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) and sympathetic vasoconstriction were assessed. The LnHF/LnLF ratio 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 (UBFR): Rest: 7.3±1.6ms, R30: 6.3±1.6ms, 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: 7.1±1.4ms, R30: 6.3±1.8ms, R60: 7.1±1.4ms) and the LnLF/LnHF ratio (UBFR: Rest: 3.9±0.9ms, R30: 5.1±10.9ms, R60: 4.8±1.0ms, LW: Rest: 3.7±1.0ms, R30: 4.9±0.8ms, R60: 4.8±0.7ms; LBFR: Rest: 4.0±1.0ms, 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 resistance exercise.
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 1.7±0.1m; 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, while lnLF is indicative of sympathetic modulation. 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 effects of HI-HRE across time (rest, Rec1, Rec2, and Rec3). Significant main effects were analyzed using pairwise comparisons with Bonferroni correction. RESULTS: There was a significant main effect of time (P<0.04) for the RMSSD (rest: 63±10bpm; Rec1: 84±10bpm; Rec2: 76±0bpm; Rec3: 70±0bpm), such that it was augmented during all recoveries compared to rest. There was a significant main effect of time (P<0.001) for the lnHF/lnHF ratio (rest: 0.9±0.1; Rec1: 1.2±0.2; Rec2: 1.1±0.2; Rec3: 1.0±0.1), such that it was augmented during all recoveries compared to rest. CONCLUSION: These data demonstrate that high-intensity heavy rope exercise results in significant decreases in vagal modulation for at least 60 minutes.
RESULTS: RAMP: FOL and LUT maximal oxygen uptake (VO2 max) (FOL: 2.36 ± 0.4 L/min; LUT: 2.36 ± 0.4 L/min), ventilation (V̇E) (FOL: 53.2 ± 25 L/min; LUT: 55.1 ± 25 L/min), and %HHb (FOL: 60 ± 3%; LUT: 57 ± 3%) were unchanged (p>0.05). However, %HHb/VO2 was 65% lower in LUT compared to FOL below lactate threshold (GET) (p<0.05). Pco2 values were lower in LUT compared to FOL (FOL: 37 ± 2 mmHg; LUT: 36 ± 3 mmHg) (p<0.01), whereas Pco2 values remained unchanged (FOL: 105 ± 6 mmHg; LUT: 107 ± 6 mmHg) (p>0.05). EP: V̇E (FOL: 83 ± 19 L/min; LUT: 89 ± 17 L/min) and Pco2 (FOL: 115 ± 4 mmHg; LUT: 118 ± 4 mmHg) were greater in LUT compared to FOL (p<0.05), without changes in breathing frequency (FOL: 32 ± 4 L/min; LUT: 35 ± 5 L/min) (p>0.05). No differences in %HHb were observed between LUT and FOL (FOL: 83 ± 21%; LUT: 85 ± 21%); however, %HHb/VO2 was 18% lower in LUT compared to the kinetic phase of the EP in LUT compared to FOL (p<0.05). Post-EP [La-] were lower in LUT compared to FOL. PET2 values were lower in LUT compared to FOL (FOL: 115 ± 4 mmHg; LUT: 118 ± 4 mmHg) whereas PET2(p<0.01), PETF (p>0.05). No differences in %HHb were observed between FOL and LUT for RAMP peak power (FOL: 218 ± 35 W; LUT: 221 ± 29 W) or EP endurance (FOL: 99 ± 20 s; LUT: 96 ± 15 s) (p>0.05). CONCLUSION: During RAMP exercise, there was a greater reliance on muscle deoxygenation at sub-GET work rates in FOL compared to LUT. During EP, the LUT phase showed higher V̇E, lower Post-EP [La-], and lower muscle deoxygenation during the kinetic portion of the step exercise, suggesting increased ventilatory buffering compared to FOL. Despite the different physiological responses between menstrual phases, short duration exercise performance is preserved.

INTRODUCTION: Prolonged vigorous exercise increases cardiac output and pulmonary arterial and capillary pressures to levels that may exceed a tolerable right ventricular and alveolar-capillary load. Accordingly, this study examined the effect of an ultramarathon on resting and exertional measures of alveolar-capillary recruitment & lung diffusion. Methods—Cardiac and lung function were examined at rest & during 3 stages of low-intensity exercise in 44 runners (Age:41±9yr BMI:23±3kg/m²) before, and 1-4h and 24h after the Hong Kong 100 and Ultra Trail Mont Blanc ultramarathons. Cardiac biomarkers (cTnI, 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. Results—Participants finished the ultramarathons in 22±11h with an average heart rate of 130±14bpm. Cardiac biomarkers increased after the race (cTnI: 0.03±0.01 vs 0.09±0.02ng/mL; BNP: 181±2 vs 129±14pg/mL, p<0.01). Stroke volume decreased post-race at rest (86±2 vs 74±2mlp<0.01) & during exercise (Stage3: 99±2 vs 92±3; p<0.01), while cardiac output was similar pre and post-race (Rest: 4.6±0.1 vs 4.9±0.2;p<0.01; Stage3: 8.7±0.3 vs 8.8±0.3;p<0.01). Resting DLco, DLno & Vc decreased post-race, while Dm was unchanged. On the contrary, DLco, DLno and Dm were reduced during low intensity exercise post-race, while Vc normalized to pre-race values. When corