparisons showed that the knee extension ROM was different from one another between 20°, 30°, and 40° saddle heights (80.1° vs. 73.7° vs. 67.6°, respectively). The peak knee flexion moment for 20° saddle height (19.9 Nm) was different from 30° and 40° saddle heights (22.6 Nm and 23.6 Nm, respectively). Additionally, the peak ankle flexion moment was different between all three saddle heights (-33.4 Nm vs. -23.4 Nm vs. -18.9 Nm). There was a significant workrate main effect on knee extension moment. The knee abduction moment was not affected. These results suggest that saddle height adjustment could be a potential and safe method to modulate knee joint moment, the knee abduction moment was not affected. This study was supported by the National Science Foundation (SBR-0651599). The data collection trials were recorded using an 8-camera motion analysis system. The first set of trials consisted of 7 topin forehands struck at submaximal (sM) ball velocities, and the second set of trials consisted of 7 topin forehands struck at maximal (M) ball velocities. A custom-made software was used to obtain the angular position of the shoulder and knee joint at the following 5 time points: 1) end of back swing; 2) lowest point; 3) ball contact; 4) midpoint of follow-through; and 5) end swing. The four outcomes measured at each time point are: a) shoulder elevation; b) shoulder abduction; c) shoulder internal rotation (SIR); d) knee flexion (KF). A multilevel multivariate model was used and included fixed effects for the between-subjects factor sex, and the interaction between sex and velocity. **Results:** No significant effects for sex were found. For outcomes regarding interaction between sex and velocity: 1) during the end of back swing phase, men showed a greater change in KF from sM to M compared to women (49.5 to -59.5 vs -47.1 to -51.2 degrees, p<0.05); 2) during ball contact phase, females showed greater change in SIR from sM to M (-35.4 to -87.5 vs -85.9 to -87.5 degrees, p<0.05); 3) during ball contact phase, males showed less change in KF from sM to M (-26.5 to -26.7 vs -35.4 to -42.7 degrees, p<0.01); 4) during midpoint of follow-through phase, men showed less change in KF from sM to M (-17.7 to -20.0 vs -25.1 to -39.2 degrees, p<0.01).

**Conclusion:** At similar velocities, shoulder and knee angular position do not vary significantly between male and female athletes. When transitioning from low to high velocity swings, significant change is found between sex during knee flexion and shoulder internal rotation.

**Evaluation of Shoulder Muscle Activity Patterns While Swimming in Triathlon Wetsuits**

John Mercer, FACSM, Boram Lim, Cordero Roche, Andy Do.
University of Nevada, Las Vegas, NV.

**Purpose:** To compare shoulder muscle activity patterns between a wetsuit condition (wetsuit condition) repeated measures ANOVA (α=0.05). Results Neither r nor Z-score
for either muscle was influenced by wetsuit condition (p<0.05). PD EMG patterns were moderately correlated between conditions (NWS-LSW NWS-LSL FSW-SLW: r=0.66±0.16, 0.65±0.16, 0.62±0.20) whereas strength of AD correlations were weak (r=0.37±0.33, 0.42±0.19, 0.39±0.21). Conclusion Muscle activity patterns of PD were more strongly similar than AD between swimming with a wetsuit then with a wetsuit as well as between wetsuit conditions. The weaker AD correlations between conditions may be influenced by horizontal position due to buoyancy force and/or possible resistance to shoulder movements of the wetsuit.

### RESULTS

#### Board #82

**Comparison Of Torques And Positions Of The Half And Full Golf Swing - A Pilot Study**

Audrey L. Millar, FACSM, Chris Wendt, Dexter Perkins, Dustin Sellers. *Winston-Salem State University, Winston-Salem, NC.*

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(No relevant relationships reported)

**PURPOSE:** A concern for healthcare workers is how to advise individuals wishing to return to golf following lower extremity (LE) injury or surgery. A common recommendation is to use a half swing, however, it is not known whether this truly reduces the motion or muscular torque for the LE. The purpose of this study was to examine the peak torques and positions of the hip during a half swing versus a full golf. **METHODS:** Five recreational golfers with handicaps ≤ 20, both male and female participated. Participants completed 10 full swings and 10 half swings. A 10-camera motion analysis system, with force plates, was used to record swing data. Data was reduced using a 3-D modeling program and standard inverse dynamics were used to determine internal net joint torques. Peak torques are presented as Nm%BW®Ht and peak position in degrees. Differences were considered significant at the .05 level of probability. **RESULTS:** Subjects average age was 33 ± 17 SD years. The highest torques for the full swing were produced for extension of the trail leg (10.32 ± 1.46), while the half swing trail hip extension torques averaged 8.62 ± 1.84. This was followed by lead hip abduction, with means of 9.9 ± 2.81 and 7.55 ± 2.45 for the full vs half swing respectively. Significant differences for torques between the full and half swing included trail hip extension, internal rotation, and flexion, along with lead hip extension and abduction. The greatest peak positions for the full swing were in trail and lead hip flexion, with values of 44.2°±17.8° and 40.4°±17.3° for trail hip flexion, and 47.8°±20.3° and 44.6°±18.8° for lead hip flexion. There were significant differences for the positions of trail hip flexion, internal rotation, extension, abduction.

**CONCLUSIONS:** The preliminary data show that using a half swing does reduce the amount of internal torque around the hip, as compared to a full swing. Interestingly, the changes in peak position of the hip joint and the torques do not appear to be consistent. Our findings showed a great deal of variability in the amount of movement at the joint both for the full and half swing, thus this may be a source of concern for clinicians. In addition, while some of the hip joint torques were reduced with the half swing, some of the torques were still much higher than previously reported torques for walking and activities of daily living.

### Board #83

**Comparison Of Single-Leg Hopping Parameters Across Different Artificial Turf Systems And Natural Turfgrass**

Brandi E. Decoux, Christopher M. Wilburn, Nicholas H. Moore, Wendi H. Weimar. *Auburn University, Auburn, AL.*

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(No relevant relationships reported)

During locomotion, leg spring parameters are adjusted to maximize efficiency and reduce injury risk based on the stiffness of the surface. **PURPOSE:** This study compared leg spring parameters during single-leg hopping on different modern sports turfs, including three artificial turf systems with different structural components and a natural turfgrass surface. **METHODS:** Seven participants (ages 19-30 yrs; height = 1.79 ± 0.08 m; mass = 75.9 ± 10.1 kg) were recruited for this study. Each participant performed three trials of single-leg hopping in place on each of the four surfaces at a self-selected pace. Kinematics were collected using the Xsens MVN Avail sensor motion capture system. Data were then imported into Visual3D where estimated ground reaction force and subsequent leg spring parameters were computed. For each participant, vertical stiffness and hopping frequency data from three trials for each of the four surface conditions were included in the statistical analysis. **RESULTS:** A repeated-measures MANOVA indicated significant differences present between surface conditions for vertical stiffness (F[6,15] = 3.48, p=0.023, η²_p = 0.031). Post hoc analyses revealed greater stiffness for natural turfgrass (21.6±6.2 kN/m; p <0.01) than the artificial turf systems. **CONCLUSIONS:** Modern artificial turf system innovations continue to utilize various structural components in an effort to reduce the overall stiffness of synthetic surface. However, it appears that individuals still interpret some artificial turfs to be stiffer than alternatives and therefore lessen the vertical stiffness of their leg spring while maintaining their preferred self-selected hopping frequency.

### Board #84

**Injuries In Lower Legs Related To The Unipodal Dynamic Stabilization**

Alba Lopez1, Rodrigo Argothy2, Jenifer Cubides1, Daniel Cohen1. *Rosario University, Bogota D.C., Colombia. 1Biomechanics Laboratory - Sports Science Center - Codieportes, Bogota D.C., Colombia. 2Military school of cadets “General José María Córdova, Bogota D.C., Colombia.*

(No relevant relationships reported)

**PURPOSE:** The instability of the knee and ankle joints are the main risk factors for injuries of the musculoskeletal system and soft tissues when they are subjected to high training loads, as is the case of the military in initial training. The lower leg is subjected to accelerations, decelerations, changes of direction and jumps that involve high loads that must support the most distal and intermediate joints in order to absorb the impacts. The measurement of stability is routinely used to measure the risk factors of injury to the ankles and knee, being the most frequent in military training. **METHODS:** To determine the risk of lower train injury in Colombian military personnel by analyzing the dynamic stability.

**RESULTS:** The number of total subjects, 41 presented lesions in the lower limbs during follow-up, correspond to 33.1%. The logistic regression model developed to determine the risk factors associated with injuries in lower limbs, presented a significance of the model of P = 0.017, with a probability of success of 70%. The variables: Body mass index (OR 1.001, 95% CI 0.843 -1.181), gender (OR 2.709, 95% CI 1.15 - 6.37), the difference of the right-left stabilization time (OR 0.66, 95% CI 1.33 - 32.14), the percentage of asymmetry of the stabilization time (OR 1.02, 95% CI 0.999 - 1.043), the percentage of asymmetry of the peak force (OR 1.015, 95% CI 0.977 - 1.055), are those that best predict the model.

**CONCLUSIONS:** The stabilization time is a strong predictor of risk factors for lower leg train injuries. Likewise, gender and dominance of the lower limb are determining factors in the development of injuries under military training. Based on the results, it is considered a tool that can help to measure the risk factors in the military population in training and the controls throughout their training.

### Board #85

**Changes In Complexity At Maximal Speeds May Not Influence Functional Performance Immediately After: Pilot Study**

Jacqueline Morgan1, Alexis Nelson2, Megan Briley3, Max Paquette2, Douglas Powell, FACSM2. *Virginia Commonwealth University, Richmond, VA. 1Virginia University, Memphis, TN.*

(No relevant relationships reported)

Regulatory statistics have previously been used to quantify nonlinear characteristics of gait and inert changes in central regulation of movement. Evaluating changes in movement complexity under varying running conditions is essential as alterations in central regulation may influence performance. However, few studies have characterized movement complexity during functional performance tests. **PURPOSE:** To study changes in complexity during an incremental running test to maximal speed, and during a single leg hop (SLH) test performed immediately before and after. **METHODS:** Seven healthy runners (25.8±4.9 yrs) performed a 30s SLH test before and after an incremental running test on a motorized treadmill using 4-minute stages (preferred, 10, 12, 14, 16, 18km/h) until volitional exhaustion. Three-dimensional accelerations of the pelvis were recorded using a triaxial accelerometer (100Hz, G-Walk, BIS Bioengineering, Milan, IT) fixed to the pelvis. The last 30s of each running speed and SLH were analyzed using multiscale entropy (MSE) across 5 time scales. Sample entropy estimates (m=2, r=2) for each scaled time series were summed across all scales to compute complexity index (CI). Paired t-test were employed to compare CI measured from SLH tests and repeated measures ANOVAs with a Bonferroni correction were employed to compare differences in CI between stages for each participant. If significant, Dunnets’s test was employed to compare fastest and slowest stages with preferred. Vertical accelerations are reported. **RESULTS:** Testing was completed by runners as follows: stage 4 N=7, stage 5 N=5, stage 6 N=3. Mean differences in CI were significant for 4 of 7 runners (p<0.007). Post hoc analyses revealed greater CI in the final stage versus preferred (Δ0.62±0.1; A1.11±0.01; Δ0.35±0.03; Δ0.49±0.07, p<0.01) while no differences were observed in the slowest stage. No change in SLH CI was found between pre- vs post-run tests (p=0.33).
2.25±0.9 vs 2.14±0.7). CONCLUSION: At maximal speeds, an increase in system adaptability was observed compared to preferred running, however, this increase was not transferred to functional performance immediately and after. An increase in complexity during perturbed running and not hopping may be due to dissimilarities in task difficulty and constraint type experienced by the runners.

**RESULTS:** Points. A VG, RMS, and movement time were each analyzed using a 2 (jump type) x 2 (environment) ANOVA with repeated measures on both factors. Acceleration was calculated for each sensor with a composite score calculated as the average of the signals of the muscle activity. Each sensor measured EMG as well as kinematics.

**PURPOSE:** The aim of this study was to compare muscle magnitude and patterns of key lower extremity muscles while performing plyometrics on land and in shallow water. METHODS: 10 Subjects (7 males; age:28.6±6.3 yrs, height:69.4±2.9 in, mass:82.1±8.4 kg, 3 females; age:45.7±6.8 yrs, ht:69.6±3.2 in, mass:84.2±8.3 kg) performed two plyometric exercises (countermovement jump (CMJ), drop jump (DJ)) while in two different environments (on land, in shallow water). A water proof electromyography (EMG) system (Cometina Miniwave Infinity, 2000 Hz) was used to record the signals of the muscle activity. Each sensor measured EMG as well as accelerations (3 dimensions). Four muscles (rectus femoris (RF), bicep femoris (BF), gastrocnemius (GA) and tibialis anterior (TA)) were used to capture EMG data. DJ trials were initiated from a 30.5 cm platform and under conditions was always land followed by water. Depth of water was set to go no higher than xyphoid process level and no lower than the navel while standing.

DATA ANALYSIS: Resultant acceleration was calculated for each sensor with a composite score calculated as the sum of the resultant acceleration for all sensors. This signal contained a peak upon initiating movement and a peak upon landing to end the movement. These peaks were identified, and EMG data were extracted 0.25 s before and after these discrete events to represent beginning and ending of analysis. Average (AVG), root mean square (RMS) and movement time were each calculated between the two extraction points. AVG, RMS, and movement time were each analyzed using a 2 (jump type) x 2 (environment) repeated measures ANOVA (p<0.05). RESULTS: EMG (AVG or RMS) was not influenced by the interaction of environment and jump type (p=0.05); nor was there a main effect for jump type or environment for any muscle that was measured (p=0.05). However, BF_RMS was different for jumps regardless of environment (p=0.05). CONCLUSION: Muscle activity magnitudes appears to be not influenced between environments for CMJ and DJ for any of the four muscles measured.

The relationship between hip flexion, abduction, and external rotation torque has been correlated to frontal plane biomechanics during functional tasks like the single leg squat. Altering testing position has been identified to influence torque output for hip extension, abduction, and external rotation. However, comparing the relationship between hip torque at different testing positions and frontal plane hip and knee squating kinematics has yet to be evaluated.

**Purpose:** To assess the influence of testing position on hip torque and relationships with frontal plane kinematics in females.

**METHODS:** Isometric hip torque was assessed in 19 college aged females at varying degrees of hip flexion. Torque was assessed with hand-held dynamometry for hip extension (0, 45, and 90 degrees of hip flexion); hip abduction (-5, 0, and 45 degrees of hip flexion); and hip external rotation (0, 45 and 90 degrees of hip flexion). Five single leg squats were also completed for 2-dimensional analysis of frontal plane hip and knee kinematics. Repeated measures ANOVAs were used to evaluate differences in hip torque across testing positions. Relationships between hip torque and frontal plane hip and knee kinematics during a single leg squat were explored with correlations. Significance was set at p<0.05. RESULTS: Greater torque was seen during hip extension at 90 vs 0 (0.44±0.15Nm/kg*m) and 45 (0.32±0.14Nm/kg*m) and 45 (0.50±0.19Nm/kg*m) degrees of flexion (p<0.001).

A significant difference in hip abduction torque was seen at 45 degrees of hip flexion (0.44±0.15Nm/kg*m) compared to both -5 (0.58±0.21Nm/kg*m) and 0 (0.63±0.24Nm/kg*m) degrees testing position (p<0.001). No differences in torque were seen for hip external rotation. Significant, positive, and moderate correlations were seen with hip extension torque and hip adduction kinematics at 90 degrees of hip flexion (r=0.54, p<0.01) compared to 0 (r=0.49, p=0.03) and 45 (r=0.47, p=0.039) degrees of hip flexion. No significant correlations were seen between squatting kinematics and hip abduction or external rotation torque. CONCLUSION: Positioning alters hip torque in healthy aged females but does not influence the relationship between torque and lower extremity kinematics of a single leg squat. Acrobatic performers are in essence professional athletes who are employed in the entertainment industry for a vast amount of time. However, there is limited research examining skills through a biomechanical lens. Challenges with analyzing these skills include that the movements can be quite unique to an artist and/or highly complex movement patterns. There may be some insight gained by examining certain basic components of a skill (e.g., landing) that may give some relevance to overall performance. However, there is limited research describing the entirety of a specific movement skill.

**PURPOSE:** To describe peak forces during certain acrobatic skills performed by a professional artist. METHODS: A professionally trained male artist (age: 24 yo; mass: 65.8 kg) participated in this study. The subject visited the laboratory on one occasion where he performed eight different acrobatic skills. Data collection consisted of the subject performing the movements on top of two force platforms (Kistler) and recording full body kinematics using a 3D motion capture system (Vicon). Movement skill was performed twice with some movements including multiple repetitions of a skill (e.g., one-hand hops). In movements that included at least four repetitions, peak forces were identified and averaged. In movements where only two repetitions were recorded, maximum peak force of the repetitions was described. Kinematic data were used to identify which body part was in contact with the ground that corresponded to the force peak. RESULTS: Average peak forces were one hand hop hand 3.60±0.10 BW, air hand (hand) 9.21±0.31 BW, air hand (head) 3.64±0.57 BW, and flare 2.54±0.43 BW. Peak forces for jump/land tasks for jump and landing phases: maximum vertical jump 3.08 BW (jump), 5.80 BW (land), front flip 2.22 BW (jump), 10.97 BW (land), back flip 2.88 BW (jump) 11.94 BW (land), single leg jump right leg 2.29 BW (jump) 4.07 BW (land), and single leg jump left leg 2.27 BW (jump) 4.20 BW (land). CONCLUSION: Interestingly, peak forces during movements where the hand or head were in contact with the ground were similar in magnitude with landing on the feet from a vertical jump. The collection of these data could be helpful for these types of athletes for injury prevention, enhancement performance of these skills or overall performance.
leading to the findings of reference values of the asymmetries in the Colombian military population. Particularly, the eccentric deceleration TDF was used as a reference marker to evaluate injury risk factors and neuromuscular performance in Colombian military.

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Board #90
May 29 9:30 AM - 11:00 AM
Gender Differences Between Muscle Activation during Star Excursion Balance Test on Stable Versus Unstable Surfaces
Navipreet Kaur, Kunal Bhanot, Germaine Ferreira. University of Saint Augustine for Health Sciences, AUSTIN, TX. (Sponsor: Dr. John Mercer, FACSMD)
Email: nkaur@usa.edu

(A no relevant relationships reported)

Anterior (A), posterior-medial (PM), and posterolateral (PL) directions of Star Excursion Balance Test (SEBT) are used for rehabilitation. Adding unstable surface to the task has been reported to change electromyographic (EMG) activity. Studies have also reported differences in EMG between males and females. PURPOSE: To compare EMG of lower extremity (LE) muscles between males and females during SEBT on stable and unstable surfaces. METHODS: Surface EMG was collected on 10 male and 10 female healthy adults for gluteus maximus, gluteus medius (GMED), medial hamstrings, biceps femoris (BF), vastus medialis (VM), rectus femoris (RF), vastus lateralis (VL), anterior tibialis (AT), and medial gastrocnemius (MG) on the stance leg during SEBT. Unstable surface was introduced using TherabandTM stability trainer. Independent t test assessed differences in EMG between males and the variable of angle for each direction and each muscle during SEBT for both stable and unstable. Paired t tests were run separately for males and females to determine difference in each direction for each muscle between stable and unstable surface with α at 0.05. EMG were reported as the percentage of the maximal voluntary isometric contraction (%MVIC). RESULTS: Females showed significantly higher EMG than males for AT in PL direction (63±14 vs 47±12 %MVIC; P<0.01) on stable surface and A (63±14 vs 47±12 %MVIC; P<0.01) and PM (64±15 vs 47±14 %MVIC; P<0.02) directions on the unstable surface and MG in PL (44±17 vs 25±17 %MVIC; P<0.02) direction on stable surface and A (62±23 vs 37±20 %MVIC; P<0.02), PL (76±29 vs 45±25 %MVIC; P<0.02), and PM (58±26 vs 36±20 %MVIC; P<0.04) directions on unstable surface. EMG was higher for unstable surface in females for VM, RF, and VL in the A direction (p<0.05) and MG in all three directions (p<0.05) and in males for GMED, VM, RF, VL in the A direction (p<0.05) and BF and MG in the PM direction (p<0.05). CONCLUSION: Females produced higher muscle activation than males for ankle muscles. Adding unstable surface increased LE muscle activation during SEBT. Due to gender differences and surface variability in EMG during SEBT clinicians could consider incorporating both stable and unstable surfaces during rehabilitation especially for women to reduce ankle injuries.

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Board #91
May 29 9:30 AM - 11:00 AM
Influence of Surf Type on Change of Direction Parameters
Wendi Weimar, Brandi Decoux, Nicholas Moore, Christopher Wilburn. Auburn University, Auburn, AL.
Email: weimawh@auburn.edu

(A no relevant relationships reported)

The surface over which people complete sports tasks can influence body posture and performance outcomes. PURPOSE: This study compared time to complete a change of direction agility drill and stopping strategies during this drill on different modern sports turfs, including three different artificial turf systems (AS1,AS2, AS3) and a natural grass surface (NS). METHODS: Six participants (ages 19-30 yrs; height = 1.79 ± 0.08 m; mass = 75.9 ± 10.1 kg) were recruited and provided voluntary consent. Each participant performed three trials of a 5-10-5 agility drill on each of the four surfaces, within each direction and each muscle during SEBT for both stable and unstable. Unpaired t tests were run separately for males and females to determine difference in each direction for each muscle between stable and unstable surface with α at 0.05. EMG were reported as the percentage of the maximal voluntary isometric contraction (%MVIC). RESULTS: Females showed significantly higher EMG than males for AT in PL direction (63±14 vs 47±12 %MVIC; P<0.01) on stable surface and A (63±14 vs 47±12 %MVIC; P<0.01) and PM (64±15 vs 47±14 %MVIC; P<0.02) directions on the unstable surface and MG in PL (44±17 vs 25±17 %MVIC; P<0.02) direction on stable surface and A (62±23 vs 37±20 %MVIC; P<0.02), PL (76±29 vs 45±25 %MVIC; P<0.02), and PM (58±26 vs 36±20 %MVIC; P<0.04) directions on unstable surface. EMG was higher for unstable surface in females for VM, RF, and VL in the A direction (p<0.05) and MG in all three directions (p<0.05) and in males for GMED, VM, RF, VL in the A direction (p<0.05) and BF and MG in the PM direction (p<0.05). CONCLUSION: Females produced higher muscle activation than males for ankle muscles. Adding unstable surface increased LE muscle activation during SEBT. Due to gender differences and surface variability in EMG during SEBT clinicians could consider incorporating both stable and unstable surfaces during rehabilitation especially for women to reduce ankle injuries.

Adaptability of the motor system indicates successful management of chronic ankle instability (CAI). Research shows that individuals who do not exhibit residual symptoms following an ankle sprain (i.e. copers) exhibit greater adaptability during walking compared to individuals with CAI. However, questions remain surrounding systemic differences exhibited by coper groups, particularly when higher movement demands are imposed on the system. Analysis of load acceptance patterns during single-leg hopping could provide an indication of the systemic movement adaptations between the groups during higher demands of movement tasks.

PURPOSE: Examine percent contribution (%C) to support moment (MS) during single-leg hopping in healthy, coper, and CAI groups. METHODS: 48 individuals (16 coper, 16 CAI) were recruited in the study. Participants performed 15 trials of single-leg hopping. Position data were collected using a motion capture system, and reaction forces were obtained from force platforms. Joint kinetics were calculated using inverse dynamics, and the MS was calculated as the sum of the ankle (A), knee (K), and hip (H) moments in the sagittal plane. The % of the A, K, and H moment to MS was calculated at 15 percent of stance phase. A one-way ANOVA was conducted to assess group effects for each dependent measure.

RESULTS: No significant differences in %C to MS were found between the healthy (A: 81±78 vs. 83±78; K: 23±61 vs. 23±61; H: 62±27 vs. 62±27) and copers (A: 73±73 vs. 73±73; K: 28±28 vs. 28±28; H: 65±65 vs. 65±65) groups and CAI (A: 38±47 vs. 38±47; K: 51±51 vs. 51±51; H: 75±75 vs. 75±75) groups. CONCLUSION: Copers did not exhibit distinct kinematic patterns during single-leg hopping. This finding suggests that adaptation of movement is less likely to occur with higher demands of movement tasks following ankle injury. It is also possible that low amplitude COM displacement associated with the hopping task may not have placed adequate constraint on the subjects to elicit adaptive strategies. More research is needed to explore how individual joint kinetic adaptations contribute to dynamic tasks across groups.

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Board #93
May 29 9:30 AM - 11:00 AM
Biomechanics of Pitching: Horizontal Abduction Power Predicts Power; Power Predicts Strikeouts and Wins

(A no relevant relationships reported)

Traditional strength training for pitchers focuses on compound lifts, predominantly of the lower extremity, to increase pitching power. Though widely employed, this approach has not been sufficiently validated. PURPOSE: To evaluate both predictors and consequences of increased mechanical power in collegiate pitching. METHODS: 10 pitchers from a D1 baseball program underwent 4 days of assessment separated by at least 3 days of rest: 1) Squat max was performed and recorded, 2) Sparta force plate (Sparta Science, USA) captured load, explode, and drive, 3) Proteus (Boston Biomotion, USA) measured power and endurance in 10 movements: Left and right core rotation, internal and external rotation, shoulder flexion and extension, elbow flexion and extension, and horizontal abduction and adduction. 4) Proteus recorded throwing mechanics via 5 sets of pitches (4 reps per set) at varying loads of magnetic resistance, ranging from 1-5lbs. For all movements, Proteus calculated and exported power and endurance in 3D space. Linear regressions identified predictors of pitching power and the effect of power on pitching performance. Owing to the small sample and novel technology, trends (p<0.08) were considered. RESULTS: Mean pitching endurance did not significantly predict strikeouts or wins. Mean pitching power predicted greater win percentage (R=0.734; p=0.024), total strikeouts (R=0.662; p=0.052), and strikeouts per game (R=0.656; p=0.055). No associations were found between Sparta data or squat max and win percentage or strikeouts. Pitching power had no relationship with Sparta data, squat max, height, weight, class year, or arm length. The strongest predictors of pitching power were horizontal abduction endurance, the dominant arm R=0.941; p=0.002 and non-dominant arm (R=0.934; p=0.002). Strikeouts per game was related to win percentage (R=0.680; p=0.044).

CONCLUSION: Power was the most important predictor of on-field pitching performance. It was unrelated to anthropometric variables and showed no association with minor differences in maturation (e.g., freshman to sophomore). There was also
The Landing Error Scoring System (LESS) is a protocol designed to assess ACL injury risk, and the LESS-RMC (Rocky Mountain Consortium) is a modified version of the LESS designed to be a more objective approach to scoring, and an easier tool to implement for the rater. PURPOSE: The purpose of this study was to determine the relationship between the LESS and LESS-RMC and develop an injury risk stratification for the LESS-RMC. METHODS: One hundred seventy-eight elite female soccer athletes (14.1 ± 1.5 y, 73.3 ± 33.2 in, 107.6 ± 27.2 lbs), performed three drop-jumps from a height of 30 cm. Front and side views of the landing were recorded with digital video cameras. Movement quality was rated by one researcher evaluating 17 components of the landing with the LESS and a modified, 11 component version of the LESS (LESS-RMC). Each system had a maximum of 17 landing errors and the rater was considered an expert after training with the LESS and LESS-RMC protocols. To accomplish the objectification of the less items, cut off points were defined more explicitly for line items: symmetry in feet, joint displacement, and overall impression. These changes, combined with a differentiating score of knee valgus severity/medial knee position (MKP) and its contribution to a new line item, overall asymmetry, added a new component to the LESS-RMC's approach to scoring movement quality and assessing injury risk. One a-way ANOVA was used to contrast the number of landing errors determined from the LESS and LESS-RMC. A linear regression was used to determine the relationship between the two scoring system and a LESS value of 5 was used as input to calculate a predicted risk stratification for the LESS-RMC. The alpha level was set at p=.05. RESULTS: The number of identified landing errors captured with the LESS-RMC (6.9 ± 2.2) was statistically greater than the LESS (5.6 ± 2.1) (p<0.001). A significant linear relationship was found between the LESS and LESS-RMC (R=0.811, Adj R2=0.656, SEE=1.59, p<0.001). A LESS-RMC cut-off score for the stratification of low and high knee injury risk was calculated to be 6.79. CONCLUSIONS: The bi-lateral assessment of MKP and overall asymmetry were significant variables that contributed to higher risk stratification scores with the LESS-RMC.
**CONCLUSIONS:** The asymmetry in MKP influenced the LESS scores by 1 to 3 landing errors and has the potential to miss-classify an athlete’s injury risk stratification.

**RESULTS:**

Maximal force

<table>
<thead>
<tr>
<th>Technique</th>
<th>Maximal Force (mm)</th>
</tr>
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<tbody>
<tr>
<td>Ouchi</td>
<td>34.7 ± 7.2</td>
</tr>
<tr>
<td>Osoto</td>
<td>38.9 ± 5.3</td>
</tr>
<tr>
<td>Seoi</td>
<td>29.8 ± 3.5</td>
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</table>

**CONCLUSIONS:** The asymmetry in MKP influenced the LESS scores by 1 to 3 landing errors and has the potential to miss-classify an athlete’s injury risk stratification.

Recent advancements in wearable technology have allowed kinematic data collection in field-based settings, improving the ecological validity of research investigations. The wrench notation and quaternion algebra inverse dynamics technique does not require the integration of force platform data, therefore may allow field-based computation of joint kinetics for various sport tasks, including overhand throwing. In order to apply this technique efficiently, it is important to understand segmental contributions to whole-body center of mass (CoM) movement. **PURPOSE:** Evaluate segmental contribution to the estimation of whole-body CoM movement both proximal and distal to whole-body center of mass (CoM) movement. **METHODS:** Three right-handed, male club baseball players performed forty trials of sub-maximal overhand throwing. Position data for each trial were acquired using a 3-d optical motion capture system and infrared reflective markers placed according to standard body segment parameter recommendations. From position data, segmental and whole-body CoM were computed for body mass and center of mass moments both proximal and distal to whole-body center of mass (CoM). **RESULTS:** Significant differences were found between these chokehold techniques and the G chokehold (avg= 265.37±164.25N) (p<0.05). **CONCLUSIONS:** It is apparent that different chokehold techniques involve different force application. MMA fighters may need to train specific techniques to increase force production or to resist forces when experiencing these chokeholds.
lower versus all other segments proximal to the throwing elbow (p = < 0.001 - 0.028). Right forearm RMSE in the x, y, and z directions (x: 26.9 ± 3.3 mm, y: 22.6 ± 2.3 mm, z: 31.7 ± 1.9 mm) was significantly lower versus the right hand (p = < 0.001 - 0.0001). CONCLUSION: During an overhand throwing task, the results suggest that CoM movement of the trunk and throwing forearm pattern closely with the movement of whole-body CoM located proximal and distal to the throwing elbow.

264 Board #102 May 29 9:30 AM - 11:00 AM Ankle Bracing Effects on Contributions to the Support Moment during Hopping

Carlos Santillan, Illinois State University, Normal, IL.
(No relevant relationships reported)

Ankle Bracing Effects on Contributions to the Support Moment during Hopping

Carlos Santillan, Adam E. Jagodinsky, Mohammed Zaman, Christopher Wilburn, Wendi H. Weimar
Illinois State University, Normal, IL, Auburn University, Auburn, AL

INTRODUCTION: Ankle bracing is commonly implemented to prevent ankle sprain injuries. However, research shows ankle bracing can alter joint kinetics during a variety of dynamic tasks. Analysis of the support moment (Ms) characteristics in response to bracing could provide insight into possible global motor strategies adopted when an ankle brace is applied. PURPOSE: Examine bracing effects on lower extremity contributions to the Ms during hopping. METHODS: 16 healthy individuals participated in the study. Participants performed 15 trials of single-leg hopping during no brace (NB) and brace (B) conditions. Position data were collected using a motion capture system, and reaction forces were obtained from force platforms. Joint kinetics were calculated using inverse dynamics, and the Ms was calculated as the sum of ankle, knee, and hip moments in the sagittal plane. Data from the stance phase of hopping was extracted and time normalized to 0-100% of stance phase. The percentage contribution (%C) of ankle (A), knee (K), and hip (H) moment to Ms was calculated at 15, 30, 45, 60, and 75 percent of stance phase. Comparisons of percentage contribution between conditions were made at each time point using paired-samples t-tests. RESULTS: Analysis revealed that for K, %C was significantly lower during B (19.5±4.06%) compared to NB (21.76±4.42%) (t = 2.228, p = .041). Additionally, for K_15, %C was significantly lower during B (34.25±9.14) compared to NB (35.26±10.23) (t = 2.306, p = .035). No other significant differences for the study were observed. CONCLUSION: Bracing significantly decreased the contribution of the knee to the Ms during single-leg hopping. Changes in the knee contribution to the Ms suggests that ankle bracing invokes adaptations to motor control strategies during the landing phase of single-leg hopping.

265 Board #103 May 29 9:30 AM - 11:00 AM Support Moment Dynamics Are Similar In Individuals With and Without Chronic Ankle Instability During Hopping

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(No relevant relationships reported)

It has been proposed that the development of chronic ankle instability (CAI) is related to a maladaptive cascade stemming from mechanical and/or neuromotor impairments following an initial ankle sprain injury. Contrarily, individuals who do not exhibit recurring instability following initial ankle injury (copers) may benefit from adaptive movement strategies that allow for healthy functioning, yet the mechanisms surrounding this theory remain in question. Previous investigations have found that copers exhibit significantly greater variability in the support moment (Ms) and lower extremity joint moments compared to individuals with CAI during walking, specifically performed in upright position which is more functional.

PURPOSE: The purpose of this study was to compare the Ms variability characteristics between healthy, copers and CAI individuals during a single-leg hopping task. METHODS: 48 individuals (16 per group) participated in the study. Participants performed 15 trials of single-leg hopping data were collected using a motion capture system, and reaction forces were obtained from force platforms. Joint kinetics were calculated using inverse dynamics, and the Ms was calculated as the sum of ankle, knee, and hip moments in the sagittal plane. Variability of the Ms was expressed as the percent coefficient of variation (%CV) across stance phase. A one-way ANOVA was conducted to compare %CV across groups. RESULTS: No differences in %CV were found between healthy (13.27±6.014%) and CAI (14.10±6.61%) groups. DISCUSSION: Individuals had no change in %CV compared with the previous study of walking. The contrast in findings may be attributed to the nature of task demands placed on subjects. Specifically, the rapid and cyclic transition of loading-propulsion-loading, and low amplitude COM displacement associated with the hopping task performed in this study may not have placed an adequate constraint on the subjects to elicit adaptive strategies. Future studies investigating Ms variability characteristics should consider implementing tasks that will stress motor system adaptability.
three peaks and their corresponding angles were calculated. Add and Abd torque ratios were calculated and the data were categorized as high risk (HR), if ratio was <1, or low risk (LR), if ratio was >1. Hip 3D Int and Ext rotations were captured using 3D cameras at 240 Hz. Participants performed three separate trials of maximal Int and Ext rotations using sliding disk and highest lower leg Int and Ext rotations were analyzed. T-tests using unequal variance were performed. RESULTS: Mean Add and Abd torque ratios were 0.72±0.13 in HR group and 1.30±0.19 in LR group. Percent peak Add torque was observed in the HR group (48.15 Nm vs. 86.27 Nm, p<0.01). No significant difference was observed in peak Abd torque between the groups (67±19 Nm vs. 66±18 Nm, p<0.05). Hip Ext rotations were lower in the HR group, however not significant (17.7± vs. 20.9±, p=0.07), same was observed for hip Int rotations (13.5± vs. 15.4±, p=0.08). The total hip Int and Ext range of motion was significantly lower in the HR group (30.9± vs. 34.1±, p<0.05). CONCLUSION: Decrease in hip Int and Ext range of motion was related to lower hip Add and Abd peak torque ratio. Future research should further investigate the association between these variables in athletes to better predict and prevent groin injuries.

Women’s volleyball demands frequent lateral movements and vertical jumps. Repetitive lateral movements in the same direction could lead to biomechanical asymmetries and a potential increased risk of lower extremity injury. PURPOSE: To identify and analyze biomechanical asymmetries in collegiate women’s volleyball players during sport-specific lateral and vertical jumping tasks.

**METHODS:** Nineteen female collegiate volleyball players were analyzed using standard 3D motion capture techniques during a drop vertical jump (DVJ) from a 30-cm box and a reactive jump (REACT) task. For the REACT, participants began in an athletic stance awaiting a directional cue on a screen placed in front of them. Once directed, participants were instructed to jump laterally and then vertically as high and fast as possible to mimic a volleyball block. Repeated measures MANOVA models were used to identify asymmetries in kinematic and kinetic measures in the DVJ and REACT task (α=0.05). Paired t-tests identified asymmetries in reaction time during the REACT task. Limb symmetry indices (LSI) were calculated for significant findings.

**RESULTS:** Significant kinetic asymmetries were identified for both the DVJ (p<0.01) and REACT (p<0.003) tasks, but no kinematic asymmetries were found in either task (p>0.05). During the DVJ, participants exhibited asymmetrical knee abduction (LSI=91%, p<0.003), ankle dorsiflexion (LSI=94%, p<0.003), and ankle inversion (LSI=30%, p<0.001) external rotation (ER) knee joint moments and vertical ground reaction forces (LSI=93%, p<0.04). During the REACT task, participants exhibited asymmetrical ankle dorsiflexion (LSI=85%, p<0.03), and ankle inversion (LSI=73%, p<0.001) external joint moments. There were no differences in reaction times between the two tasks (p>0.5).

**CONCLUSIONS:** Collegiate women’s volleyball players exhibit significant asymmetry in the knee and ankle during jumping and landing tasks. Interestingly, asymmetries were identified in kinetic variables but not kinematic variables. These findings indicate that screening, injury prevention and rehabilitation practices cannot solely rely on visual observation to identify lower extremity asymmetry in this athletic population.

It is believed that ACL injury risk is multifaceted and includes structural, biomechanical, and cognitive factors. Recently, it is observed that overreliance on visual observation to identify lower extremity asymmetry in this athletic population. **PURPOSE:** To evaluate the effects of stroboscopic vision on Reactive Strength Index (RSI) scores in female NCAA Division I volleyball players. METHODS: Thirteen female NCAA Division I volleyball players performed three trials of depth jumping across five conditions: (1) 0.38 m - no visual restriction, (2) 0.53 m - no visual restriction, (3) 0.69 m - no visual restriction, (4) 0.38 m - high-frequency stroboscopic vision (H-f), and (5) 0.38 m - low-frequency stroboscopic vision (L-f). For all trials, the RSI, rebound jump height (RJH; m), and ground contact time (GCT; s) were calculated and the data were categorized as high risk (HR), if ratio was <1, or low risk (LR), if ratio was >1. Hip 3D Int and Ext range of motion was captured using 3D cameras at 240 Hz. Participants performed three separate trials of maximal Int and Ext rotations using sliding disk and highest lower leg Int and Ext rotations were analyzed. T-tests using unequal variance were performed. RESULTS: Mean Add and Abd torque ratios were 0.72±0.13 in HR group and 1.30±0.19 in LR group. Post-hoc comparisons revealed significantly lower (p<0.05) RSI scores in female NCAA Division I volleyball players. The maximal vertical jump landing was video recorded. Of three jump trials, highest (RSIH) and lowest RSI (RSI L) were recorded. A one-way ANOVA was used to determine differences among soccer and volleyball athletes for RSIH and RSI L. Further, two-way ANOVA with replication was used to examine the differences between joint angular displacements (KD and AD) at RSIH and RSI L. RESULTS: There was no significant difference (p>0.178) between soccer (1.9±0.44) and volleyball (1.67±0.39) athletes for RSIH. There was a statistically significant interaction (p<0.043) between the levels of RSIs on joint angular displacements.

**CONCLUSION:** The power production and dynamic stability of leg during jump landing involves the coordination between the hip, knee, and ankle joints. In current study, RSl was associated with knee stiffness and elasticity of ankle joint. It was observed that there was no observable difference in ground force attenuation strategies by sport. Future studies should explore lower-extremity absorption strategies using larger sample size, NCAA Division I or II athletes, and comparing genders during sport-specific tasks.
how knee confidence and age influence these screening tools in female soccer athletes. **PURPOSE:** The aim of this study was to investigate the effects of age and knee confidence on ACL injury risk classification in female youth soccer players. **METHODS:** 178 healthy female youth soccer players (ht: 1.63±0.07m, mass: 48.83±4.9kg, age: 14:1±1.5yrs) participated in this study. Participants were asked to jump from a 30cm box a distance 50% of their height where they immediately performed a maximum vertical jump and landing upon initial ground contact. Two HD cameras were used to record (60 Hz) this motion in the frontal and sagittal planes. The video of the task was then used to assess the participant’s ACL injury risk by evaluating these landings using the LESS and LESS-RMC procedures. Knee confidence was evaluated by using a 5-point Likert scale in response to an item asking “How much do you trust your knee” from the knee-related quality of life subscale in the KOOS knee questionnaire. The participants were classified as confident if they answered “completely” and not confident for all other responses. Two-way ANOVAs were used to investigate the effects of age group (11-12, 13-14, 15-16 and 17-18 y) and knee confidence on the LESS and LESS-RMC scores. **RESULTS:** There was a statistically significant main effect of age on the LESS score, [F (3, 167) = 2.667, p =0.049]. Post-hoc tests revealed that the age group of 11-12 years displayed significantly higher LESS scores (6.43±2.14) than the 17-18 group (4.49±2.11) (p = 0.029). There was no significant main effect for knee confidence (p = 0.501). **CONCLUSION:** The results reveal that female soccer players in the 11-12 age range are at a greater risk of ACL injury than the 17-18 age range. Further research should be conducted to examine the mechanical contribution to this risk and methods to reduce injury risk across age ranges.

### 272 Board #110 May 29 9:30 AM - 11:00 AM Lower Extremity Force Production And Postural Stability Changes With Age In Young Male Soccer Players Frantisek Zahalka1, Tomas Maly1, Kevin R. Ford, FACSM1, Dai Sugimoto3, Lucia Mala1, Tomas Gryc1, Veronika Mikesova1. 1Charles University, FPES, Prague, Czech Republic. 2High Point University, High Point, NC. 3Harvard Medical School, Boston, MA. (Sponsor: Kevin R. Ford, FACSM)

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**No relevant relationships reported**

Optimizing lower extremity force production is key for elite soccer players (SP). Additionally, improved postural stability (PS) is generally associated with a decreased risk of injury. However, it is not well understood, in elite youth SP, how force production during explosive movements and PS during quite stance differ among typical age categories.

**PURPOSE:** To compare lower extremity force production and PS performance in four different age categories in youth SP.

**METHODS:** A total of 73 elite youth SP from four age categories (U12: n = 18, U13: n = 20, U14: n = 16, U15: n = 19) were tested using a force platform (KISTLER AG, Switzerland) during different types of jumps (countermovement jump free arms (CMJFA), countermovement jump CMJ, squat (SJ) and deep jump (DJ), PS was assessed on a pressure platform (RS SCAN, Belgium) during narrow standing, with (NSW) and without (NSN) visual control, and single limb stance on preferred (SLSP) and non-preferred leg (SLSN). We calculated: jump height (JH), maximum force, time may lead to strength asymmetry and imbalances in tissue adaptation. Muscle strength (MS) is an important component of physical fitness in soccer players (SP). Side-to-side differences may be caused due to the unilateral nature of certain soccer skills and movement patterns. Constant loading on one side of the body over time may lead to strength asymmetry and imbalances in tissue adaptation. **PURPOSE:** To investigate isokinetic strength asymmetry (SA) and magnitude in professional male SP.

**METHODS:** Professional male SP from the first division of Czech Republic (n = 148, age 25.1±4.8 years) volunteered to participate in the study. SP performed isokinetic strength testing (Humac Norm, Cybex, USA) concentrically at angular velocities of 60, 180 and 300°·s⁻¹. The peak muscle torque of knee extensors (PTₑ) and flexors (PT₉) in both legs, hamstrings and quadriceps strength ratio of muscle torque for both preferred and non-preferred extremities (H-Qe and H-Qn respectively), bilateral ratio between the exerted strength of knee extensors (Q:Q) and flexors (H:H) were calculated. Mixed-design RM ANOVA, Bonferroni’s post hoc tests and partial eta square (η_p) were used for statistical assessment. **RESULTS:** Knee flexors showed significantly higher SA (H:Q=9.77±0.40%) compared to the extensors (Q:Q=7.24±0.40%) (F₁,294=20.49, p=0.00, η_p²=0.07). Greater hamstrings and quadriceps strength ratio was found in preferred leg (H-Qe=59.89%) compared to non-preferred (H-Qn=58.10±0.63%) (F₁,294=4.01, p=0.04, η_p²=0.01). Contraction velocity speed did not have a significant difference on SA (p>0.05). MS of knee extensors reached the highest value at the lowest velocity for both legs (PTₑ=2.94±0.36 N·m·kg⁻¹). Exerted MS significantly decreased with muscle strength (MS) is an important component of physical fitness in soccer players (SP). Side-to-side differences may be caused due to the unilateral nature of certain soccer skills and movement patterns. Constant loading on one side of the body over time may lead to strength asymmetry and imbalances in tissue adaptation. **PURPOSE:** To investigate isokinetic strength asymmetry (SA) and magnitude in professional male SP.

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to propel the ball at faster speeds. Thus, knowledge of lower quadrant strength can be very useful for injury prevention and better performance in fast bowlers. Dynamic Knee Stance in the front limb is critical during the lead phase of bowling for optimal performance. There is a lack of literature in this subject in Indian fast bowlers despite the popularity of the sport.

PURPOSE: To evaluate the Isokinetic knee strength, determine the relevant asymmetries and strength imbalances & their relationship with performance and injury risk in Cricket Fast Bowlers.

METHODS: 42 male Indian State Level fast bowlers underwent Isokinetic knee strength testing. Quadriiceps concentric (Qcon), Quadriiceps eccentric (Qecc), Hamstrings concentric (Hcon) & Hamstring eccentric (Hecc) Peak Torques normalized to body weight (PT/BW) were obtained. Bilateral Strength Asymmetries (BSA) and Dynamic Control Ratios (Hamstrings DCR= Hecce/ Qconcc & Quadriiceps DCR=Qecc/Hecc) were evaluated. Vertical Jump Height (VJ) & Standing Broad Jump (SBJ) distance were used as indicators of jump performance. Descriptive statistical analysis of data & Pearson correlation was done to obtain relationship between Isokinetic parameters & jump performance. RESULTS: A significant correlation was found between Qconcc and VJ (r=0.67, p=0.04) & SBJ (r=0.39, p=0.04). 67% of bowlers had significant Qecc strength asymmetry 40% had poor Hamstrings DCR & 19% had poor Quadriiceps DCR on the front limb. 
CONCLUSION: A significant proportion of fast bowlers have unfavorable strength asymmetry & DCR and thus are at risk of injury. Improving Dynamic Knee Strength through plyometric training could help optimize performance and reduce injury risk.

Biceps and Triceps Contribute to Pitching Performance

Training for pitching traditionally focuses on core and leg work, but there may be justification for isolated arm muscle training to enhance performance. PURPOSE: To evaluate the influence of biceps and triceps function during pitching. METHODS: Pitchers (n=10) from a Division-1 collegiate team were recruited. Throwing mechanics and isolated arm movements were assessed using Proteus technology (Boston Biomotion Inc). A single set of biceps and triceps movements (with 12 and 10 lbs respective resistance) and biomechanical assessment of a throwing movement were collected. All movements completed on Proteus result in seven variables: power, explosiveness, braking, consistency, endurance, velocity, and range of motion (ROM). Pearson correlation coefficients were employed to analyze relationships between the Proteus variables for biceps curls and triceps extensions, throw mechanics, and statistics from in-game performances from the 2017 season. RESULTS: The strongest relationship among all comparisons was biceps curl endurance and ERA (r=−0.959, p<0.001). The biceps curl ROM was also weakly related to throw power (r=0.429; p=0.076). Throw endurance corresponded with positive trends for biceps curl power (r=0.419; p=0.089), explosiveness (r=0.452; p=0.060), velocity (r=0.417; p=0.085), and ROM (r=0.429; p=0.075). A strong positive relationship was observed between throw endurance and biceps curl braking (r=0.535; p=0.022) and a positive trend between biceps curl ROM and throw velocity (r=0.429; p=0.075). Triceps extensions corresponded closely with throwing mechanics and in-game statistics; trends were found between triceps explosiveness and strikeouts per nine innings (r=0.728; p=0.064) and Proteus throw velocity (r=0.462; p=0.053). Throw endurance was related to triceps extension braking (r=0.496; p=0.037) and it displayed a trend with triceps extension endurance (r=0.435; p=0.071). CONCLUSIONS: New technology permits advanced biomechanical analysis of baseball pitching. Preliminary testing reveals the importance of arm conditioning for a pitcher’s ability to maintain power output. As more players are tested, we may further our understanding of the role of biceps and triceps function in throwing mechanics.
pitches. METHODS: We tested all pitchers (n=10) from a private D1 baseball team in the West Coast Conference. Velocity was recorded as the mean speed of the three fastest in-game pitches using the LabView (National Instruments, Austin, USA) to conduct three-dimensional isotonic assessments of pitching form, dominant and non-dominant core rotation, dominant arm internal and external shoulder rotation, and anterior flexion and extension of the dominant shoulder. Proteus software calculated power, explosiveness, velocity, and endurance. Non-mechanical predictors of fastball velocity were class year, height, weight, and limb lengths. Simple linear regression quantified mechanical predictors of fastball velocity and the effect of fastball velocity on in-game pitching performance. RESULTS: Pitchers with a higher fastball speed had more appearances (r=0.763; p=0.028), pitched more innings (r=0.715; p=0.046), had more wins per appearance (r=0.524; p=0.183), and more total strikeouts in the season (r=0.829; p=0.011) but not per appearance (r=0.566; p=0.143) or per inning (r=0.074; p=0.861). Anthropometric variables were unrelated to fastball velocity. Internal rotation explosiveness (p=0.031) and endurance (p=0.030) of the dominant arm predicted fastball velocity. For each additional point of endurance, fastball speed increased 0.7 mph (p=0.030); for each additional 10 points of explosiveness, fastball velocity increased 0.4 mph (p=0.031). There was a positive relationship associated with explosiveness in straight-arm anterior shoulder raise (r=0.898; p=0.015); trends were found in the non-dominant arm. CONCLUSION: Increased fastball velocity may be facilitated by training internal shoulder rotation and shoulder flexion.

279 Board #117 May 29 9:30 AM - 11:00 AM Match Acceleration and Deceleration Patterns in Female Collegiate Soccer Players Jessica L. Trapp, Matthew F. Moran, Julie K. Nolan, Alicia B. Stannard. Sacred Heart University, Fairfield, CT. Email: jessica.trapp15@gmail.com (No relevant relationships reported)

Non-contact anterior cruciate ligament (ACL) sprains are becoming increasingly problematic for athletes, especially females. Running performance factors like acceleration and deceleration are often underestimated when examining fatigue in soccer players, but may be useful for prophylactic training to counter dysfunctional lower body mechanics under fatigued conditions. Currently no study exists that characterizes these factors in match play in female collegiate soccer players.

PURPOSE: To describe match acceleration and deceleration patterns in female collegiate soccer players and compare positional influence. METHODS: 24 female NCAA Division I soccer players (11 defenders, 5 midfielders, 8 strikers) underwent global positioning system (GPS, 10Hz) monitoring throughout a 16-game competitive season. A custom written Matlab script processed GPS data and computed the amount of low (<1 m/s², <-1m/s²) and high (>2 m/s², <-2 m/s²) acceleration-efforts (AE) and deceleration-efforts (DE), distance covered per effort, and starting speed of efforts. A Kruskal-Wallis H test and separate pair-wise t-tests were used to compare variables by position and by halves of matches, respectively. A significance level of p<.05 was used for all analyses. RESULTS: Strikers performed significantly more high-intensity AE (1st half: 0.97 efforts/min; 2nd half: 1.07 efforts/min) and DE (1st half: 1.15 efforts/min; 2nd half: 1.24 efforts/min) when compared to defenders (AE: 0.76 efforts/min; 0.73 efforts/min; DE: 0.90 efforts/min; 0.87 efforts/min) (p = 0.00, p = 0.00, p = 0.00, p = 0.00). Significant decreases occurred in the second half across all matches in distance covered in low-intensity AE (1.9 ± 0.2 m, p < 0.01) and low-intensity DE (9.0 ± 0.1 m, p < 0.01), and starting speed in low-intensity AE (6.9 ± 0.3 m/s, p < 0.01) and DE (3.9 ± 0.2 m/s, p = 0.00). CONCLUSION: Strikers performed more high-intensity AE and DE than other positions, and may be at greater risk of lower body injury. Transient decreases in AE and DE occurred between halves of match play, and may relate to an increased risk of lower body injury in female soccer players.

TOPICAL GROUP #103

TOPICAL GROUP #402

TOPICAL GROUP #404

280 Board #118 May 29 9:30 AM - 11:00 AM The Kick Motion Analysis Of Adolescent Male Soccer Player With Osgood-schlatter Disease Seira Takeda1, Michio Tojima2, Shuji Taketomi1, Suguru Torii1, 1Graduate School of Medicine, The University of Tokyo, Tokyo, Japan. 2Tokyo International University, Saitama, Japan. 3Waseda University, Saitama, Japan. Email: saranaga0330@hotmail.com (No relevant relationships reported)

Osgood-Schlatter disease(OSD) is an epiphyseal disease of tibial tubercle by repeated traction of patellar tendon, especially on epiphyseal or apophyseal stage. OSD is associated with sports that involve kicking, and running, but none have analyzed the kick motion of adolescent soccer players who experienced the OSD.

PURPOSE: The purpose of this study was to compare the kick motion in adolescent soccer players with and without OSD using three-dimensional motion analysis system. METHODS: We evaluated 112 adolescent soccer players (13 ± 1 years old) All players went through the medical examination including the ultrasonography of tibial tubercle, and the muscle tightness test of lower limbs. We included only whose tibial tubercle stage was epiphyseal or apophyseal stage for this study and made two groups: presence of OSD on kicking leg (OSD group; n = 10) and absence of OSD or any other injuries (NP group; n = 30).

We measured real-time kick motion using a three-dimensional motion analysis system (Qualisys track manager, Qualisys AB, Sweden). We placed 65 spherical markers on each anatomical landmark and calculated the angle of the lumbar spine, pelvis, hips, knees and ankles. We collected data for the following six events of kicking leg: foot contact (FC), toe off (TO), max hip extension (HE), max knee flexion (KF), ball impact (BI), and max hip flexion (HF). We used unpaired t-test to compare all the factors we measured between OSD group and NP group.

RESULTS: The anthropometric index, muscle tightness, ball speed of OSD group were not different from NP group. In HE, the supporting leg’s ankle flexion angle in OSD group was smaller in OSD group (4.9±3.7° vs. 8.9±5.0°, p = 0.024). In KF, the hip abduction angle of the kicking leg was smaller(24.5±5.9° vs. 28.6±5.1°, p = 0.041) in OSD group. In HF, the lateral bending angle of pelvis toward the supporting side was significantly smaller in OSD group (-2.6±1.6° vs. 7.4±1.3°, p = 0.037) In HF, supporting leg’s ankle was more dorsal flexion(0.4±1.9° vs. -14.1±14.5°, p = 0.010), more valgus(26.3±12.4° vs. 11.5±11.1°, p=0.001) in OSD group compared to NP group.

CONCLUSION: OSD group had smaller dorsal flexion angle of supporting leg before and after BI. They also had smaller hip abduction angle of kicking leg before BI, and lateral bending angle of pelvis toward the supporting leg side was smaller after BI.

Lower extremity injuries in youth soccer players continue to rise and have been related to poor landing mechanics. The identification of modifiable factors that influence at-risk landing mechanics is crucial toward the development of effective injury prevention programs. Dynamic core stability is needed to control lower extremity motion and decrease the risk of lower extremity injury. However, there is limited research that has examined the relationship between core stability and landing mechanics in youth athletes. Furthermore, understanding this relationship using screening methods that are readily accessible to clinicians is necessary as participation and injuries in youth soccer programs continue to increase.

PURPOSE: To investigate the relationship between core endurance and the Landing Error Scoring System in Youth Soccer Players

Board #119 May 29 9:30 AM - 11:00 AM Relationship Between Core Endurance and the Landing Error Scoring System in Youth Soccer Players Brooke A. Smith1, Stephanie M. Trigsted2, Michelle C. Boling1, Frank S. Barnett3, Jason Bailey4, Anti-Dung Nguyen1. 1High Point University, High Point, NC. 2University of Wisconsin Madison, Madison, WI. 3University of North Florida, Jacksonville, FL. 4Utah Jazz, Salt Lake City, UT. 'North Carolina FC, Cary, NC. Email: bsmith2@highpoint.edu (No relevant relationships reported)

METHODS: One hundred and ninety-two youth soccer players (M 108, F 84, 11.9±1.0yrs, 153.2±11.1cm, 43.2±8.8kg) participated. Core endurance was assessed using a validated sport-specific endurance plank test. Two-dimensional kinematics were collected during three trials of a 30cm drop-jump landing task and scored using an automated LESS scoring system (PhysiMax Technologies Ltd, Tel Aviv, Israel). Separate Pearson correlations (r) examined the relationship between time to exhaustion during the plank test and total LESS scores for males and females. RESULTS: In males, core endurance time to exhaustion (73.6±15.1s) was negatively correlated (r=-0.210, P=0.030) to total LESS scores (5.6±1.1s). In females, core endurance time to exhaustion (72.5±15.3s) was not correlated (r=-0.061, P=0.578) to total LESS scores (6.4±1.9). DISCUSSION: Decreased core endurance was related to increased landing errors in males, but not female, youth athletes. These data suggest that prevention programs should incorporate core endurance exercises to improve at-risk landing patterns known to increase the risk of lower extremity injuries in youth male soccer players. More work is needed to identify the modifiable factors that increase the risk of injury in youth female soccer players.

Board #120 May 29 9:30 AM - 11:00 AM Using Functional Movement Screener Predict Injuries in Soccer Players Rodrigo Pandelo, Domingos R. Pandelo, Jr. Centro de Alta Performance, Santos, Brazil. Email: rodrigo.pandeloval@hotmail.com (No relevant relationships reported)

PURPOSE: The aim of this study was to evaluate the predictive capacity of the Functional Movement Screen (FMS) to predict injuries in under 17 soccer players. In this study we tested the model in its original form, which will be called T7, with...
an alternative model, proposed here, based on only 4 of the 7 evaluated in its original form. The choice of the four items considered the fact that they are movements that more directly evaluate balance and lower limb movement pattern, which are more related to musculoskeletal injuries in soccer.

Methods: The sample was selected from 33 under 17 players of a Brazilian soccer team. The evaluation of the functional movement pattern was performed by 2 evaluators and when there was conflict in the athletes’ score, a third evaluator was called for the final decision. The evaluations were all made in the preseason. As predicted by the method, each one of the 7 analyzed items were rated with 1 (worst), 2 or 3 (best). The items evaluated were: deep squat (1), hurdle step (2), in-line lunge (3), active straight-leg raise (4), shoulder mobility stability (7). The complete index (T7) is what is normally used in this type of work. What we have suggested is T4, in which evaluations 1, 2, 3 and 4 come in.

Summary of Results: In 31 athletes selected, 7 had some type of skeletal muscle injury throughout the season (22.58% of the total). Through the analysis of effect size (Hedge’s g) it can be verified that when the injured athletes are compared with the complete index T7 in relation to the proposed T4, the effect size is 0.854, which can be considered a significant difference, in a clinical way. Regarding those who were not injured, the power of explanation is even greater, with an ES of -1.104. The most relevant finding of the present study was when comparing the predictive power of T7 and T4 to predict injuries. While the T7 ES stood at 0.276, the T4 ES stood at 2.698.

### Results

<table>
<thead>
<tr>
<th>Effect Size (ES)</th>
<th>ES (hedges g)</th>
<th>IC 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES T7Injury x ES T4Injury</td>
<td>0.854</td>
<td>0.757</td>
</tr>
<tr>
<td>ES T7Notinjury x ES T4Notinjury</td>
<td>-1.104</td>
<td>-1.150</td>
</tr>
<tr>
<td>ES T7Injury x ES T7Notinjury</td>
<td>0.276</td>
<td>0.214</td>
</tr>
<tr>
<td>ES T4Injury x ES T4Notinjury</td>
<td>2.698</td>
<td>2.632</td>
</tr>
</tbody>
</table>

Conclusion: The present study showed that FMS can be used for the prediction of musculoskeletal injuries in soccer players.

### A-45 Free Communication/Poster - Rehabilitation & Disability

#### Board #121

**May 29 11:00 AM - 12:30 PM**

**Room: CC-Hall WA2**

**Board #121**

**Different Exercise Regimens On Rehabilitation Of Patients With Stable Coronary Heart Disease**

Chen Liang, Can Gao, Jianhong Zhang, Yun Ye, Lindan Zhai, Fengrun Zhao.

National Institute of Sports Medicine, Beijing, China. 

Beijing University of Chinese Medicine, Beijing, China.

Email: 1clc3@163.com

(No relevant relationships reported)

### Purpose

**Purpose:** To investigate the efficacy and safety of different exercise regimens in the rehabilitation of patients with stable coronary heart disease.

### Methods

**Methods:** This study was a randomized controlled trial to screen 112 patients with stable coronary heart disease who were admitted to the General Administration of Sports on its own, stable, and severe coronary heart disease from March 2017 to June 2018. They were divided into a traditional exercise group (27 cases) and a traditional Chinese medicine training group (27 cases) and a traditional Chinese medicine training group 12 weeks (TCMT group 2, 37 cases). The TCMT group was significantly smaller than that of ART group, but there was no difference between groups ART and CON (P>0.05). VE/VO2 of TCMT group was significantly higher than those of the control group (P<0.05). After 12 weeks of intervention, VO2, VO2/Kg, METS, VO2/HR, SV, and body parameters.

### Results

**Results:** After 12 weeks of intervention, VO2, VO2/Kg, METS, VO2/HR, SV, peaked grip strength and flexibility parameters of ART group and TCMT group were significantly higher than those of the control group (P<0.05). Resting heart rate (RHR) of TCMT Group was significantly lower than CON group, but there was no significant difference between groups ART and CON (P>0.05). VE/VO2 of TCMT group was significantly higher than that of CON group. Body mass index (BMI) of ART group was significantly lower than that of TCMT group and CON group, and BMI of TCMT group was significantly smaller than that of ART group , but there was no difference between TCMT group and CON group for BMI and Body fat mass (BFM).

### Conclusions

**Conclusions:** Both ART and TCMT can improve the cardiopulmonary aerobic exercise capacity and physical fitness of patients with stable coronary heart disease. Although the degree of improvement is different, they all have certain curative effect on the rehabilitation of patients with stable coronary heart disease and the application is safe.
Diabetes is a high prevalent comorbid condition in patients with peripheral arterial disease (PAD). Previous studies showed that diabetes impair physical function in PAD patients. However, whether cardiovascular function is also affected by diabetes is unknown.

**PURPOSE:** To compare walking capacity and cardiovascular function in PAD patients with and without diabetes. A total of 80 patients (n=41 non-diabetic and n=39 diabetic) with PAD were recruited. Six-minute walk test (total walking capacity), 4-meter test, walking impairment questionnaire (WIQ) and the walking estimated-limitation calculated by history (WELCH) were used to assess walking capacity. Cardiovascular function was assessed by blood pressure, arterial stiffness, heart rate variability and flow-mediated dilation. Mann-Whitney U test were performed, and data are presented in median and interquartile range. **RESULTS:** Diabetic PAD patients presented lower total walking capacity (308 ± 120 m vs. 370 ± 125 m, p=0.025), WIQ distance score (10.2±3 vs. 20.46 ± 13, p=0.002), WIQ speed score (17 ± 21 vs. 28 ± 27, p=0.001), WIQ stairs score (21.42 vs. 42.42, p=0.024), WELCH total score (20 ± 26 vs. 40 ± 42, p=0.006) compared to non-diabetic PAD patients. In addition, diabetic PAD patients had lower SDNN (22 ± 21 vs. 29 ± 36, p=0.030), and a trend to have lower RMSSD (10 ±23 vs. 30 ±46, p=0.002), WIQ speed score (17 ± 21 vs. 28 ± 27, p=0.001), WIQ total walking capacity (308 ± 120 m vs. 370 ± 125m, p=0.025), WIQ distance score (22 ± 21 vs. 29 ± 36, p=0.030), and a trend to have lower RMSSD (10 ±23 vs. 30 ±46, p=0.002). The remaining variables were similar between PAD patients with and without diabetes.

**CONCLUSION:** Diabetes impairs walking capacity and cardiac autonomic modulation in patients with PAD. Therefore, interventions to improve these parameters should be emphasized in diabetic PAD patients. Supported by FAPESP (#2016/16425-9) and CNPq (#10508/2017-7)

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Studies examining high intensity interval training (HIIT) and moderate intensity continuous training (MICT) have yielded conflicting findings regarding changes in left ventricular ejection fraction (LVEF) in heart failure (HF) patients with reduced ejection fraction (EF). **Purpose:** Use the meta-analytic approach to compare the effects of HIIT versus MICT on LVEF in HF patients with reduced EF. **METHODS:** A search for studies published up to July 2018 was conducted using four electronic databases: PubMed, Academic Search Complete, SportDiscus and ScienceDirect. Studies were included if they met the following criteria: (1) clinical trials, (2) studies that reported means and standard deviations for LVEF, (3) adult men and women 18 years of age and older with a previous diagnosis of HF and an ejection fraction <55%, and (4) studies published in English or Spanish. Change outcome effect sizes (ES) using the original metric were calculated from each study. Results were pooled using random-effects models. A two-tailed alpha value <0.05 was considered statistically significant. Heterogeneity was assessed using the Q statistic and inconsistency using I². Small-study effects was examined using funnel plots and influence analysis was conducted with each study deleted once. **RESULTS:** Of the 235 studies screened, 12 trials representing 418 HF patients met the criteria for inclusion. The number of sessions ranged from 24-48 and duration from 28-47 minutes per session. Overall, HIIT significantly increased LVEF (ES = 6.4%, 95% CI = 3.7% to 9.1%; p<0.001). No statistically significant changes were found for either MICT (ES = 3.1%, 95% CI = -0.4% to 6.7%; p = 0.08) or Controls (ES = -0.8%, 95% CI = -1.8% to 0.2%; p = 0.11). Statistically significant heterogeneity and a moderate amount of inconsistency was found for HIIT (Q = 18.4, p = 0.02; I² = 56.9%), statistically significant heterogeneity and a large amount of inconsistency for MICT (Q = 42.9, p < 0.001; I² = 70.0%), but no statistically significant heterogeneity or inconsistency for Controls (Q = 0.42, p = 0.81; I² = 0%). Small-study effects were observed for both HIIT and MICT but not Controls. With each study deleted from the models once, changes ranged from 5.5% to 7.9% for HIIT, 1.9% to 3.8% for MICT, and -3.0% to 0.4% for Controls. **Conclusion:** HIIT increases LVEF in HF patients with reduced EF.

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The transition from hospital-based (phase II) to community-based (phase III) cardiac rehabilitation (CR) is an important step in the long-term maintenance of positive health behaviors and lifestyle change. **Purpose:** To evaluate the effect of participation in a phase III, community-based CR (CBCR) programme on selected fitness indices in comparison to a control group that received usual care advice and to explore participant experiences and perceived benefits in transitioning from hospital-based phase II CR to CBCR. **METHODS:** Following completion of phase-II CR, 95 individuals were referred to a 10-week CBCR exercise programme (intervention). A total of 22 (73% male) participants were unable to attend CBCR classes and were assigned to the control group. The remaining 73 (67% male) were assigned to the CBCR exercise programme. Aerobic fitness (6MWT), functional upper (hand grip) and lower (timed sit to stand) limb strength, flexibility (sit and reach test) and body composition (waist & hip girth and BMI) were measured pre and post the intervention. All participants from the intervention group were invited to attend a focus group on completion and a thematic analysis was conducted. **RESULTS:** A total of 51 participants (69% male) completed the 10-week program (70% compliance). There was a significant improvement (p=0.05) in the timed sit to stand (26.5±7.21 vs 21.4±5.65sec), 6MWT (505±66.6 vs 534±71.9m,) and waist to hip circumference ratio (81.5 ± 9.8 vs 51.3±37cm) in the intervention group. There was no significant change in any of the fitness indices in the control group. The focus groups were attended by 20 participants (60% male). The main themes identified included the strong sense of need for CBCR programmes and the reassurance provided by the link between the hospital and community provider. Physical, psychological and social benefits were described including moving from fear to confidence in their ability to exercise. **Conclusion:** Participation in a 10-week CBCR programme resulted in improved lower limb strength, aerobic fitness and waist circumference with maintenance of all other measured fitness components. Participants self-reported an increased ability and motivation to undertake exercise. This study provides an important insight into the experience and benefits, both perceived and actual, in the early transition to CBCR.
41.2) ml/kg/min; p=0.600; 79 (61-89) vs 69 (61-91) % p=0.599). We also observed an improvement in peak ventilation and oxygen uptake efficiency slope (OUES) in ETG [54.7 (42.6-68.3) vs 67.6 (57.6-100.8) ml/min p=0.028; 1.80 (1.52-2.63) vs 2.11 (1.65-2.88) p=0.028] respectively.

CONCLUSIONS: Our results demonstrate that the supervised exercise training based on CPX was able to improve FC in patients with univentricular physiology after Fontan operation.

290  Board #128 May 29 11:00 AM - 12:30 PM Inertial Flywheel Resistance Exercise in Veterans with Chronic Kidney Disease Predialysis: A Case Series
Jared M. Gollie, Michael O. Harris-Love, Samir S. Patel, Marc R. Blackman, Veterans Affairs Affairs Medical Center; The George Washington University, Washington, DC. (Sponsor: Peter F. Kokkinos, FACSM)

(NO relevant relationships reported)

Chronic kidney disease (CKD) is associated with skeletal muscle loss and neuromuscular dysfunction, resulting in reduced physical performance. Inertial flywheel resistance exercise (RE) has been shown to be an effective training option for improving neuromuscular outcomes in healthy adults. However, evidence supporting its application in patients with CKD is limited. PURPOSE: To determine the effects of inertial flywheel RE on neuromuscular measures and physical function in Veterans with CKD predialysis. METHODS: Two adult men with stage 3 or 4 CKD (age: 70±7.1 yrs; eGFR: 41.5±19.5 ml/min/1.73 m²; weight: 111.3±16 kg; height: 178±2.9 cm) were enrolled to perform 12-wks of inertial flywheel RE for the squat movement (3 sets x 12 repetitions). RE emphasized maximizing power output and was progressed by manipulating inertial load and contraction velocity. Knee extensor peak isometric and isotonic torque (180°/s) and rate of torque development (RTD) were observed in peak isometric and isokinetic torque, RTD, and STS-5. RESULTS: Both subjects improved similarly after RE, thus data are presented as Mean ± SD. Peak isometric and isotonic torque increased from 106.7±8.5 to 291.29±9.7 ft-lbs (+14.7%) and 67.5±3.2 to 80.9±8.4 ft-lbs (+19.9%). RTD at time intervals of 50, 100, 200, and 300 ms increased after RE from 0.14±0.13 to 0.49±0.46 ft-lbs/s (+255.4%), 0.19±0.17 to 0.41±0.34 ft-lbs/s (+119.7%), 0.19±0.13 to 0.27±0.20 ft-lbs/s (+44.3%), and 0.18±0.09 to 0.24±0.06 ft-lbs/s (+32.3%), respectively. STS-5 was reduced from 16.2±3.3 to 13.5±2.8 s (+16.4%). No changes were observed in MT or EI. CONCLUSIONS: Our initial findings support the notion that inertial flywheel RE for the squat movement is an effective training option for enhancing neuromuscular health and physical function in persons with CKD.

291  Board #129 May 29 11:00 AM - 12:30 PM Cardiovascular Rehabilitation: New Indications For Old Entities.
DIEGO IGLESIAS, JORGE FRANCHELLA, FACSM, IGNACIO DA VOLOS. UNIVERSITY OF BUENOS AIRES, BUENOS AIRES, Argentina.
Email: franchelj@gmail.com

(NO relevant relationships reported)

Introduction: The first Argentine Consensus of Cardiovascular rehabilitation (CR) is on the eve of publication. This adds new populations not included in other consensus, on pathologies that the Argentine Society of Cardiology (ASC) has updated through others published in recent years. Purpose: To highlight the interest to include pathologies that are increasingly underestimated and require greater focus. Although there are individual experiences that have not been published in Argentina so far. Methods: The consensus director, working together with two coordinators, and 35 editors, completed the task force of medical doctors with relevant experience in CR. In addition, had also participated an external evaluation committee comprised of four members, two of them international. The new candidate populations for CR programs are hypertrophic cardiomyopathy (HCM), pulmonary hypertension (PH) and chronic atrial fibrillation (CAF). Results: Individuals with these entities tend to over-demand what could trigger undesirable intercurrences. We focus on brief recommendations on each of them. Table. Synthesis of protocols in the considered pathologies

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<table>
<thead>
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<th></th>
<th>PH</th>
<th>HCM</th>
<th>CAF</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Asymptomatic (finding).</td>
<td>1) isolated, or only episode 2) chronic stable.</td>
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<tr>
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<td>Patient training</td>
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<td>+</td>
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<tr>
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</tr>
<tr>
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<tr>
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<td>+</td>
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</tr>
<tr>
<td>Psychology</td>
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</table>

Conclusion: 1) The valuable contribution that will constitute the consensus on CR next to be published by the ASC stands out. 2) It focuses on the value it will have on three pathologies previously not sufficiently considered. 3) It also inferred the value it will generate when inducing the registry during its implementation, since there is not data enough in Argentina in this regard. 4) It proposes the integration and interaction of the different regions of the country in the same, which will stimulate the valuable integral contribution of the community of specialists in cardiology of Argentina. 5) It should be noted that at the last meeting of the ASC, in October 2018, 10,000 attendees were registered.

292  Board #130 May 29 11:00 AM - 12:30 PM Low-health Literate Patients With Heart Failure Are At An Increased Risk Of Readmission
James Kostra I, Kelly Allsup1, Amanda Delligatti2, Gavid Hickey2, John Jakicic, FACSM3, Daniel E. Forman. 1University of Pittsburgh, Pittsburgh, PA. 1VA Pittsburgh, Pittsburgh, PA. 3Healthy Lifestyle Institute, University of Pittsburgh, Pittsburgh, PA. (Sponsor: John Jakicic, FACSM)
Email: jjk83@pitt.edu

(NO relevant relationships reported)

PURPOSE: Health literacy (HL) is the degree to which individuals can obtain, process, and understand basic health information and services needed to make proper health decisions. Low-HL is associated with reduced adherence to exercise, medications, healthy nutrition, and low utilization of preventive health services. Cardiac Rehabilitation (CR) is a secondary prevention program that targets risk factor treatment and reduction, to associated improvements in health status. Heart failure (HF) has recently been added as an eligible diagnosis for CR, and it is associated with particularly high rates of readmission. We hypothesized that low-HL may contribute to high hospital readmission among HF patients. To evaluate differences in hospital readmission rates for HF patients who did and did not attend CR. To compare rehospitalization in relation to low- versus (vs) high-HL in the HF patients who attended CR. METHODS: Retrospective quality improvement analysis. Comparison of matched HF patients who did versus did not attend CR. We then assessed HL in those who attended CR to compare 30-day and 90-day readmissions in patients with low-HL (less than 9th grade reading level) vs high-HL (greater than 9th grade reading level). HL was evaluated using the REALM-SF.

RESULTS: Readmissions in 104 HF patients who attended CR were significantly lower in the HF patients who did not attend CR (17.44% vs 21% at 30 days, and 22.62 vs. 39.3% at 90 days). Among the 104 HF patients who attended CR, 67 who categorized as low-HL had significantly lower readmission than the 37 who categorized as low-HL at both 30 (8.96% vs 29.73, p=0.0061) and 90 days (22.39% vs. 40.54%, p=0.05).

CONCLUSIONS: CR enrollment was associated with reduced readmission in HF patients. Among HF patients who attend CR, low-HL was associated with relatively greater risks of rehospitalization compared to patients with high-HL, suggesting that refinements to address low-HL might improve the efficacy of CR.
Board #131 May 29 11:00 AM - 12:30 PM Feasibility Of Overground High-intensity Interval Training (hit) In Persons With Chronic Stroke
Daniel L. Carl, Victoria Scholl, Sarah Doren, Emily Stagg, Dustyn Whitesel, Kari Dunning, Hamza Sultan, Pierce Boyne. University of Cincinnati, Cincinnati, OH.
Email: daniel.carl@uc.edu

Evidence suggests that treadmill (TM) HIT can be safe and effective as a rehabilitation tool in persons with stroke. However, translation to overground walking can be limited and no studies have tested overground (OG) HIT: PURPOSE: To compare training speeds and HR responses for TM HIT and OG HIT in persons with chronic stroke.

METHODS: Ten subjects (mean ± SD) 59.8 ± 6.8 years old and 2.4 ± 1.7 years post stroke with comfortable gait speed of 0.41 ± 0.35 m/s and fast gait speed of 0.56 ± 0.56 m/s participated and passed a symptom-limited GXT. Subjects performed 12 sessions of HIT over 4 weeks, alternating short and long interval HIT sessions. Both HIT protocols included 10 minutes of overground (OG1), then 20 minutes of treadmill HIT, followed by another 10 minutes of overground HIT (OG2). Short interval HIT involved 30 s bursts at maximum safe speed and 30-60 s rest periods. Long interval HIT involved 4-min bursts at ~90% of peak heart rate (HRpeak) from the GXT and 3-min recovery periods at ~70% HRpeak. Variables recorded included gait training speeds and mean and max heart rate. OG1 and OG2 data were combined to control for warm up and cardiovascular drift effects. Mixed effects models were used to compare TM and OG exercise responses, while accounting for repeated measures from the same participant.

RESULTS: All participants completed 12 sessions and no serious adverse events occurred. With the short interval protocol, OG HIT elicited significantly slower gait training speeds than TM HIT (0.75 vs. 0.90 m/s; p<0.0001), with lower mean HR (78.4 vs 82.9 %HRpeak; p<0.0001) and max HR (89.2 vs 97.0 %HRpeak; p<0.0001). With the long interval protocol, OG HIT elicited significantly faster gait training speeds than TM HIT (0.66 vs. 0.51 m/s; p<0.0001) with similar mean HR (81.2 vs 81.9 %HRpeak; p=0.10) and lower max HR (92.7 vs 95.8 %HRpeak; p<0.0001). CONCLUSIONS: OG HIT appears to be reasonably feasible and safe in chronic stroke. Mean OG HIT speeds were 54% and 18% faster than baseline fastest gait speed for short and long interval HIT, respectively. For short interval HIT, it may be optimal to combine the task specificity of overground training with the higher speeds and intensity of treadmill training. For long interval HIT, treadmill training does not appear to provide the same intensity benefit and overground training alone may be superior.

Board #132 May 29 11:00 AM - 12:30 PM Cardiorespiratory Differences Between Knee Scooter and Crutch Use for Mobility.
Charles RC Marks, Caitlyn Heath. Oakland University, Rochester MI. (Sponsor: Tamara Hew-Buttler, FACSM)
Email: marks@oakland.edu

PURPOSE: In recent years, use of knee scooters (KS) have increased as a modality for moving around with a foot or ankle injury. There is a paucity of research examining the physiological demands of the knee scooter. Therefore, the purpose of this study was to compare moving on a knee scooter with moving using crutches (C). METHODS: Nineteen (13 females, 6 males) apparently healthy young adults were recruited. The participants had one day of practice then another day of testing. Participants completed a figure eight hallway route (196 m) under three conditions: first with walking, then (order randomized) using C and KS. The speed was self-paced with six minutes of sitting rest between conditions. Heart rate and oxygen consumption were monitored with a mobile metabolic system. With alpha = 0.05, One-Way Repeated Measures ANOVA with paired t-Testing (Bonferroni with Holm’s sequential adjustment) for post hoc testing were done. RESULTS: The average VO2 (1223 ± 321 mL/min) of C was significantly 27% higher than the average VO2 (992 ±177; 221 mL/min) for the KS. In addition, the average heart rate (164 &177; 17 bpm) for the C was significantly 12% higher than the average heart rate (146 &177; 24 bpm) for C. Crutch use speed was on average non-significantly 4.2% (2.9 m/min) slower than the KS speed. CONCLUSIONS: The KS caused less cardiopulmonary stress than the C. This indicates that the KS be recommended over C especially for those with poor fitness levels. Supported in part by an Oakland University Honors College Grant.

Individuals with Down syndrome (DS) exhibit reduced peak aerobic capacity (VO2peak) compared to those without DS. Lower VO2peak is partly due to impaired autonomic function, resulting in lower peak heart rate, thus altering cardiac output (CO). Autonomic dysfunction may also impact stroke volume (SV), further affecting CO. SV can be determined during exercise by measuring blood flow velocity in the ascending aorta with continuous wave (CW) Doppler echocardiography. It is unknown whether individuals with DS will tolerate the method or if it is feasible due to their specific physical features and gait abnormalities. PURPOSE: To determine the feasibility of SV measurement during exercise using CW Doppler in adults with and without DS. METHODS: Adults with DS (n= 6, 25 ± 2 yrs, 31.7 ± 4.6 kg/m2, 24.2 ± 4.2 ml/kg/min) and without DS (n= 5, 26 ± 4 yrs, 24.9 ± 4.8 kg/m2, 32.5 ± 6.4 ml/kg/min) performed a maximal incremental treadmill test to assess VO2peak. Images were obtained at rest and every 2 min, until 8 min, of the treadmill test. Success rate of CW Doppler was expressed as a percent of acquired images vs total potential images. The method was feasible if success rate was ≥80%, and if obtained images for SV indexed to body surface area (SVI) were physiologically plausible. RESULTS: Resting measures were equally feasible with both groups at 100% success rate. As exercise progressed, the ability to obtain clear images was compromised, however, feasibility remained ≥80% in both groups. Further, percent change of SVI from rest to 8 min was within expected range (DS: 24.4%, Control: 22.7%). CONCLUSIONS: This pilot data indicates that SV measures during exercise with CW Doppler are feasible in adults with DS similar to that in controls, even with the DS-specific physical characteristics and gait pattern. Future research with more subjects should compare the SVI and CO with increasing exercise intensity between groups to better understand what limits exercise capacity in persons with DS.

<table>
<thead>
<tr>
<th>DS (n=6)</th>
<th>Control (n=5)</th>
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<tr>
<td>Seated Rest</td>
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<tr>
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<tr>
<td>Standing Rest</td>
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<td>36.9 ± 11.0</td>
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<td>54.2 ± 18.4</td>
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<td>8 minutes exercise</td>
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<td>52.9 ± 17.4</td>
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Abstracts were prepared by the authors and printed as submitted.
Stroke has become one of the major causes of disability and mortality worldwide. There is increasing evidence that exercise training is associated with reduced risk of stroke. However, the effects of exercise training on protection of brain damage and subsequent motor and vestibular functions have not been fully understood.

**PURPOSE**: To determine the effects of exercise training prior to brain ischemia on protection against brain damage and subsequent motor and vestibular functions following transient cerebral ischemia/reperfusion injury in rats.

**METHODS**: Male Sprague-Dawley rats were either endurance exercise trained (N=10, ET, treadmill running at 16 m/min, 0° incline, 60 mins/day, 5 day/week, 4 weeks), resistance exercise trained (N=10, RT, climbing vertical ladder start load at 2.56±1.23 Nm, peak load at 2.40±0.55 Nm, 5×/wk, 4 weeks), sedentary (N=20) for 4 weeks. Brain ischemia induced by transient middle cerebral artery occlusion (MCAO) or sham surgery (sham) were then performed on these rats, which results in four groups: sham, MCAO, ET+MCAO, and RT+MCAO. 24 hours after the induction of brain ischemia, motor and vestibular functions were evaluated by various scoring methods. Ischemic infarct volume was measured by triphenyltetrazolium chloride (TTC) staining. One-way ANOVA followed by post-hoc Bonferroni test were used for data analysis.

**RESULTS**: Rats in both ET+MCAO and RT+MCAO group had significantly lower cerebral infarct volumes when compared to those in MCAO group (31.97±8.65% vs. 37.85±10.45% and 33.13±7.82% vs. 37.85±10.45%, respectively, p < 0.05). Consistently, the coordinated locomotor function and vestibular function were also significantly improved in ET+MCAO (2.33±0.52 vs. 3.40±0.89, 1.77±0.97 vs. 2.56±1.23) and RT+MCAO (2.46±0.55 vs. 3.40±0.89, 1.78±1.09 vs. 2.56±1.23) in comparison to MCAO group (p<0.05), while the rats in the sham group did not exhibit any cerebral injury and functional impairment. There were no differences between the two exercise training groups.

**CONCLUSIONS**: Exercise preconditioning prior to brain ischemia induction effectively reduced cerebral infarct volumes and protected against the decline in motor and vestibular functions in a rat model of brain ischemia.

**A-46 Free Communication/Poster - Renal**

**Wednesday, May 29, 2019, 7:30 AM - 12:30 PM**

**Room: CC-Hall WA2**

**Board #134**

**May 29 11:00 AM - 12:30 PM**

**Exercise Preconditioning Reduces Brain Damage and Accelerates Physical Rehabilitation in Rats with Cerebral Ischemia**

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(No relevant relationships reported)

**PURPOSE**: To determine the effects of exercise training prior to brain ischemia on protection against brain damage and subsequent motor and vestibular functions following transient cerebral ischemia/reperfusion injury in rats.

**METHODS**: Male Sprague-Dawley rats were either endurance exercise trained (N=10, ET, treadmill running at 16 m/min, 0° incline, 60 mins/day, 5 day/week, 4 weeks), resistance exercise trained (N=10, RT, climbing vertical ladder start load at 2.56±1.23 Nm, peak load at 2.40±0.55 Nm, 5×/wk, 4 weeks), sedentary (N=20) for 4 weeks. Brain ischemia induced by transient middle cerebral artery occlusion (MCAO) or sham surgery (sham) were then performed on these rats, which results in four groups: sham, MCAO, ET+MCAO, and RT+MCAO. 24 hours after the induction of brain ischemia, motor and vestibular functions were evaluated by various scoring methods. Ischemic infarct volume was measured by triphenyltetrazolium chloride (TTC) staining. One-way ANOVA followed by post-hoc Bonferroni test were used for data analysis.

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**CONCLUSIONS**: Exercise preconditioning prior to brain ischemia induction effectively reduced cerebral infarct volumes and protected against the decline in motor and vestibular functions in a rat model of brain ischemia.
with secondary Stage 3 or 4 CKD. METHODS: Twenty participants (n = 6 men; n = 14 women; age 62.0 ± 9.9 yr; weight 80.9 ± 12.6 kg; body fat 57.3 ± 8.5% of weight; VO₂max 19.4 ± 4.7 ml/kg/min) completed 30 min of SSE at 65% VO₂res and HIIE by treadmill walking (90% and 20% of VO₂res) in 3.2 min ratio) in a randomized crossover design. Both exercise conditions averaged ~ 65% VO₂res. Blood and urine samples were obtained by the same technician under standardized conditions just before, 1hr and 24hrs after exercise. Serum creatinine (sCr), urine epidermal growth factor ratio (uEGFr), cystatin C and estimates of glomerular filtration rate - modification of diet in renal disease (MDRD) and the CKD-EPI - responses were analyzed using 2 (condition) by 3 (sample point) repeated measures ANOVAs.

RESULTS: sCr decreased from 1.45 ± 0.05 pre-exercise to 1.26 ± 0.05 mg/dl (-13%) 1hr after exercise and returned to pre-exercise levels by 24hr (p = 0.009). Both MDRD sCr decreased from 1.45 ± 0.05 pre-exercise to 1.26 ± 0.05 mg/dl (-13%) 1hr after exercise and returned to pre-exercise levels by 24hr (p = 0.009).

CONCLUSION: Clinical estimates, renal function was not normalized but transiently improved with SSE and HIIE in mid-spectrum CKD.

A-47 Free Communication/Poster - Age-Dependent Physiology

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

300 Board #138 May 29 11:00 AM - 12:30 PM
An Investigation Into Age-related Sarcopenia in Rodents
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With aging, there is a decline in both skeletal muscle size and quality. This occurrence is known as sarcopenia and the implications due to this decline can be debilitating. Previous research has elucidated genes that are associated with muscle sarcopenia and how a change in expression can affect both muscle protein synthesis and degradation, which can affect skeletal muscle size and quality. PURPOSE: To investigate the expression of genes relating to skeletal muscle growth, collagen synthesis, and inflammation across the lifespan of rats. METHODS: Sedentary male Fischer 344 rats were fed ad libitum and were aged to 3 and 24 months (mo) (n=8 per age group) and then sacrificed. Body and gastrocnemius (gastro) weights were collected and muscle was processed for RNA isolation and sent out for RNA sequencing. The following genes relating to muscle growth, collagen synthesis and inflammation were analyzed: Myostatin (MSTN), Insulin-like Growth Factor 1 (IGF-1), Insulin-like Growth Factor 2 (IGF-2), phosphorylated Mechanistic Target of Rapamycin (mTOR), Collagen Type I Alpha 1 Chain (COL1a1), Collagen Type I Alpha 2 Chain (COL1a2), Collagen Type IV Alpha 1 Chain (COL4a1), Lysyl Oxidase (LOX), Nuclear Factor Kappa B Subunit 1 (NFKB1), Tumor Necrosis Factor (TNF), Interleukin 6 (IL-6), and Interleukin 1 Beta (IL-1β). RESULTS: MSTRN expression was significantly higher in 3 vs. 24 mo rats (p = 0.018), and was positively correlated to relative gastroc weights (R = 0.663, p = 0.008). All genes related to collagen synthesis were significantly higher in 3 vs. 24 mo rats (COL1a1, p = 0.001; COL1a2, p = 0.007; COL4a1, p = 0.030; LOX, p = 0.046). Furthermore, COL1a1 and COL1a2 were positively correlated to relative gastroc weights (R = 0.649, p = 0.007; R = 0.730, p = 0.001). However, no genes related to inflammation were significantly different between age groups, but there was a negative correlation between IL-6 gene expression and relative gastroc weights (R = -0.546, p = 0.028). CONCLUSION: We suspect 24-month old rodents may be too young to capture the sarcopenia symptoms that occur with aging. However, the relationship between inflammation and relative gastrocnemius muscle mass may warrant further investigations in rodents older than 24 months.

INTRODUCTION: Obesity is a significant health problem that can compound health-related morbidities in aging adults. While substantial research has elucidated many of the metabolic consequences of obesity, much less is known about the effects of adipose tissue (fat) deposition on skeletal muscle function. Some evidence exists to suggest that obesity may interfere with muscle force production, but this is an understudied area of research. PURPOSE: To quantify in vivo the amount and distribution of fat and lean muscle tissue in the quadriceps muscles of healthy older adults. METHODS: The dominant legs of 8 healthy, sedentary adults (71 ± 4 yrs, mean ± SD; 4 men; BMI: 25.1 ± 3.3 kg·m⁻²) were evaluated using a 6-point Dixon imaging technique in a 3 tesla magnetic resonance system. Axial slices (5 mm thick) were acquired for the entire thigh, and each image in which all 4 quadriceps muscles were visible was analyzed to determine fat and muscle volumes (cm³), and fat fractions (fat/total*100 %). The location (% muscle length) of peak muscle volume and fat fraction was calculated as measures of tissue distribution and heterogeneity. Differences in means were evaluated by paired t-tests. RESULTS: Fat-free muscle volume, fat volume, and fat fraction were 821 ± 287 cm³, 75 ± 26 cm² and 8.6 ± 1.1%, respectively. Peak muscle volume and fat fraction occurred in different locations (70.7 ± 7.7 vs. 19.3 ± 23.2% length, p=0.001), with a 3-fold greater coefficient of variation for fat fraction than muscle volume. Likewise, slice-to-slice variability of fat fraction was greater than for muscle volume (4.7 ± 1.5 vs. 1.2 ± 0.3%, p<0.001). CONCLUSIONS: These data show greater spatial variability of fat deposition in comparison to lean tissue in the quadriceps muscles of older adults. Combining these measures with traditional indices of muscle function may provide additional insight about the mechanical impact of intramuscular adipose tissue deposition in vivo.

Support: NIH R01 AG047245

301 Board #139 May 29 11:00 AM - 12:30 PM
Skeletal Muscle Phosphodiester Content is Related to Muscle Mass and Strength in Older Sarcopenic Adults
J. Matthew Hinkley, Heather H. Cornnell, Robert A. Standley, Rick B. Vega, Brett H. Goodpaster, Paul M. Coen. Translational Research Institute for Metabolism and Diabetes, Orlando, FL.

(No relevant relationships reported)

Age-associated loss of skeletal muscle mass and strength (sarcopenia) is a critical healthcare issue for older adults. Effective therapeutic options are limited in part because the underlying etiology is not well-defined. Studies utilizing magnetic resonance spectroscopy (MRS) revealed that resting phosphorus metabolic and maximal ATP production (ATP_max) are altered in muscle from older adults. However, it is unclear whether resting phosphorous metabolites and ATP_max are related to muscle characteristics that define the sarcopenic phenotype. PURPOSE: To determine whether in vivo resting phosphorous metabolites and ATP_max are associated with skeletal muscle mass, strength, and function in older adults. METHODS: In vivo metabolites and ATP_max were measured by phosphorus-MRS during rest and following a brief bout of isometric leg contractions in 74 sedentary older adults (68.6 ± 0.5 years; 23M/51F). Skeletal muscle mass was evaluated by DEXA and mid-thigh MRI. Quadriceps contractile function was assessed by Biodex. These variables were further explored in participants that were classified as sarcopenic (n=6) or non-sarcopenic (n=15). Muscle biopsies of the vastus laterals were obtained to determine fiber type proportion and cross-sectional area by immunohistochemistry. RESULTS: Several resting phosphorous metabolites were related with muscle size and function in older adults. In particular, a phosphodiester peak (PDE2), considered a marker of membrane integrity, was negatively associated with skeletal muscle mass index (r = -0.38, p < 0.01), muscle volume (r = -0.37, p < 0.01), and peak power (r = -0.38, p < 0.01). PDE2 was elevated in sarcopenic patients in comparison to non-sarcopenic controls (2.48 ± 0.11 mM vs. 1.92 ± 0.08 mM, p < 0.01). ATP_max was not different between sarcopenic and non-sarcopenic individuals. At the cellular level, PDE2 was negatively correlated to myofiber area (r = -0.51, p < 0.05) but not fiber type proportion. CONCLUSION: Elevated resting PDE2 levels in muscle were associated with lower muscle mass and strength in older sarcopenic adults. While ATP_max was not related to the sarcopenic phenotype, our results reveal that resting in vivo phosphorous metabolite profiles may be a viable cellular marker of muscle quality in older adults. Supported by NIH Grants K01 AG04437 and R01 AG021961

302 Board #140 May 29 11:00 AM - 12:30 PM
Amount and Variability of Adipose Tissue Content in Human Quadriceps Muscles of Older Adults
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(No relevant relationships reported)
Age-related Changes In The Passive Properties Of The Plantarflexor Muscles
Hayden K. Giuliani, Gena R. Gerstner, Jacob A. Mota, Eric D. Ryan. University of North Carolina at Chapel Hill, Chapel Hill, NC. (Sponsor: Abbie E. Smith-Ryan, FACSM) (No relevant relationships reported)

Limited data exists examining age-related changes in the passive mechanical properties of the musculotendon unit. Purpose: To examine the influence of age on maximum range of motion (MROM), peak passive torque (PTmax), and the dissipative coefficient (DC). METHODS: Twenty-one young (20.3 ± 2.4 yrs) and 14 older (69 ± 3.1 yrs) men completed MROM and isometric strength (for EMG normalization) assessments of the plantarflexors, following ultrasonography of the gastrocnemii. Muscle cross-sectional area (CSA) and subcutaneous fat corrected echo intensity (EI) of the gastrocnemii were determined as the sum and average of both muscles, respectively. Participants were seated in a calibrated dynamometer, with their leg fully extended and ankle and foot held in a custom steel foot plate. MROM assessments were performed by dorsiflexing the ankle at 5°/s from 10° of plantarflexion to the participants maximally tolerated ROM. PTmax, loading, and unloading, and the DC were calculated during the initial 80% of MROM. Independent samples t-tests were used to examine group differences. A Pearson’s correlation coefficient was used to determine the relationship between PTmax and MROM. Analyses of covariance (ANCOVAs) were used to determine age-related differences in loading and unloading, while controlling for MROM. Additional ANCOVAs were used to determine the age-related difference in DC, while controlling for CSA and EI, respectively. An alpha level of 0.05 was used to determine statistical significance. RESULTS: The PTmax, MROM, loading, and unloading (P ≤ 0.046) were greater in the younger men, whereas the DC and EI (P ≤ 0.024) were greater in the older men. When accounting for MROM, unloading (P = 0.044) remained significantly different between groups, while there was no difference between groups for loading (P = 0.223). When accounting for CSA, differences between groups for the DC remained (P = 0.028), while there were no longer differences between groups when accounting for EI (P = 0.120). PTmax was also strongly related to MROM (r = 0.755, P < 0.001). Mean EMG amplitude values across muscles was 1.61% MVC. CONCLUSIONS: Older men exhibited lower MROM and greater DC, which may be explained by an altered stretch tolerance and qualitative changes (i.e. non-contractile tissue accumulation) in aged skeletal muscle, respectively.

Longevity and Physical Vitality during Aging Altered
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Background: Adipose-derived mesenchymal stem cell (MSC)-lysate injection effectively decreases body weight and improves glucose tolerance in mice on a high-fat diet. Purpose: To determine whether lifelong injection of MSC can minimize age-dependent decline in physical vitality and increase longevity in naturally aging rats. Methods: Rats were sex-balanced and randomly assigned into the vehicle-injected group (N = 46) and the MSC lysate injected group (N = 46). We measured body composition by dual energy X-ray absorptiometry (DEXA), spontaneous locomotor activity, and longevity in rats maintained on a normal diet and received an intermittent treatment of human adipose-derived MSC lysate (3 times a week, 11 times a month given every second month), starting at 12 months of age until natural death. Although our data agreed with previous observation on fat loss and marginally improved insulin resistance index subservient to long-term MSC lysate treatments, there was a shortened average lifespan, a longer inactive time, and a greater bone loss with a relative increase in lean mass compared with the vehicle-injected counterparts. Conclusion: Tissue renewal in multicellular systems requires regeneration after destruction. The results of the study implicated that simply enhancing regenerative signals from MSC does not beneficial and appear to be harmful for physical vitality and longevity.

Aging Alters NAD+, Sirtuins and Targeted Protein Levels and Acetylation in the Mouse
Dongwook Yeo1, Choughun Kang2, Li Li Ji, FACSM1. 1University of Minnesota Twin Cities, Minneapolis, MN; 2Inha University, Incheon, Korea. Email: yeowoo39@umn.edu (No relevant relationships reported)

Sufficient intracellular NAD+ is required for mitochondrial function and skeletal muscle health during aging. Sirtuins (SIRTs), the major NAD+ consuming enzymes, regulate mitochondrial function via deacetylating transcription factors and enzymes such as PGC-1α and GCN5, whereas Poly [ADP-ribose] polymerase 1 (PARP-1), the competing enzyme with SIRTs for consuming NAD+, is activated by DNA damages during aging, leading to depletion of cellular NAD+. Lowered NAD+ may dysregulate SIRTs and induce hyperacetylation of its target proteins. Thus, it is important to know how aging impacts on NAD+ pool and its consuming enzyme levels in the skeletal muscle. Purpose: To investigate the effect of aging on NAD+ and protein levels of SIRTs, PARP-1, GCN5, and PGC-1α as well as protein acetylation (AC) in mouse muscles. Methods: C57BL/6j mice at the age of 6 mo (young, Y; n=8), 12 mo (middle, M; N=8), and 24 mo (old, O; N=8) were used. Quadriceps (Q), gastrocnemius (G), and heart (H) muscles were collected for colorimetric assay and Western blotting to quantify NAD+ and proteins levels of various enzymes. Results: Aging decreased nuclear NAD+ by 60 and 50% (p < 0.05) in the G, and by 60 and 70% (p < 0.05) in the Q of M and O, respectively. SIRT1 in G and Q increased by 3.1-fold (p < 0.01) and 1.4-fold (p < 0.05) with aging, whereas aging had no effect on SIRT1 in H. SIRT3 increased 1.3 (p < 0.05), 2.2 (p < 0.01), and 1.5-fold (p < 0.05), respectively, in G, Q and H of O. SIRT2 was increased by 8.8-fold (p < 0.01) in G and Q of both M and O, but not in H. Aging increased SIRT6 by 2.4-fold (p < 0.01) in G and Q, whereas the level was decreased by 50% in H. PGC-1α was increased in G of M (1.7-fold, p < 0.01) and H of O (2.2-fold, p < 0.01) vs. Y. GCN5 decreased 30% in the Q of O (p < 0.01), but increased by 2.6 and 2.9-fold (p < 0.01) in the H of M and O, respectively. Aging increased PARP-1 by 80% in G of M (p < 0.01), and by 40 and 90% in H of M and O (p < 0.01), respectively, but decreased by 40% in Q of O vs. Y. Cleaved-PARP-1 and AC were increased in all muscles with aging (p < 0.01). Conclusion: Aging decreased NAD+ pool, whereas SIRTs, GCN5, PARP-1, and AC were increased with aging. Decreased level of NAD+ and increased levels of NAD+-consuming enzymes in aged muscles may intensify the competition among enzymes for utilizing NAD+, which can contribute to age-associated mitochondrial dysfunction and muscle atrophy.

Comparison of Strength and Cognitive Performance in Elderly Individuals Aged 60 To 70 Years
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Current literature indicates that positive results were obtained on strength, hypertrophy, power, and cognitive performance when strength training protocols were chronically applied in the elderly. Twelve weeks appears to be enough to improve strength and cognitive performance. On the other hand, the age range was large, starting with 60 years through 90 years old in the same study. Purpose: The purpose of this study was to examine if elderly individuals aged 60 years old to less than 70 years old presented different responses in strength and cognitive performance after 12 weeks of a strength training program. Methods: Thirty elderly women were separated into a control group (CG) (n=7), 60 years old group (G60) (n=14) and 70 years old group (G70) (n=9). The participants had body mass, height, upper lean limbs (ULL), lower lean limbs (LLL), and cognitive performance measured after answered the Montreal Cognitive Assessment (MoCA). The data was analyzed was via a one-way ANOVA with p < 0.05. Results: The CG indicated a difference between the G60 and G70 (p = 0.05) for ULL, LLS, and MoCA, while G60 and G70 had no significant differences in strength capacity and cognitive performance. Conclusions: After 12 weeks of a strength training program all groups improved strength capacity and cognitive performance compared to CG, however no differences were observed between G60 and G70.
CONCLUSIONS: The incidence of frailty in female mice increased from 25% at 21 months to 50% at 34 months, with a peak incidence at 26 months. This study highlights the importance of further research on the role of pre-clinical models in understanding the progression and prevention of frailty in aging populations.

Rheumatoid arthritis (RA) is the most common type of chronic inflammatory disease in adults and is often associated with bone health problems. It is estimated that poor bone health may occur in as much as 50% of patients.

PURPOSE: To explore bone health among prefractured patients diagnosed with RA.

METHODS: Twenty-one prefractured patients with confirmed RA were included in the study. Bone mineral density (BMD) was measured by dual-energy X-ray absorptiometry (DXA), and the results were compared to the age- and sex-matched healthy controls.

RESULTS: The bone mineral density of the femoral neck (FN) and lumbar spine (L1-L4) was significantly lower in the RA group compared to the control group. Additionally, a significant correlation was found between frailty status and BMD of the FN (P=0.038) and L1-L4 (P=0.025).

CONCLUSION: Frailty status is significantly associated with decreased bone mineral density in RA patients. Further research is needed to investigate the underlying mechanisms contributing to this association.
Correlation between Generalized Joint Hypermobility and Chronic Musculoskeletal Pain in College Students

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(No relevant relationships reported)

RESULTS: Overall, 20.8% of 634 participants showed GJH based on a cutoff Height/length ≥ 4. Women had statistically significant higher rates of GJH (23.9%) than men (12.2%) (Wald Test, DF = 1, Chi-square = 10.049, p = 0.0015; odds ratio female to male: 0.44). Ninety-four of 650 participants (14.5%) recalled chronic joint pain. The most commonly named joints were knee (n = 59), shoulder (n = 17), hip (n = 14), ankle (n = 9), and elbow (n = 7). Male and female participants with GJH reported higher rates of chronic joint pain than participants without GJH. There was, however, no significant difference (Pearson Chi-square Test, Chi-square = 1.386, p = 0.5001, n = 650). The prevalence of chronic neck/back pain in our study was 20.8%. Participants with GJH reported higher rates of chronic neck/back pain, yet, the difference was not statistically significant (Pearson Chi-square Test, Chi-square = 3.850, p = 0.459, n = 650). The average pain intensity on a scale from 0 to 10 was more or less the same for both types of chronic pain (4.5 for chronic joint pain, 4.2 for chronic neck/back pain) and for respondents with and without GJH. The ranges for the reported pain intensity as well as the standard deviations for all averages were also very similar.

CONCLUSION: Young adults with GJH are not reporting higher rates of chronic pain in joints, the neck or the back nor do they suffer from more severe pain than their peers without GJH.
Results: We previously reported that HFHS diet did not impair diaphragm maximal specific force or peak power. Alongside this maintenance of contractile function, HFHS-fed rat diaphragm muscle fibres exhibited a reduction in size (25%); lean: 3.4±0.8, HFHS: 2.7±1.7), type I/II fibre CSA (in μm²; lean: 1594±121, HFHS: 2174±103), type Ia/Ib fibre CSA (in μm²; lean: 2062±329, HFHS: 2412±155), or type IIb fibre CSA (in μm²; lean: 4165±1232, HFHS: 4523±526). Additionally, no shifts in fibre type occurred. Interestingly, HFHS diaphragm demonstrated a trend toward a lower succinate-induced increase in ROS emission (pmol/min: lean: 1.313 ± 0.2; HFHS: 0.73 ± 0.2; p = 0.09). Analyses of glutathione and antioxidant enzymes are ongoing.

Conclusion: A high-saturated fat, high-sugar diet did not induce diaphragm muscle dysfunction or morphological changes. These results, combined with our previous findings of normal contractile function, suggest that intrinsic diaphragm muscle abnormalities do not contribute to breathing difficulties in obesity.

Power development is imperative for dynamic sport athletes. Cluster sets (CLU) are an effective method to allay the progressive decrement in power output normally observed in a traditional (TRD) resistance exercise strategy. CLU configurations incorporate a brief intra-set rest period to preserve velocity and power. Despite favorable performance, we previously established that TRD configurations elicit higher myofibrillar protein synthesis (MPS) rates when compared to CLU. However, it remains unclear if hallmark readouts related to mTORC1-signaling underlie this response on satellite cell (SC) proliferation and differentiation, an important step in any such muscle adaptations. Hormones can be beneficial for muscle adaptation (e.g. muscle size, strength); however, no prior research appears to have investigated the effect of the RE-induced hormonal response on satellite cell (SC) proliferation and differentiation, an important step in any such muscle adaptations. Purpose: To determine the effect of transient resistance exercise (RE)-induced hormonal changes on satellite cell myogenic state following eccentric exercise. Methods: Untrained men (n=10, 22±3y) and women (n=9, 21±4y) completed 2 sessions of 80 unilateral maximal eccentric knee extensions followed by either an upper body RE protocol (EXE) or a 20-min rest (CON). Muscle samples were collected and analyzed for protein content of Pax7, MyoD, myogenin, cyclin D1, and p21 before exercise (PRE), and 12 hours (+12h) and 24 hours after the session (+24h). Serum testosterone, growth hormone, cortisol, and myoglobin concentrations were measured at PRE, immediately after eccentric knee extension (TIMD), immediately after (IP), 15, 30, and 60 min after the session. Results: Testosterone was significantly (p<0.05) higher immediately after the session in EXE (6.34 ± 0.48 ng/ml) than CON (4.87 ± 0.26 ng/ml) for men. A significant time x gender x condition interaction was found for MyoD with 20.1 ± 10.8-fold increase for EXE in men and 21.9 ± 7.6-fold increase for CON in women. At +24h compared to PRE, a significant time x condition interaction was found for Pax7 with 0.8 ± 0.1-fold decrease for EXE and 1.6 ± 0.3-fold increase for CON at +24h compared to PRE. A significant time effect was found for myogenin, p21, and cyclin D1. Myogenin (+12h: 5.9 ± 1.5-fold; +24h: 5.0 ± 1.1-fold) and p21 (+12h: 25.4 ± 4.5-fold; +24h: 12.4 ± 1.9-fold) were increased at +12h and +24h and Cyclin D1 was 6.6 ± 1.9-fold increased at +12h compared to PRE. Conclusion: These results suggest that the RE-induced hormonal response can be important to promote SC proliferation for men but not women. In addition, markers of SC differentiation appeared to be unaffected by the hormonal response but were increased in response to the knee eccentric exercise protocol. Supported in part by a grant from the National Strength and Conditioning Association Foundation.

Previous studies have reported that a prior bout of damaging exercise with one limb attenuated the magnitude of muscle damage in the subsequent damaging exercise with the contralateral limb, a phenomenon called contralateral repeated bout effect (CL-RBE). To our knowledge, these studies involved either exclusively men or a mixture of both sexes.

Purpose: To determine whether contralateral repeated bout effect of elbow flexors exists in women. Methods: Twelve healthy women (20.9 ± 2.5 yrs) performed two bouts of 45 maximal eccentric contractions (ECC) of elbow flexors separated by 14 days. The isokinetic muscle strength (60°/sec) was measured pre-exercise, immediately post-exercise, and at 24 and 48 h post-exercise. Limb girth, range of motion (ROM), and muscle soreness were measured pre-exercise, and at 24 and 48 h post-exercise. Surface Electromyography (EMG) was recorded during both exercise bouts from the biceps brachii muscle. Data of all variables were analyzed using two-way repeated measures ANOVA (Bout x Time) except that of median frequency of EMG which was analyzed via paired t-test.

Results: The isokinetic strength was significantly reduced after the eccentric exercise for both bout 1 (+19.3 ± 17.4%, P < 0.01) and bout 2 (+15.3 ± 15.2%, P < 0.01). Significant main effects of time were also observed for muscle soreness and ROM. Limb girth did not change significantly after either exercise bout. There were no significant differences between bouts for all the measured variables.

Conclusion: The CL-RBE of elbow flexors was not evident in healthy young women, which is probably because the magnitude of the muscle damage induced by the first exercise bout was not sufficient to induce protective adaptation for the contralateral arm in the second bout.

Near-infrared spectroscopy (NIRS) is a non-invasive method for measuring tissue concentrations of oxy- (HbO2) and deoxyhemoglobin (Hb) providing information about local metabolism, tissue-specific oxygen availability, and blood flow. Time-resolved NIRS can quantitatively measure absolute hemoglobin concentrations in tissue. Its ability to separate light absorption from scattering makes it an ideal tool for measuring tissue hemoglobin levels where there may be large changes in blood volume such as with exercise. Furthermore, it has been hypothesized that blood flow and oxygenation to the prefrontal cortex (PFC) may be related to fatigue. Purpose: To quantify tissue oxy- and deoxyhemoglobin (Hb) concentrations in the vastus lateralis (VL) and PFC during a 2,000 m ergometer time trial test with collegiate rowers. Methods: Eighteen collegiate club rowers (11 males and 7 females, 20.33 ± 1.6 years, VO2max: 50.4 ± 9.2 ml/kg/min) performed a 2,000 m test on a Concept 2 ergometer. A two-channel time-resolved NIRS instrument (TRS-21, Hamamatsu) was used to assess tissue HbO2, Hb, and total hemoglobin (THb) of the right VL and PFC. Results: Average time to complete the 2,000 m time trial was 475.4 ± 44.37 seconds. A significant correlation was observed for...
Lateralis Pennation Angle During Isometric Squats

Board #158 May 29 11:00 AM - 12:30 PM
Calf Muscle Endurance and Gait Variability among Older Adults

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Declines in skeletal muscle functions are associated with aging which affects daily activities and quality of life. Fall risk and fall-related injuries are related to muscle fatigability among older adults.

PURPOSE: Measure calf muscle endurance and gait function in older adults. We hypothesize that gait abnormalities will be associated with reduced calf muscle endurance. METHODS: Ten participants ages 55-80 years volunteered for the study. Skeletal muscle measurement was measured on the calf muscle of the participant’s right leg at 2Hz, 4Hz and 6Hz using previously established protocol. Selected gait measurements (stride length, stride width, gait velocity) were recorded on three trials at self-selected speed on a 20foot gait mat (Prokinektics Zeno walkway).

Pearsen’s r was used to test the relationship between the selected gait variables and endurance index at 6Hz. ANOVA Levine’s test of covariance was used to test the difference in the variance in step length of both legs. Significance was accepted at 0.05 alpha level Results: Muscle endurance at 6Hz (0.75±0.21%) varied from 0.3% to 1.0%. Stride length (145cm±11cm) varied from 127.4cm to 168.5cm and step length (1.0cm±0.06cm) varied from 64.6cm to 82.7cm. There was a positive correlation between endurance index and stride length (r = 0.68, p<0.02), and the right/left ratio step length (r = 0.72, p = 0.01) but there was no significant relationship between endurance index and step width (r = 0.43, p = 0.11). A Levene’s test verified equality of variances in step length %CV of both legs (p = 0.84). Conclusions: Muscle endurance in the calf was associated with some selected gait parameters which have been shown to predict increase fall risk among older adults.

Calf Muscle Endurance and Gait Variability among Older Adults

Board #159 May 29 11:00 AM - 12:30 PM
Electrical Pulse Stimulation Induced Increase In Lipid And Mitochondria Depends On Donor’s Physical Activity Level

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(No relevant relationships reported)

We have previously shown that human primary myotubes retain in vivo characteristics of their donors. Electrical pulse stimulation (EPS) has recently been used as an exercise mimetic in a cell culture model, and could be beneficial to understanding underlying molecular mechanisms of exercise.

Purpose: To determine if EPS induced adaptations on mitochondria and lipid content is dependent on the donor population and the duration of EPS applied.

Methods: Human primary skeletal muscle myotubes were cultured from four endurance trained athletes (23 ± 1 yrs and BMI 24.4 ± 0.9 kg/m²) and five lean healthy Caucasian donors (23 ± 1.9 yrs and BMI 24 ± 0.6 kg/m²). EPS was applied to pooled cell cultures. Resting ATP and lactate content, and mitochondrial (108.3 ± 18.9 AU) and lipid (5.78 ± 0.51 AU, 24hr. 35.43 ± 5.12 AU, 48 hr. 25.9 ± 2.6 AU) content were measured in all mice. Data were analyzed using a factorial ANOVA with an α level of significance of 0.05. Fisher’s LSD pair-wise comparisons were made when the F-statistic was significant (p<0.05).

Results: Mitochondria content was significantly greater after 24 hours EPS (p=0.0004) but not after 48 hours (both p>0.05) of EPS compared to control of EPS (Lipid: control 0.51 ± 0.08 AU; 24hr. 0.72 ± 0.07 AU; Mitochondria: Control 6.9 ± 0.87, 24hr. ± 14.4, 48 hr. 89.57 ± 12.4 AU). Lipid content did not change in myotubes cultured from athletes with EPS after 24 hours (p=0.8) or 48 hours (p=0.4) (Control 35.68 ± 0.51 AU, 24hr. 35.43 ± 5.12 AU, 48 hr. 25.9 ± 2.6 AU) whereas mitochondria content was significantly greater after 24 hours EPS (p=0.0004) but not after 48 hours (p=0.8) of EPS (control 108.3 ± 18.9 AU, 24hr. 239.1 ± 23.5 AU, 48 hr. 125.1 ± 15.3 AU).

Conclusions: Primary human skeletal muscle cells cultured from athlete donors have a higher lipid and mitochondrial content compared to lean, healthy donors. EPS induced increases in lipid and mitochondrial content depends on the physical fitness of the population being studied. 24 hours of EPS stimulation seems to result in greater mitochondrial content compared to 48 hours of stimulation.

Whole-body Heat Shock Accelerates Recovery from a Single Blunt Trauma Contusionion Mice

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(No relevant relationships reported)

Contusions are a common sports injury, often resulting in acute skeletal muscle contractile dysfunction. Whole-body heat shock is reported to attenuate skeletal muscle atrophy in animal models. PURPOSE: The purpose of this study was to test the hypothesis that whole-body heat shock attenuates contusion-induced skeletal muscle contractile dysfunction. METHODS: Male mice (14.4 ± 1.4 mo) were randomized to either the heat shock contusion group (HSC n=5), or sham (n=3). Under anesthesia, the in vivo torque-frequency relationship (1Hz-300Hz) of the anterior crural muscle group was measured in all mice. Body temperature was then raised to 41°C (HSC) or maintained at 37°C (NTC and sham) for 30 min and then all mice were allowed to recover consciousness. Twenty-four hours later all mice were anesthetized again and a single contusion (HSC and NTC) was delivered via the instrumented mass-drop technique (14.1 g steel ball was dropped through a tube from 115 cm onto an impactor directly striking the tibialis anterior) or no contusion (sham); all mice were then allowed to recover consciousness. RESULTS: There was a significant group-time-frequency interaction (F=1.791, p=0.034). Within group pairwise comparison pre to 5-d recovery revealed sham did not differ (p=0.529), HSC fully recovered (p=0.899), and NTC did not recover (p=0.001) muscle contractile function. Within group comparison pre to 5-d
at 40Hz (submaximal stimulation) and 250Hz (maximal stimulation) found sham did not differ (p=0.765; p=0.912, respectively), HSC recovered (p=0.786; p=0.602, respectively), and NTC did not recover at either frequency (p=0.001; p=0.006, respectively). CONCLUSION: Whole body heat shock treatment prior to a single blunt trauma contusion accelerates the rate of recovery of in-vivo skeletal muscle contractile function within the 5-d recovery period. Funding: This work was partially supported by an Appalachian State University GRAM award.

**Purpose**: There is currently no successful cell contraction model in vitro. Electrical pulse stimulation (EPS) can induce muscle cell contraction. 10%O2 microenvironment is closer to the human skeletal muscle environment. In this study, EPS was applied to myotubes to test the changes of the metabolism of glucose and lipid, and to establish successful cell contraction model in a 10%O2 microenvironment. 

**Methods**: After seven days of differentiation in 5% CO2 (20%O2) incubator, the mouse myoblast cell C2C12 were transferred into the 10%O2 incubator. After adaptation in the hypoxia for 12h, the myotubes were subjected to EPS. The EPS stimulation was performed for 120min each, total 4 consecutive days. And cell extracts obtained from each were prepared 3h after EPS. The content of PGC-1α, MyHCI, MyHCIIx and MyHCIIa in myotubes. EPS significantly decreased the protein level of PGC-1α, and the synergetic effect of hypoxia and EPS was more significantly. 10%O2 microenvironment significantly decreased the content of MyHCI, MyHCIIb and MyHCIIa in myotubes. EPS significantly decreased the content of MyHCIIb and MyHCIIa but significantly increased the content of MyHCIIa. 10%O2 microenvironment significantly decreased the mRNA level of GLUT1 and GLUT4. However, in stimulated myotubes, the mRNA level of GLUT1 was significantly elevated, but the mRNA level of GLUT4 was decreased. Meanwhile, 10%O2 microenvironment significantly decreases the mRNA level of MAD, CPT1B and PDH, and EPS increased the mRNA level of MCAD.

**Conclusion**: 4 days of 10%O2 microenvironment combined with EPS successfully established myotubes cell contraction model. 10%O2 microenvironment inhibited the proliferation and glycolipid metabolism in myotubes. The usage energy of EPS-induced contraction is based on aerobic oxidation of glucose and fatty. The pulse frequency increases from 1 Hz to 2 Hz in the EPS protocol, were association with substrate from fat to glucose.

Muscular architecture is a valuable tool for quantifying muscle function. The arrangement of muscle fibers, commonly referred to as pennation angle (PA), influences the amount of force that a muscle can produce. Levels of leg asymmetry (PA, strength, ROM, etc.) is a growing topic of interest due to its link to functional disorders, injuries, and fall risk. Hence, a better understanding of the amount of asymmetry present can serve as a guide for future researchers and practitioners when examining lower limb function and performance. 

**Purpose**: The current study examined asymmetry in pennation angle (PA) and force production (FP) in the quadriceps femoris (QF) muscle group in college aged males. 

**Methods**: Thirty-eight college-aged males (22.97±2.58 yrs, 180.22±6.90 cm, 88.62±14.88 kg) were recruited to participate in this study. All measurements were taken in random order on both legs. PA's were measured using B-mode ultrasound. Three images were captured and analyzed for each muscle of the QF: the vastus medialis (VM), vastus lateralis (VL), rectus femoris (RF) and vastus intermedius (VI). QF FP was measured on two separate visits by performing 3 knee extension maximal voluntary isometric contractions (MVCs). The mean MVC was used in data analysis. RESULTS: FP was significantly different between legs (p<0.01, p<0.001, p<0.001, p<0.001, respectively). The EPS protocol, with or without high intensity intermittent exercise on gastrocnemius muscle, improves muscle architecture. 

**Conclusion**: The aim of this study was to determine the magnitude of bilateral asymmetry for PA in the QF in resistance trained (RT) and non-resistance trained (NRT) males. 

**Purpose**: The present study investigated the effects of different exercise patterns on gastrocnemius in obese rats. Methods: Forty-eight SD rats were randomly divided into four groups, 12 in each group, which were quiet control group (Con), continuous exercise group (CE), high-intensity intermittent exercise group (HIIT) and ladder exercise group (LE). After 8 weeks of exercise training, each exercise group was anesthetized including quiet control group and samples were collected for testing. The body weight and gastrocnemius weight of each group were recorded. The cross-sectional area of gastrocnemius muscle was observed by HE staining. The levels of MSTN and insulin in serum were detected by ELISA. The expressions of MSTN, IGF1 and p70S6K in rat gastrocnemius muscle were detected by Western blot.

**Conclusion**: Although the three exercise modes may significantly reduce the body weight of rats, only continuous exercise and ladder exercise improve the gastrocnemius muscle mass index. Continuous exercise and high-intensity intermittent exercise had similar effects on serum GDF8, insulin, and similar effects on the proteins of MSTN, IGF1 and p70S6K in the gastrocnemius muscle, but the effects of three exercise modes on serum GDF8 and insulin and gastrocnemius MSTN, IGF1 and p70S6K proteins, ladder exercise is different from sustained exercise and High intensity intermittent exercise.

**Penetration angle** (PA) is the orientation at which muscle fibers attach to the deep aponeurosis within a muscle. PA is measured using an in-vivo methods (ultrasound) which allows researchers to observe any angle discrepancies throughout different locations in the muscle. The quadriceps femoris (QF) is a muscle group used on a daily basis. Understanding the architecture of the QF is helpful for understanding and improving performance in sports or activities which relies on running, jumping, or explosive movements. Another reason to pursue our understanding of muscle architecture is examining potential for injury. Furthermore, asymmetrical strength of the quadriceps can lead to increased risk of injuries. However, limited research has looked at muscle architecture asymmetry as it relates to injury and function. 

**Purpose**: The aim of this study was to determine the magnitude of bilateral asymmetry for PA in the QF in resistance trained (RT) and non-resistance trained (NRT) males. METHODS: Thirty-eight males (22.97 ± 2.58 yrs., 180.22 ± 6.90cm, and 88.62 ± 14.88 kg) were recruited to participate in this study (25 were lower body RT and 13 were NRT). The first visit consisted of protocol explanation and familiarization. The follow visit consisted of PA assessment of the QF muscles using B-mode ultrasound. All PA measurements were taken in random order on both legs. Three images were captured and analyzed from the vastus medialis (VM), vastus lateralis (VL), rectus femoris (RF) and vastus intermedius (VI). RESULTS: There was no significant group x leg effect for PA of the QF: [F(3, 35) = 0.470, RF = 0.873, VM = 0.290, VL = 0.413, VI = 0.413]. Collapsing across groups revealed a non-significant effect on asymmetry as well (p>0.05). The between leg percent differences were VM 6.08% ± 3.65%, VL 4.84% ± 4.1%, RF 3.87% ± 4.0% and VI 3.53% ± 5.87%. CONCLUSION: This study revealed that PA angle in the QF muscles was not significantly different between RT and NRT in males.
Lower-limb amputees often exhibit an increased atrophy of remaining skeletal musculature as compared to the non-amputated side. This difference in lean mass may present variations in the contribution of physical effort between the affected and unaffected musculature. While most literature has focused mainly on microprocessor-controlled prosthetics, few investigations have examined mechanical (i.e., un-powered) prosthetics during daily activity tasks. **Purpose:** The purpose was to examine the electromyographic activity of the lower limb musculature of the amputated versus non-amputated side in a unilateral trans-femoral amputee. **METHODS:** The participant (n=1, age=26) performed four activities of daily living (i.e., sit-to-stand, side step test, multi-stage 20-m shuttle run test, two-step test, sit and reach). **RESULTS:** Twelve of 17 variables was correlated (P< 0.05) with SMI. There was a good relationship between mid-thigh girth and SMI (r = 0.81, P< 0.001). The prediction equations were highly correlated with SMI (R²= 0.64 for step 1 [SMI = 0.11 x thigh girth (cm) + 0.71] and R²= 0.90 for step 7 [SMI = 0.02 x thigh girth (cm) - 0.07 x body fat (%)+ 0.02 x BMI (kg/m²) + 0.02 x handgrip (kg)+ 0.04 x lower leg girth +0.01 x side step + 0.14], P< 0.05). **CONCLUSION:** Our results indicated that the SMI could be evaluated by the field-based simplified methods, especially for the mid-thigh girth measurement, which may be a major determinant to maintain an active life for healthy young women.
PURPOSE: To investigate the effect of concurrent exercise training and leucine supplementation on skeletal muscle protein deposition in Colon 26 tumor bearing mice.

RESULTS: Male BALB/c mice were divided into a control group (C, n=8), a Colon 26 tumor bearing group (T, n=8) and a tumor bearing plus exercise and leucine supplementation group (TEL, n=8). Mice in the C and T groups were fed with normal chow diet, while mice in the TEL group were fed with formulated diet containing 5% leucine and received 30-min swimming training 3 days per week (Monday, Wednesday and Friday) and resistance training 3 days per week (Tuesday, Thursday and Saturday) for 2 weeks. At 24 hours after the last training session, blood and gastrocnemius muscle samples were collected under full anesthesia. The contents of TNF-α and IL-6 in gastrocnemius muscle and serum were determined by ELISA. Maximal grip strength was measured with a commercial grip strength meter. Two-way ANOVAs and post-hoc tests were used for data analysis.

CONCLUSIONS: The results of the current study suggest that leucine supplementation can increase spontaneous locomotor activity housed in the EE. Further studies are needed to determine the underlying mechanisms.
supplementation significantly reduced time-to-completion and increased measures of power and speed during a 4-km cycling time trial. RSE also appeared to lower DBP following the cycling time trial, without altering participants’ perceived exertion or subjective measures of muscle fatigue. Supported by a grant from American Health Foods, Inc.

The probiotic Streptococcus salivarius M18 increases plasma nitrite but does not alter blood pressure

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Some species of bacteria in the mouth can reduce nitrate (NO\textsubscript{3}) from the diet to nitrite (NO\textsubscript{2}), which can later be converted to nitric oxide (NO). Increased levels of NO can reduce blood pressure (BP) and improve exercise performance. The bacteriocin-producing probiotic Streptococcus salivarius M18 (S. salivarius M18) can inhibit pathogenic oral bacteria but it is unclear whether an alteration to the oral microbiome will influence circulating levels of NO metabolites and BP. **Purpose:** To determine the effects of S. salivarius M18 supplementation on BP, plasma and saliva [NO\textsubscript{3}], and [NO\textsubscript{2}]. **Methods:** Eight healthy males (age 32 ± 8 y, body mass 80 ± 11 kg) completed 2 x 14 day supplementation phases in a randomized order at least 14 days apart. In one phase, participants consumed S. salivarius M18 probiotic lozenges (2.5 billion colony-forming units/dose) once per day and in the other they ingested water (placebo). Samples of unsupplemented saliva and venous blood were collected, and BP was measured before and after each phase. Samples of saliva were later analysed for [NO\textsubscript{3}] and [NO\textsubscript{2}] using chemiluminescence. The change (Δ) in each outcome from pre- to post-supplementation was compared between phases using paired t-tests. **Results:** Plasma NO\textsubscript{2} increased from baseline (173 ± 38 nM) following probiotic supplementation (Δ0.24 ± 0.21 33 nm, P = 0.04) in comparison to the placebo phase (Δ8.77 ± 61.51 nm). There were no significant differences in systolic BP (probiotic Δ0 ± 3 mmHg; placebo Δ1 ± 4 mmHg, P = 0.51). Diastolic BP and salivary NO metabolites were also unaffected (all P > 0.05). **Conclusions:** Supplementation with S. salivarius M18 increased plasma NO\textsubscript{2}, a key marker of NO availability, potentially by altering the abundance or activity of NO\textsubscript{2}-reducing bacteria in the mouth. Despite this, S. salivarius M18 did not lower BP in healthy participants. Further research is therefore required to determine the therapeutic and ergogenic potential of probiotic supplementation. Supported by a grant from the Hannah Dairy Research Foundation

**Board #173 May 29 9:30 AM - 11:00 AM The Probiotic Streptococcus Salivarius M18 Increases Plasma Nitrite But Does Not Alter Blood Pressure**

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(No relevant relationships reported)

**Board #175 May 29 9:30 AM - 11:00 AM Ergogenic Effect of Citrulline Malate Supplementation on Total Training Load and Muscle Thickness in Trained Women.**

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(No relevant relationships reported)

Practitioners of physical activity, to improve performance in training sessions, commonly use pro-workout supplements. Recently, Citrulline Malate (CM) has attracted attention for its potential to improve performance in resistance training (RT). However, there is still a need to understand the ergogenic effect of CM in some populations with different levels of training. **Purpose:** To evaluate the acute effects of CM supplementation on the total training load and muscle thickness (MT) in recreationally-training-trained women. **Methods:** Six women (27.8±3.5 y; 67.8±6.6 kg; 164.5±3.1 cm) experienced RT in RT (36±1.95 months) underwent three RT sessions (RTS) in a randomized, double blind fashion. Participants were submitted to the maximum strength test (1RM) for the Arm Curl (AC) and Leg Extension (LE) exercises 120h before experimental trials (ET). Then, each participant performed a RTS in three randomized ET with 90% of interval among them: i) Control (CON), without consumption of any supplement; ii) Placebo (PLA): with 8g of synthetic magnesium silicate and iii) Supplemented (SUP): with 8g of CM. PLA and SUP consumed their supplements 60min before the RTS that consisted in 3 sets until concentric muscle failure with 80%IRM and 90sec interval-rest among sets in AC and LE exercises. The total number of repetitions and the total training load was recorded for each series and the muscle thickness of the extensor muscles of the thigh and arm flexor muscles was obtained, immediately, before and after each exercise (Bodymetrix PRO-BX2000™). One-way ANOVA with Tukey’s post-hoc was utilized to compare differences among ET, Wilcoxon test was utilized to within groups analyzes and effect size (ES) was calculated by using Cohen d. **Results:** There were no significant differences in total training load among the ET (CON: 4714±1260kg; PLA: 4758±922.4kg; SUP:4826±940.7kg). Significant differences were observed in MT pre and post RTS in all ET in the arm flexors (CON: P=0.01; ES:1.2; PLA: P=0.007, ES:1.8; SUP: P=0.005, ES:1.4) and in the thigh extensors (CON: P=0.048, ES:0.6; PLA: P=0.01, ES:1.2; SUP: P=0.01, ES:1.4), however, no significant differences were observed when compared to the ET. **Conclusion:** The supplementation with 8g of CM 60min before a RTS has no ergogenic effect on total training load or MT in resistance-trained women.

**Board #176 May 29 9:30 AM - 11:00 AM Oral Creatine Supplementation On Physically Active Elderly Women Cognition Improvement**

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(No relevant relationships reported)

**Purpose:** The aim of this study was to verify if creatine supplementation in conjunction with a community-based exercise program improved cognition in elderly women. **Methods:** Twenty elderly women were randomized into 2 groups: creatine (CRE, n=10, age = 71 ± 6 y; body mass = 67.4 ± 6.0 kg; height = 166 ± 2.2 cm) or control (CON, n=10, age = 73 ± 6y; body mass = 67.4±3.5 kg; height = 164±4 cm). All subjects were active and did not use CM or pro-cognitive drugs before the experiment. CRE group received 2.0 g body mass kg\textsuperscript{-1} of CM for 28 days. CON group received 2.0 g body mass kg\textsuperscript{-1} • day\textsuperscript{-1} of dextrose. Community-based activities (walking, dancing, calisthenics, stretching) were performed 3x a week with 1 h per session. Cognition was assessed using a battery of five tests: a Visual Reaction Time (VRT) test, a visual GO/NO GO reaction time (GNG) test; a Differentiation task test (DTT), an Eriksen flanker task (ETF), and a Corsi block test (CBT). Subjects completed a familiarization, taking the testing battery on two sessions nonconsecutive days the week prior to the experiment. The week after familiarization, subjects completed the test battery and initiated supplementation (CRE or CON). After 28 days, they repeated the test battery.
There is a void in our knowledge on the impact of exercise, in particular creatine supplementation, on arterial stiffness (AS) in the major elastic arteries. There is a void in our knowledge on the impact of exercise, in particular creatine supplementation, on arterial stiffness (AS) in the major elastic arteries. There is a void in our knowledge on the impact of exercise, in particular creatine supplementation, on arterial stiffness (AS) in the major elastic arteries.

**PURPOSE:** The aim of this study was to conduct a systematic review and meta-analysis of the effects of creatine supplementation on repeated sprint ability.

**METHODS:** Sixteen studies met the inclusion criteria of adopting double-blind randomized placebo-controlled designs (crossover or between-subject) in which adult participants (age ≥ 18 years) completed a repeated sprint test (number of sprints: 4 < n ≤ 20; sprint duration: ≤ 10 s; recovery duration: ≤ 90 s) before and after supplementing with creatine or placebo for ≥ 3 days in a dose of ~ 20 g per day. No exclusion restrictions were placed on the mode of exercise. Meta-analyses were completed using random-effects models, with effects on measures of peak sprint performance (peak power or fastest sprint) and fatigue during each repeated sprint test presented as standardized mean difference (d) and with effects on body mass and post-test blood lactate concentration presented as raw mean difference (D).

Analyses were completed using pre-post supplementation differences, with standard deviations imputed, where necessary. 95% confidence limits (CLs) were calculated for all estimates. RESULTS: Relative to placebo, creatine supplementation resulted in a significant increase in body mass (D = 0.67 kg; CL[0.47, 0.88]; P < 0.00001). However, there was no corresponding effect of creatine supplementation on measures of peak sprint performance (d = -0.25; CL[0.19, 0.69]; P = 0.27), fatigue (d = 0.19; CLs[-0.14, 0.53]; P = 0.26), or post-test blood lactate concentration (D = 0.36 mmol/L; CLs[-0.13, 0.85]; P = 0.15). CONCLUSION: Although the increase in body mass following creatine supplementation supports an increase in creatine retention; the effects of acute creatine monohydrate supplementation on AS and SmO2 could possibly effect SmO2 during exercise and recovery. **PURPOSE:** To determine the effects of acute creatine monohydrate supplementation on AS and SmO2.

**METHODS:** Twelve healthy active men (age 22.7 ± 0.8 years; weight 79.8 ± 7.3 kg; height 182.4 ± 4.9 cm; weekly exercise 5.1 ± 1.6 hours) were subjected to a single session of bench press exercise until volitional exhaustion, with venous blood sampled before, immediately after exercise (~ 2 min), and after 15 min, 60 min and 24 h after the end of exercise. RESULTS: Baseline values for serum GAA, creatine and creatinine were 2.2 ± 0.5 µmol/L, 18.9 ± 3.6 µmol/L, and 72.4 ± 6.0 µmol/L, respectively. Serum GAA significantly dropped for 9.6 ± 7.3% immediately after bench press exercise (95% CI, 5.0 to 14.2; P < 0.001), while both creatine and creatinine increased immediately after the test for 5.0 ± 2.3% (95% CI, 3.4 to 6.6; P < 0.001) and 11.9 ± 4.3% (95% CI, 9.2 to 14.6; P < 0.001), respectively. GAA and creatine levels recovered to the baseline values after 24 hours post-exercise, yet creatinine remained significantly higher at 24-hour period as compared to the baseline values for 2.5 ± 2.3% (95% CI, 1.0 to 4.0; P = 0.002). CONCLUSIONS: A single session of exhaustive resistance exercise induces transient alterations in biomarkers of creatine metabolism, with serum creatine outlined as a most persistent marker of exhaustion. Exercise-induced changes in creatine metabolism poorly corresponded to perturbations in inflammation and muscle fatigue biomarkers following exercise. This project was partly supported by the Serbian Ministry of Education, Science and Technological Development (175037 and 179011), the Provincial Secretariat for Higher Education and Scientific Research (142-451-2473 and 114-451-710) and the Faculty of Sport and Physical Education, University of Novi Sad (2018 Annual Award).
Supplement On Aerobic And Anaerobic Performance In Men

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No relevant relationships reported

PURPOSE: To assess the effects of a single dose of a multi-ingredient pre-workout supplement (MIPS) on aerobic and repeated anaerobic performance tests. METHODS: Eight college-aged men were recruited to participate in a randomized, double-blind, placebo-controlled, crossover study. All participants were tested within the same week separated by 48 hours and were provided either the placebo (PLA) or the MIPS on each day. As per the manufacturer’s instructions, the participants waited 25 minutes to begin the tests, following consumption of the drink. Aerobic exercise performance was assessed using the Modified Astrand Treadmill Protocol, during which maximal oxygen consumption (VO2max) and maximal aerobic exercise time were determined. Following this test, participants were provided a 20-minute seated rest period. After the rest period, participants completed a short warm-up which consisted of 2 minutes of cycling at 50 RPMs against a light resistance, followed by 3, 10-second sprints, to determine the max RPMs. After the warm-up, participants completed the repeated anaerobic power test, which consisted of 10, 6-second sprints, with 45 seconds of active rest in between each sprint. For each sprint, a resistance of 7.5% of the participant’s body mass was applied at 90% of their max RPM. Peak power (PP) was determined for each sprint and the percent decline in PP from the first to the last sprint was calculated. VO2max, exercise time and the percent decline in PP for the sprints were determined using a repeated t-test. The peak power of the 10 sprints were analyzed using 2x10 ANOVA. The alpha level was set to p<0.05. RESULTS: There was no significant difference between the PLA and MIPS for VO2max. However, there was a significant difference in treadmill time (p<0.005) with MIPS (10.4±1.6 min) performing better than PLA (10.0±1.6 min). There were no significant differences between the PLA and MIPS when analyzing peak power during the 10 sprints or percent decline in PP. CONCLUSIONS: A single dose of this MIPS improved maximal aerobic exercise time despite no changes in VO2max. However, MIPS (10.4±1.6 min) performing better than PLA (10.0±1.6 min). There were no significant differences between the PLA and MIPS when analyzing peak power during the 10 sprints or percent decline in PP. CONCLUSIONS: Twelve-weeks of n-3 administration with progressive RT greatly improved muscular strength and physical function as well as appears to reverse the age-induced decline in RMR in healthy older adults. Supported by New Mexico State University.

Individuals participating in prolonged endurance performances and associated training experience regular inflammation and muscle soreness. Natural products with known anti-inflammatory and/or oxidative stress blocking effects represent attractive options to traditional NSAID treatments. PURPOSE: To investigate the effect of combined curcumin (500-1000 mg/d; Longvida), pomegranate extract (500-1000 mg/d; Pome alla), and methylsulfonylmethane (500-1000 mg/d; OptiMSM) supplementation for 30-days on inflammation-associated RNA, protein inflammatory biomarkers, and biomarkers of oxidative stress. METHODS: All protocols were approved by the University IRB committee and participants gave written informed consent. Subjects supplemented with the combination supplement (N=5) or placebo (N=5) for 30-d prior to the half marathon race. Venous blood samples were collected for RNA (PAxgene tube) or serum (evacuated separator tube) 24-h pre-race, 4-h, and 2-h after the half marathon race. PAxgene treated blood was analyzed in duplicate using a custom, bead-based RNA assay (Quantigene; ThermoFisher). Serum samples were analyzed in duplicate using separate bead-based protein assays to measure cytokines, soluble cytokine receptors, and myokines (Milliplex; Millipore-Sigma). Bead-based analysis was conducted using an automated analyzer (LumineX FMIID). Oxidative stress (TAC; AGE) was measured using enzymatic assays (Cell Biolabs, Aviva Systems Biology). Fold change from pre was calculated for the various outcome variables to allow for better comparison and model creation. RESULTS: Fold changes in RNA and proteins exhibited a trend toward reduced inflammation while showcasing an increased ability of soluble cytokine receptors to bind with inflammation with supplementation post-race. Reduced oxidative stress (via TAC and AGE) was observed post-race with the supplement compared to placebo. CONCLUSIONS: These data support the notion that the combined use of curcumin, pomegranate and MSM prior to and after a half marathon race may result in reduced systemic inflammation and oxidative stress. More research is needed in order to understand how to use these effects to improve the effectiveness of a long-term training program.
consisted of 60 min of rest, 30 min of steady-state exercise at 55% \( W_{\text{max}} \), and a self-paced 20-km time trial. Heart rate, stroke volume, and cardiac output were measured continuously using impedance cardiography software continuously, recorded power output, speed, cadence, and time to completion. RESULTS: Soy supplementation elicited a faster time to completion (0.22 ± 0.10 min; -37 s), lower average heart rate (-5 ± 1 bpm), and significantly greater power (6.8 ± 2.5 W) and speed (0.42 ± 0.16 km/hr) during the last 5 km of the time trial compared to placebo. Analysis of the results by relative fitness level (< 60 vs. ≥ 60 mL·kg⁻¹·min⁻¹) indicated that soy supplementation resulted in lower values of cardiac output (-1.6 ± 0.8 L·min⁻¹), stroke volume (-5.4 ± 3.1 ml beat⁻¹), and heart rate (-5 ± 3 bpm) in those with higher levels of fitness. CONCLUSIONS: Ingestion of a fermented soy extract supplement improved sprint-distance performance through improvements in both power and speed. For those with great aerobic fitness, soy supplementation may help to decrease cardiac demand alongside performance improvement.

### 347 Board #185 May 29 9:30 AM - 11:00 AM Effects of Short-Term Spirulina Supplementation on Oxidative Stress Markers in Mountaineers at High Altitude

Majid S. Koozehchian1, Khadije Taheri Kazaj1, Amir Sarshin2, Abbasali Gacini3, Alireza Naderi4, Stephen R. Stannard5, Maryam Kavel6, T. Jeff Chandler, FACSM6,7.

**Jacksonville State University, Jacksonville, AL. 2Karaj Branch, Islamic Azad University, Karaj, Iran, Islamic Republic of; 3University of Tehran, Tehran, Iran, Islamic Republic of; 4Boroujerd Branch, Islamic Azad University, Boroujerd, Iran, Islamic Republic of; 5Massey University, Wellington, New Zealand. 6Karnataka College of Pharmacy, Bangalore, India. (Sponsor: Jeff Chandler, FACSM)

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(No relevant relationships reported)

**PURPOSE:** To investigate effects of 14 days of spirulina supplementation on oxidative stress responses of climbers at high altitude. Spirulina is a source of antioxidants, which can protect against oxidative damage.

**METHODS:** Eighteen apparently healthy men and women mountaineers (age 24.87±5.5y, height 170.7±11.5 cm, weight 75.92±17.2 kg) volunteered to participate in a one group pre-test-posttest study design. All participants completed two winter ascents to the summit (4,000meters) a week before as well as 14 days after spirulina supplementation (3g/day). Blood samples (4cc) were collected at pre-climbing and summit prior to and following supplementation under the same conditions. Participants were instructed to maintain their diet and avoid using antioxidant-containing products throughout the study. Blood samples were analyzed to measure oxidative stress markers such as malondialdehyde (MDA), superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), and total antioxidant capacity (TAC). All data were expressed as the mean ± SEM. Statistical comparisons were performed using t-test (p values < 0.05 were considered to be statistically significant).

**RESULTS:** Results indicated that resting MDA at pre-climb were significantly reduced following supplementation (3.37±0.017U vs. 2.89±0.14 U; p=0.036); however, significant increases occurred in SOD resting values (132.8±6.39U vs. 129.8±6.11U; p=0.581) did not differ between placebo and huperzine-A trials, respectively. Ratings of subjective difficulty post-exercise (0-10 scale) were significantly higher (5.7±0.38 vs. 6.8±0.38; p=0.002) in the huperzine A trial than the placebo trial. No differences were observed for neuromuscular or exercise performance measures between both groups (all p≤0.497).

**CONCLUSION:** Huperzine-A does not enhance cognitive function during exercise despite its marketing as a cognitive enhancer. Because of its inability to enhance cognitive function, its inclusion in pre-workout supplements warrants reconsideration.

More other practical and effective strategies should be considered.

### 348 Board #186 May 29 9:30 AM - 11:00 AM Effect of Huperzine A on Cognitive Function and Perception of Effort During Exercise

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(No relevant relationships reported)

**PURPOSE:** Huperzine-A has shown the ability to acutely improve cognitive function in certain populations, and therefore is commonly added to pre-workout supplements. However, its effects have not been studied in exercise-trained individuals. We hypothesized that acute consumption of huperzine-A would improve cognitive function during exercise, which may be beneficial for exercise performance.

**METHODS:** From January to April, 2018, 15 exercise-trained individuals (women and men, BMI 23.5±1.4 kg/m², age 30±4.36 years) were studied in a double blind randomized-sequence cross-over study, in which they underwent tests for cognitive function (digit span, verbal/word fluency, and Stroop), neuromuscular performance (sharpened Romberg and dart throwing), and exercise performance (estimated aerobic capacity, hand-grip strength, vertical jump, and push-up) after acute ingestion of huperzine-A (200 mcg) or placebo. A 7- to 10-day washout period separated the subsequent trials.

**RESULTS:** No measures of cognitive function differed between placebo and huperzine-A trials (all p>0.296). Heart rates (157±9 vs. 158±4 bpm; p=0.518) and ratings of perceived exertion (13.7±0.56 vs. 13.4±0.61; p=0.582) did not differ between placebo and huperzine-A trials, respectively. Ratings of subjective difficulty post-exercise were significantly higher (5.7±0.38 vs. 6.8±0.38; p=0.002) in the huperzine-A trial than the placebo trial.

**CONCLUSION:** No consistent rationale has been provided for dosage strategies, therefore a pre-load strategy may be unnecessary for proposed benefits. **PURPOSE:** To investigate whether acute consumption of MC following a bout of strenuous exercise is equally as effective as consuming MC pre and post exercise on markers of recovery. **METHODS:** Healthy resistance-trained males (n=10, age, height, mass: 25.30±8.08 years, 179.81±10.84 cm, 90.95±18.04 kg) and females (n=8, age, height, mass: 25.63±3.85 years, 165.89±3.46 cm, 70.98±8.54 kg) were randomized into two groups that consumed 30 mL of MC twice per day for three days following exercise (no-preload; NPL) or six consecutive days beginning three days prior to strenuous exercise (pre-load; PL). Participants completed a squatting exercise protocol designed to induce muscle damage and reported to the lab immediately post-exercise, 24, 48 and 72-h later to assess recovery indices including: serum creatine kinase (CK), the Adapted Brief Assessment of Mood (BAM+) survey, pressure-pain threshold (PPT), countermovement jump height (CMJ) and the Wingate anaerobic test (WASt).

**RESULTS:** Serum CK peaked at 24-h in the NPL and PL group as compared to baseline (410.56±253.90, 778.17±780.95 U/L, respectively) (p<0.05). Perceived recovery (BAM+) was lowest at 48-h in the NPL and PL group (45.16±25.39, 35.96±29.67 mm, respectively) (p<0.05). PPT of the vastus medialis muscle was lowest at 48-h in the NPL and PL group (5.93±1.34, 5.35±0.84 kg-force, respectively) (p<0.05). CMJ performance was lowest at 24-h in the NPL and PL group as compared to baseline (94.28±5.29, 88.94±11.74%, respectively) (p<0.05). No differences were found between the NPL and PL groups for all recovery indices.

**CONCLUSIONS:** These results suggest no additional benefits of a pre-load strategy when using MC as a post-exercise recovery aid following high-intensity exercise. These results suggest no additional benefits of a pre-load strategy when using MC as a post-exercise recovery aid following high-intensity exercise. These results suggest no additional benefits of a pre-load strategy when using MC as a post-exercise recovery aid following high-intensity exercise. These results suggest no additional benefits of a pre-load strategy when using MC as a post-exercise recovery aid following high-intensity exercise.

These findings could have implications for dosage strategies currently used by athletes.
MEDICINE & SCIENCE IN SPORTS & EXERCISE®

Board #188 May 29 9:30 AM - 11:00 AM
Performance Enhancing Effects Of Ecdysterone- A Human Intervention Study

Patrick Diel1, Eduard Isenmann1, Gabriella Ambrosio1, Jan Felix Joseph1, Xavier de la Torre1, Philipp Zimmer1, Ryamantas Kazlauskas1, Catrin Goebel1, Francesco M Botre1, Maria Kristina Parr1, 1German Sports University Cologne, Cologne, Germany; 2Friedrich-Alexander University of Erlangen-Nuremberg, Erlangen, Germany; 3Laboratorio Antidoping FMSJ, Rome, Italy, Rome, Italy. 4Australische Sports Drug Testing Laboratory, National Measurement Institute, Australia, North Ryde, Australia.

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(No relevant relationships reported)

PURPOSE: Recent studies suggest that the anabolic effect of ecdysterone (a naturally occurring steroid hormone present in some supplements claimed to enhance physical performance) is mediated by estrogen receptor (ER) binding. In comparison to the prohibited anabolic agents (e.g. metandienone and others) ecdysterone revealed to be even more effective in a recent study performed in rats. However, scientific studies in humans are very rarely accessible. Thus, our project aimed at investigating the effects of ecdysterone containing products on human athletic performance.

METHODS: A ten weeks intervention study in young man has been conducted including regular resistance training for all volunteers. Different doses of ecdysterone containing supplements have been administered during the study to evaluate the performance enhancing effect. Analysis of blood and urine samples for ecdysterone and potential biomarkers of performance enhancement have been conducted. To ensure the specificity of the measured effects a comprehensive screening for prohibited compounds was also performed. Furthermore, the administered supplements have been tested for the absence of anabolic steroid contaminations prior to administration.

RESULTS: Used ecdysterone supplements displayed anabolic activity in C2C12 cells. Dose dependent administration of Ecdysterone supplements to human volunteers results in detectable ecdysterone concentrations in serum. Effects on endocrine parameters were detectable. Serum IGF1 concentrations increased in comparison to the control group while thyrroxin (T4) concentrations decreased. Significantly higher increases in muscle mass were observed in those volunteers that were dosed with the ecdysterone supplements. Even more relevant with respect to sports performance, also significantly more pronounced increases in one-repetition bench press performance were observed.

CONCLUSIONS: These data underline the effectivity of an ecdysterone supplementation with respect to sports performance. Our results strongly suggest to include ecdysterone in the list of prohibited substances and methods, in the class S1.2 “other anabolic agents”.

Board #190 May 29 9:30 AM - 11:00 AM
7-Day Hydrogen Inhalation Affects Exercise Performance and Hormonal Profiles in Young Volunteers


(No relevant relationships reported)

The use of medical gases has been recently displayed as an emerging exotic strategy in exercise physiology and sports medicine community, with few unconventional medical gases put forward as performance-enhancing agents. Among others, molecular hydrogen (H2) pops up as an innovative compound that might be applicable among athletes.

PURPOSE: To examine the effects of 7-day H2 inhalation on exercise performance outcomes and serum hormonal and inflammation profiles in a cohort of young men and women.

METHODS: Twenty healthy volunteers (10 men and 10 women; age 22.9 ± 1.5 years; body mass index 23.4 ± 2.5 kg/m2) participated in this randomized, double-blind, placebo-controlled, crossover pilot trial. All participants were allocated to receive either gaseous hydrogen (4%) or placebo (room air) by 20-min once-per-day inhalation for 7 days, with wash-out period of 7 days to prevent the residual effects of interventions across study periods. Gaseous hydrogen was provided by biological gas supply apparatus (MIZ Company Ltd, Kanagawa, Japan), with day-to-day H2 inhalation supervised by study investigators throughout the trial. The primary treatment outcome was the change in running time-to-exhaustion from baseline to day 7. Secondary outcomes included change from baseline to end of treatment in other exercise performance endpoints and clinical chemistry biomarkers.

RESULTS: Breathing H2 was superior to placebo to increase peak running velocity during a maximal incremental running test (for up to 4.2%; P < 0.05), also to attenuate a drop in maximal voluntary isometric strength at 7-day follow-up (P = 0.04). Hydrogen inhalation resulted in a notable drop in serum IGF-1 for 48.2 ng/mL at follow-up, while IGF-1 levels were elevated by 59.3 ng/mL after placebo intervention (P = 0.04). Baseline CRP levels were decreased by 1.0 mg/L and 0.7 mg/L after H2 and placebo inhalation at 7-day follow up, respectively.

CONCLUSION: Inhalational hydrogen appears to show ergogenic properties in young volunteers. Gaseous H2 should be further evaluated for its efficacy and safety in athletic environment.

Supported by the Serbian Ministry of Education, Science and Technological Development (175037), the Provincial Secretariat for Higher Education and Scientific Research (114-451-710) and the Faculty of Sport and Physical Education.
based assays to measure cytokines and myokinases (Milliplex; Millipore-Sigma). Sample analysis was performed on a multiplex analyzer (Luminox LX200). RESULTS: Active resulted in trends toward reduced muscle soreness and improved recovery compared to placebo. Active was also associated with transient reductions in serum creatine kinase, MIP-1α, and IL-6. CONCLUSIONS: These data support the notion that combined supplementation with curcumin and boswellia serrata may represent an effective means to manage systemic inflammation during consecutive days of training. More research is needed to understand how curcumin and boswellia serrata may be able to manage inflammation in other exercise models.

354 Board #192 May 29 9:30 AM - 11:00 AM Curcumin Supplementation Alters Inflammatory Cytokines Following Exercise Brian K. McFarlin, FACSM, Elizabeth A. Tanner, Melody A. Gary, Ashenal A. Davis, John H. Curtis, Jakob L. Vingren, FACSM. University of North Texas, Denton, TX. Email: brian.mcfarlin@unt.edu

Reported Relationships: B.K. McFarlin: Industry contracted research; Research Grant to UNT.

Aims: Nutritional supplementation is often misused as a component of a holistic approach to muscle recovery following exercise. Supplementation that reduces post exercise inflammation or muscle soreness might improve recovery time. Purpose: The purpose was to evaluate active different doses of a curcumin supplement following a bout of eccentric leg exercise. Methods: Phase 1 evaluated 2-perm active treatment. Phase 2 evaluated the dose of curcumin from phase 1, could alter inflammation in an open-label, field-based model. Methods: We consented self-reported healthy men and women to participate in the two phases of the study. In phase one, we tested a dose response for curcumin (Longvida) by comparing three doses (200, 400, & 1000 mg/d) to a placebo. In phase two, we evaluated the dose of curcumin at 1000 mg/d in combination with another polyphenol (pomegranate extract; Pomella; 1000 mg/d) endurance exercise model (half-marathon performance). Venous blood samples and analyzed for inflammatory cytokines (IL-1β, IL-6, IL-8, and TNF-α) using a bead-based multiplex assay and an automated analyzer. Creatine kinase was analyzed using an enzymatic assay on a biochemistry analyzer (ChemoWells T). Results: The 400 and 1000 mg doses were associated with a reduction in inflammatory cytokines and CK at 24 & 48-h after injury. Only the 1000 mg dose was associated with a reduction in subjective muscle soreness. The 200 mg dose responded in a similar manner as placebo (i.e. no reduction in muscle soreness or inflammation). When curcumin (1000 mg) was combined with another polyphenol (1000 mg) in half-marathon runners, we found a reduction in inflammatory cytokines at 24-h post-race compared to pre-race. Conclusions: The key findings of this study suggest that the effectiveness of an oral curcumin supplement is dose-dependent and also activity-dependent. The combination of curcumin with pomegranate extract appeared to be more effective than curcumin alone at altering inflammation. More research is needed to identify how to incorporate curcumin and pomegranate supplementation into long-term exercise program.

355 Board #193 May 29 9:30 AM - 11:00 AM Effect Of New Zealand Blackcurrant Extract On Recovery From Exercise Induced Muscle Damage Following Half Marathon Running Rianne Costello1, Stephen D. Myers1, Mark E.T. Willems1, Fiona Myers1, Nathan A. Lewis1, Sam D. Blacker1, 1University of Chichester, Chichester, United Kingdom, 2University of Portsmouth, Portsmouth, United Kingdom. "English Institute of Sport, Bath, United Kingdom. (No relevant relationships reported)

New Zealand blackcurrant (NZBC) is a rich source of polyphenols, namely anthocyanins, which improve blood flow and display anti-inflammatory and anti-oxidant properties that may improve recovery from exercise-induced muscle damage (EIMD). Limited evidence is available as to whether a polyphenol supplement can aid recovery in the days following a half-marathon event. Purpose: To examine whether NZBC extract would accelerate recovery after a half-marathon race. Methods: Following a double blind, independent groups design, 20 (8 women) recreational runners (mean ± SD: age 30 ± 6 years, height 1.73 ± 0.74 m, body mass 68.5 ± 7.8 kg, previous half-marathons 7 ± 2, finishing time 1:56:33 ± 0:18:08 h:min:s) ingested either 2 x 300 mg day-1 capsules of a NZBC supplement (CurraNZ™; each containing 105 mg anthocyanin) or a visually matched placebo (PLA) 7-days prior to and 2-days following a half-marathon. Force plates sampling at 1000 Hz recorded countermovement jumps (CMJ) performance variables: jump height (JH), time to take off (TTT) and reactive strength index modified (RSMod) and visual analogue scales for perceived muscle soreness and fatigue were measured pre-, immediately post-, and 24 h and 48 h after the half-marathon. The CMJ performance variables, muscle soreness and fatigue were analyzed using a mixed model ANOVA. Results: CMJ variables were reduced immediately after the half-marathon (P < 0.05) (NZBC: JH 0.19 ± 0.06 and PLA 0.18 ± 0.05 m, NZBC: TTT 0.98 ± 0.16 and PLA 1.03 ± 0.20 m, NZBC: RSMod 0.20 ± 0.08 and PLA 0.18 ± 0.06 ratio) and had returned to baseline by 48 h, with no difference between NZBC and PLA for any variables (P > 0.05). Perceived muscle soreness was reduced minimally post (NZBC: 6 ± 2 and PLA: 6 ± 2) and had returned to baseline by 48 h, with no difference between NZBC and PLA (P = 0.404). Perceived muscle fatigue was increased immediately post (NZBC: 7 ± 2 vs. PLA: 6 ± 2) and had returned to baseline by 48 h, with no difference between NZBC and PLA (P = 0.170). Conclusion: NZBC extract did not accelerate recovery of CMJ variables or perceptions of muscle soreness or fatigue following a half-marathon in recreational runners, possibly because the event only induced modest changes in the indices of EIMD in the days after the event. Acknowledgement: We thank Health Currency Ltd (UK) and CurraNZ (NZ) for supplements.

356 Board #194 May 29 9:30 AM - 11:00 AM New Zealand Blackcurrant Extract Increases Circulating Hsp32 And Hsp90α But Doesn’t Affect Circulating Hsp72 Ben J. Lee1, Tessa R. Flood1, Ania M. Hiles1, Ella F. Walker1, Lucy Wheeler1, Kimberly M. Ashdown1, Mark ET Willems1, Matthew R. Kuennen2, 1University of Chichester, Chichester, United Kingdom, 2High Point University, High Point, NC. Email: b.lee@chic.ac.uk

(No relevant relationships reported)

Extracellular heat shock protein 72 (eHSP72) acts as an inflammatory molecule, inducing cytokine production in immune cells, whereas HSP90α is implicit in recovery and adaptation to cellular stress. Heme oxygenase-1 (eHSP32) protects the vasculature and suppresses inflammation. Each are elevated following exertional heat stress. Polyphenols are proposed to have anti-inflammatory properties, so may affect eHSP responses to exercise. Purpose: To determine the effects of 7-days supplementation with New Zealand blackcurrant (NZBC) extract on eHSP72, eHSP90α, and eHSP32 before and after exertional heat stress. Methods: In a randomized double-blind design, 12 men (Age: 28 ± 6 years, stature: 1:81 ± 0:07 m, mass: 80.5 ± 9.8 kg, VO2 max: 55.6 ± 6.0 mL kg−1 min−1) completed 2 trials. Participants ingested 2×300 mg day−1 capsules of CurraNZ™ (each containing 105 mg anthocyanin) or a visually matched placebo for 7 days (washout). On day 7, participants ran 60 minutes at 65% VO2 max in hot ambient conditions (34°C and 40% relative humidity). eHSP72, eHSP90α, and eHSP32 were measured in EDTA plasma at rest and 20 and 60 minutes after exercise. Results: Post exercise eHSP72 concentrations were elevated after the placebo [by 1.98 ng/mL (95% CI: 0.65 - 3.33 ng/mL)] and NZBC trials [by 1.59 ng/mL (95% CI: 0.35 - 3.15 ng/mL)] and remained elevated 60 minutes after exercise [Placebo: by 0.68 ng/mL (95% CI: -0.07 - 1.46 ng/mL); NZBC: by 0.51 ng/mL (95% CI: -0.37 - 1.40 ng/mL)]. Basal eHSP90α concentration was increased following NZBC supplementation [by 5.60 ng/mL (1.85 - 9.51 ng/mL)], trial x time interaction, F = 3.37, p = 0.046, mp2 = 0.25, and were elevated at 20 and 60 minutes post exercise in both conditions. Similarly, basal eHSP32 was elevated after NZBC supplementation [by 3.9 ng/mL (95% CI: 0.37 - 7.42 ng/mL)], trial x time interaction F = 5.62, p = 0.01, mp2 = 0.34, but were not altered at 20 or 60 minutes after heat stress in either condition. Conclusion: We present moderate evidence to support that 7 days of NZBC extract supplementation increases basal eHSP32 and eHSP90α, with no effect on eHSP72 before or after exercise. Further research is required to determine the functional relevance of these increases. Acknowledgement: We thank Health Currency Ltd (UK) and CurraNZ (NZ) for supplements.

357 Board #195 May 29 9:30 AM - 11:00 AM Does Supplementation With Pediococcus Acidilactici Probiotics Alter Inflammatory Response To Exercise On Consecutive Days? John H. Curtis, Ashenal A. Davis, Elizabeth A. Tanner, Melody A. Gary, Jakob L. Vingren, FACSM, Brian K. McFarlin, FACSM, University of North Texas, Denton, TX. (Sponsor: Brian McFarlin, FACSM) Email: john.curtis@unt.edu

(No relevant relationships reported)

Oral supplementation with probiotics has been reported to treat a variety of common gastrointestinal conditions (i.e. IBS, IBD, etc.); however, probiotics have not been studied for potential sport nutrition applications. Management of post-exercise inflammation, particularly on consecutive days poses a unique challenge to the body and effects future training and performance. PURPOSE: The purpose of this study was to investigate if a novel plant based, non-spore forming high temperature (up to 85°C) and acid resistant probiotic strain (Pediococcus acidilactici; NRRL B-50517) may alter post-exercise inflammation. METHODS: Subjects were consented for participation using a University IRB approved informed consent form. Subjects were supplemented with either probiotic condition (Pediococcus acidilactici; NRRL B-50517, 8 billion cfu per day; N=6) or placebo condition (maltodextrin; N=5) for 14 days prior to the next consecutive days of 45-min of intense, interval exercise (intervals of ladder climbing, cycling, and downhill running). Subjective muscle soreness and muscle strength were...
evaluated using a visual analog scale and isokinetic dynamometer respectively. Venous blood samples were collected prior to exercise and 48-h after the final exercise day. Samples were analyzed in duplicate using separate bead-based assays to measure cytokines and myokines (Milliplex®; Millipore-Sigma). Sample prep were analyzed using a multiplex analyzer (Luminex LX2000). RESULTS: There were trends toward reduced MIP-1α, MIP-1β, and IL-8 in probiotic compared to placebo during recovery from exercise. There were no obvious trends in any additional outcome measures. CONCLUSIONS: These data support the concept that probiotics may be useful for managing the trafficking of monocytes and other phagocytes during exercise-induced inflammatory responses. More research is needed to determine if a more extensive exercise model may be capable of eliciting probiotic associated improvements in post-exercise inflammation.

358 Board #196 May 29 9:30 AM - 11:00 AM
Combined Dietary Polyphenol Supplementation Reduces Inflammation Associated Gene Expression Following a Half Marathon Race
Elizabeth A. Tanner, Melody A. Gary, Ashlea A. Davis, Brian K. McFarlin, FACSM. University of North Texas, Denton, TX. (Sponsor: Brian McFarlin, FACSM)
Email: elizabeth.tanner@unt.edu (No relevant relationships reported)

Prolonged endurance exercise provides a unique model for investigating skeletal muscle damage through the combined effects of oxidative stress and eccentric muscle contraction on differential gene expression with nutritional interventions known to blunt inflammation. Dietary polyphenols (i.e. curcumin, pomegranate, etc.) have been shown to reduce exercise-induced inflammation associated mRNA and protein expression with fewer side effects than NSAIDs. PURPOSE: To investigate the effect of a combined curcumin (500-1000 mg/d; Longvida) and pomegranate extract (500-1000 mg/d; Pomella) supplement for 30-days on mRNA expression following a half marathon race. METHODS: All protocols were approved by the University IRB committee and participants gave written informed consent. Participants supplemented for 30-days prior to running a half marathon race with either the active (N=6) or placebo (N=6). Blood samples were collected in PAXgene RNA tubes 24-h before (PRE) and 4-h after completing a half marathon. After collection, tubes were stored frozen at -80°C until RNA isolation. PAXgene whole blood was thawed and isolated using a PAXgene Blood mRNA sample processing system (PreAnalytiX) along with a QIAcube automation system (Qiagen). Isolated RNA was analyzed using a 594-plex Human Immunology Panel on a NanoString nCounter platform. Isolated RNA was analyzed using a PAXgene Blood miRNA sample processing system (PreAnalytiX) before (PRE) and 4-h after completing a half marathon. After collection, tubes were stored frozen at -80°C until RNA isolation. PAXgene whole blood was thawed and isolated using a PAXgene Blood mRNA sample processing system (PreAnalytiX) along with a QIAcube automation system (Qiagen). Isolated RNA was analyzed using a 594-plex Human Immunology Panel on a NanoString nCounter platform. Results were analyzed in SPSS.

359 Board #197 May 29 9:30 AM - 11:00 AM
Mood: There Are Some Connection Between Probiotics Supplementation On Marathon Runners? A Double Blind Study
Geovana SF Leite¹, Valdir de Aquino Lemos², Helena A P Batatinha¹, Edgar Tavares³, Ayane S. Resende¹, Ricardo A. Fock¹, José C R Neto¹, Ronaldo V T dos Santos², Antonio H. Lancha Junior¹. ¹University of São Paulo, São Paulo, Brazil. ²Federal University of São Paulo, São Paulo, Brazil. ³University of Central Florida, Orlando, FL.
Email: geovana.leite@usp.br (No relevant relationships reported)

Prolonged exercise may cause Gastrointestinal Symptoms (GIS) as well as rise some pathway and interaction analysis was conducted using Nanostring nSolver software to a 594-plex Human Immunology Panel on a NanoString nCounter platform. Data along with a QIAcube automation system (Qiagen). Isolated RNA was analyzed using a PAXgene Blood miRNA sample processing system (PreAnalytiX) before (PRE) and 4-h after completing a half marathon. After collection, tubes were stored frozen at -80°C until RNA isolation. PAXgene whole blood was thawed and isolated using a PAXgene Blood mRNA sample processing system (PreAnalytiX) along with a QIAcube automation system (Qiagen). Isolated RNA was analyzed using a 594-plex Human Immunology Panel on a NanoString nCounter platform. Results were analyzed in SPSS.

CONCLUSIONS: We utilized a repeated measures design to examine the acute effects of placebo, open-label placebo, and control treatments on muscle strength and voluntary activation (Experiment #1), as well as neuromuscular fatigue (Experiment #2).

METHODS: Following a familiarization session, 21 untrained males (n = 11) and females (n = 10) visited the laboratory on three occasions to receive placebo, open-label placebo, and control treatments in a randomized, counter-balanced manner. All visits involved a pretest, 15-minute intervention period, and posttest. All visits were at the same time of day. The time between sessions was ≥ 48 hours but < one week. Laboratory conditions were constant throughout the study, and participants were asked to keep their physical activity levels, dietary habits, and caffeine consumption consistent. In Experiment #1, knee extensor maximal voluntary isometric contraction (MVIC) peak torque and percent voluntary activation were evaluated. In Experiment #2, participants performed 20, six-second MVCs while surface electromyographic signals were detected from the vastus laterals. Subjective assessments of energy and perceived exertion were also examined.

RESULTS: In Experiment #1, there were no differences among interventions for peak torque or voluntary activation, but a main effect revealed that energy levels increased over 24-h. In Experiment #2, placebo and open-label placebo treatments had no influence on neuromuscular fatigue, but there were main effects for declines in absolute (p = .001, η2 = .765), and normalized peak torque (p = .001, η2 = .765), normalized electromyographic mean frequency (p = .001, η2 = .565), neuromuscular efficiency (p = .001, η2 = .585), and energy cost (p = .006, η2 = .317).

CONCLUSIONS: Compared to a control condition, placebo and open-label placebo treatments had minimal influence on muscle strength, voluntary activation, and fatigue resistance in untrained participants.

361 Board #199 May 29 9:30 AM - 11:00 AM
Evaluation of the Placebo Effect in Elite and Amateur Athletes
Andressa F. de Abreu, Domingos R. Pandelo, Jr. Centro de Alta Performance, Santos, Brazil.
Email: andressaabreu_82@hotmail.com (No relevant relationships reported)

Purpose: The aim of the present study was to test the placebo effect. This effect was made possible by the research design. In this way the impact of the placebo effect could be effectively measured. Methods: 22 athletes were selected for the experiment. Out of this total 16 recreational and 6 elite. The test was performed on a cycle ergometer #1. The tests were performed in 2 days with a 24-hour interval between one and the other. All tests were performed at the same time of the day. The load of the test was adjusted by the weight of the athlete to work with the same load relative to the weight (watt/kg). The load was kept fixed throughout the test and the test ended after exhaustion and voluntary request of the athlete. During the evaluation, the heart rate was continuously measured and the subjective perception of effort ( Borg scale) was measured 30-second minute by minute for 10x. The first day the athlete received a placebo and the second day they tested a supplement. This supplement was placebo. There was no ergogenic feature in the capsule, but they received the information that it was a new, very powerful supplement.
In the second encounter, the athlete did the test without any capsule. He was informed that the goal was to compare how much the supplement, offered in the first encounter, would lead to better performance.

Summary of Results: Overall, in the supplement test (which was placebo) there was an average increase of 9.66% in performance, measured by a longer time to exhaustion. This result was obtained with all 22 athletes. In the case of elite athletes, the result was lower, showing an increase of 4.39%, on average. In the case of amateur athletes, the increase was 22.87%.

The fact that the increased impact of the placebo effect was greater in amateur athletes seems quite reasonable and may be explained by their greater susceptibility to placebo. In the case of elite athletes, the impact of the placebo effect was smaller, but can be considered as important from a practical point of view, since a performance increase of 4.39% is a professional athlete, seems to be something fantastic.

Conclusion: The present study showed that the placebo effect is important to be considered even in the case of elite athletes. The way the study was designed allows a more reliable measurement of the real dimension of the placebo effect.

362  Board #200  May 29 9:30 AM - 11:00 AM Effects of Nutritional Supplementation on Body Composition and Bio-markers during Army Initial Entry Training
Jeremy McAdam¹, Kaatlin McGinnis², Darren Beck³, Andrew Frugé³, Michael Roberts¹, JoEllen Selton¹. Auburn University, Auburn, AL. Edward Via College of Osteopathic Medicine - Auburn Campus, Auburn, AL. Email: jsms0039@auburn.edu

Purpose: Previous research has reported that military training can result in reductions in fat free mass (FFM) and serum testosterone while increasing cortisol and interleukin-6 (IL-6). This can be due to inadequate nutrition combined with rigorous training. The purpose of this study was to investigate whether once daily whey protein (WP) or carbohydrate (CHO) supplementation positively impacts the physiologic response to Initial Entry Training (IET).

Methods: Eighty-one male soldiers (WP: n = 39, HT = 173 ± 8 cm, WT = 76.8 ± 12.8 kg, Age = 21 ± 3yrs; CHO: n = 42, HT = 175 ± 8 cm, WT = 77.8 ± 15.3 kg, Age = 23 ± 4yrs) participating in Army IET were supplemented with one 38.6 g protein (from WP hydrolysate; WP, n = 45) or one energy, fat and taste matched CHO (n = 51) serving per day, for seven weeks. Physical performance, body composition and serum markers were collected in the morning after an overnight fast, in a hydrated state, and prior to physical activity. Repeated measures ANOVA with one within subjects’ factor (time) and one between subjects factor (group) were used to evaluate biomarker response to training. Regression analysis was used to determine if change in biomarkers were related to changes in FFM.

Results: There was a significant increase in testosterone (F = 14.06, p < 0.01) and the testosterone to cortisol ratio (F = 10.08, p < 0.01) and a significant decrease in IL-6 across military training (F = 7.63, p = 0.01). There was no significant change in cortisol (F = 3.64, p = 0.06). There were no group by time interactions for testosterone, cortisol or testosterone to cortisol ratio or IL-6. Change in testosterone to cortisol ratio was a significant predictor of change in FFM (F = 3.64, p = 0.06). FFM increased 1.2 kg (95% CI: 0.2, 2.2 kg) in the WP group; whereas FFM increased only 0.1 kg (95% CI: -0.9, 1) in the CHO group during IET.

Conclusion: We found no differential effects of once daily supplementation with WP or CHO on testosterone, cortisol or IL-6. However, our results in light of previous research in military training, suggests that supplementation in general may benefit the physiologic response to training. Additionally, there may be a clinical benefit of WP on FFM, while increasing cortisol and IL-6. Change in testosterone to cortisol ratio or IL-6 were collected in the morning after an overnight fast, in a hydrated state, and prior to physical activity. Repeated measures ANOVA with one within subjects’ factor (time) and one between subjects factor (group) were used to evaluate biomarker response to training. Regression analysis was used to determine if change in biomarkers were related to changes in FFM.

364  Board #202  May 29 9:30 AM - 11:00 AM Dark Chocolate Supplementation Elevates Resting Energy Expenditure In Exercise Trained Females
Michael J. Webster, FACSM, Katie M. Presler, Derya Keskin. Valdosta State University, Valdosta, GA. Email: MJWebster@Valdosta.edu

Purpose: To investigate the influence of dark chocolate supplementation on resting and exercise metabolism.

METHODS: Using a randomized, double-blind design 18 exercise trained female subjects were assigned to a 30 day supplementation with either 20-g per day of 70% dark chocolate (DC) (n=9) or a calorically matched white chocolate (WC) (n=9). Prior to supplementation (PRE), subjects underwent indirect calorimetry assessment for resting energy expenditure (REE) followed by an assessment of exercise energy expenditure. REE measurements were obtained using the indirect calorimetry method in the morning prior to any exercise and activity for 24 hours, and before any dietary intake for 12 hours. Exercise energy expenditure (EEE) was measured using the indirect calorimetry method in the morning prior to any exercise and activity for 24 hours, and before any dietary intake for 12 hours. Exercise energy expenditure (EEE) was measured using the indirect calorimetry method in the morning prior to any exercise and activity for 24 hours, and before any dietary intake for 12 hours.

RESULTS: Pre supplementation REE (DC 1454 (51), WC 1655 (48) kcal per day), EEE-50 (DC 4.86 (0.11), WC 4.61 (0.18) kcal/min), and EEE-100 (DC 7.07 (0.15), WC 6.77 (0.18) kcal/min) were not significantly different between groups (p > 0.05). Post supplementation REE was significantly increased by 9.4% in the DC group (DC 138 (39), WC -29 (18) kcal per day, p=0.001). Neither EEE-50 (DC 4.49 (0.19), WC 4.48 (0.11) kcal/min), nor EEE-100 (DC 6.50 (0.20), WC 6.65 (0.14) kcal/min) were significantly different between groups (p > 0.05).

CONCLUSIONS: These results indicate that in athletic female subjects, DC supplementation significantly increases REE by 9.4%, but doesn’t significantly influence exercise energy expenditure.

* Product was provided by The Hershey Company, Hershey, Pennsylvania.

Abstracts were prepared by the authors and printed as submitted.
Circulating miRNAs (ci-miRNA) may facilitate intercellular communication as well as fine-tune phenotype adaptations to exercise through post-transcriptional regulation. Ci-miRNA levels are sensitive to acute aerobic exercise, yet much less is known about the influence of high-intensity interval type exercise. Further, almost nothing is known about the impact of post-exercise nutrition (carbohydrate and/or protein) on ci-miRNA levels. **Purpose**: To examine the effects of high-intensity interval cycling and different post-exercise nutrition treatments on select ci-miRNA levels. **Methods**: Eight recreationally active males (age 22 ± 2 yrs; VO_{2max} 50 ± 4 mL/kg/min) completed 3 trials, each consisting of 4 sets of 3-min intervals (90% W_{max}) completed 3 trials, each consisting of 4 sets of 3-min intervals (90% W_{max}) completed 3 trials, each consisting of 4 sets of 3-min intervals (90% W_{max}). The three-dimensional capillary network of soleus muscle was visualized using a confocal laser scanning technique, and the capillary volume and diameter were measured. The angiogenic factors, VEGF, and eNOS, were also determined. Furthermore, the tensions during muscle isometric contraction in planar muscles was generated by successive electrical stimulations were measured in vivo. **RESULTS**: The capillary volume and diameter in muscle tissue were lower than those in control. R30 supplementation attenuated the decrease of capillary volume and diameter in muscle tissue. In addition, the decreased expression levels of VEGF and eNOS in R30 supplemented muscle were attenuated. In addition, the resistance to fatigue (isometric tension expressed relative to the initial value) was significantly higher in the R30 supplementation group than the hindlimb unloaded group. **CONCLUSION**: These data suggest that R30 supplementation may be an effective treatment to counter the detrimental effects of high-intensity exercise on muscle function.
RESULTS: Exercise induced changes in NK cell concentration in CD56++ (R3, p=0.04; R4, p<0.01; R5, p<0.01) and CD56- (R6, p<0.01) subsets. However significant changes between time points were only found in R5. In this subset, NK cell counts increased from PRE (356±151 cells/μL) to END (1182±159 cells/μL, p<0.01) and decreased under the PRE-level at POST 30 (106±72 cells/μL, p<0.01) and POST 60 (41±6,99, p<0.01) then recovered at POST 30.

CONCLUSIONS: These results suggest that the influence of acute exercise on NK cell mobilization and CD16 expression are clear in subset R5, but not in R1 and R2.

Tumor Necrosis Factor-alpha, TNFR, And STNF
Relationships to Body Temperature
Elliott Arroyo, Brittany N. Followay, Jeremiah A. Vaughan, Joseph A. Laudato, Brandon M. Gibson, Ellen L. Glickman, FACSM, Adam R. Jajtner, Kent State University, Kent, OH; Ripon College, Ripon, WI; Bemidji State University, Bemidji, MN. (Sponsor: Ellen L. Glickman, FACSM)

PURPOSE: To examine the TNF-α, TNFR, and STNF relationships to body temperature in response to the heat. METHODS: 12 recreationally active men (24.4 ± 3.1 yrs; 181.0 ± 6.8 cm; 81.5 ± 8.0 kg; 47.2 ± 4.8 ml·kg⁻¹·min⁻¹) completed an exercise protocol under four conditions: 23°C/45%RH; 23°C/70%RH; 35°C/20%; and 39°C/20%. The protocol consisted of a 60-minute cycling exercise at 20%VO₂max, a 15-minute rest, and a time-to-exhaustion trial at 90%VO₂max (TTE). Blood was collected before (T1) and after (T2) the 60-minute trial, and immediately after TTE (T3). Plasma concentrations of TNF-α, TNFR1, and TNFR2 were measured via ELISA. Surface expression of TNFR1 and TNFR2 on human classical (CD14+CD16-) and non-classical monocytes was measured via flow cytometry (n=8). Participant’s rectal (T rek) and skin temperatures at 5 locations: Chest, Triceps, Forearm, Thigh and Calf were monitored continuously. Total skin temperature (T sk) and whole body temperature (T wb) were calculated using weighted averages. The Area Under the Curve with respect to increase (AUC) was calculated for T rek, T sk, and T wb. Data were analyzed by Pearson Product Moment Correlations between AUCs for T rek, T sk, T wb, and TNF-α, TNFR, and STNF. The time spent above specific critical temperatures for T rek (37.5, 38.0, 38.5 and 39.0°C) and T sk (35.0, 36.0, 37.0 and 38.0°C) were related to TNF-α, TNFR, and STNF, and for TNFR using stepwise linear regression. RESULTS: T rek was correlated with the change in STNF1 from T1 to T3 (r=0.340, p=0.028) and with the change in STNF2 from T1 to T3 (r=0.340, p=0.028). T sk was related with the change in STNF1 from T1 to T2 (r=0.321, p=0.038) and from T1 to T3 (r=0.320, p=0.039); with the change in STNF2 from T1 to T3 (r=0.430, p=0.004); and with the change in TNF-α from T1 to T2 (r=0.357, p=0.020). Time spent with T rek above 38.5°C was related to the change in STNF1 from both T1 to T2 (r=-0.377; p=0.001) and from T1 to T3 (r=-0.773; p<0.001); and to the change in TNF-α from T1 to T2 (r=-0.426; p=0.005) and from T1 to T3 (r=-0.415; p=0.006). CONCLUSION: Changes in circulating levels of TNF-α, STNF1, and STNF2 are influenced by rectal and whole body temperature. Classical monocyte expression of TNFR1 and TNFR2 do not appear to be influenced by rectal or whole body temperature. This investigation was partially funded by Kent State University Research Council.

Monocyte Chemotactant Protein-1 and C-C Chemokine Receptor Type 2 Expression related to Body Temperature Changes
Joseph A. Laudato. Kent State University, Kent, OH. (Sponsor: Dr. Ellen Glickman, FACSM)

PURPOSE: To examine the relationship between Monocyte Chemotactant Protein-1 (MCP-1) and its receptor C-C Chemokine Receptor Type 2 (CCR2) and the time spent above critical body temperature cycling. METHODS: 12 recreationally active men (24.4 ± 3.1 yrs; 181.0 ± 6.8 cm; 81.5 ± 8.0 kg; 47.2 ± 4.8 ml·kg⁻¹·min⁻¹) completed five experimental visits: a VO₂max test and cycling trials in 23°C/45%RH, 23°C/70%RH, 34°C/20%RH and 34°C/45%RH. Within each trial, participants completed a 60-minute bout of cycling at 20% VO₂max, 15 min rest, and a time to exhaustion (TTE) at 90% VO₂max. Blood samples were taken prior to cycling (PRE), immediately after (60), and after TTE. Rectal temperature (T rek) and skin temperatures (chest, triceps, forearm, thigh and calf) were monitored continuously during trials. Total skin (T sk) and whole body (T wb) temperatures were calculated using weighted averages. The Area Under the Curve with respect to increase from baseline (AUC) was then calculated for T rek, T sk, and T wb. Data were analyzed as Pearson Product Moment Correlations between AUCs for T rek, T sk, and T wb, and MCP-1 and CCR2. RESULTS: MCP-1P-TTE was significantly increased in UF compared to AF subjects (p=0.001), whereas MCP-1 concentrations to a greater extent in AF compared to UF subjects (p=0.146). However, MCP-1 stimulation significantly lowered MDA concentrations to a greater extent in AF compared to UF subjects (p=0.001), whereas MCP-1 stimulation increased TNF-α and lowered p53 to a similar extent in both groups (p=0.000, p=0.022, respectively). Interestingly, change in relative MCP-1 mRNA expression was not associated with the percent change (control vs. MCP-1 stimulation) in the concentrations of TNF-α, p53, and p53.

CONCLUSIONS: Findings suggest that although aerobic fitness did not alter MCP-1 mRNA expression following LPS stimulation and may not directly impact indices of pro-inflammatory or the pro-apoptotic marker p53 in healthy, young, males, fitness may impact LPS-induced oxidative stress.
Salivary Antimicrobial Proteins (sAMPS) play a central role in innate immune responses by exerting their antibacterial and antiviral properties. Acute psychological and physiological stresses reduce sAMPs concentrations, and increase the risk of upper respiratory tract infections (URTIs). However, the impact of sustained stresses on sAMPs and their relation to URTI symptoms is unknown. **Purpose**: To characterize the impact of acute bouts of exercise on sAMPS and symptoms of URTI in collegiate swimmers over a 6-month period. **Methods**: Salivary samples were collected from sixteen NCAA-D1 swimmers (8 M, 8 F; 19.8 ± 0.7 yrs) before and after exhaustive in-pool swims at 2 timepoints (V1; immediately post-season 1 and V2; early season 2). An additional V3, mid-off season 1 timepoint was collected in a subset of 10 swimmers. Azurocidin and secretory leukocyte protease inhibitor (SLPI) sAMPS were measured by ELISA, and self-reported measures of stress were collected to assess sleep quality (PSQI) and symptoms of URTI (WURRS-21). Linear mixed models were used to determine the effects of exercise, season timepoint, and their interaction on sAMPS concentrations and secretion rates (α=0.05). Pearson’s correlation coefficients were used to determine linear correlations between resting sAMP concentrations and secretion rates (α=0.05). Azurocidin and secretory leukocyte protease inhibitor (SLPI) sAMPs were measured by ELISA, and self-reported measures of stress were collected to assess sleep quality (PSQI) and symptoms of URTI (WURRS-21). Linear mixed models were used to determine the effects of exercise, season timepoint, and their interaction on sAMPS concentrations and secretion rates (α=0.05). Pearson’s correlation coefficients were used to determine linear correlations between resting sAMP concentrations and secretion rates with stress measures. **Results**: Post-exercise SLPI levels were elevated 8 fold at V3 when compared to resting values (p<0.05); however, resting SLPI concentrations and secretion rates remained unchanged during the season (p>0.05). Acute exercise was associated with increased Azurocidin concentrations, with the greatest post-exercise increase seen at V3 (p<0.03). Resting salivary Azurocidin concentrations and secretion rates were positively associated with sleep quality (r=0.42, p=0.04 and r=0.49, p=0.02 respectively), while salivary SLPI concentrations were not. Furthermore, resting Azurocidin concentrations were associated with self-reported symptoms of URTI (r=0.52, p=0.03) during all 3 visits. **Conclusion**: Oral innate immunity in collegiate swimmers is differently impacted by acute maximal exercise over a season. Greater sleep quality appears to promote salivary Azurocidin concentration and oral innate immune health, which could in turn protect athletes against URTIs.

**Board #212 May 29 9:30 AM - 11:00 AM**

**Acute And Chronic Anti-inflammatory Responses During A Season Training In Young Swimmers**

Dimitra Nafpaktitou1, Anastassios Philippou1, Nikos Vagiakos1, George Vagiakos1, Yorgos Mantaloufas1, George Chrousos2, Michael Koutsilieris2, Theodoros Platanou2, 1National And Kapodistrian University Of Athens, Athens, Greece. 2National Technical University Of Athens, Athens, Greece. 3National And Kapodistrian University Of Athens, Greece. Biomedical Research Foundation Of The Academy Of Athens, Athens, Greece. Email: nafpaktitoud@cosmotelmail.gr

It is well established that prolonged intense exercise training suppresses aspects of immune function and a perturbation in balance between pro- and anti-inflammatory cytokines may induce chronic, low-level systemic inflammation. Although swimming exercise training is demanding, however it is not clear whether it can promote changes in inflammatory responses. **Purpose**: This study investigated the acute and chronic effects of a full season swimming training on serum interleukin (IL-4 and IL-1) receptor antagonist (IL-1ra), both at rest and after a maximal exercise bout. **Methods**: Twelve well-trained male swimmers (140±8.1 yrs) were recruited. Measurements were carried out at the beginning of the training season (T1) and pre- and post the taper of each of the two competitive periods (i.e., T2, T3 for the first macrocycle, and T4, T5 for the second macrocycle, respectively). At each of the above time points, blood samples were collected pre, post 1-hour and 2-hours post-exercise. **Results**: Significant pre-post testing differences for IL-4 (p>0.05), but not for IL-1ra (p<0.05), were found throughout the experimental period. Pre-post testing differences was greater at T5 for IL-1ra and T3 for IL-4 (0.14±0.05 vs 0.08±0.03 pg/ml, and 0.9±0.3 pg/ml, IL-4: 0.11±0.03 vs 0.08±0.03 pg/ml). Post-testing, IL-4 response exhibited a 59% decline from T1 to T4 (0.14±0.05 vs 0.08±0.03 pg/ml) and a 157% increase from T4 to T5 (0.08±0.03 vs 0.13±0.03 pg/ml), however those responses failed to reach statistical significance throughout the experimental period (p<0.05). **Conclusion**: These findings indicate that long-term swimming training can affect the resting and acute (pre-post testing) anti-inflammatory profile in young swimmers.

**Board #213 May 29 9:30 - 11:00 AM**

**Fitness-related Differences In The Polarization Of Lipid-exposed Macrophages Following Acute Exercise**

Lauren Pedersen, Lindsay Laferrata, Natalie Bohmke, Anson Blanks, Virginia Mihalick, Morgan Senter, Robert Lee Franco. Virginia Commonwealth University, Richmond, VA.

(_No relevant relationships reported_) Compared to anti-inflammatory M2 (CD206+) macrophages, pro-inflammatory M1 (CD16/30) macrophages are considered to be highly atherogenic. Increased cardiovascular fitness is linked to attenuated atherosclerotic plaque formation as well as anti-inflammatory alterations in the immune cells that mediate this process. Therefore, macrophage polarization in unfit individuals may differ from that of fit individuals following exposure to physical stress and elevated lipids. **Purpose**: To compare macrophage polarization in young fit and unfit individuals immediately post-season 1 and V3: early season 2. An additional V4: immediately post-season 1 and V5: early season 2 and V6: early season 3 fold at V1, when compared to resting values (p<0.05). Post-exercise SLPI levels were significantly higher compared to resting values during all 3 visits. **Results**: When compared to resting values: M1 (CD86+) macrophages are considered to be highly atherogenic. Increased cardiovascular fitness is linked to attenuated atherosclerotic plaque formation as well as anti-inflammatory alterations in the immune cells that mediate this process. Therefore, macrophage polarization in unfit individuals may differ from that of fit individuals immediately after a maximal exercise bout. Blood samples were collected pre-exercise (PRE) and immediately- (POST), 1 hour- (1HR), and 2-hours (2HR) post-exercise. Peripheral blood mononuclear cells (PBMCs) were isolated by density gradient centrifugation. **Conclusion**: Macrophage expression of CD206 was observed to be different between fit and unfit individuals immediately before and following an acute bout of moderate-intensity exercise and lipid exposure. Alterations in “M2” macrophage polarization may contribute to cardiovascular risk in unfit individuals.

**A-52 Free Communication/Poster - Exercise and Children**

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM

**Room: CC-Hall WA2**

**Board #214 May 29 9:30 AM - 11:00 AM**

**Associations Among Obesity, Physical Activity, Nutrition, And Family Environment In Adolescents**

Kimbo E. Yee1, Karin A. Pfieffer, FACSM2, Lorraine J. Weatherspoon3, Deborah L. Feltz4, Joey C. Eisenmann3, 1The Citadel, Charleston, SC. 2Michigan State University, East Lansing, MI. 3Leeds Beckett University, Leeds, United Kingdom. 4Virginia Commonwealth University, Richmond, VA.

(_No relevant relationships reported_) Previous research has shown that the Family Nutrition and Physical Activity (FNPA) Screening Tool is related to obesity risk in children. However, there is limited research on the utility of the FNPA among adolescent populations and its association with health behaviors. **Purpose**: To examine the association of the FNPA Screening Tool with physical activity, dietary quality, screen time behaviors, and obesity risk in ninth grade students. **Methods**: Data were collected from ninth grade students (n=175, 51% boys, 72% Caucasian) from a Midwestern high school. Physical activity, dietary quality, and screen time behavior were measured using the Physical Activity Questionnaire (PAQ-A; 8 items, scored 1-5), Healthy Eating Index-2010 (HEI-2010; scored 0-100), and self-reported total screen time (television, video game, and computer usage), respectively. Trained research assistants measured height and weight to calculate body mass index (BMI). Percent body fat (BF) was measured using a foot-to-foot bioelectrical impedance scale. The FNPA Screening Tool was mailed.
home to parents of the students to be completed. Upon completion, parents returned the FNPA to researchers, and it was scored (range 20-80). Multiple linear regression, with and without controlling for age, sex, and race (Caucasian or non-Caucasian), was used to examine associations between the FNPA and PAQ-A, HEI-2010, and total screen time. Logistic regression was used to determine differences in FNPA score relative to peers, and may require supplementary feeding to meet energy demands. It Children with complex congenital heart defects (CHD) are often short/lightweight, and may require supplementary feeding to meet energy demands. It

Factors Associated to Mechanical Efficiency among Adolescent Boys Performing a Graded Maximal Exercise

Georges Jabbour1, Lena Majed1

Qatar University, Doha, Qatar.

PURPOSE: To determine the mechanical efficiency (ME) and associated factors among adolescent boys at different stages of graded maximal exercise. METHODS: 45 sedentary adolescent boys were separated into three groups according to their percentage of fat mass as follows: 15 normal-weight (NW) (body fat: 16.0 ± 1.9%), 15 overweight (OW) (body fat: 24.0 ± 1.6%) and 15 obese (OB) (body fat: 31.0 ± 3.0%). Each of them completed a maximal graded test in which energy consumption in watt (E), ME (expressed as a %), plasma epinephrine, and norepinephrine concentrations were determined consecutively through three stages corresponding to 50% and 75% of each participant’s maximal heart rate (50%HRmax and 75%HRmax) and at peak oxygen consumption (VO2peak) level. RESULTS: During the maximal graded test, plasma epinephrine, and norepinephrine as well as ME determined at 50%HRmax, 75%HRmax and at VO2peak stages were significantly lower in OB compared to NW and OW individuals (p<0.01). ME correlated significantly to power output (r=0.88 and r=0.91, p<0.01) as well as with epinephrine (r=0.82, p<0.01) and norepinephrine concentrations (r=0.88, p<0.01) for entire group. CONCLUSION: These findings suggest that the body’s weight exerts a negative effect on ME values at a low intensity, while at higher intensities (75%HRmax and VO2peak) the lower ME could be better explained by the reduced catecholamine responses as observed in obese adolescent boys.

Submaximal energy consumption was significantly higher (model R² = 0.29) with lower initial weight z-score (b=1.4 [0.2, 2.5] per 1 unit increase, p<0.02), a decreasing slope of the weight z-score (b = -7.9 [1.8, 14.0], p<0.01), male sex (b = 3.8 [1.2, 6.3], p<0.004) and severe CHD (b = 4.0 [0.7, 7.4], p<0.02), but not by age (b = 0.4, p=0.15).

CONCLUSIONS: Children with CHD who were overweight or had a negative growth trajectory had significantly higher energy consumption during submaximal exercise. The relationship between a negative growth trajectory and daily physical activity should be examined to assess whether the higher energy demands for submaximal exercise are also associated with an inactive lifestyle, and therefore the known increase in risk for sedentary lifestyle morbidities. Prospective studies are required to understand the mechanisms linking growth limitations to reduced exercise capacity.

Craft Brewing Establishments Located in Knoxville, Tennessee

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A-53 Free Communication/Poster - Exercise & Neuroscience

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

Weight Trajectories Are Associated With Exercise Capacity Among Children With Complex Congenital Heart Defects

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Children with complex congenital heart defects (CHD) are often short/lightweight relative to peers, and may require supplementary feeding to meet energy demands. It was hypothesized that CHD patients with limited growth would also have decreased energy for exercise. PURPOSE: To investigate the impact of chronic energy deficit, as evidenced by negative growth trajectory, on submaximal exercise capacity. METHODS: Retrospective chart review of Bruce treadmill exercise test results, weight/height at each visit for 5 years prior to the exercise test, age at exercise test, sex and CHD diagnosis among children with 8 years to 14 years of age. Submaximal energy consumption (VO2) was estimated ml O2/kg/min at heart rate of 150 bpm and growth trajectory (slope of the weight z-score over 5 years) were calculated per child. A linear regression model examined energy consumption by growth trajectory, adjusting for age, sex, CHD severity and initial body weight z-score. RESULTS: Participants were 90 children with CHD (54 females (38%)), mean age 10.5 (SD=2.3) years. CHD diagnoses were simple (n=19, 21.1%), moderate (n=33, 36.7%) or complex (n=38, 42.4%). Mean VO2 at 150bpm was 28.7 (SD=7.4). Initial height (median 0.36, IQR: -0.65, 1.04) and weight (median 0.21, IQR: -0.69, 1.12) z-scores indicated most participants were taller/heavier than expected for age. Researchers have consistently observed a positive relationship between physical activity (PA) and alcohol consumption (AC). Anecdotally, craft breweries (CBs) appear to capitalize on this relationship by marketing to active populations (e.g. sponsorship of athletic associations, post-competition product donation, hosting of PA-related events). To date, empirical analysis of PA promotion by CBs has not been conducted. PURPOSE: Preliminarly assess PA promotion by CBs located in a single community. METHODS: Facebook posts by 15 CBs located in Knoxville, TN were screened between November 2016-October 2017, with PA-related posts coded by activity type. Non-parametric correlations assessed associations between CBs’ total PA posts and built environment factors via Geographic Information System (e.g. walk score, transit score, culture score). Chi-square tests were also used to assess the distribution of PA-posts across each season (Winter, Spring, Summer, Fall). Abstracts were prepared by the authors and printed as submitted.
RESULTS: Of 3845 Facebook posts, 147 (3.82%) referred to PA. PA posts made by individual CBs ranged from 0-47 (median=4.50; IQR=9; mean=10.13) over one year, and pertained to fitness classes (29.25%), biking (24.49%), running (21.77%), outdoor activities (12.24%), sports (4.08%), and miscellaneous PA (8.16%). PA posts were not equally distributed across seasons (χ2(N=3)=14.68, p=0.002); Summer contained the highest percentage of posts (34.51%), followed by Spring (28.87%), Fall (23.94%), and Winter (12.68%). PA posts were significantly and inversely correlated with scores regarding culture (r=−0.67, p=0.01) and shopping (r=−0.62, p<0.01). Moderate, but statistically insignificant correlations were observed between PA posts and scores for walkability (r=−0.36, p=0.18), dining and drinking (r=−0.46, p=0.08), and errands (r=−0.38, p=0.16). CONCLUSIONS: Although PA posts represent a minimal portion of social media advertising in this local sample of CBs, a wide variety of activities is promoted. Additionally, promotion volume fluctuates seasonally, and CBs that promote PA more frequently tend to be located in areas that are less walkable, with fewer desired amenities.

Amid growing concern of potential brain trauma caused by repetitive head impacts (RHI) in athletes, 

WEDNESDAY, MAY 29, 2019

FEATURED CONTRIBUTOR: Zhiying Li, 1, 2, Fei Chen, 3, Cui Li, 1, 4, Xi Zhou, 1, 5, Forrest Sabatke, 1, 6

BACKGROUND: In our previous study, we showed that depression scores were higher in youth football players with a history of multiple concussion (MCC) than in a non-concussion control group. We hypothesized that depression scores differ depending on the severity of MCC.

METHODS: A total of 60 youth football players (ages 8-14) were recruited, with 30 players in each of the following groups: non-concussion control (NC), mild concussion (MC), and moderate concussion (MC). The MCC group included players with a history of MCC (≥1) and the MC group included players with a history of MC (1). Depression scores were assessed using the Depression Symptom Scale (DSS) at the beginning of the season and at the end of the season.

RESULTS: At the beginning of the season, there was no significant difference in depression scores among the three groups (NC: 8.2 ± 1.3; MC: 8.4 ± 1.2; MCC: 8.8 ± 1.3). However, at the end of the season, there was a significant difference in depression scores among the three groups (NC: 9.5 ± 1.5; MC: 9.7 ± 1.4; MCC: 10.2 ± 1.4). The MCC group had significantly higher depression scores compared to the NC group (p=0.03) and the MC group (p=0.02).

CONCLUSIONS: The history of MCC may increase the risk of depression in youth football players. This study suggests that youth football players with a history of MCC should be monitored for depression.

381 Board #221 May 29 9:30 AM - 11:00 AM
Pre- and Post-Season Electroencephalography Measures of Brain Vital Signs in Youth Football Players
Thayne A. Muncie, FACSM, 1, Shaun D. Fickling, 1, Daniel N. Poel, 2, Jason D. Dormain, 1, Ryan C.N. D’Arcy 3
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(No relevant relationships reported)

Amid growing concern of potential brain trauma caused by repetitive head impacts (RHI) in athletes, the purpose of this study was to evaluate the memory function of the mice. Multichannel recording technology was used to record electrical activity of hippocampal CA1 in vivo. Theta oscillation and sharp waves and ripples (SWRs) were detected by MATLAB programs, and spectral analysis was computed using multi-taper methods. Immunofluorescence was used to detect the Aβ deposits in CA1.

RESULTS: Of 12 weeks of treadmill exercise ameliorated working memory (2.00±0.35 vs. 1.20±0.38, p<0.05) and reference memory (5.47±0.36 vs. 3.70±0.45, p<0.05) deterioration of 3×Tg mice. The 9-month-old 3×Tg mice exhibited a reduction of both gamma power (0.33±0.05 vs. 0.10±0.02, p<0.01) during the theta rhythms awaking and slow gamma power (0.50±0.03 vs. 0.55±0.04, p<0.01) during SWRs sleeping in the hippocampal CA1 compared to control mice, respectively. 12 weeks of treadmill exercise could increase gamma power either being awake (0.50±0.06, p<0.01) or being asleep (0.54±0.03, p<0.05) in 3×Tg mice. Furthermore, these disturbances were observed to be consistent with Aβ pathological deposits (A5, 1.42±0.21, p<0.01 vs. CS: A5, 1.35±0.09, p<0.01 vs. CS).

CONCLUSIONS: Consistencies between these alteration in gamma power and Aβ deposits suggest that disturbances in rhythmic organization of theta and gamma may contribute to spatial memory deficits in 9-month-old 3×Tg mice. Given these data, aerobic exercise could improve spatial performance by regulating gamma power when theta oscillations or SWR occur.

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383 Board #222 May 29 9:30 AM - 11:00 AM
Aerobic Exercise Differential Alters Intrinsic Neuronal Properties In The 3xtg Mouse Model Of Alzheimer’s Disease
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(No relevant relationships reported)

PURPOSE: Alterations in network activities in Alzheimer’s disease (AD) are accompanied by an early imbalance of excitation and inhibition that related to cognitive function. Although that aerobic exercise could enhance synaptic plasticity from various AD mouse models have been found, the properties of neurons firing in specific conditions remains poorly understood. This study was to investigate the neuronal properties firing rates altered by aerobic exercise in the brains of APP/PS1/Tau transgenic (3Tg) mice and 129 mice as wild type (WT) control at 9 months of age.

METHODS: 3Tg mice (6 months old) were randomly divided into exercise groups and sedentary groups (AS, AE), and WT mice as cohort control. The exercise groups would run on the treadmill for 12 weeks. Multichannel recording technology was used to record population spikes in cortical and hippocampal region at 9 months of age in vivo during awake or sleep state. Spike sorting was performed using offline software. Pyramidal cells (PNs) were distinguished from putative interneurons (INs) on the basis of average firing rate, bursting properties, and spike width.

RESULTS: Recordings took place across 5-7 consecutive days while mice were awake exploring or asleep, and the number of spikes was calculated every 10 sec as a session. During awake, in three AS, AE and WT mice, we recorded 15 PNs, 48 PNs and 10 INs, while 9, 23 and 11 INs in cortex (with a total of 192 place fields); 36 PNs, 77 PNs and 23 INs in hippocampus (with a total of 330 place fields). During sleep state, with a total of 138 place fields, we recorded 22 PNs, 19 PNs and 13 INs, while 7, 15 and 14 INs in cortex; 29 PNs, 58 PNs and 21 INs, while 9, 24 and 11 INs in hippocampus (with a total of 270 place fields). In both awake and sleep state, IN firing rates were differentially changed in AS compared to the control, and the ratio of IN/PN was lower in both cortex (0.60±0.02, 0.31±0.00) and hippocampus (0.28±0.00, 0.31±0.01) of AS compared to WT mice (1.10±0.02, 0.43±0.01 / 1.08±0.02, 0.52±0.01, p<0.01). Exercise attenuated the phenomena (0.48±0.01, 0.48±0.01 / 0.79±0.02, 0.41±0.02, p<0.01).

CONCLUSIONS: Aerobic exercise could regulate aberrant cellular neurophysiology related to cognitive impairments dependent network function.

384 Board #223 May 29 9:30 AM - 11:00 AM
Aerobic Exercise Regulates GSK3β Activity to Attenuate the Neuropathology In APP/PS1 Transgenic Mice
Peng HAN, Boya GU, Li ZHAO. Beijing Sport University, Beijing, China.

(No relevant relationships reported)

PURPOSE: Glycerol synthase kinase 3 beta (GSK3β) is involved in hypophosphorylated Tau, one of the hallmarks of Alzheimer’s disease (AD). This study was to evaluate the possible effect of aerobic exercise on GSK3β and the phosphorlysating Tau protein in APP/PS1 transgenic mice. METHODS: C57BL/6J (6-month-old) and APP/PS1 transgenic mice (6-month-old) were randomly divided into exercise group (CE/AS) and sedentary group (CS/AS) respectively. Animals
were subjected to treadmill exercise for 12 weeks. The changes observed during exercise, being detected by eight arm maze. The phosphorylation levels of AKT, GSK3β, and Tau were measured by Western Blotting. RESULTS: The eight arm maze showed that working and reference memory errors and time to complete testing in AE decreased significantly compared with the mice of AS(3.6±0.1 vs 4.8±0.2,p<0.05; 6.0±0.7 vs 8.4±0.5;p<0.01;109:35 vs 256±45.26;p<0.05), indicating that aerobic exercise improved behavioral and cognitive response ability. The levels of pTau ser262 and pTau ser396 were significantly decreased in hippocampus of AS compared with those of the control (C57BL/6J mice) (0.89±0.09 vs 0.9±0.06;p<0.05; 0.8±0.09 vs 0.8±0.06;p<0.05). Aerobic exercise could decrease pTau ser262 and pTau ser396 (0.69±0.08 vs 0.88±0.09; p<0.01;0.67±0.02 vs 0.89±0.06; p<0.05). As in case of GSK3β, the levels of pGSK3β ser9 were significantly decreased, while levels of pGSK3β tyr216 were significantly increased in hippocampus of AS compared with those of C57BL/6J mice (0.69±0.07 vs 0.69±0.06; p<0.05). The levels of pGSK3β ser9 were increased (0.79±0.09 vs 0.71±0.08; p<0.01), and the levels of GSK3β tyr216 were decreased after aerobic exercise training in the hippocampus (0.69±0.06 vs 0.7±0.07; p<0.05). The levels of pAKT (GSK3 upstream regulator) ser473 were significantly decreased in hippocampus of AS compared with those of C57BL/6J mice (0.73±0.13 vs 0.05; p<0.05). Aerobic exercise tended to increase the activity of pAKT ser473 (0.74±0.13 vs 0.49±0.07; p<0.05). CONCLUSION: Aerobic exercise regulates GSK3β activity to attenuate the neuropathology of hyperphosphorylated Tau in APP/PS1 transgenic mice. Supported by the National Natural Science Foundation of China (NSFC) (No. 31571229).

385 Board #223
May 29 9:30 AM - 11:00 AM
Aerobic Exercise Attenuates The Aβ Oligomer-induced Mitochondrial Permeability Transition Pore Opening In App/ps1 Transgenic Mice
Lianwei MU, Cui Li, Boya Gu, Yuanyuan LV, Li Zhao. Beijing Sport University, Beijing, China. (No relevant relationships reported)

PURPOSE: The mitochondrial permeability transition pore (mPTP) plays a role in the onset and the progression of Alzheimer’s disease (AD). This study was to analyze the effects of 12 weeks aerobic exercises on mPTP activation in AD models mice. METHODS: 6-month-old of APP/PS1 transgenic mice and C57BL/6J mice were randomly divided into exercise group (CE), sedentary group (AS, CS) respectively. The exercised mice were subjected to a treadmill exercise for 12 weeks, then the experimental age was at 9-month-old. The behavioral changes were detected by eight arm maze. Immunofluorescence, histochemistry and Dot blot were to analyze mPTP opening, the level of amyloid-β (Aβ) and soluble oligomers (oAβ). ELISA and Western Blotting were used to detect the activity of COXIV, ABAD, and the levels of COXIV, ABAD, Cyp-D, ANT1, ANT2, VDAC-1. RESULTS: Both working memory errors and reference memory errors were significantly increased in AS compared with those in the CS (40±4%; 30±4%; 71±2%, p<0.05). The AE performed better than AS (22±1% vs 39±3%; 55±3% vs 71±2%, p<0.05), Aβ was aggregated at hippocampus in AS, accompanied with an increase of oAβ (1±1x.11±1x; p<0.05). A decline was detected in Aβ plaque and oAβ content in CE than AS (0.61±1.1x.15±1.0; 0.9±1.1 vs 1.1±1.0; p<0.05). There was an increase in AS compared with CS in the mPTP opening (0.07±0.02 vs 0.08±0.02; p<0.01), and which was decreased after aerobic exercise training (0.07±0.02 vs 0.08±0.02; p<0.01). The activity of COXIV and ABAD in the hippocampus of AS were decreased compared with those of the CS (3.3±1.0x.3±1.0; 5.0±1.0x.3±1.0; p<0.05), and aerobic exercise increased an increase of their activities (3.3±1.0x.5±1.0; 5.5±1.0x.8±1.0; p<0.01). CONCLUSIONS: Aerobic exercise attenuates the Aβ deposition and the opening of mPTP, then regulates the mitochondrial oxidative phosphorylation for energy production in AD models. Supported by the National Natural Science Foundation of China (NSFC) (No. 31571229).

386 Board #224
May 29 9:30 AM - 11:00 AM
Effects Of Aerobic Exercise On Learning And Memory Ability And Hippocampal Tgf-1 In Depressed Rats
Xue Li, Lu Wang, Yu Jin, Xiang Hu, Qi Ye. Chengdu Sport Institute, Chengdu, China. Email: 361128550@qq.com (No relevant relationships reported)

OBJECTIVE: To investigate the effects of different periods of aerobic exercise intervention on hippocampal TGF-1 expression and spatial learning and memory ability in depressive model rats. METHODS: 36 male SPF grade Sprague Dawley (SD) rats were randomly allocated into 4 groups (n=9) : Control group (C group), Pre-model exercise group (EC group), Model group (M group), Model group + exercise group. Except for group C, all other groups used CUMS stress stimulation to establish an animal model. Morris water maze test was used to detect spatial learning and memory ability of rats. Nissl staining was used to observe the morphology of rat hippocampal neurons. Real-time PCR, Western Blotting were used to detect the expression of TGF-β1. RESULTS: There was no significant difference in time-consumption of escaping the incubation period between the 1st and the 2nd day in each group (p>0.05). On the 4th day, the escape latency of M group was significantly longer than that of rats in the C and CE groups (p<0.05). On the 5th day, the escape latency in M group was significantly longer than that in C and CE groups (p<0.05), and EC group was significantly longer than that in C group (p<0.05). Results of the number of crossing platforms: The number of crossing in the M and EC groups were significantly lower than those in the C and CE groups (p<0.01). Compared with EC and M group, the morphological structure of neurons in CE group was better. The expression of TGF-β1 mRNA in hippocampus of EC and CE group was significantly lower than that of C and M groups (p<0.01). The expression levels of TGF-β1 protein in C and M groups were significantly higher than those in CE group (p<0.01). The expression of TGF-β1 protein in M rats was significantly higher than that in EC and CE groups (p<0.01). CONCLUSIONS: Aerobic exercise intervention can improve the morphological structure of hippocampal CA3 neurons, and decrease the expression of TGF-β1. It indicated that aerobic exercise can improve the depression.

387 Board #225
May 29 9:30 AM - 11:00 AM
Aerobic Exercise Inhibits Tau Hyperphosphorylation Through Activation Of The Pi3k/akt Pathway In The Hippocampus Of App/ps1 Mice
Guoliang Fang. China Institute of Sport Science, Beijing, China. Email: fangguoliang@ciss.cn (No relevant relationships reported)

PURPOSE: Many studies suggest that regular physical exercise can reduce the risk of Alzheimer’s disease and slow its onset and progression. However, the exact mechanism is still unclear. Clinically, Alzheimer’s disease is characterized by the presence of extracellular amyloid plaques and intraneuronal neurofibrillary tangles, which are associated with amyloid-β and tau hyperphosphorylation respectively. The PI3K/Akt signaling pathway regulates tau phosphorylation and plays a pivotal role in the development of pathology in Alzheimer’s disease. Therefore, we try to investigate the effects of aerobic exercise on tau phosphorylation and examined whether these effects were mediated by the PI3K/Akt pathway in the hippocampus of APP/PS1 and C57BL/6J mice.

METHODS: 40 male APP/PS1 mice and 40 male C57BL/6J mice were randomly divided into four groups respectively: sedentary group, exercise group, sedentary with GNE-317 treatment group and exercise with GNE-317 treatment group. The mice in the exercise group and exercise with GNE-317 treatment group were given exercise training on a treadmill for 8 weeks. After 8 weeks of treadmill exercise, the Morris water maze, immunohistochemistry and western blot analysis were performed.

RESULTS: We found that 8 weeks of aerobic exercise enhanced PI3K expression and increased phosphorylation of Akt at Thr308 and Ser473 and of GSK3β at Ser9. Furthermore, 8 weeks of aerobic exercise reduced tau phosphorylation at multiple sites including Ser202, Thr231 and Ser396. In the Morris water maze test, the exercise group showed a reduced escape latency and distance compared with those of the sedentary group, suggesting that aerobic exercise improved the cognitive ability in mice. While the above-mentioned results were attenuated in the PI3K/Akt inhibitor GNE-317 treatment groups.

CONCLUSIONS: Our study demonstrated that 8 weeks of aerobic exercise could inhibit tau hyperphosphorylation and improve cognitive function through activation of the PI3K/Akt pathway in the hippocampus of APP/PS1 and C57BL/6J mice.

388 Board #226
May 29 9:30 AM - 11:00 AM
Cutaneous Sensitivity Increases During an Ultra-Marathon
Domenica A. Rivera, Sharon C. Thompson, Amina Rahmoune, Steven B. Hammer, James W. Agnew. Indian River State College, Fort Pierce, FL. Email: riverrada2@mail.irsc.edu (No relevant relationships reported)

Very little data is available on variation in cutaneous sensation that occurs during ultra-endurance activities. Very little data is available on variation in cutaneous sensation that occurs during ultra-endurance activities. Wednes...
and 25mm apart. Calipers were placed on the calcaneal plantar surface of the foot before the ultra-marathon and again immediately after the runners completed their ultra-marathon distance. The different width calipers were placed randomly either in a horizontal or vertical position. Subjects were in a prone position and were unable to observe caliper placement. Subjects were asked to indicate caliper placement position. Technicians used hand signals to indicate to the recorder: 1. caliper position and 2. the subject’s response either correct or incorrect. This was repeated 5 times randomly for each caliper setting and their respective answers were recorded as: correct=1 and incorrect=0. Two-Way ANOVA was used to analyze the overall Pre vs. Post accuracy difference (p<.05). Pre vs. post accuracy differences between each specific caliper distance were analyzed with a paired t-test (p<.05). RESULTS: A significant increase in 2PD was observed after completing the ultra-marathon across all caliper distances (p<.05). While the 2PD across all caliper distances increased in accuracy only the two widest caliper settings 20mm and 25mm were significantly more accurate (p<.05). CONCLUSION: The increased 2PD suggests an increase in cutaneous sensitivity following an ultra-marathon. We have previously found increased sensitivity in pain threshold after an ultra-marathon. There, and in this present study, it is likely that the inflammatory response from ultra-endurance activity has a sensitizing effect on nociceptors and cutaneous receptors, respectively, thus increasing pain and cutaneous sensitivity.

Arterial hypotension, minutes to hours after exercise, is a well described phenomenon. The drop in mean arterial blood pressure (MAP) likely results from a combination of sustained vasodilation of the previously active muscles, centrally mediated reduction in sympathetic nervous activity and resetting of thermo-, chemo-, and baroreceptors. Despite decreased MAP, cerebral blood flow is generally well maintained. PURPOSE: To characterize effects of moderate aerobic exercise on intracranial pressure (ICP) as a mechanism for maintaining cerebral perfusion pressure during and following exercise. METHODS: Sixteen healthy volunteers completed 30-min exercise at 70% estimated VO2-max on an upright ergonomic bicycle followed by a one-hour recovery phase in supine position. MAP, heart rate, stroke volume, and total peripheral resistance (TPR) were recorded continuously (Nexfin). In 15 subjects (8 female, 20±2 years, height 169±10 cm, weight 64±12 kg) ICP was estimated non-invasively by evoked tympanic membrane displacement (Cerebral Cochlea Fluid Pressure device). Invasive parenchymal ICP recordings were performed in one, cerebrally intact, former patient (male, 74 years, 176 cm, 80 kg) via a permanently implanted tip-transducer telemetric ICP-sensor (Neurovent-P-tele). RESULTS: 30 min moderate exercise did not increase ICP (-6.1 mmHg during seated rest vs -6.8 mmHg during exercise). Invasive (N=1) and non-invasive (N=15) ICP recordings followed the same trend, demonstrating a (No relevant relationships reported)

389 Board #227 May 29 9:30 AM - 11:00 AM Postexercise Intracranial Hypotension
Lonnie G. Petersen, Evan Grace, Alan Hargens, FACSM, Johan Petersen. University of California, San Diego, San Diego, CA. (Sponsor: Alan Hargens, FACSM)
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Visual sensory performance (VSP) tasks may dynamically assess deficits following concussion, as these tasks reflect visual and cognitive function and motor response. The pupillary light reflex (PLR) represents autonomic nervous system activity, and is inexpensive and noninvasive to assess. This activity may be compromised following concussion; however, deficits in young adults are currently unknown. The relationships among PLR and VSP outcomes are interesting given these metrics may reflect different but overlapping visual domains.

PURPOSE: To investigate the effects of concussion history on the relationships between PLR and VSP outcomes in young adults. METHODS: Participants [n = 89, age = 21.0 ± 1.5 years, concussion history = 19 (21.3%)] completed a test battery including PLR and VSP. Seven PLR parameters included initial and final pupil diameters, constriction and dilation velocities, constriction latency, time to 75% initial diameter recovery (T75), and average maximum constriction velocity. VSP tasks included visual clarity, contrast sensitivity, depth perception, near-far quickness, perception span, multiple object tracking, reaction time, target capture, eye-hand coordination, and go/no-go. Regression models tested concussion history effects on PLR controlling for age; and whether history moderated relationships between

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PLR and VSP outcomes. RESULTS: The PLR and VSP outcomes did not differ by concussion history (P > 0.05). We found a negative relationship between reaction time and TTS (r = -0.40, p > 0.005) which was expression moderated by concussion history (t = -0.97, p = 0.33), indicating that people with faster PLR recovery times also had faster reaction times. No other significant relationships were observed (P > 0.01).

CONCLUSION: Our PLR and VSP measures did not differ by concussion history. These measures may be insensitive to long-term physiological and behavioral deficits due to prior concussive injuries or no such long-term effects exist in young adults. It is worth further studying the inverse relationship between reaction time and diameter recovery, providing a possible link between an involuntary process supporting vision with visual-sensory task performance.

Falls are a major concern for older adults and their quality of life. Cognitive impairment is associated with falls in older adults; however, the electrophysiology while performing a working memory task has not been investigated. Working memory is a necessity for everyday function (walking, postural control, conversing), and the processing of a stimulus to elicit the appropriate response might lead to important insights into potential causes for falls and help us identify older adults at risk or develop future intervention strategies. PURPOSE: To examine differences between Non-Fallers and Fallers in performance on a working memory task and corresponding electrophysiology. METHODS: Older adults (n=38, female=23) aged 60 - 80 years (m=68.8, SD=4.7) completed two separate sessions on two separate days. The first session incorporated general demographic questionnaires and mobility and neuropsychological assessments. Participants were classified as Non-Fallers or Fallers based on their self-reported falls history over the past 12 months. In the second session, we assessed working memory using the n-back (0-, 1-, 2-), while behavioural and electroencephalograms (EEG) results were recorded. RESULTS: In the 2-Back test, the EEG results showed that Fallers were more impaired in processing the stimuli, with earlier latencies for the N2 (p<0.001) and P3 (p=0.001) components in comparison to Non-Fallers. As well, delayed peak latencies in the N2 (p=0.507, p=0.01) and P3 (p=0.451, p=0.024) components were associated with increased accuracy in the working memory task. CONCLUSIONS: Fallers show processing impairments in working memory compared to Non-Fallers. Future studies should consider incorporating working memory as a component of falls risk screening for older adults. Many studies suggest that regular exercise could reduce memory impairment, the main symptoms of Alzheimer’s disease (AD), but the underlying mechanisms have not been elucidated. Inflammation induced by β-amyloid (Aβ) deposition has been shown to play a critical role in AD pathogenesis. Increasing evidence shows that aerobic exercise has anti-inflammatory and neuroprotective effects. We hypothesized that aerobic exercise could attenuate memory deficits by regulating inflammatory status. PURPOSE: To investigate whether regular aerobic exercise regulate inflammation and attenuate memory deficits induced by Aβ1-42 in rat. METHODS: Sprague-Dawley rats were divided into 3 groups: control group (C), Aβ1-42 infusion group (A), Aβ1-42 infusion with exercise group (E). Rats in group A and E were injected 10μg Aβ1-42 oligomer (1μg/μl saline) into their hippocampus, and rats from group C were injected with same volume of saline. The rats in group E underwent aerobic exercise training on a leveled motorized treadmill at a moderate speed for consecutive 5 weeks (once a day, 6 days/week) starting at the 2nd day after Aβ1-42 injection. The memory ability was evaluated by Morris Water Maze (MWM) and the inflammatory status was analyzed by expressions levels of proinflammatory cytokines (TNF-α, IL-1β) and anti-inflammatory cytokine (TGF-β, IL-10) in hippocampus using Western Blot. RESULTS: MWM test showed that memory functions of rats were impaired by Aβ1-42 infusion, and the impairment was alleviated by aerobic treadmill exercise. Compared with group C, both pro-inflammatory and anti-inflammatory cytokines in group A increased by different degrees (TNF-α: 306.9%, IL-1β: 255.6%, TGF-β: 78.3%, IL-10: 80.0%). Compared with group A, the expression of TNF-α and IL-1β in group AE decreased by 31.4% and 25.0%, whereas TGF-β and IL-10 increased by 68.5% and 39.0% respectively. CONCLUSIONS: The findings demonstrated that treadmill exercise could adjust inflammation status in hippocampus and attenuate the cognitive impairment of rats induced by Aβ1-42. Supported by the Fundamental Research Funds for the Central Universities, Southwest University for Nationalities (2018QN19) and the Sichuan Science and Technology Project (18YJC1355).

OBJECTIVE: To investigate effects of different load forced swimming exercise on the spatial learning and memory ability of rats and to detect the expression of hippocampus PSD-95 and NCAM. METHODS: Thirty male 2-monthes old Sprague-Dawley rats were divided randomly into three groups: Control group (C), moderate load exercise group (M), overload exercise group (O), 10 in each group. Group C rats were fed naturally for 8 weeks, and Group M rats were involved in 8 weeks of moderate load swimming intervention, and Group O rats were involved in 8 weeks of overload swimming intervention. Then, the Morris Water Maze (MWM) test was performed to estimate rats’ learning and memory abilities and the Western Blot and Real-time PCR were used to determine the expression level of PSD-95 mRNA, NCAM mRNA, PSD-95 and NCAM in the hippocampus. RESULTS: In the process of navigation training, all animals’ escape latencies gradually shortened. On the third day, the average escape latency of Group M was significantly lower than that of Group C and Group O (p<0.05), there were no significant difference in other days; in a day, the average escape latency of Group M was significantly lower than that in Group C and Group O (p<0.05), as well as the expression of PSD-95 mRNA in Group O was significantly lower than that in Group C and Group M (p<0.05); the expression of NCAM mRNA and NCAM protein in Group M was significantly higher than Group C (p<0.05), as well as the expression of NCAM protein in group O was significantly lower than Group M (p<0.05), but there was no significant difference with Group C (p<0.05). CONCLUSION: Moderate load swimming can improve the expression of PSD-95 and NCAM in the rat hippocampus, as well as improve the spatial learning and memory ability of rats; overload swimming has little influence on PSD-95 and NCAM expression.

Microglia has been shown to play a pivotal role in the pathogenesis and progression of Alzheimer’s disease (AD) for its’ distinct activation phenotype, including pro-inflammatory, neurotoxic M1 and anti-inflammatory, neuroprotective M2. Previous studies have showed that regular exercise has anti-inflammatory effect and can reduces the memory deficit of AD rats induced by β-amyloid (Aβ), but whether exercise modulates microglial phenotype remain unclear.

PURPOSE: To evaluate the impact of a moderate treadmill exercise program on activation of microglial M1/M2 phenotype in the hippocampus of rats injected with Aβ1-42 and to probe the underlying molecular mechanism. METHODS: Sprague-Dawley rats were randomly separated into sham (S), Aβ1-42 (A) and Aβ1-42 exercise (AE) groups. Rats in group A and AE were bilateral hippocampally injected with 10μl Aβ1-42 solution (1μg/μl), and rats in group S were injected with 10μl saline. Rats in group AE performed running on a treadmill for 5 weeks (6 days/week, once a day, 8-10 min for 10-20 min at a time in the first week, 15 min/more for 30 min at a time in the next 4 weeks) starting 1 day after Aβ1-42 injection. The microglial M1/M2 phenotype in the hippocampus were determined by flow cytometry (FC) and immunofluorescence (IF). The expression of nuclear factor-kappa B (NF-κB/p65), which has been shown to be involved in the regulation of microglial phenotype, was measured using western blotting (WB) and quantitative real-time PCR (qRT-PCR). RESULTS: Both FC and IF showed that the number of M1 microglia (CD11b+CD86+ cell, Iba-1+I Nos3+ cell) increased markedly in comparison with group C (p<0.01), but no significant change was observed in M2 microglia (CD11b+CD206+ cell, Iba-1+Arg1+ cell), and that the number of M1 microglia in group AE was significantly lower than group A (p<0.01), whereas that of M2 microglia was increased (p>0.01). WB and qRT-PCR analysis suggested that the expression of NF-κB/p65 in the hippocampus was significantly increased after Aβ1-42 injection (P=0.01), which was
down-regulated by exercise (P<0.05). CONCLUSIONS: These results indicated that the treadmill exercise could suppress the M1 phenotype activation of microglia following Aβ1–42 insult and effectively promote microglia toward M2 polarization, which may relate with inhibition of NF-κB pathway.

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**Board #233 May 29 9:30 AM - 11:00 AM**

**Brain Modulation For Perceived Exertion Processing After Different Cycling Exercise Intensities: An fMRI Study**

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(Related relationships reported)

Ratings of perceived exertion (RPE) during exercise is processed in the brain, however, the modulation of the associated areas at different intensities levels remains unclear. PURPOSE: To verify the brain modulation while RPE processing immediately after cycling exercise performed at different intensities. METHODS: 24 healthy adults (77.6±9.4 kg; 176±7.2 cm; 25.9±5.9 years old) performed an incremental load test on an adapted cycling ergometer attached to a MRI scanner. The workload started at 25 W and increased 25 W after every four blocks of 30 s of cycling and 30 s rest. At the end of each block, participants had four seconds to report their RPE based on the 6-20 Borg scale presented on a screen. The RPE processing periods for RPE responses from 6 to 12 were labeled as LOW intensity while those from 13 to 18 were considered as HIGH intensity. To identify the common areas associated to RPE processing, the one sample t-test was used for each condition (all RPE, LOW and HIGH intensities). The statistical threshold established was family-wise error corrected (FWE<0.05).

RESULTS: When grouping all RPE responses throughout exercise intensities, we found an activation of several areas related to motor control (primary motor cortex, primary somatosensory cortex and cerebellum), homeostatic regulation (insular cortex) and cognition for executive functions (dorsolateral and anterior prefrontal cortex), primary somatosensory cortex and cerebellum), homeostatic regulation (insular cortex) and cognition for executive functions (dorsolateral and anterior prefrontal cortex), and spatial cognition (superior parietal lobule), reflective self-awareness (precuneus), and others (T=5.33, FWE<0.05). For the inhibited areas, we observed brain structures located in occipital lobe, prefrontal cortex, and thalamus, angular gyrus, Wernicke’s area, associative visual cortex, premotor cortex and supplementary motor cortex (T=5.44, FWE<0.05). At LOW, the somatosensory cortex and cerebellum (T=6.46, FWE<0.05) were activated and at HIGH, only the cingulate gyrus was activated (T=6.53, FWE<0.05). CONCLUSIONS: By using a gold standard technique to analyze brain activity, we described here the modulation of brain areas to the RPE processing immediately after exercise cessation performed at different intensities. The integration of motor control, homeostatic regulation and cognitive related areas seems to, together, process the RPE responses after exercise.

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**Board #234 May 29 9:30 AM - 11:00 AM**

**Different Characteristics Of Brain Function Between Endurance And Sprinting Athletes: A Resting State fMRI Study**

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(Related relationships reported)

Long-term motor training has been shown to create adaptations in regional brain plasticity, including brain structure and function, and this has been demonstrated by a number of studies. However, different influences on brain characteristics caused by different specific physical ability like endurance or sprinting still remain unknown. PURPOSE: To investigate spontaneous brain activity characteristics of national level endurance and sprinting athletes, as well as different pattern of brain functional connectivity between these two groups. METHODS: Fifty-seven Chinese national level athletes were recruited and assigned to the endurance group (n=29) and the sprinting group (n=28) according to their physical fitness. Their resting functional magnetic resonance imaging data were acquired by Philips Achieva 3.0T T3 scanner with a standard 32 channel head coil for all subjects. Amplitude of low frequency fluctuation (ALFF) was used to evaluate the intensity of regional spontaneous brain activity. Based on the ALFF results and previous studies, six region of interests (ROIs) were defined, including the cingulate gyrus (6, -21, 27) and right SMA (4, 12, 74). Then whole-brain seed-based functional connectivity analysis was conducted to examine characteristics of brain activation pattern. SPM8 was used for preprocessing and statistical analysis of the images, and DPARSF was used to acquire the ALFF and FC maps for each individual. Two-sample t-tests were used to analyze differences in brain activity with a standard p-value of 0.05. RESULTS: 1. Compared to the sprinting group, the endurance group demonstrated higher ALFF in the right cingulate gyrus (peak t= 4.20) and lower ALFF (peak t= 4.5) in the left precuneus (p<0.001, cluster size>6). 2. The sprinting group showed higher functional connectivity between right cingulate gyrus and left Temporal Lobe (peak t= 3.83), as well as right SMA and lateral prefrontal cortex (peak t= 4.06) (p<0.001, cluster size>25). CONCLUSIONS: Long time specialized training seems associated with the changes in athletes’ regional spontaneous brain activity and patterns of brain functional connectivity.

(No relevant relationships reported)

Studies exploring the effects of exercise in the brain mainly focus on exercise induced modulation of growth factors, whereas research regarding inhibitory factors for plasticity in the brain such as Nogo-A and chondroitin sulfate proteoglycans (CSPGs) is limited. PURPOSE: To determine the expression of CSPGs and Nogo-A in selected brain areas after treadmill exercise training or intermittent hypoxia. METHODS: Male Wistar rats (228g ± 12.63) underwent six weeks of moderate intensity continuous training (MICT), high intensity interval training (HIIT), intermittent hypoxia (IH), IH and HIIT simultaneously (IH+HIIT), or remained sedentary (CON). MICT animals trained for 3 minutes at 25 cm.s⁻¹ followed by 30 minutes at 32 cm.s⁻¹. HIIT animals trained for 3 minutes at 25 cm.s⁻¹ followed by five cycles of 3 minutes at 50 cm.s⁻¹ and 3 minutes at 15 cm.s⁻¹. MICT and HIIT protocols were matched for duration and distance. IH animals were exposed to five cycles of 3 minutes of hypoxia (FiO₂, 15%) and 3 minutes of normoxia (FiO₂, 20.95%). The IH+HIIT animals were exposed to the IH and HIIT protocols simultaneously, training at the higher speeds during the hypoxic intervals. Hindlimb muscles were snap frozen and citrate synthase activity was measured. Brains were harvested following transcardial perfusions and fixation in 4% paraformaldehyde. 25 μm coronal brain sections were immunohistochemically stained for Nogo-A and CSPGs.

RESULTS: Preliminary results show that MICT reduced the average staining intensity of Nogo-A in the dentate gyrus (DG) (99%), CA1 (51%) and CA3 (98%) regions of the hippocampus compared to the CON group. HIIT reduced the intensity of Nogo-A to a larger extent than MICT in the CA1 region (62%). However, HIIT only slightly reduced the intensity of Nogo-A in the DG (22%) and CA3 (9%) regions compared to CON. HIIT increased the expression of CSPGs in the CA1 (300%) and CA3 (27%) regions compared to the CON group. HIIT reduced the intensity of CSPGs in the DG (75%) compared to CON. HIIT reduced the intensity of CSPGs in the DG (75%), CA1 (62%) and CA3 (61%) regions compared to the CON group.

CONCLUSIONS: These results show that MICT and HIIT have the capacity to reduce inhibitory molecules within the brain which may contribute to enhancing plasticity.

There is insufficient data available on age-related variation in pain mechanisms during ultra-marathon competitions.

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**Board #235 May 29 9:30 AM - 11:00 AM**

**Changes in Inhibitory Markers of Neuronal Plasticity Following Exercise and Intermittent Hypoxia**


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(No relevant relationships reported)

**Board #236 May 29 9:30 AM - 11:00 AM**

**Age-Related Variation of Pressure Pain Threshold and Condition Pain Modulation During an Ultra-Marathon**


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(No relevant relationships reported)
and CPM from the Pre PPT and CPM, respectively. Independent sample t-tests were used to assess differences in Delta values for PPT and CPM between the two age groups. RESULTS: The Post PPT and CPM were significantly decreased (p<0.05) for both age groups, indicating greater pain sensitivity. The age group analysis (<40 versus >40) showed a decrease in Delta PPT in the older age group. (Mean Delta <40 years = 149.40 μPa, Mean Delta >40 years = 48.38 μPa (4.2) ± 2.69; p<0.05. A similar decrease was found in Delta CPM. (Mean Delta <40 years = 31.75 μPa, Mean Delta >40 years = 11.69 μPa (4.2) ± 0.05). PRE-TEST: Previous research from our group has shown a decreased PPT and CPM, indicating greater pain sensitivity, across all ages during an ultra-marathon. In this present study we have seen similar decreases in PPT and CPM but clearly a difference between age groups in the degree of these changes. Further research is required to determine how factors of immunosenescence, directly or indirectly, may affect the age group variations in pain during an ultra-marathon.

5 minutes after the IDCS/practice session ended. Motor performance was quantified as the endpoint error, whereas MEP amplitude was used to quantify cortical excitability. Percent change* and endpoint error were between the baseline-test block and the post-test block for the two groups was compared with an unpaired t-test. Similarly, percent change in MEP amplitude before and after the 5 minutes of IDCS for the two groups was compared with an unpaired t-test. RESULTS: The percent change in endpoint error (degree) was greater for the IDCS group compared to the SHAM group, but this difference failed statistical significance (-16.9 vs. -5.2; P = 0.127), whereas the percent change in MEP amplitude was significantly greater for the IDCS group compared to the SHAM group (49.7 vs. -13.5%; P = 0.012).

CONCLUSION: These findings indicate that a single-session of IDCS enhances cortical excitability and appears to improve motor skill, although there was high individual response variability to IDCS for this difficult motor task.

Physical exercise has been shown to reduce craving for alcohol in alcoholics. There is a high prevalence of heavy episodic drinking in college-aged adults (18-29 years of age). This can be predictive of an alcohol or other substance use disorder developing later in life. PURPOSE: The purpose of this investigation is to examine the impact of acute aerobic exercise on cue reactivity to alcohol in heavy episodic drinkers. METHODS: Seven participants (6 females, 1 male) (Age = 20±4.4 years, BMI=22.1±4.59, VO2peak=51±14 ml.kg⁻¹.min⁻¹) completed 2 experimental sessions. Heavy episodic drinking was identified using an adapted version of the CAGE questionnaire. During one session subjects rested for 30 minutes and during the other session subjects exercised for 30 minutes at a moderate exercise intensity (77±1% of Peak HR). Sessions were randomized for each participant. Prior to and immediately following each session, EEG data were collected using a 64-channel system while subjects were exposed to 180 images (90 alcoholic drinks (ALC), 90 non-alcoholic drinks (NON)). Images were presented in a random order and proceeded by a fixation stimulus using a variable time span (0.5 to 1.5 sec). Mean amplitude and peak latency was calculated for F300 (300-500 ms post stimulus) in parieto-occipital electrodes. RESULTS: Before exercise, subjects had a greater response (p=0.002) to ALC (1.85±0.20 μV) as compared to NON (1.47±0.21 μV). After exercise the response to ALC (1.62±0.37 μV) was similar to that seen for NON (1.72±0.31 μV). Before exercise the peak latency was shorter (p=0.025) for ALC (325.13±2 ms) compared to NON (366±25 ms). After exercise, the peak latency was similar for ALC (313.52±2 ms) and NON (323.27±2 ms). CONCLUSION: These findings suggest that acute aerobic exercise of moderate intensity attenuates cue reactivity to images of alcoholic beverages in heavy episodic drinkers.
metabolic health independent of weight loss in PD. Whether AEX improves metabolic health and PD related clinical outcomes more than other exercise prescriptions awaits further investigation. Supported by a grant provided by The Manning Foundation.

Multiple studies have indicated that physical activity regulation may be largely controlled by central neural factors, such as dopamine (DA) signaling in the nucleus accumbens (NAc). DA signaling has been shown to be altered by nutritional interventions. The key identified proteins involved with DA signaling are DA receptors one and two (DRD1, DRD2), tyrosine hydroxylase (TH), vesicular monoamine transporter (VMAT), and DA transporter (DAT).

**PURPOSE:** To determine if a high fat/high sugar (HFHS) diet alters DA signaling in the NAc of male and female C57Bl/6j mice. METHODS: Mice were randomly assigned to either a HFHS diet or a standard Chow diet (C) at three weeks of age for a total of nine weeks. The C diet consisted of 4% fat, 25.2% protein, 39.5% carbohydrate, and 23.2% fiber, while the HFHS diet consisted of 45% fat, 20% protein, and 35% carbohydrate with a 20% fructose solution replacing drinking water. Physical activity was measured using a running wheel for three days during the last week. Mice were sacrificed at 12 weeks, the NAc was dissected on ice, and flash frozen in liquid nitrogen. Immunoblotting was performed using NAc lysate probed for DRD1, DRD2, TH, VMAT, DAT, and other DA-related proteins. Densitometry was performed using MATLAB software. Statistical comparisons were made using two-way analysis of variance followed by post-hoc analysis.

**RESULTS:** There were no significant differences in protein densities in mice for DRD1, TH, VMAT, DAT, or any other DA-related proteins between the HFHS and C diet conditions. After normalization using Welch’s t-tests to compare target protein densitometries to control DAT, no differences in protein densitometries in male mice for DRD1, TH, VMAT, DAT, or any other DA-related proteins were observed between the HFHS and C diet conditions.

**CONCLUSION:** Exercise studies that have examined the effects of the opiate receptor blocker naltrexone, found that its administration prior to exercise altered these before mentioned phenomena. PURPOSE: The purpose of this study was twofold: 1) to establish an exercise modality that is sufficient to stimulate the release of endogenous opioids and 2) to examine the role endogenous opioids play in post-exercise pain tolerance and depression. METHODS: Following a week of familiarization, mice underwent a 50-minute (min) bout of forced swimming (FS). Mice were injected with either saline (S; 0.9%) or the opioid blocker naltrexone (NTX; 4g/kg) 15 mins prior to exercise. Following exercise mice were challenged with a tail suspension test (TST), pain tolerance test or monitored for post exercise food consumption for 2 hours. RESULTS: Naltrexone increased total FS time (46 ± 1.2 mins. vs. 35 ± 1.6 mins; p<0.05). Forced swimming increased food consumption by 88% ± 11% (p<0.05) two hours following exercise but was abolished by naltrexone (p<0.05), verifying an increase in opioid mediated hyperphagia. An increase in hot water tail immersion time following forced swimming (5 ± 2.7 ± 0.13 vs. FS = 4.28 ± 0.19; p<0.05) demonstrated an improvement in pain tolerance. Pain tolerance decreased by 20% ± 0.05 with the addition of NALTX (p<0.05). Finally, a TST demonstrated that following a bout of exercise, mice spent 49 ± 3.1% less time immobile (p<0.05), signifying lower depression levels. This effect was reversed with the opioid blocker naltrexone (p<0.05). CONCLUSIONS: Fifty minutes of forced swimming is an effective stimulus for the release of endogenous opioids and modulates behavioral changes specific to the release of endogenous opioids in mice.

**Acute aerobic exercise has been shown to reduce cravings for various addictive substances like cigarettes and alcohol. A similar effect has been seen in children when examining brain MRI responses to fatty foods. PURPOSE:** The purpose of this investigation was to determine the impact of aerobic exercise on cue reactivity to fatty and healthy foods in college-aged women. METHODS: Sixteen women (Age=21.1 ± 2.0 years, BMI=22.1 ± 0.6, VO2peak=39.1 ± 1.5 ml kg⁻¹ min⁻¹) participated in two experimental sessions. The primary session subjects rested for 30 minutes and during the second session subjects exercised for 30 minutes at a moderate exercise intensity (77±2% of Peak HR). During the treatment session, subjects were treated with a counter-balanced fashion and subjects fasted for 4 hours prior to each session. Prior to and immediately following each session, EGG was collected using a 64-channel system while subjects were exposed to 280 images (40 Distractor (DIS), 120 Fatty Foods (FAT), 120 Healthy Foods (HEALTHY)). Images were presented in a random order and proceeded by a 1 minute filler image of a 20% white frame. Adaptive mean and peak latency for N100 (100-130 ms post stimulus) and P300 (240-300 ms post stimulus) were determined in parietal-occipital electrodes. RESULTS: Before exercise, subjects had a greater P300 response (p<0.001) to FAT (5.68±0.46 μV) as compared to HEALTHY (5.23±0.48 μV). After exercise the response to FAT and 42.4±0.45 (μV) was similar to that seen for HEALTHY (4.94±0.54 μV). The N100 response to FAT (Pre=3.48±0.24 μV, Post=2.96±0.28 μV) was greater than the response to HEALTHY (Pre=3.20±0.22 μV; Post=1.96±0.42 μV) before (p<0.001) and after (p<0.05) exercise. No differences in peak latency were seen for N100 or P300 at either time point.CORRELATION: These findings suggest that acute aerobic exercise of moderate intensity can influence cue reactivity to images of fatty and healthy foods in college-aged women.

**PURPOSE:** Autophagy and neurogenesis play a pivotal role in maintaining cellular homeostasis of neurons in the brain. Endurance exercise (EXE) serves as a potent activator of both autophagy and neurogenesis in the hippocampus of the brain; however, the molecular mechanisms of the dual activation remains unclear. We investigated EXE-induced molecular signaling nexus of autophagy and neurogenesis pathways in the hippocampus. METHODS: C57BL/6 mice (8 weeks old, male, n=24) were randomly divided into two groups: control (CON, n=12) and endurance exercise (EXE, n=12). Animals performed treadmill running exercise at 13 m/min (65%–70% VO₂ max) for 60 min/day for 6 weeks. 24 hours after the last session of EXE, whole brains were excised and the hippocampi were isolated for Western blot analysis. For immunofluorescence microscopy, the excised whole brains were frozen. A student t-test was used for statistical analysis (p<0.05).

RESULTS: EXE significantly increased autophagy evidenced by an increase in LC3II, ATG7, BECLIN1, and phosphorylation of BCL-x, by JNK activation along with an increase in lysosomal proteins (LAMP2, CATHEPSIN L and TEEB, p<0.05). Intriguingly, EXE-induced autophagy coincided with activation of anabolic signaling cascades (AKT-mTOR/p70S6K, p<0.05), known to interface in autophagy. This autophagy promotion was associated with activation of endoplasmic reticulum stress adaptors (p-PERK, ATF6, and p-IRE1, p<0.05). Interestingly, EXE-mediated neurogenesis was induced, despite the downregulation of canonical neurotrophic factors (BDNF, GDNF, and NGF, p<0.05). Instead, EXE promoted neuregulin-mediated trophic signaling (p-ERK, p-RSK, and p-CREB, p<0.05). CONCLUSIONS: EXE-induced coactivation of autophagy and anabolism suggest that enhanced recycling of damaged molecules along with increased anabolism in the hippocampus may confer neuronalprotective phenotypes of the brain. Furthermore, EXE-mediated improvement in neurogenesis devoid of canonical neurotrophic factors suggests that there exists a potential modular mechanism regulating the optimal levels of neurogenesis, which prevents undesired excessive chronic neurogenesis. Our results suggest that coactivation of autophagy and neurogenesis via EXE is critical for maintaining optimal neuronal homeostasis.
PURPOSE: Exercise is inversely related to both sadness and suicidality in developing adolescents. To date, the literature has addressed neither the contextual factors nor the dynamic fluctuations of these relationships in middle and high school children over time. The purpose of this study is to examine the temporal changes in the relationship between physical activity, sport participation, sadness, and suicidality in students in grades 6-12 in the U.S.

METHODS: Using the 2015 National Youth Risk Behavior Survey (N=199,194), regression models adjusted for age, sex, and race estimated the odds ratios between sadness, suicidal ideation, and suicidal attempts, stratified by exercise and sports participation.

RESULTS: Overall, 19.7% of students in grades 6-12 reported suicidal ideation or attempt. Only 68.4% of students reported ≥60 minutes of physical activity on four or more days of the week, and 55.2% reported sport team participation. Physical activity on four or more days per week was associated with a 27% reduction in the odds of suicidality, and sport team participation was associated with 17% reduction in suicidality.

CONCLUSIONS: Exercise and sport team participation are inversely related to sadness and suicidality in adolescents and this relationship persists throughout adolescence. Future research should examine the influence of exercise and sport participation on a longitudinal basis and identify other biopsychosocial factors that may be contributing to these results in developing adolescents.
Mindfulness meditation (MM) and aerobic exercise (AE) decrease stress, but the combined effects are unknown. **Purpose:** Assess effects of AE plus MM, compared to effects of MM alone, on stress in young adults. **Methods:** High-stress, sedentary (N=32), 27 ± 2.7 years, 23.9 ± 5.0 kg/m²) individuals were randomized to a 4-week MM, AE+MM, or control group. MM and AE+MM groups participated in 200 minutes/week of guided MM or AE+MM. MM consisted of present moment, non-judgmental awareness. AE consisted of moderate-intensity (40-60% heart rate reserve) exercise. Stress (PSS) and anxiety-depression symptoms (DASS) were measured at baseline, and after weeks 1 and 4. An analysis of variance assessed effects of group and time on PSS and DASS. **Results:** There were no group x time interactions for PSS (P = 0.12) or DASS (P = 0.21). There were main effects of week in which PSS and DASS were significantly lower after week 1 (PSS: p = 0.04; DASS: p = 0.01) and at post-intervention (PSS: p < 0.001; DASS: p = 0.004) compared to baseline. There were large effect size (ES; Cohen’s d) changes in the pre to post PSS and DASS scores for the MM (PSS: -1.33; DASS: -1.03) and AE+MM (PSS: -1.24; DASS: -0.97) groups, and small ES changes in the PSS and DASS scores for the control group (PSS: -0.45; DASS: -0.13). **Conclusion:** MM may be as effective as AE+MM in combating psychological distress in high-stress young adults. Further research should compare AE-only to AE+MM.
variance explained 90.25% and 70.56% of the variance in state anxiety change over the same period, respectively. Correlations between AUC indices and other NA measures also were negative but nonsignificant, possibly due to sample size.

CONCLUSIONS: AUC indices were significantly and inversely associated with changes in state anxiety from baseline to wk 3 and the remaining outcomes showed nonsignificant associations in the predicted directions. HIIT could be a promising intervention to reduce NA in anxiety disorders.

The demands of being a female college athlete/performer may create mental and physical stress that may increase the likelihood of eating disorders and disordered eating. PURPOSE: The overall purpose was to examine the prevalence of Eating Disorder (ED) risk among female college athletes/performers across academic status and sport type (equestrian, volleyball, beach volleyball, women’s soccer, softball, and ballet). METHODS: Data from a larger cross sectional was used. A convenience sample of NCAA Division I female athletes/performers (n=127; age: 19.8±2.0 years; weight: 63.6±9.2 kg; height: 165.9±8.8 cm) was invited to complete an online survey on the academic region of the United States participated in the study. Participants completed a basic demographic survey, the Eating Disorder Inventory-3 (EDI-3), and the EDI-3 Symptoms Checklist (SC). Basic descriptive stats were used for demographic information. Cross-tabulations were used to examine the proportion of participants classified as “at risk for EDI-3 and EDI-3 SC” across sport and academic status. RESULTS: Significant differences (X2(15,N=127)=25.2, p<0.04) were found between the distribution of ED risk and sport with 18.9% (n=24) at risk for EDI-3; 29.9% (N=38) EDI-3 SC, and 31.5% (n=40) were at risk for both EDI-3 and EDI-3 SC. Overall, pathogenic behaviors revealed: 52.8% (n=66) dieting, 13.6% (n=17) purging, 4.0% (n=5) laxatives, 7.2% (n=9) diet pill use, and 1.6% (n=2) use diuretics. A significant difference between dieting and sport [X2(5, N=125) = 12.2, P=0.03] was found with the highest prevalence within equestrian (16%, n=20/128) and ballet (13.6%, n=17/129). Sport type and exercise to control weight more than 50-100% of the time was significantly different [X2(20, N=125) = 54.1, P<0.01] with the highest prevalence within equestrian (10.4%, n=13/129). CONCLUSIONS: Athletes in the college setting are at risk for eating disorders. Medical professionals such as athletic trainers who work within this setting need to be educated on the potential risk factors that can lead to EDs. There should be a referral process in place for those athletes who are at risk. Those involved in the screening, prevention, and treatment of at-risk athletes should understand the sensitive nature of the topic.

It is well known that moderate exercise can improve mental health. The present investigation sought to examine the associations of physical activity on mental health by sex. METHODS: Eighty-one young adults (20.5±1.5 years) took part in the investigation. The participants underwent body fat percentage assessment and completed the Depression, Stress and Anxiety Scale (DASS 2.1) and the Leisure and Physical Activity Survey (LPA). Data were analyzed for associations between sex, physical/SEDary activities, body composition and mental health via multiple linear regression analysis. RESULTS: Female participants (n=59) reported less weight lifting exercise (p=0.005), greater HIIT, 57% 0-2 days, 41% 3-5 days, 4% 6-7 days) compared to males (23% 0-2 days, 61% 3-5 days, 16% 6-7 days); however, no significant sex differences were noted for aerobic exercise. Physical activity by sex was regressed against scores from the DASS 2.1. Significant interactions were noted between sex and min/day of aerobic exercise (F=6.26, p=0.003) and days/week engaged in weightlifting exercise (F=5.46, p=0.006) for anxiety. In contrast to males, females engaged in higher numbers of weight training sessions and reported increased anxiety (0-2 days: 5.33±4.28; 3-5 days: 5.65±5.51; 6-7 days: 7.50±9.19). Whereas increasing time of aerobic exercise among females was associated with lower anxiety (0-15 min per session: 12.5±5.0; 16-30 min per session: 4.65±4.74; >30 minutes per session: 4.47±2.87), male students who engaged in more minutes of aerobic exercise reported lower levels of anxiety (0-2 days: 10.00±5.88; 3-5 days: 4.52±2.98; 6-7 days: 3.63±3.21). CONCLUSIONS: For college-aged females, a focus on time engaged in aerobic exercise may produce not only cardiovascular benefits, but also psychological, and encouraging resistance exercise among college males may have similar results. University and college communities should encourage different patterns of exercise for male and female students to reduce anxiety.

While previous studies have well documented the beneficial effects of physical activity (PA) and sleep quality on mental disorders (e.g., depression and anxiety), relatively few have explored their relationship with subjective well-being (SWB), which is a core construct in positive psychology and is linked with various health outcomes. PURPOSE: To examine the associations between the PA, sleep quality, and SWB in college students while controlling for gender and age. METHODS: 726 college students (41.1% female, mean age = 19.28 years) voluntarily completed self-report and subjective assessments measuring PA (PAQ) and sleep quality (Sleep Quantity, Sleep Quality, and Subjective Well-being: Sleep Quality Scale), happiness (Subjective Happiness Scale), and negatively affective variables (State scale in the following time-courses: baseline (B), immediately after (IA) and 30 minutes after (R) finishing of the exercise. The Feeling Scale (FS) was recorded at 1, 5, 10 and last minutes of exercise. The situations were compared by two-way ANOVA with post-hoc Duncan test, with significance p≤0.05. The protocol was approved by Unifesp Ethics Committee (02.381.537).

CONCLUSIONS: For college-aged females, a focus on time engaged in aerobic exercise may produce not only cardiovascular benefits, but also psychological, and encouraging resistance exercise among college males may have similar results. University and college communities should encourage different patterns of exercise for male and female students to reduce anxiety.
lower compared to 1 (p<0.001) and 5 (p<0.001). When comparing intensities 60% showed higher scores at the FS at the 10 (p<0.001) and the last minute (p<0.001) compared to 85%.

CONCLUSIONS: The comparison between the exercise intensities show that, there was no difference between anxiety scores, on the other hand, moderate exercise presented better IA well-being response, faster fatigue recovery and maintained affectivity with positive values indicating pleasure from the beginning to the end of the test.

419 Board #257 May 29 11:00 AM - 12:30 PM Impact of Wearing Graduated Compression Stockings on Psychological and Physiological Responses during Prolonged Sitting
Yukari Horiuichi1, Yoko Honda Kirihara2, Masahiro Horiuichi2. 1Kyu Shogong University, Fukuka, Japan. 2Mt. Fuji Research Institute, Fuji-yoshida, Japan. Email: yhoriiu@ip.kyusan-u.ac.jp
(No relevant relationships reported)

PURPOSE: Links between a prolonged sitting and increased risk of cardiovascular diseases or poor mental health have been found. A usage of compression garment may have some potential psychological and physiological benefits during prolonged sitting. METHODS: We investigated the impact of with or without wearing graduated compression stockings on psychological and physiological responses in 18 healthy young people (12 men and six women) during 3 h prolonged sitting. Heart rate (HR) was measured throughout the sitting time, and heart rate variability (HRV) was analyzed to evaluate sympathetic and parasympathetic nervous activity at pre, 1h, 2h, and 3h during the sitting for 5-min each. To assess psychological stress-related variables, Profile of Mood States (POMS) and saliva cortisol were evaluated before and after 3 h sitting. Visual analogue (VAS) scale was also assessed for whole body and lower limbs uncomfortable feelings. RESULTS: POMS scores did not show marked differences between with and without stockings. A 3 h sitting significantly decreased saliva cortisol in both conditions (P<0.05) with no differences between conditions (0.263±0.108 mg/dl vs. 0.189±0.075 mg/dl without stockings at pre vs. post, 0.267±0.100 mg/dl vs. 0.186±0.081 mg/dl with stockings at pre vs. post). Wearing stockings suppressed a subjective uncomfortable sensation (e.g., pain, swelling) in the lower limbs assessed by VAS (58.2±23.3 mm without vs. 39.3±24.4 mm with stockings, P<0.001). HR at 1 h and 3 h was significantly greater without than with stockings (77±8 bpm without vs. 74±6 bpm with stockings at 1h, and 80±9 bpm without vs. 75±6 bpm with stockings at 3h, P<0.05, respectively). High-frequency oscillations (-0.15-0.44 Hz) showed higher values with than without stockings throughout the 3 h sitting period, and it was significantly higher at 1 h (229±169 m sec without vs. 324±251 m sec with stockings, P<0.05). When data for both conditions were pooled, pre-to-post changes in saliva cortisol were positively associated with higher VAS in the lower limbs and negatively associated with changes in the Vigor subscale of POMS (P<0.05, respectively). CONCLUSIONS: These findings suggest that wearing graduated compression stockings may benefit from subjective comfort and increased parasympathetic nervous activity.

420 Board #258 May 29 11:00 AM - 12:30 PM Psychosocial Mechanism of Adolescents’ Physical and Mental Health: A Self-Determination Behavior Health Perspective
Tao Zhang1, Xiangli Gu2, Scott Martin, FACSM1. 1University of North Texas, Denton, TX. 2University of Texas at Arlington, Arlington, TX. Email: TAO.ZHANG@UNT.EDU
(No relevant relationships reported)

PURPOSE: Research indicates that adolescents’ health can be promoted by satisfying their basic psychological needs through a supportive social environment in school. However, the relations among perceived need support (i.e., autonomy support, competence support, and relatedness support), need satisfaction (i.e., autonomy, competence, and relatedness), physical health (i.e., physical fitness [PF]), and mental health (i.e., health-related quality of life [HRQOL]) among adolescents. The mediation models were conducted to specify the relations among psychosocial processes toward PE, adolescents’ PF and HRQOL, respectively. METHODS: A prospective correlational design was used across one academic school year. Participants were 198 adolescents (58.6% female; M = 12.63) recruited from three schools in the south region of the U.S. At the beginning of school year, participants completed previously validated questionnaires assessing their perceived need support and relatedness, PF and HRQOL, respectively. RESULTS: Correlation analysis revealed positive associations among the study variables (rs ranged from .19 to .83). Using structural equation modelling (AMOS 22.0), the hypothesized model resulted with a good fit to the data (χ2/df=130.46/61; IFI = .93; CFI = .93; RMSEA = .076; 90% CI [.058, .094]). The need support had a direct influence on need satisfaction (β = .79, p<.01), and need satisfaction had a direct contribution on PF (β = .23, p<.05). The psychosocial process from need support to need satisfaction had no direct influence on HRQOL. The need satisfaction had an indirect influence through PF (β = .34, p<.01). CONCLUSION: The findings supported the theoretical tenets of SDHBM in adolescents, particular on their physical health. Creating a need-supportive environment in PE is critical in order to enhance adolescents’ need satisfaction, which ultimately indirectly influence their HRQOL.

421 Board #259 May 29 11:00 AM - 12:30 PM Differences in Depressive Symptoms across Physical Activity Levels Based on Comorbid Anxiety and Depression Status
Chloe Forte, Cillian P. McDowell, Ciaran MacDonnacha, Matthew P. Herron. University of Limerick, Limerick, Ireland. (No relevant relationships reported)

Research supports inverse associations between physical activity (PA) and depressive symptoms and status among adolescents. However, the degree to which comorbid anxiety and depression status may influence relations of PA with depressive symptoms is unknown. PURPOSE: This study investigated differences in depressive symptoms across low, moderate, and high PA frequencies among adolescents with no anxiety or depression, anxiety-only, depression-only, and comorbid anxiety and depression. METHODS: Adolescents (N=481; 200 female) aged 15.1±1.7y self-reported PA frequency (modified PACE+); low, moderate, and high PA were classified as engaging in ≥60mins of PA 0-2, 3-4, and 5+d/wk, respectively. Depressive symptoms were assessed with the Quick Inventory of Depressive Symptomatology (≥6 indicated depression status). The Trait subscale of the State-Trait Anxiety Inventory assessed trait anxiety (≥50 indicated high trait anxious status). Two-way ANCOVA examined variation in depressive symptoms according to the interaction of PA and comorbid anxiety and depression status. Covariates were age, sex, rural or urban residence, and school sex-type (i.e., female only, male only, or mixed sex). Bonferroni-adjusted simple effects analysis decomposed significant interaction. RESULTS: The two-way interaction between PA and comorbid status was statistically significant (F1,366,349=6.69, p<0.001, n2=0.07). Depressive symptoms were significantly lower among those with comorbid anxiety and depression with moderate PA compared to low PA (mean difference=–2.29, p<0.001) and high PA (mean difference=–2.65, p<0.003). Depressive symptoms were significantly higher for comorbid anxiety and depression compared to depression-only for those engaged in low PA (mean difference=–3.73, p<0.001) and high PA (mean difference=–3.40, p<0.001), and non-significantly higher among those engaged in moderate PA (mean difference=–1.26, p>0.30). This finding may be due partly to the smaller number of comorbid anxiety and depression participants with moderate PA (22 vs. 48). CONCLUSIONS: Depressive symptoms differed across PA levels based on comorbid anxiety status. Though the exact role of comorbid anxiety is not clear, it may be important to consider relative to relations of PA with depressive symptoms among adolescents.

422 Board #260 May 29 11:00 AM - 12:30 PM Improving Acute Exercise Prescription In Depression: Predictors Of Optimal Intensity For Improving Depressive Mood
Gabriel Cruz-Maldonado1, Maria Perez1, Jeni E. Lansing1, Laura D. Ellingson, FACSM1, Dane Cook, FACSM1, Jacob D. Meyer1. 1Iowa State University, Ames, IA. 2University of Wisconsin-Madison, Madison, WI. Email: gcruzar@iastate.edu
(No relevant relationships reported)

Overall mood improves following acute exercise for people with major depressive disorder (MDD); yet it is unclear how to maximize this effect. Determining factors that predict what the most beneficial intensity of exercise is for an individual could lead to prescriptions that maximize the positive effects of each session potentially leading to increased exercise participation. PURPOSE: To explore potential factors influencing the most effective exercise intensity for improving mood in individuals with MDD. METHODS: Women with MDD (n=24) were prescribed 20-minute sessions of light (L), moderate (M), and high (H) intensity exercise (rating of perceived exertion: 11, 13, 15, respectively) in a counterbalanced, within-subject design. The most effective session was defined as the one resulting in the greatest reduction in depressive mood (measured via depressive subscale of Profile of Mood States) from pre- to post-exercise for each participant [L (n=10); M (n=9); and H (n=5)]. Potentially important factors related to these effects were, age, body mass index (BMI), objectively measured minutes of total daily moderate to vigorous physical activity as well as weekly physical activity in bouts ≥10min, and total sedentary time and prolonged sedentary time.

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Exercise improves sleep and reduces apnea severity in adults with obstructive sleep apnea (OSA). However, whether reducing sedentary behavior impacts sleep and apnea severity is unknown. **Purpose:** To examine whether reducing prolonged sitting during a simulated workday by use of a sit-stand desk leads to changes in sleep compared to a sedentary workday in a sample of adults at high risk for OSA. **Methods:** Eight inactive adults (5 males, 35.8±8.5 y, body mass index: 29.8±5.5 kg/m²) who were classified as ’high risk’ for OSA based upon the STOP-BANG screening algorithm participated in a randomized crossover trial consisting of two simulated 8-h workdays: (1) continuous sitting (SIT); and (2) alternating periods of sitting and standing every 30 min (SIT-STAND). Sleep and apnea were assessed on the night following each simulated workday by wrist-worn actigraphy and a portable OSA testing device, respectively. Actigraphic measures of total sleep time (TST) and wake after sleep onset (WASO) served as the primary sleep variables, while the apnea-hypopnea index (AHI) assessed OSA severity from the OSA testing device by a blinded assessor. Natural logarithm transformation of AHI was performed due to non-normality. Effect sizes (Hedges’ g) and Pearson correlations evaluated differences in sleep following each condition and associations between changes in sleep measures, respectively. **Results:** In the full sample, trivial improvements in WASO (g=0.16) and TST (g=0.03) were observed following SIT-STAND compared to SIT (p>0.31). The change in AHI was associated with the change in actigraphic WASO (r=0.3, P<0.09). Four of the 8 adults had clinically significant OSA (i.e., mean AHI>10 across conditions). Among those with clinically significant OSA, large increases in WASO and AHI were seen following SIT-STAND relative to SIT (g=1.16 and 0.89, respectively). In those without significant OSA, small- to moderate-sized reductions in WASO and AHI were observed following SIT-STAND compared to SIT (g=0.68 and 0.30, respectively). **Conclusion:** Following sedentary behavior reduction during a simulated workday, changes in sleep and apnea seemed to differ based upon the presence of clinically significant OSA.

**Key words:** sleep, actigraphy, sit-stand desk, OSA

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### Effectiveness of Short-term Yoga Interventions for Stress of College Students: A Meta-analysis

**Methods:**
- **Participants:** 42 senior athletes, 55 physically active, and 61 sedentary adults (aged 55-85 years) were submitted to anthropometric (body mass, height - Body Mass Index [BMI]), weekly energy expenditure (EE), and dietary intake (EI) evaluations, and administered Body Image Dimensional Assessment (body composition, satisfaction) on the relation between age and dietary intake (EI), body composition (BC) and dissatisfaction (BD) on the relation between age and health and quality of life perception.
- **Methods:** Two serial multiple model mediation analyses were applied to assess whether mechanisms involving diet-related and physical activity-related personal characteristics and behaviors (4 mediators: EE, EI, BMI, BD) mediated the relation between age and PCS or MCS health-related quality of life perception.
- **RESULTS:** Only for MCS the mediation analysis showed: a) a direct effect of age on MSC (β=0.31, p=0.002; CI=95%:0.12; 0.50); b) a mediation path by EE, EI, BMI, and BD (β=0.0027; Bootstrap CI=95%:0.0105; -0.0002; and c) a positive total effect (β=0.22, p=0.02; CI=95%:0.04; 0.39). **CONCLUSIONS:** The combination of positive and negative effects throughout the mediation path of mental health perception of older individuals underlined that the maintenance of adequate level of physical activity could influence the body image and, in turn, positively impact mental health with advancing age.

**Supported by:** MIUR Grant 2010KL2Y73

### Cardiorespiratory Fitness Moderates the Relation Between Years of Drug Use and Stress in Drug Abusers

**Methods:** Substance use disorders (SUD) have increased worldwide and is currently a major global issue. In SUD, stress is linked to drug-seeking behaviors and greater rates of relapse. Physical activity has been related with increased self-esteem, mood and reduced stress levels in SUD. However, it remains unclear whether the relation between the time of drug use over the years and stress might be under influence.
of cardiorespiratory capacity. **PURPOSE:** This study investigated whether cardiorespiratory fitness has a moderate function over the relation between years of drug use and stress levels. METHODS: Sixth-two male SUD individuals (34.17±8.82 years; 24.62±2.91 m/kg²) have participated in the study. We took a collection of measures in one visit including: (1) anthropometric measures of height and weight to compute BMI; (2) self-reported demographics and drug use history, including years of drug use, days of abstinence, and number of hospitalizations; (3) a questionnaire to measure depressive emotional states; and (4) a shuttle run test to estimate the maximum consumption of oxygen (VO₂max). For this study, we tested a moderation analysis using the Macro PROCESS plugin for SPSS (Model 1), in which the independent variable was the years of drug use, the dependent variable was stress levels and the moderator was VO₂max. The moderation analysis was adjusted for age, days in abstinence, BMI and number of hospitalizations. RESULTS: It was found that VO₂max moderates the relation between years of drug use and stress levels (β=-0.82, p<0.05, 95% confidence interval (-0.15 to -0.007). The conditional effect at each level of the moderator (one SD below the mean, at the mean and one SD above the mean) showed that for those individuals with lower VO₂max the negative relation between years of drug use and stress was not significant (β=-0.23, p>0.05), for those with an average VO₂max it was significant (β=-0.48, p<0.05) and for those with higher VO₂max the relation was even more significant (β=-2.03, p<0.01). **CONCLUSION:** For those SUD individuals with an average and higher VO₂max, the negative relation between years of drug use and stress is more pronounced. Therefore, fitness seems to have a protective effect over stress in SUD individuals, which may minimize the chances of relapse and enhance the rehabilitation process.

427 **Board #265** May 29 11:00 AM - 12:30 PM Identifying Mental Health Risks through Screening among Collegiate Ethnic-Minority Athletes Samantha R. Weber, Toni M. Torres-McGhee, Allison Smith. University of South Carolina, Columbia, SC. (No relevant relationships reported)

Ethnic minority student-athletes are under immense amounts of pressure to perform, meet academic requirements for scholarships, and maintain relationships with peers, coaches, and parents. A change in stressors can cause physiological disturbances and mental health disorders such as depression (DEP), eating disorders (ED), low self-esteem (LSE) and body image dissatisfaction (BID). **PURPOSE:** To examine the prevalence of DEP, ED, LSE, and BID in ethnic minority student-athletes. A secondary purpose examined mental health risks across sex, academic status, and sport type. METHODS: Student-athletes (n=274) were recruited from multiple Ethnic Minority Universities to participate in an online study. Demographic information, Center for Epidemiologic Studies Depression Scale. Eating Attitudes Test. Rosenberg Self-Esteem Scale, and Standard Figural Stimuli were completed. **RESULTS:** Overall prevalence was 31.8% for DEP, 18.1% for ED, and 8.4% for LSE. Chi-square analysis revealed no significant differences between mental health risks and sex, academic status and sport type. A 2 sex (female, male) x 2 clothing type (daily clothing, competitive uniform) x 2 perceptions (perceived, desired) repeated measures ANOVA indicated a main effect (P≤0.01) with significant interactions for LSE, male athletes still displayed weight pressures for their sport. Healthcare professionals working with male athletes need to be aware of these sub-clinical mental health concerns to ensure that prevention and treatment can occur before the onset of issues such as eating disorders and depression. **Character count no spaces:** 1956

429 **Board #267** May 29 11:00 AM - 12:30 PM Characterization of Potential for Relationship between Anxiety and Cardiovascular Health in Different Racial Groups Zana B. Lee1, Emily N. Blaszkow1, Rachel L. Dickinson1, Clara N. Baker1, Emily H. Reeve1, Kevin M. Gill1, Matisen L. O’Brien1, Concetta M. Magliocchetti1, Christopher S. Pak1, Amber N. Orle1, Megan A. Carty1, Lindsay J. Rusby1, Brielle S. Clarke1, Emily E. Ruch2, Paige E. DeAlba1, Rachel L. Coleman1, Alyssyn K. Getty1, Cassandra C. Derella1, Avery N. Perez2, Joyann E. Oakman1, Vanessa V. Volpe1, Michael D. Brown1, FACSM2, Deborah L. FearrEller1, FACS M3, L. O’Brien3, Emily H. Reeve1, Kevin M. Gill1, FACSM4 (1) University of South Carolina, Columbia, SC. 2) University of South Carolina, Columbia, SC. 3) University of South Carolina, Columbia, SC. 4) University of South Carolina, Columbia, SC. (No relevant relationships reported)

There are a multitude of factors that contribute to cardiovascular (CV) health. Psychosocial factors contribute to CV risk, and anxiety is one of the psychological disorders diagnosed in CV patients. It is unclear whether there is a potential relationship between inflammation and anxiety. **PURPOSE:** 1) To compare CV health between Caucasian (C) and Mixed-Race (MR) adults, and 2) to explore the relationship between anxiety levels and CV health measures across these populations. This pilot study is the first step in our clinical trial to investigate the relationship between anxiety measures and CV risk factors across racial differences. METHODS: Thirty-two young adults (C: N=16, 22.94±7.4; MR: N=16, 22.81±7.5 years) underwent 2 test visits. First, CV health was assessed by fasting glucose, lipids, blood pressure (BP), carotid artery intima media thickness (IMT), body fat (BF) measured by biochemical impedance, and flow-mediated dilation (FMD). At the second visit, ECC, clinic BP and VO₂max were measured. Anxiety measurements using the DASS-21 scale are ongoing. **RESULTS:** Pilot data on physiological outcomes show no differences between groups. Compared to C adults, the adults in MR group show a small trend towards having worse CV profiles. In the MR group, we found higher levels of cholesterol (156.4±27.2 vs. 144.2±36.6 mg/dL), BF (31.9±7.9 vs. 28.9±2.2 %), and lower levels of FMD (71.4±4.3 vs. 87.7±4 %) and VO₂max (42.9±8.8 vs 38.65±10.6 ml/kg-min). Within groups, we found significant (p<0.05) race-related relationships between several variables. In C, we found an inverse relationship between IMT and HDL (R=-0.654). In MR, we found an inverse relationship between BF and FMD (R=-0.832), BF and HDL (R=-0.836), and BF and VO₂max (R=-0.741). Also, we found direct relationships between BF and glucose (R=0.834) and BF and DBP (R=0.751). Data from DASS-21 is being analyzed between groups. **CONCLUSION:** We found relationships with BF in the MR group that did not exist in the C group. Considering that literature suggests that young adults of color tend to have higher levels of anxiety, we hypothesize that we will find relationships between anxiety and CV measures in the MR group that are different than that in the C group.
340 Board #268 May 29 11:00 AM - 12:30 PM Effect Of Aerobic Exercise On Depression In Rats: Role Of Mitophagy
Lu Wang, Yingying Lv, Wenqian Deng, Xue Li, Yu Jin. Chengdu Sports Institute, Chengdu, China. (Sponsor: Tongjian You, FACSIM) (No relevant relationships reported)

Abstract:
Depression is a common health problem and a major cause of agrypnia and disability. Recent evidence supports an anti-depressant effect of aerobic exercise on unpredictable chronic mild stress (UCMS)-induced depression in rats; however, the biological mechanism remains to be investigated.

Purpose: To investigate whether aerobic exercise could improve UCMS-induced depression and alter mitophagy in depressive rats.

Method: Thirty-six male Sprague-Dawley rats were randomly divided into three groups: a control group (Con, n=12), a UCMS-induced depression group (UCMS, n=12), and a UCMS-induced depression plus aerobic exercise group (UCMS+E, n=12). After 4 weeks of UCMS stimulation, rats in the UCMS+E group carried out 3 weeks (60 min/day) of swimming exercise. A sucrose preference test (SPT) was performed, and the content of 5-hydroxytryptamine (5-HT) was measured to verify whether the depression model was successful. A Morris water maze (MWM) test was used to evaluate spatial learning and memory ability. The expression levels of mitophagy-related proteins (Bclin1, LC3-I, LC3-II and P62) were determined by Western blot. Statistically significant group differences were assessed by using one-way ANOVAs and post-hoc tests.

Results: Based on the change of sucrose consumption and the expression level of 5-HT following UCMS treatment, the depression model was successfully established in the rats. Spatial learning and memory ability were lower in the UCMS group than the Con group (both p<0.05), but improved in the UCMS+E group (both p>0.05). According to the Western blot results, the expression levels of Bclin1 (Con: 0.37±0.02, UCMS: 0.26±0.04, UCMS+E: 0.43±0.07) and P62 (Con: 0.34±0.03, UCMS: 0.20±0.02, UCMS+E: 0.31±0.05), as well as the LC3-II/LC3-I ratio (Con: 0.36±0.05, UCMS: 0.19±0.04, UCMS+E: 0.33±0.04) were significantly lower in the UCMS group than the Con group (all p<0.05), but were significantly higher in the UCMS+E group than the UCMS group (all p<0.05).

Conclusion: This study suggests that rats with UCMS-induced depression presented alterations in mitophagy. Three weeks of aerobic exercise significantly up-regulated mitophagy in depressive rats. Therefore, mitophagy may play an important role in the biological mechanism underlying the anti-depressant effect of aerobic exercise.

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Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

431 Board #269 May 29 11:00 AM - 12:30 PM Exercise And Physical Activity Promotion Improves Cardiorespiratory Fitness, Symptoms Of Disease And Well-being In Patients With Schizophrenia
Mirko Brandes1, Sirka Giselle2, Christian Figge3, Alexandra Philipse4, 1Leibniz Institute for Prevention Research and Epidemiology, Bremen, Germany. 2Oldenburg University, Oldenburg, Germany. 3University Hospital for Psychiatry and Psychotherapy, Oldenburg, Germany. 4University Hospital for Psychiatry and Psychotherapy, Bonn, Germany.
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Patients suffering from Schizophrenia (SZ) show low fitness, a sedentary lifestyle and comorbidities like diabetes and cardiovascular diseases, resulting in 20 years less of life expectancy.

Purpose: To evaluate the impact of an intervention combining exercise and physical activity promotion (PAP) on cardiorespiratory fitness (CRF), severity of SZ, symptoms of disease and well-being.

Methods: 35 patients were randomized into an intervention (n=19, aged 39.0 ± 13.6 years, BMI 28.3 ± 7.3) or control group (n=16, aged 36.0 ± 9.3 years, BMI 25.7 ± 5.2), directly after inpatient treatment for SZ. Intervention included two sessions of high intensity indoor cycling (IC), each 45min, and one session of PAP (60min) per week for three months. In months 4-6, the intervention was reduced to one session IC and one session PAP per week. The control group received a psychologically ineffective control intervention. Measurements were conducted at baseline (t0), after three (t1) and 6 months (t2) of intervention, and after 12 months (six-month follow up, t3). Measurements included CRF (bicyle ergometry), severity of SZ (PANSS-Score), well-being (SF-36), and psychological distress (SCL-90). Results: The intervention improved significantly severity of SZ (t0: 55.4 ± 16.3, t2: 34.8 ± 3.3, p<.05), well-being (t0: 50.4 ± 10.1, t2: 60.5 ± 7.1, p<.05) and psychological distress (t0: 159 ± 47.4, t2: 119.8 ± 34.3, p<.05). CRF, patients were able to improve their physical capacity, expressed as W/kg (t0: 1.83 ± 0.6, t2: 2.13 ± 0.6, p<.05), but did not significantly improved with ACSM-parameters (V02max: t0: 17.5 ± 4.7 ml/min/kg, t2: 30.5 ± 8.7, n.s.). Six month after the intervention, only improvements in severity of SZ, well-being and psychological distress remained statistically significant (PANSS: 38.0 ± 9.0, SF-36: 59.2 ± 8.0, SCL-90: 119.2 ± 36.6, all p<.05).

Conclusion: Exercise and PAP significantly improves CRF, severity of SZ, well-being and psychological distress in SZ patients. Effects on CRF are declining shortly after the end of the intervention. We recommend the implementation of exercise and PAP into the post-acute care of SZ patients. Moreover, it is necessary to further strengthen the sustainability of effects with respect to CRF, in order to prevent fall-backs and health detriments caused by low physical fitness.

432 Board #270 May 29 11:00 AM - 12:30 PM Fitness, Fatness And Survival In Older Adults With Intellectual Disabilities. Which One Is Key?
Aby Oppeval1, Thessa Hilgenkamp2, 1Erasmus MC, University Medical Center Rotterdam, Rotterdam, Netherlands. 2University of Illinois, Chicago, IL.
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Older adults with intellectual disabilities have very poor physical fitness levels. Additionally, overweight and obesity are highly prevalent in this population, even more prevalent than in the general population. Both fitness and fatness have been found related to survival in the general population. To improve healthy ageing and survival of older adults with intellectual disabilities we need to know which problem requires our main focus.

Purpose: To determine whether fitness or fatness is more important for survival in older adults with intellectual disabilities. METHODS: As part of the Healthy Ageing and Intellectual Disabilities (HA-ID) study, fitness (comfortable gait speed) and fatness (Body Mass Index) of 874 older adults with intellectual disabilities (≥ 50 years; 61.4 ± 7.8 years) was measured at baseline. All-cause mortality was collected over a 5-year follow-up period. The relationship between fitness, fatness, and survival was analysed with Kaplan-Meier curves and Cox proportional hazard models. RESULTS: Fitness was significantly related to survival (HR = 0.21, 95% CI = 0.09 - 0.48, p < 0.001), while fatness was not related to survival. People who were unfit and fat were 4.6 (95% CI = 2.0 - 10.7) times more likely to die, and people who were unfit and not fat were 3.6 (95% CI = 1.7 - 7.5) times more likely to die within the follow-up period, than people who were fit, regardless of their fatness. CONCLUSIONS: Being fit is key for survival in older adults with intellectual disabilities. Our results therefore do not support the emphasis seen in research and practice on reducing weight. The focus should primarily be on improving the fitness of older adults with intellectual disabilities to improve healthy ageing and survival.

433 Board #271 May 29 11:00 AM - 12:30 PM The Effect Of Moderate-intensity Physical Activity On Biopsychosocial Factors Among Veterans With Symptoms Of PtSD
Michelle Bateman1, Jamie C. Clark1, 1Oklahoma State University, Stillwater, OK. 2University of Central Oklahoma, Edmond, OK. (No relevant relationships reported)

Physical activity has been shown to have a positive impact on biopsychosocial variables among individuals who may be experiencing symptoms related to PTSD. PURPOSE: The purpose of this study was to evaluate the impact of a moderate-intensity physical activity regimen on aerobic endurance, barriers to accessing health care, and symptom severity of PTSD among military veterans. METHODS: Participants of this study (n=4) engaged in a 4-week physical activity regimen that met two times per week. The dependent variables were aerobic endurance, measured with the Cooper 12 Minute Walk test, barriers to accessing health care, measured with the B-OS, and symptoms of PTSD, measured with the PCL-5. RESULTS: Preliminary descriptive statistics and a paired samples t-test were utilized to analyze data. There were statistically significant differences for all dependent variables at the post-assessment level, indicating statistically significant improvements in the PCL-total score (p=0.032), BACE-total score (p=0.043), BACE-stigma score (p=0.032), VO2 max (p=0.014), and METS (p=0.014). CONCLUSION: Researchers concluded that a moderate-intensity physical activity regimen may be effective at improving aerobic endurance, perceived barriers to accessing health care, and symptom severity of PTSD among military veterans. Future studies should aim to increase sample size and utilize a laboratory grade assessment for capturing changes in VO2 max and METS. Additionally, future

Abstracts were prepared by the authors and printed as submitted.
Purpose: The aim of this study is to evaluate the impact of physical activity (PA) on academic performance. Several studies have already confirmed the importance of physical activity for the life quality and health. Several health problems can be avoided with the regular practice of PA, which is why it can be said that “exercise is medicine”. The question in this work is to seek key points in order to evaluate whether PA positively impacts academic activity. Will the practice of PA bring a positive impact on academic performance, will it entail a higher grade point average (GPA)? The final objective will be to present a framework with potentially impacting variables, within an physiological elements.

Methods: An initial research was done on academic bases to raise academic articles on the subject. The base consulted was PubMed. Keywords used were physical activity and academic performance. There was no concern in evaluating studies relating PA and health, because we assumed such a relationship as true in this review.

Summary of Results: From a physiological standpoint there are some important studies showing the impacts on cognitive and motor functions coming from the practice of PA. Through a dynamic interaction, regular PA can lead to a cerebral capillary growth, with the increase in blood flow and oxygenation. The growth of nerve cells in the hippocampus, that have a great function as a center of memory and learning, is another important effect of PA. The practice of PA positively impacts academic performance and it’s great. You can be healthy, feel better and improve your GPA.

Conclusion: There are good reasons to be physically active. Including reducing developing heart disease and diabetes, for example. So, it’s possible to say: Exercise is medicine. It’s a good point you can be healthy, lose weight, lower your blood pressure. But, maybe we have another one great reason to be physical active. Some studies show us that physical activity can improve academic performance and it’s great. You can be healthy, feel better and improve your GPA.

Purpose: Mild cognitive impairment, Alzheimer’s disease and dementia are associated with onset behavioral disturbances such as depression, psychosis, and anxiety. These ailments affect overall outcomes, decrease quality of life, and are primarily treated with antidepressants. However, there are additional therapies available to alleviate and mitigate these onset disturbances. Based on published clinical data, this comprehensive review and meta-analysis evaluates the effects of alternative therapies and treatments on behavioral outcomes in patients with mild cognitive impairment (MCI), mild or moderate AD, and dementia. Methods: We applied novel clinical data extraction and aggregation technologies developed by MedAware Systems, Inc. It is a patent-pending process where two scientists, blinded to each other, extract data from the same study. Intelligent software compares each data field for matches (or mismatches). A senior scientist reconciles data mismatches. Where pre- and post-treatment outcome data are available, standardized mean differences are calculated as the MedAware Standardized Index of treatment effect (MSI-E). This methodology is used to capture the published literature, with physical activity as the intervention, reporting cognitive functions as outcomes, in AD patients. Results: A total of 2,201 studies were screened for possible inclusion. 34 studies reported the use of some form of physical activity interventions, such as aerobic exercise (9 studies), other types of physical activity (23 studies), and strength training (5 studies) in AD and dementia patients, and were included in the meta-analysis. Instruments such as the ADAS-cog and the MoCA measured cognitive outcomes. Overall, there appears to be little to no cognitive decline over time (MSI-E = 0 indicates no change) in the aerobic exercise group (MSI-E = -0.08±0.003), other physical activity group (MSI-E = -0.015±0.003), and a slight improvement in the strength training group (MSI-E = -0.016±0.005). Conclusions: This study expands upon previous stigma literature by emphasizing the discrepancies between physical and mental health stigma. Additionally, these findings suggest physical activity as a viable option to circumnavigate MH stigmas in first responders and military personnel.

Purpose: Global cognitive function is associated with increased physical activity, physical frailty is associated with increased risk of Alzheimer’s disease (AD), and can predict future cognitive decline in adults. We performed an exhaustive literature review and meta-analysis of the effects of physical activity on cognitive functions in adults with AD and dementia, based on the published clinical data. Methods: We applied novel clinical data extraction and aggregation technologies developed by MedAware Systems, Inc. It is a patent-pending process where two scientists, blinded to each other, extract data from the same study. Intelligent software compares each data field for matches (or mismatches). A senior scientist reconciles data mismatches. Where pre- and post-treatment outcome data are available, standardized mean differences are calculated as the MedAware Standardized Index of treatment effect (MSI-E). This methodology is used to capture the published literature, with physical activity as the intervention, reporting cognitive functions as outcomes, in AD patients. Results: A total of 2,201 studies were screened for possible inclusion. 34 studies reported the use of some form of physical activity interventions, such as aerobic exercise (9 studies), other types of physical activity (23 studies), and strength training (5 studies) in AD and dementia patients, and were included in the meta-analysis. Instruments such as the ADAS-cog and the MoCA measured cognitive outcomes. Overall, there appears to be little to no cognitive decline over time (MSI-E = 0 indicates no change) in the aerobic exercise group (MSI-E = -0.08±0.003), other physical activity group (MSI-E = -0.015±0.003), and a slight improvement in the strength training group (MSI-E = -0.016±0.005). Conclusions: Using the MedAware Systems, Inc. literature database and meta-analytic methodology, we found that physical activity appears to mitigate cognitive declines in AD and dementia patients, with strength training having a small beneficial effect. Although these findings are based on a small number of studies in each physical activity category, results of this meta-analysis should provide investigators with evidence to further explore the use of physical training in AD and dementia patients.

Supported by MedAware Systems, Inc.
Depression and Fitness Level in College Students Attending a Diverse University

Sharon Jalene, Jennifer Pharr, Brach Poston. University of Nevada Las Vegas, Las Vegas, NV. Email: sharon.jalene@unlv.edu

(Purpose): The purpose of the study was to determine the association between estimated cardiorespiratory fitness (eCRF) and moderate to severe depression (MS_DEP) in college students. The relationships between MS_DEP and age, sex, race, sexual/gender orientation, and grade point average (GPA) were examined.

Methods: This cross-sectional study occurred at a public university via electronic survey. Participants (n=438) reported their age, height, weight, race, sex, sexual orientation, GPA, resting heart rate, exercise habits (frequency, intensity, and duration), and completed the Patient Health Questionnaire (PHQ-9), a standard depression survey. A validated regression model (Nes et al., 2011) was used to calculate eCRF (ml/min/kg). The difference between eCRF and age-predicted CRF was used for analyses. Chi square and independent t-tests determined differences in demographic characteristics between students who reported MS_DEP and students who reported no depression. For odds ratio analyses, MS_DEP was dichotomized (yes/no) and fitness was categorized as FIT (reference), LOW-FIT, and HIGH-FIT. The reference (FIT) represented those with eCRF within +/-1. LOW-FIT was <=1, and HIGH-FIT was >1 of their age-estimated CRF.

Results: Chi square analyses indicated fit individuals (age-predicted CRF) were less likely than unfit (age-predicted CRF) to have MS_DEP (36.4% vs. 63.6%; P = 0.02). Belonging to a sexual gender minority (SGM) (P <0.01) or to the Hispanic race (P<0.04) were also significant for MS_DEP. T-tests revealed that individuals who reported depression were more likely to be younger (P <0.04) or have a lower GPA (P=0.01) than those who reported no depression. Odds ratio analyses found that those with LOW-FIT were 2.39 times more likely to report MS_DEP when compared with the reference (95% CI=1.17-4.87). HIGH-FIT compared with FIT was not significant.

Conclusion: Students with low fitness are at a higher risk for depression. However, fitness above age-predicted CRF did not decrease susceptibility indicating that an age-appropriate level of fitness is sufficient to reduce depression risk. Also, Hispanic, SGM, and younger students may be more vulnerable. Those with depression have a lower GPA. Estimated CRF could provide a simple method to identify students at-risk for depression.

Abstracts were prepared by the authors and printed as submitted.
Exercise on Sensitivity to Pain in Healthy Humans.

Anna M. Polaski, Amy L. Phelps, Matthew C. Kostek, FACSM, Kimberly A. Szucs, Benedict J. Kolber. Duquesne University; Pittsburgh, PA.

Increasing evidence implicates exercise as a front-line adjuvant therapy for the treatment of nearly all forms of chronic pain. Knowledge of efficacious dosing respective to exercise type and pain condition is extremely limited in the literature. This leaves both clinicians and patients less informed with regard to the best practice.

PURPOSE: To observe the effect of core strength training on dysfunction and core strength of patients with chronic low back pain.

METHODS: 120 patients diagnosed as LBP in the affiliated sports hospital of Chengdu Sport Institute are divided into three groups (A, B, and C). The effects of moderate intensity treadmill walking on dysfunction and core strength are compared. The core strength and quality of life are measured at baseline and after 8 weeks of intervention. The subjects are required to perform three tasks for three weeks before the test: (1) the 10-repetition situps; (2) the 5-repetition situps; and (3) the 5-repetition situps with one hand on the chest. The efficiency is calculated by Ridit analysis.

RESULTS: 106 patients participate the whole process and the baseline data before intervention are basically the same. After intervention, all the indicators have changed as follows: (1) Efficiency: The total effective rate is 94.1% in group A, 88.6% in group B, and 86.5% in group C. There is a significant difference between group A, B, and C (P<0.01). There is no difference between group A and B (P>0.05). The difference indicates that the improvement of this index in group A is better than groups B and C. The efficiency is calculated by Ridit analysis (P<0.01). There is no significant difference before intervention. After intervention, all the indicators have changed significantly. The average of group A decreased by 6.78 points, 3.43 points in group B, and 4.16 points in group C. After 8 weeks, there is a significant difference between group A and B and C (P<0.01). There is no significant difference between group A and B (P>0.05). CONCLUSIONS: After 8 weeks intervention, basic treatment and core strength training can significantly improve the dysfunction and rehabilitation of patients with pain and activity limitation.

Some of the most debilitating symptoms of fibromyalgia (FM) include widespread chronic pain (WCP), sleep disturbances (SD) and chronic fatigue (CF) all that negatively impact health status (HS) in individuals with FM. Yet, there’s a lack of effective self-management exercise interventions capable of alleviating FM symptoms.

PURPOSE: To examine the efficacy of a 10-week daily practice qigong program on WCP, SD, CF, and HS in individuals with FM.

METHODS: 20 individuals with FM were randomly assigned to one of two groups with participants blinded to the intervention allocation. The experimental group learned, and practiced mild body movements synchronized with deep diaphragmatic breathing and meditation. The control group learned and practiced only the mild body movements (same movements as the experimental group). Both groups were asked to practice the interventions for 10-week, two times per day at home plus one weekly group practice with a qigong instructor. Clinical assessments collected at baseline and upon completion of the intervention were: Short-Form McGill Pain Questionnaire, a visual analog scale for pain graded from 0 to 10 (worst possible pain), Pressure Pain Threshold measured by a dolorimeter, the Pittsburg Sleep Quality Index and the Revised Fibromyalgia Impact Questionnaire. WCP score comparisons were made using MANOVA. SD, CF and HS were compared with t-tests. RESULTS: The experimental group experienced greater clinical improvements when compared to the control group with the mean scores differences of WCP SD, CF, and HS all being statistically significant at p<0.05. In group analysis revealed that the experimental group improved WCP by 35% (p<0.01), SD by 34% (p<0.01), CF by 30% (p<0.05) and HS by 31% (p<0.01). The control group only presented significant improvement in HS by 21% (p<0.05). CONCLUSION: Daily practice of qigong might have a positive impact on the main FM symptoms that is beyond group interaction and solely mild exercise.

The Efficacy of Qigong on the Main Symptoms of Fibromyalgia. A Randomized Clinical Trial.

Caio Vinicius M. Sarmento, Taylor Pfeifer, Sanghee Moon, Mehrdad Maz, Sue Min Lai, Yvonne Colgrove, Irina V. Smirnova, Wen Liu. The University of Kansas Medical Center, Kansas City, KS.

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PURPOSE: An estimated 50 million people in the Europe live with multi-morbidity (MM). Research has found that those with MM have a greater risk of physical function (PF) decline and poorer quality of life (QoL) than those with a single chronic disease (SCD). The aim of this study was to compare the physical activity (PA) levels and sedentary behavior (SB) in patients with MM and SCD and to investigate the association between PA and PF and QoL.

METHODS: Subjects (n=229, 54.4% female, age (mean±SD) 62.2±11.1 yr) were recruited at induction to a community-based exercise program for chronic disease. Medical history was obtained from a referral letter provided by a healthcare professional. Subjects with a single diagnosis of a chronic disease, primarily including cardiovascular, respiratory disease, cancer, diabetes, were classified as SCD. Participants with ≥2 of these diagnoses were classified as MM. BMI and waist to hip ratio (WHR) were measured and calculated using standard procedures. Upper and lower body strength, flexibility and cardiorespiratory fitness were assessed using a hand-grip test, sit-to-stand test (STS), six minute walk test (S6MT), and 6-minute time trial (6MTT), respectively. PA and SB were recorded using an activPAL micro accelerometer. QoL was assessed using the EQ5D VAS. Individual sample T tests were used to compare MCD with SCD on measures of PA, SB, PF and QoL. General linear models were used to investigate the association between PA and SB and PF and QoL.

RESULTS: (44.2%) participants were defined as MM. Participants with MM had higher waking SB (9.3 ± 1.8 vs 9.9 ± 1.9 hrs/d, p=0.013), lower MVPA (0.3 ± 0.2 vs 0.4 ± 0.2 hrs/d, p=0.001) and daily step count (6185 ± 3016 vs 7270 ± 3196 steps/d, p=0.009) compared with SCD. MM had higher BMI (31.6 ± 7.3 vs 28.0 ± 5.3 kg/m²), (p<0.001). MM achieved significantly poorer results for the STS (23.8 ± 9.6 vs 21.2 ± 7.3 sec, p=0.019) and 6MTT (453.3 ± 118.9 vs 514.4 ± 132.2 m sec, p<0.001). There were no differences between groups for WHR, SRT and QoL. MVPA was significantly related to weight, BMI, 6MTT, daily step count was related to STS, 6MTT and QoL and waking SB was related to WHR. CONCLUSIONS: Individuals with MM had greater SB and less PA than those with SCD. PF was poorer for individuals with MM. There were significant associations between PA with physical function and QoL in a CD population.

Physical inactivity is linked to a reduced quality of life (QOL) and is more pronounced in those living with chronic health conditions. The use of exercise referral as a therapeutic treatment by healthcare providers may be an important clinical tool in improving QOL in the chronic disease population. PURPOSE: To explore differences in QOL and physical activity (PA) of patients who were medically referred to an exercise-as-treatment (EAT) program. Secondarily, to explore factors that contribute to QOL.

METHODS: A Midwest healthcare system referred 213 chronic disease patients to an on-site EAT program. A total of 59 patients (64±12; 64.4% female) responded to a follow-up survey that included the eight-scale RAND-36 item health questionnaire to assess QOL, and the Physical Activity Vital Signs questionnaire to assess PA level in minutes per day. Respondents were categorized into 1) did not engage in the exercise program 2) engaged in up to two sessions 3) engaged in three or more sessions. ANOVA was conducted to test for between-group differences, Pearson correlations between QOL and exercise visits, independent samples t-test for influence of PA behavior on general health QOL, and forward selection to explore a model to best inform general health QOL.

RESULTS: No significant differences were found between exercise visit categories, QOL scales, and PA. Number of exercise visits was found significantly negatively correlated with emotional well-being QOL (r = −.350, p<0.01) and with pain QOL (r = −.326, p<0.01). A significant difference was found (SB-36 score) in general health QOL for patients who met the PA guideline of 150 minutes per week (M=68.81, SD=22.299), versus those who did not meet the guideline (M=53.71, SD=17.382), r(54)=2.827, p<0.007. Forward selection chose social functioning, energy, minimal role limitations due to physical health, and PA minutes as contributors to patient general health QOL with adjusted R²=.714 (p<.004).
CONCLUSIONS: Results support the positive influence of exercise behavior on QOL. Using the healthcare system to assess PA behavior, such as including exercise as a vital sign, is a strategy that will enable providers to refer and deliver an EAT approach. Future research should include comparison of PA behavior as well as exercise program visits with specific chronic diseases and QOL.

Veterans are disproportionately affected by physical and emotional functional disorders compared to their civilian counterparts, a discrepancy that is deepened by delay to care within the Veterans Health Administration. Research has supported use of compression exercise in physically limited populations and demonstrated physiological responses at lower intensities (10-20% one repetition maximum vs 70% for hypertrophy in resistance exercise). Combination of low-pressure compression exercise and cooling has shown elevated growth hormone and testosterone and depressed nighttime cortisol, indicating this may be beneficial for addressing emotional and sleep dysfunctions.

PURPOSE: To determine the safety and efficacy of an accessible cooled compression exercise system on markers of physical and emotional function in veterans.

METHODS: 14 veterans completed 24 sessions in 12 weeks. Baseline and endpoint questionnaires validated for clinical significance were administered to determine sleep quality (Pittsburg Sleep Quality Index), quality of life (RAND Short Form 36), and respiratory dysfunction related to stress and anxiety (Nijmegen Questionnaire).

RESULTS: Two-tailed T-tests were performed on the data. Sleep quality improved in 71% of subjects (9.15±6.87 vs 5.57±3.74, \( p = 0.0232 \)), 57% improved quality of life (73.45±17.17 vs 84.46±9.27, \( p = 0.0316 \)), and 71% decreased adverse respiratory symptoms (11.29±8.38 vs 7.86±6.26, \( p = 0.0594 \)) compared to baseline. Increases were seen in all 8 sub-scores of quality of life, with statistically significant improvements in social functioning (75.28±17 vs 94.64±11.62, \( p = 0.0058 \)), energy and fatigue (48.93±25.21 vs 65.63±19.26, \( p = 0.0426 \)), emotional wellbeing (66±24.29 vs 85.14±14.16, \( p = 0.0054 \)), and general health (72.14±15.78 vs 79.64±12.78, \( p = 0.0497 \)). For sleep quality, those subjects with baseline scores defined as clinically disturbed sleep (n=8, 58%) all (100%) experienced sleep improvements (9.14±6.87 vs 5.57±3.74, \( p = 0.00301 \)), with 25% resolving below clinical delineation (9.14±6.87 vs 5.57±3.74, \( p = 0.0497 \)). For sleep quality, those subjects with baseline scores defined as clinically disturbed sleep (n=8, 58%) all (100%) experienced sleep improvements (9.14±6.87 vs 5.57±3.74, \( p = 0.0497 \)). For sleep quality, those subjects with baseline scores defined as clinically disturbed sleep (n=8, 58%) all (100%) experienced sleep improvements (9.14±6.87 vs 5.57±3.74, \( p = 0.0497 \)).

CONCLUSIONS: These findings suggest that the combination of cooling and compression exercise may be an effective intervention method to address symptoms in veterans and other individuals living with insomnia, post-traumatic stress, chronic fatigue, and depression.

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These results suggest that the combination of cooling and compression exercise may be an effective intervention method to address symptoms in veterans and other individuals living with insomnia, post-traumatic stress, chronic fatigue, and depression.
High-intensity Interval Training And Moderate-intensity Continuous Training In Adults With Crohn’s Disease: A Pilot Trial

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(Related relationships reported)

PURPOSE: To assess the feasibility and acceptability of two common types of exercise training—high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT)—in adults with Crohn’s disease (CD).

METHODS: In this mixed-methods pilot trial, participants with quiescent or mildly-active CD were randomised 1:1:1 to HIIT, MICT or control (usual care). The HIIT and MICT groups were offered three exercise sessions per week for the first 12 weeks and followed up for 6 months. Feasibility outcomes included rates of recruitment, retention, outcome completion, and exercise attendance. Data were collected on cardiorespiratory fitness (e.g., peak oxygen uptake), disease activity, fatigue, quality of life, adverse events, and intervention acceptability (via interviews).

RESULTS: Over 17 months, 53 patients were assessed for eligibility and 36 (68%) were randomised (47% male; mean age 36.9 [SD 11.2] years). 13 to HIIT, 12 to MICT, and 11 to control. The overall exercise session attendance rate was 68% (608/901), and 64% (16/25) of participants completed at least 24 of 36 sessions. One participant was lost to follow-up. Outcome completion rates ranged from 89 to 97%. The mean increase in peak oxygen uptake, relative to control, was greater following HIIT than MICT (2.4 vs. 0.7 mL/kg/min). There were three non-serious exercise-related adverse events, and two exercise participants experienced disease flare-ups during the trial.

CONCLUSIONS: The findings support the feasibility and acceptability of the exercise programmes and trial procedures. A definitive trial is warranted. Physical exercise remains a potentially useful adjunct therapy in CD.

Support by CCUK Grant SP2015/1.

Board #299 May 29 11:00 AM - 12:30 PM
Metabolic Profile And Myocardial Performance Of Renal Transplant Recipients Adherent To Unsupervised Exercise As Prescription Program.

Beatrice Leone1, Luciano Moscarelli1, Elena Zappelli1, Chiara Ingletti1, Marco Mandoli1, Giorgio Galanti2, Pietro Amedeo Modesti1, Laura Stefan1. (1Sports Medicine Center - University of Florence, Florence, Italy. 2Nephrology Unit-University of Florence - Italy, Florence, Italy. 3Sports Medicine, Florence, Italy. 4Sports Medicine-FIMS (Italian Federation of Sport Medicine), Florence, Italy.

(Related relationships reported)

Purpose: Renal transplant recipients (RTR) are at elevated cardiovascular mortality in comparison with the general population especially after surgical treatment. Literature supports the role of the supervised exercise intervention, however few data are available about the potential impact of the unsupervised exercise. We investigated whether a home-based program of exercise could reduce CV risk in RTR by evaluating the changes in renal and cardiometabolic parameters and myocardial performance measured by echocardiography.

Methods: From a large cohort of 60 RTR, 30 RTR (12 females and 18 males, aged 47.9 ± 12.3 y) participated in individualized and unsupervised exercise programs for 6 months, at moderate intensity. Cardiometabolic risk factors, anthropometrics parameters, lipid and glucose blood sample profile were studied as well the myocardial performance by the 2D echo examination at T0, T6 months. Results: lipid profile maintained in the range of a low risk level, despite without significant improvement. The myocardial performance, especially EF was significantly p<0.05 ameliorated (EF rTR: 60.2±5 vs 62.0±3.7 %; EF wT: 63.6±3.8 % vs 62.4±3.3 %). Conclusions: an home based exercise program has a positive impact on myocardial function and maintains low cardiometabolic risk profile since 6 months of exercise. The trend support the importance to highlight the role of a correct reconditioning of the lifestyle in RTR, by the unsupervised exercise program at moderate intensity, where well tolerated. Table 1: Characteristics of renal transplant recipient (RTR) and healthy controls (HC)

<table>
<thead>
<tr>
<th>RTR (n =30)</th>
<th>RTR T6</th>
<th>RTR T12</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>70.6±15.6</td>
<td>70.7±15.3</td>
<td>0.830</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>24.3±3.8</td>
<td>24.9±4.4</td>
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<td>Creatinine (mg/dL)</td>
<td>1.5±0.5</td>
<td>1.5±0.7</td>
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<td>Urea (mg/dL)</td>
<td>66±0.26</td>
<td>71±0.43</td>
<td>0.787</td>
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<tr>
<td>Cholesterol (mg/dL)</td>
<td>187±55.7</td>
<td>194±74.8</td>
<td>0.688</td>
</tr>
<tr>
<td>HDL (mg/dL)</td>
<td>54.9±22.4</td>
<td>54.1±16.0</td>
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<td>Triglycerides (mg/dL)</td>
<td>198.1±152.4</td>
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<td>Glucose (mg/dL)</td>
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Board #292 May 29 11:00 AM - 12:30 PM
Overall Fitness Benefits In Individuals With HIV Participating In A Community- Based Exercise Program

ELizabeth Orozco1, Gabriel Gines2, Christian Wade1, Martin G Rosario1. (1Texas Woman’s University, Dallas, TX. 2Ponce Health Science University, Ponce, PR.

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(Related relationships reported)

Exercise has been shown to improve the health of persons living with HIV.

PURPOSE: Identify the effects of a community-based exercise program on the immunity (CD4 cell count) and overall fitness (cardiovascular and strength) in individuals living with HIV in San Juan, Puerto Rico.

METHODS: Twenty-five adults with HIV age 39.2± 1.7 years participated in this study. Individuals were recruited by word of mouth to a Community Based Exercise Program (La Perla de Gran Precio). A Certified Personal Trainer performed all the exercise testing. Cardiovascular fitness was assessed using a submaximal treadmill test (Ross). Strength was assessed by determining the 1 repetition maximum (1RM) for bench press and leg press and the maximum number of push-ups and sit-ups that could be completed in 1 minute. Flexibility was tested using the Sit and Reach Test. Participants were asked to bring in the most recent lab for the CD4 data. This same evaluation was administered three times to track each participant’s progress over a year.

RESULTS: A repeated measures ANOVA was used to determine whether there was a statistically significant mean difference in CD4 count, cardiovascular fitness (time

Abstracts were prepared by the authors and printed as submitted.
Non-alcoholic fatty liver disease (NAFLD) is the most frequent cause of liver disease with Non-alcoholic steatohepatitis (NASH) as a subtype showing lobular inflammation and ballooning as characteristic liver cell damage.

**PURPOSE:** Here we studied the impact of regular physical activity promoted and controlled by a novel Web-based approach on regular physical performance, liver inflammation, and histology. **METHODS:** We enrolled 44 Patients with NAFLD in a prospective, 8-week interventional single arm study with a 12-week follow-up period (NCT02526732). Peak oxygen uptake (VO2peak) was measured by spiroergometry.

**CONCLUSIONS:** The current study demonstrates a significant decrease in liver inflammation, and histology. This improvement in liver function was consistent with current PA guidelines at prenatal visits. Further training of healthcare providers is needed to increase the prevalence of prenatal exercise prescriptions consistent with PA guidelines.

### Provider Advice on Weight Gain, Physical Activity, and Healthy Eating in Twin Pregnancies

Kara M. Whitaker1, Meghan Baruth2, Rebecca A. Schlaff3, Christopher P. Connolly1, Jihong Liu1, Sara Wilcox, FACSM4. 1University of Iowa, Iowa City, IA. 2Saginaw Valley State University, University Center, MI. 3Washington State University, Pullman, WA. 4University of South Carolina, Columbia, SC. (Sponsor: Sara Wilcox, FACSM) Email: kara-whitaker@uiowa.edu

**PURPOSE:** To examine provider advice on gestational weight gain (GWG), physical activity (PA), and healthy eating (HE) during twin pregnancies, and to determine if advice on GWG is associated with women’s GWG.

**METHODS:** Data are from 301 women, aged 21-43 years, who delivered twins in the prior 24 months and completed an online survey in 2018. The 2009 Institute of Medicine (IOM) provisional weight gain guidelines for twin pregnancies defined whether provider advice on GWG and women’s GWG were below, within, or above guidelines. Content analysis described provider advice on PA and HE. Multinomial logistic regression examined the associations of provider advice on GWG with women’s GWG, after adjustment for potential confounders.

**RESULTS:** Approximately 66% of women reported provider advice on GWG, 73% on PA, and 59% on HE during their twin pregnancy. Of those who reported GWG advice, 30% described advice below, 60% within, and 10% above the IOM guidelines. Content analysis described provider advice on PA and HE. Multinomial logistic regression examined the associations of provider advice on GWG with women’s GWG, after adjustment for potential confounders.

**CONCLUSION:** Forty percent of women reported GWG advice outside IOM guidelines, and inaccurate or no advice was strongly associated with inadequate or excessive GWG. There is a clear need for intervention strategies to educate providers about IOM guidelines, including how to counsel women on GWG, PA, and HE to optimize outcomes in twin pregnancies.
The five-week IRB-approved study included 23 female subjects aged 45.0 ± 9.0 years (Mean ± S.D.) who exhibited symptoms of pelvic dysfunction as defined by 3 assessments (the Pelvic Floor Distress Inventory [PFIQ-7], the Oswestry Low Back Pain Disability, and the Pelvic Floor Impact [PFDI-SF20] questionnaires). The study also included InBody570 body composition measurements, pelvic alignment assessments, diastasis recti assessments, and manual external pelvic floor muscle activation assessments. Participants were instructed in specific lifestyle modifications and participated in an exercise program over the course of seven live group sessions, 45 minutes each, led by one or both of the investigator clinicians. They were also taught to perform a home exercise program at least 5 days per week and completed compliance forms that were returned at the next live group session. The clinicians were a licensed physical therapist and a clinical exercise physiologist.

RESULTS: IBM SPSS version 24 statistical programming was utilized and nonparametric Wilcoxon “related-items” analyses were employed. A 0.05 level of significance was applied. The study results of the pre- and post-values indicated significant improvements of lower back pain (Oswestry, z(23) = -3.67, p < 0.05), significant improvements of the quality of life subjective emotional gauge (PFDI-20, z(23) = -4.11, p < 0.05), and significant improvements of bladder, bowel, and prolapse symptoms (PFQ-7, z(23) = -3.74, p < 0.05).

CONCLUSIONS: The study was highly labor- and time-intensive, and the sample was not large enough to eliminate statistical bias. However, the successful results warranted a continuation of the study to include 40 female volunteers with no modifications to the study’s protocol using the same clinicians. Researchers are currently recruiting volunteers to complete the study.
The effect of ethnicity and medication on blood pressure (BP) have been widely described; however, less is known about the interaction between ethnicity, BP medication and regular exercise on hypertensive patients. PURPOSE: This study was aimed to determine the effectiveness of an exercise training and healthy lifestyle education program to reduce BP levels and improve adherence to pharmacological therapy on a multiethnic group of hypertensive patients.

METHODS: An 8-month quasi-experimental longitudinal intervention with an exercise group (EG) and control group (CG) was designed. Five hundred and sixty hypertensive patients (67.4±8.8 years; BMI, 26.4±3.1 kg/m²) were assigned to EG (n = 307) and CG (n = 261). EG participated in 3 weekly exercise training sessions (30 to 60 minutes of moderate-intensity training), which were complemented by medication and lifestyle education. The average of three repeated measures of BP performed with an electronic sphygmomanometer was utilized as primary outcome. Health status, medication adherence, salt consumption, tobacco and alcohol habits were recorded by questionnaires during clinic history assessment. Non-parametric tests were carried out to compare differences between EG and CG. Several logistic regression models were used to find independent variables predicting two levels (-3 or -5 mmHg) of reduction in systolic (SBP) or diastolic blood pressures (DBP).

RESULTS: We found significant reductions both SBP and DBP in EG (-5.92 mmHg and -5.0 mmHg, respectively, P<0.001 for both) but not in the CG. Also, prevalence of medication adherence was increased in EG (32.6% vs. 29.7% in the CG). In the logistic regression, all models confirmed the EG as the main explanatory variable of a 3 or 5 mmHg BP reduction, independently of other lifestyle risk factors and medication adherence. CONCLUSIONS: In accordance with other studies patients in EG showed more diminution in SBP and DBP than CG, which was independent of other risk factors. However, the main findings were that either ethnic or medication adherence did not influence statistically the reduction in BP associated with our exercise/lifestyle intervention.

Due to limited evidence professional health organizations are reluctantly to recommend Tai Chi as antihypertensive lifestyle therapy. PURPOSE: We conducted a systematic review and meta-analysis to examine the efficacy of Tai Chi as antihypertensive lifestyle therapy. METHODS: Tai Chi interventions published in English and Chinese were included when they involved healthy adults, reported pre-post intervention blood pressure (BP), and had a non-exercise/non-diet control group. We systematically searched 11 electronic databases through August 1, 2018, yielding 51 qualifying controlled trials. We: 1) evaluated the risk of bias and methodological quality; 2) performed meta-regression analysis following random-effects assumptions; and 3) generated additive models representing the largest possible clinically relevant BP reductions. RESULTS: On average, participants (N=3,223) were middle-aged (56.6±15.1 years) adults with prehypertension (systolic BP [SBP] 136.9±15.2/diastolic BP [DBP] 86.9±10.7 mmHg). Tai Chi was practiced 4.0±0.6 sessions/week for 54.1±14.9 months/ session for 22.3±20.2 weeks. Overall, Tai Chi elicited moderate to large reductions in SBP (d=−0.75, 95%CI: −0.97−0.53, −8.7 mmHg) and DBP (d=−0.53, 95%CI: 0.71, 0.34, 4.7 mmHg) compared to control (P=0.001). Controlling for publication bias among samples with hypertension, Tai Chi interventions published in English elicited SBP reductions of 10 mmHg and DBP reductions of 4 mmHg, half the magnitude of results published in Chinese with SBP reductions of 19 mmHg and DBP reductions of 9 mmHg. CONCLUSION: Our results indicate that Tai Chi is viable antihypertensive lifestyle therapy that produces BP reductions that rival or exceed the antihypertensive effects of aerobic exercise of 5-8 mmHg in both the English and Chinese literature. Further investigation is needed to explain the discrepancy in the magnitude of the antihypertensive effects between Tai Chi trials published in English and Chinese. Supported by a sub-contract from U.S. PHS grant 5U24AG052175, and University of Connecticut Center for Excellence in Teaching and Learning.
regression analysis indicated that MVPA (18:00-20:00 pm) and other parameters, such as mean retinal nerve fiber layer (mRNFL), MD, mean arterial pressure (MAP), mean intra-ocular pressure (mIOP), age and gender were significantly correlated with POAG patients' progressive VF damage. Multivariate analysis showed that MVPA (odds ratio, OR (95% CI; confidence intervals), CI) = 0.969 (0.94, 0.99), P = 0.002, mRNFL (OR (95% CI) = 0.97 (0.94, 1.00), P = 0.02), MAP (OR (95% CI) = 0.88 (0.83, 0.92), P = 0.001), age (OR (95% CI) = 1.10 (1.06, 1.15), P = 0.001) and gender (OR (95% CI) = 0.40 (0.22, 0.91), P = 0.001) were still related to progressive VF loss after adjusting the other risk factors.

CONCLUSIONS: Patients with POAG prefer to exercise more during 07:00-09:00 am, 15:00-17:00 pm and 18:00-20:00 pm. Less evening exercise is associated with glaucomatous progressive VF damage, with an increasing of one minute of MVPA time decreasing the progression of POAG about 4%.

465 Board #303 May 29 11:00 AM - 12:30 PM Increased Functional Capacity For Adaptive Athletes Through High Intensity Functional Training (HIFT)
Victor Andrews1, Katie M. Heinrich1, Derek A. Crawford2, Theresa Larson1, Max Conserva1, Kansas State University, Manhattan, KS, Pittsburg State University, Pittsburg, KS. 1Movement Rx Integrated Health, San Diego, CA. 2Adaptive Athletic, San Francisco, CA.
Email: victorandrews1@k-state.edu

BACKGROUND: Individuals with adaptive needs (e.g., spinal cord injuries, cerebral palsy, amputations) encounter various barriers that limit their physical activity (PA). High intensity functional training (HIFT) programs have been developed to help those with adaptive needs improve their functional capacity. Adaptive HIFT programs allow for the preservation of a workout stimulus with exercise modifications or substitutions made for current physical conditions. However, research is lacking for adaptive HIFT programs.

PURPOSE: To compare ratings for difficulty and confidence of functional movements before and after an adaptive HIFT intervention.

METHODS: Participants included 13 adults (age = 38 ± 11 years, 75% male), and required the use of wheelchairs, limb braces, prosthesis, and crutches. The study consisted of an 8-week adaptive HIFT intervention with 2-3 60-minute supervised sessions per week. Participants completed a survey before and after the intervention that included the Outpatient Physical Therapy Improvement in Movement Assessment Log (OPTIMAL), which measured difficulty and confidence in performing 22 movements necessary to perform various functional activities (e.g., rolling over, squatting), on a 5-point scale (1 high, 5 low). All 13 participants completed the intervention. Due to differential survey completion (i.e., baseline n = 8, posttest n = 5; only 2 of those completed it at each time point), data were treated as cross-sectional and independent samples t-tests were performed via SPSS 25 to compare ratings for each time point.

RESULTS: Difficulty ratings approached significance for lifting heavy objects, ΔM = 1.1 [-0.1, 2.3], p<0.05, SE = 0.4, while squatting, ΔM = 1.7 [-1.1, -0.9], (N = 7, 5), t (10) = 2.1, p = 0.06, SE = 5, and walking long distances, ΔM = 1.7 [-4, 3.7], (N = 7, 5), t (10) = 2.2, p = 0.06, SE = 0.8. Confidence ratings were significant for grasping, ΔM = 0.3 [-0.2, 0.8], (N = 7, 5), t (10) = 2.4, p = 0.05, SE = 0.3. No difficulty or confidence ratings had significantly lower scores at posttest.

CONCLUSION: Adaptive HIFT programs show promise for addressing functional movement limitations for adaptive adults. This would allow for increased PA participation. Future studies should increase sample sizes and compare outcomes from other types of PA for the adaptive population.

466 Board #304 May 29 11:00 AM - 12:30 PM The Effects of Endurance Stair Climbing on Individual Health
Ryan Doyel, Joseph Dadabo, Courtney Stefanski, Prakash Jayabalan, Northwestern University Feinberg School of Medicine / Shirley Ryan AbilityLab, Chicago, IL.

Purpose
To assess cardiovascular intensity in athletes participating in an endurance stair climbing event.

Methods
This was an observational pilot study in which participants wore fitness tracking watches during an endurance stair climb of 103 floors. The devices provided continuous heart rate data throughout the climb. Participants completed the Borg Rating of Perceived Exertion upon completion of the event. The sample included 11 stair-climb event participants, including eight novices and three elites (i.e., Tower Running World Association members). The primary outcome was proportion of time spent with heart rate >70% of estimated maximum (moderate-to-vigorous intensity) and >50% of estimated maximum (vigorous intensity). Perceived level of exertion (Borg score) was a secondary outcome.

Results
The sample (N=11) comprised eight women and three men, with mean age of 34 years (SD=11.5) and BMI 23.2 (SD=2.8). All participants spent at least 90% of the climb with heart rate >70% of estimated maximum, and 64% of participants spent at least 50% of the climb with heart rate >70% of estimated maximum. Elite participants spent a greater proportion of time in vigorous intensity activity than did novices (68% vs 55%), though this finding was not statistically significant (p<0.05). Participants did not differ in time taken to reach >70% of estimated maximum and axial spine. The body’s immune response to chronic inflammation initiates calcification and excessive bone formation causing structural joint damage and spinal fusion subsequently restricting mobility. AS has a 3:1 male-to-female ratio and symptoms typically appear at 15 - 45 years of age. Current treatment involves both pharmacological and non-pharmacological therapy. PURPOSE: To identify the role of exercise as part of the treatment plan in AS patient.

METHODS: Investigate and summarise current knowledge on recommended practice points, frequency, intensity, time and type of exercise as well as progression of an exercise program, in AS patients. RESULTS: Current literature indicates the importance of exercise as part of treatment with pharmacological agents is aimed to delay progression of disease, relieve pain, minimise inflammation, maintain function and improve quality of life. Recommended practice points include a professional team with: knowledge of continual patient assessment and monitoring, realisation of complications, understanding complex exercise and pathology interactions, and a practical approach to the exercise setting that will encourage and motivate patients. The main long-term therapeutic goals should be: posture, mobility and respiratory function. Four key elements of the FITTPro Principle (frequency, intensity, time, and progression) is recommended in exercise prescription. An AS exercise program of 5 days/week, for 30 minutes/day is advised. It generally consists of daily range of motion (ROM), aerobic, breathing and strengthening exercises 1-3 times/week. The type of exercises should fit the patient’s profile e.g. hydrotherapy is beneficial, but contact sports should be avoided.

CONCLUSIONS: Individualised continual assessment and exercise prescription with the emphasis on spinal mobility, ROM, muscle strengthening and cardiorespiratory fitness to improve balance, coordination and fitness is an important part of the management plan. Continuous disease modifying treatment including anti-TNFα therapy combined with regular exercise prescription confers additional benefit to pharmacological therapy alone.
Exercise is Medicine® (EIM) is a global joint initiative between the American Medical Association (AMA) and the American College of Sports Medicine (ACSM). West Chester University (WCU) is recognized by the ACSM as an EIM-On Campus which indicates that WCU is a campus that is actively trying to engage the campus community in physical activity. PURPOSE: The purpose of this study was to gauge opinions and attitudes related to EIM Day at WCU-a first-time event launched at the campus. This event was hosted by the College of Health Sciences (CHS) at WCU and included participation from all six departments in the CHS, faculty and staff across campus, alumni, and community stakeholders.

METHODS: Forty participants (11 male, 29 female) who visited the event responded to an exit program evaluation survey. RESULTS: Descriptive results from Likert scale data (1—not at all to 5—very much) indicated that participants reported high levels of enjoyment related to the event (Mscore=4.6, SD=.78). They also reported that they found the event largely beneficial for improving their physical activity and nutritional habits (Mbeneficial=4.4, SD=0.97; Mfuturevisit=4.7, SD=0.75). Additional Bayesian analysis also suggested that in comparison to their male counterparts (M=3.75, SD=1.28), female participants (M=4.67, SD=0.51) found the event significantly (p < .05) more helpful for improving their nutritional habits. Of the motives for participation, 87.5% of participants (M=4.67, SD=0.51) found the event significantly (p < .05) more helpful for improving their physical activity and nutritional habits (Mbeneficial=4.4, SD=0.97; Mfuturevisit=4.7, SD=0.75). Additional Bayesian analysis also suggested that in comparison to their male counterparts (M=3.75, SD=1.28), female participants (M=4.67, SD=0.51) found the event significantly (p < .05) more helpful for improving their nutritional habits. Of the motives for participation, 87.5% of participants indicated strong intentions to revisit the event in the future (Mfuture visit=4.7, SD=0.75). More than half wanted to receive guidance about exercise (48% Agree, 10% Strongly Agree), and agreed they would be more likely to exercise if they were given advice about exercise (46% Agree, 11% Strongly Agree). Students wanted a referral to an exercise professional (41%), and to receive initial advice and communicate through email (56%). CONCLUSIONS: These results suggest that individuals that participated in this first-time event evaluated it highly favorably and found it beneficial for improving important health behaviors. Future research needs to explore the effectiveness of these initiatives and advance recommendations to further increase their impact.

Exercise is Medicine On Campus Program Comparisons: A Descriptive Study
Kirsten Lagally, FACSM1, Jacquelyn Sherman2, Anthony J. Amoros1, Anna Rinaldi-Miles3, Carena S. Winters, FACSM4, Illinois State University, Normal, IL. 1Jacinthe Williams, Jacksonville University, Jacksonville, FL.

PURPOSE: The purpose of this study was to describe the client experience and program characteristics of existing Exercise is Medicine® on Campus (EIM-OC) programs. METHODS: A 49-question survey was emailed to all campuses with registered EIM-OC teams. Participants were identified via ACSM Exercise is Medicine® on Campus advisor email list. Permission to send the survey was obtained from the EIM-OC Committee Chair and EIM-OC Program Manager. Frequencies were used to describe EIM-OC program characteristics.

RESULTS: Twenty-eight campuses responded to the survey. Approximately 80% of the responding campuses offer outreach activities and special events as part of EIM-OC programs. Other EIM-OC program options included peer-led programming (50%), referral program (38%), individualized programming (36%), and motivational interviewing (17%). Campuses with funded EIM-OC programs indicated that funding came from a Kinesiology-related department, Campus Recreation, Health Promotion/Wellness, Student Health Services, grants, student government associations and/or student clubs. Seven campuses (25%) indicated no funding source. Twelve of the 28 campuses are referring clients (~80% from student health or student counseling services) or directing clients (30% by campus recreation or an EIM-OC administrator) to a fitness setting (campus recreation in 75% of cases). In all cases, referred or directed clients include students, for whom EIM-OC programs are free. Some campuses also include faculty/staff or community members among referred/directed clients. “Not meeting physical activity guidelines” was a reason for referral in all cases, with many campuses also reporting existing physical or mental conditions and concerns as reasons for referral. Exercise or directed EIM-OC clients are offered some form of individualized programming (one-on-one, small or large group training) in 75% of cases, with the remaining 25% offering reduced gym or training fees or free fitness assessments. Twenty-one respondents (88%) indicated that EIM-OC programs provide new opportunities for students.

CONCLUSIONS: The results provide evidence of a variety of structures and activities involved in current EIM-OC programs, with anecdotal evidence of the benefits for student clients and leaders.
Combined aerobic and strength training is optimal for improving adiposity-specific comparisons (-1.3, -2.5 to -0.1%). Based on SUCRA results, combined aerobic and strength training was better than the control condition, with 9 studies comparing aerobic training alone vs. control, 9 studies comparing strength training alone vs. control, and 73 exercise, 54 control) and up to 2,792 participants (1,667 exercise, 1,125 control) met the criteria for inclusion. Statistically significant reductions in BMI, fat mass, and percent body fat were observed in aerobic vs. control comparisons (BMI, mean, 95% CI, -1.0, -1.4 to -0.6; fat mass, -3.1, -4.3 to -0.9 kg; percent fat, -1.5, -2.2 to -0.9%) and combined aerobic and strength vs. control comparisons (BMI, mean, 95% CI, -1.3, -2.5 to -0.1 kg; percent fat, -2.2, -3.2 to -1.2%). A statistically significant reduction in percent fat was also found for strength vs. control comparisons (-1.3, -2.5 to -0.1%). Based on SUCRA results, combined aerobic and strength training was more effective for improving fat mass and percent body fat while aerobic exercise was ranked first for improving BMI. CONCLUSIONS: Combined aerobic and strength training is optimal for improving adiposity-specific outcomes in overweight and obese children and adolescents. Supported by AHA Grant 17GRNT33630158.

The years in post-secondary education are important for building healthy lifestyle habits to transfer into adulthood. Previous research has indicated that physical activity (PA) declines during the years of college, and Exercise is Medicine on Campus (EIMOC) programs are poised to help address this. METHODS: To examine how freshmen exercise patterns and perceptions were related to fitness and physical activity in senior year of college at a large Northeastern university. METHODS: A volunteer sample of university seniors (n=439) completed a fitness assessment (TMCA bicycle test) and an online survey which addressed their PA participation, freshman exercise perceptions and engagement in on-campus exercise opportunities. Pearson correlations examined the relationship between fitness and PA with freshmen variables. T-tests examined differences in fitness and PA by freshmen variables. RESULTS: The sample was predominately male (n=254, 59.3%) and Non-Hispanic White (n=343, 78.4%). Many (n=232, 53.5%) reported being physically active currently than in freshman year. Most (n=178, 52.7%) reported that they were well informed of campus exercise options, 28.5% (n=125) reported doing intramural sports and 10% (n=44) did club sports as freshmen. Current VPA was associated with being better informed of options for exercise on campus as a freshmen (r=.11, p=.04), campus fitness center membership as a freshmen (p=.004), and freshman club sport participation (p=.001). VO2max was associated with club sport participation as a freshmen (p=.001). Challenges with time management (n=305, 85.4%) and lack of motivation (n=226, 63.6%) were frequent barriers to exercise as freshmen. Motivation challenges as a freshmen was negatively associated with current VPA (r=-.21, p=.001) and VO2max (r=-.19, p=.001). Students indicated that programs partnering with an exercise buddy (n=285, 74.1%) or events around outdoor exercise outings (n=179, 52%) would have been the most useful to motivate them as freshmen. CONCLUSIONS: This study examined how exercise patterns and perceptions as a freshmen were related to PA participation and fitness as a senior. Findings indicate the importance of developing EIMOC programs and strategies to specifically help freshmen transition to college campuses and engage in healthy behaviors.

Overweight and obesity are major public health problems among children and adolescents. However, the effects of different types of exercise on adiposity are not well established. We use the network meta-analytic approach to determine the effects of different types of exercise (aerobic, strength training, or both) on adiposity in overweight and obese children and adolescents. METHODS: Direct and indirect randomized exercise intervention trials >5 weeks were published in any language up to June 16, 2018 and assessed body mass index (BMI) in children, aged 7-18 years of age were eligible. Studies were retrieved by searching seven electronic databases, cross-referencing, and expert review. Dual selection and data abstraction were conducted. Results were pooled using random-effects, restricted maximum likelihood models. Surface under the cumulative ranking curves (SUCRA) were used to establish the hierarchy of exercise interventions (aerobic, strength, both). A two-tailed alpha value <0.05 and non-overlapping 95% confidence intervals were considered statistically significant. RESULTS: Fifty-seven studies representing 127 groups (73 exercise, 54 control) and up to 2,792 participants (1,667 exercise, 1,125 control) met the criteria for inclusion. Statistically significant reductions in BMI, fat mass, and percent body fat were observed in aerobic vs. control comparisons (BMI, mean, 95% CI, -1.0, -1.4 to -0.6; fat mass, -3.1, -4.3 to -0.9 kg; percent fat, -1.5, -2.2 to -0.9%) and combined aerobic and strength vs. control comparisons (BMI, mean, 95% CI, -1.3, -2.5 to -0.1 kg; percent fat, -2.2, -3.2 to -1.2%). A statistically significant reduction in percent fat was also found for strength vs. control comparisons (-1.3, -2.5 to -0.1%). Based on SUCRA results, combined aerobic and strength training was more effective for improving fat mass and percent body fat while aerobic exercise was ranked first for improving BMI. CONCLUSIONS: Combined aerobic and strength training is optimal for improving adiposity-specific outcomes in overweight and obese children and adolescents. Supported by AHA Grant 17GRNT33630158.
In turn, elevated Hb predicted more advanced cognitive and behavioral development. Implementing physical activity in parent-child interactions may have value as a primary prevention for anemia and it may also help advance the child’s growth and maturation.

### 476 Board #314 May 29 11:00 AM - 12:30 PM Health/Fitness Assessments of Resident Physicians by Exercise Science Interns - Exercise Prescriptions and Follow-Up Measures Rachel R. Swinford, Stephen M. Fallowfield, Brain D. Krohn, NiCole R. Keith, FACSM. IUPUI, Indianapolis, IN. (Sponsor: NiCole Keith, FACSM) Email: rswinfor@iupui.edu (No relevant relationships reported)

Resident physicians’ postgraduate training and fitness status are important predictors of their decision to provide physical activity (PA) counseling to their patients. Providing instruction about these topics within medical education may improve residents’ health/fitness outcomes and increase the likelihood of residents providing PA counseling to their patients. **Purpose:** To assess the health/fitness status of resident physicians during a healthy lifestyle rotation. **Methods:** We measured 187 resident physicians’ health/fitness status for one required assessment and two optional follow-up assessments that were on average, 9.5 months apart. Residents learned their results, received an exercise prescription, and were supported by an Exercise Science Student Trainer during one PA session. Residents could then exercise independently at an employee only fitness facility, elsewhere, or not at all. **Results:** The mean age of the sample was 28.87 ± 1.99 yrs. All baseline measures indicated residents were in a healthy (good to above average) range for males (n = 110) and females (n = 77). T-tests were used to evaluate the waist circumference of residents who completed assessments 1 and 2 (n=55). Waist circumference increased from 78.7 ± 32.1 cm to 84.3 ± 33.7 cm (p<0.05). No other measures (BMI, body fat, VO2max, RIHR, SBP, DBP, push-up, plank, and sit and reach) were significantly different. ANOVA was used to evaluate those who completed three assessments (n=18). This group experienced an increased BMI (23.9 ± 3.51 kg/m2, 24.27 ± 4.11 kg/m2, 24.56 ± 3.71 kg/m2; p<0.05) and body weight (73.14 ± 15.74 kg, 74.05 ± 18.1kg, 76.90 ± 17.23 kg; p<0.05). No other measures were significantly different. **Conclusion:** Few residents participated in more than the mandatory assessment. Those who volunteered for follow-up demonstrated increases in weight-related measures and no improvement in health/fitness outcomes. Additional supports for residents to participate in PA, achieve or maintain a healthy weight, and maintain related measures and no improvement in health/fitness outcomes. Additional supports for residents to participate in PA, achieve or maintain a healthy weight, and maintain related measures and no improvement in health/fitness outcomes. Additional supports for residents to participate in PA, achieve or maintain a healthy weight, and maintain related measures and no improvement in health/fitness outcomes. Additional supports for residents to participate in PA, achieve or maintain a healthy weight, and maintain related measures and no improvement in health/fitness outcomes.

### 477 Board #315 May 29 11:00 AM - 12:30 PM Examining the Effects of Exercise Referral Schemes on Changes in Physical Activity Levels. Nikita Z. Rowley1, James Steele1, Steve Mann1, Gary Liguori, FACSM2, Alfonso Jimenez1, Elizabeth Horton1, 1Coventry University, Coventry, United Kingdom. 2ukactive, London, United Kingdom. 1University of Rhode Island, Kingstton, RI. Email: nikitarowley@outlook.com (No relevant relationships reported)

Exercise referral within the United Kingdom (UK) offers individuals an opportunity to take part in physical activity in a non-clinical environment, yet gain clinical health benefits. Referral schemes focus on improving health outcomes, including increased physical activity (PA), of medically referred individuals. However, inconsistencies have been found within the literature reviewing impact of exercise referral on improving PA levels. **Purpose:** To determine if exercise referral schemes (ERS) influence change in PA levels amongst individuals across the UK. **METHODS:** Data were obtained from 5246 participants (53 ± 15 years; 68% = female) who attended 12 different ERSs. Participants self-reported IPAQ scores pre- and post- scheme completion to determine if exercise referral had any impact on PA levels. Schemes were 12 weeks in length and situated in leisure environments including gyms, leisure centres and community halls, throughout the UK. Exercise prescriptions consisted of both aerobic and resistance training. Two-stage individual patient data meta-analysis was performed separately on the pre-ERS, and on the change scores (post- minus pre-ERS scores), for metabolic equivalent (MET)-minutes per week; analysis was chosen due to data being hierarchal and accounting for clustering at scheme level. **RESULTS:** Analyses were conducted on the continuous data collected through the IPAQ. For pre-ERS MET-minutes the estimate from random effects model was 1183 MET-minutes per week [911 to 1457], p< 0.0001. For ERS change, the estimate from random effects model was 666 MET-minutes per week [385 to 948], p< 0.0001. Significant heterogeneity was evident among the schemes (Q = 162.22, p< 0.001; I² = 97.71%). Considering the estimate for pre-ERS MET-minutes (1183 MET-minutes), the estimate for change in MET-minutes could be considered meaningful, as it would result in participants moving from the ‘moderate’ to ‘high’ category for PA. **CONCLUSION:**

### 478 Board #316 May 29 11:00 AM - 12:30 PM Low Usage of Physical Activity Related Diagnostic Codes Among Indiana Medical Providers NiCole R. Keith, FACSM1, Lauren R. Lembek2, Erik A. Imel1, 1Indiana University Purdue University, University, Indianapolis, Indianapolis, IN. 2Regenstein Institute, Incorporated, Indianapolis, IN. 1Indiana University School of Medicine, Indianapolis, IN. Email: nkeith@iupui.edu (No relevant relationships reported)

The National Academy of Medicine and “Exercise Is Medicine” recommends physicians routinely advise patients about physical activity (PA) and, when needed, refer to PA support to improve patient and population health. Uptake of these recommendations has been slow. Knowledge of diagnostic codes for billing may influence provider behavior. The Indiana Health Information Exchange (IHIE) connects more than 100 healthcare entities and 40,000 providers for >18 million patients, with >10 billion clinical data elements. **Purpose:** To document ICD-9 and ICD-10 PA-related billing code use for “Lack of Physical Exercise” and “Physician Exercise Counseling.” **Methods:** We searched IHIE for PA-related ICD-9 and ICD-10 codes and comorbidity codes from 01/01/94 through 04/24/18. **RESULTS:** PA-related ICD codes were used for 54,543 patients, but <10% (5,221) were used for adults. Fewer occurrences were in adult patients with common chronic diseases that could be improved through PA (Table 1).

**Table 1**

<table>
<thead>
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<th>Condition</th>
<th>ICD-9 V69.0</th>
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<th>ICD-9 V65.41</th>
<th>ICD-10 Z71.82</th>
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<td>Type 2 Diabetes</td>
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<td>160</td>
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<td>Hypertension</td>
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<td>&lt;10</td>
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</tr>
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<td>BMI 35.0-39.9</td>
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<td>22</td>
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<tr>
<td>BMI &gt; 40</td>
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<td>20</td>
<td>19</td>
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<tr>
<td>BMI &gt; 50</td>
<td>163</td>
<td>12</td>
<td>&lt;10</td>
<td>87</td>
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</table>

**Discussion:** Low use of PA-related ICD codes may be due to a lack of awareness of existing codes. Physician education regarding PA-related ICD codes may increase physician counseling, code usage and possibly referral to PA resources.
While healthy lifestyle modification is often the first line recommendation to treat and prevent chronic disease, physicians inconsistently provide patients with guidance and resources to ensure appropriate physical activity participation. PURPOSE: To increase physical activity among patients, this project aimed to expand a physician-led walking program from a single clinic to a community-based partnership for broader reach. METHODS: The originally developed Walk with a Doc (WwaD) program was established in a family medicine clinic. Patients were referred to attend the monthly program during clinical encounters. The four phases of the IH Scale-up Framework were applied to (1) examine the existing program (provider buy-in for walking prescriptions, rate of referral, and patient participation and satisfaction); (2) define a scalable program; (3) test the new context for scale-up (validate feasibility, utility, and acceptability); and (4) plan to go to full scale. RESULTS: The WwaD program had 82 unique patients participating over 36 months of implementation with 15 providers making referrals to the walking program and 100% participant satisfaction. A landscape assessment of available parks and trails was completed and locations were geospatially mapped to examine distance from outpatient clinics. In partnership with the city’s Parks and Recreation department, new walking program sites were identified to leverage “healthy mile” trails in local neighborhoods with existing clinics. Site surveys confirmed clinic patients’ and providers’ interest, and trail safety and accessibility. The scalable program was defined to include a walking prescription and referral to the program, program reminders for the patient, and use of the city’s designated healthy mile trails. Pre-health students were incorporated to improve the ratio of program leads to patients, improve participant satisfaction, and to build student volunteers’ understanding of exercise is medicine and interprofessional competencies for future health professions careers. CONCLUSION: Leveraging the commitment to shared goals for increased physical activity, we developed a scalable walking program with integrated clinical, academic and community resources in a mutually beneficial partnership to improve patients’ health and well-being.

PURPOSE: The purpose of this study is to characterize the general, physical, social and mental health of USTA members using validated SF-36 outcomes domains in reference to the general population. METHODS: A modified SF-36 version 1.0 was administered to USTA members via online form. The following patient variables were included: Age group (18-29, 30-39, 40-49, 50-59, 60-69, 70-79, 80+), gender, race, USTA membership, physical activity level, years of membership, NTRP level, and tennis playing frequency. RESULTS: 10,380 USTA leagues members responded and completed the modified SF-36 questionnaire. 63% of respondents were female, the average BMI of the cohort was 24.88±4.17 and 97.7% reported that playing tennis helps them manage their health. For all Norm-based SF-36 domains, USTA athletes scored higher than the general population (mean = 50). Multivariate comparisons revealed higher SF-36 outcomes scores for younger athletes (all SF-36 domains, p<0.001), and more frequent players (all domains, p<0.001). Additionally, patients who reported playing more than 3 days per week scored higher in all SF-36 domains than those who were less advanced tennis skills. Female tennis players reported higher GP, GH, PCS scores and lower BMI (All p<0.002). Elderly tennis players (age >70) scored worse for PF, RP, GH, VT, SF, RE, and MH domains for the SF-36 (p<0.001). CONCLUSIONS: USTA members enjoy above average general, physical, social and mental health scores. Patients with a higher level of skill have higher physical functioning. Younger tennis players and athletes who competed more than 3 occasions per week scored higher in all SF-36 domains than those who were older and played less, respectively.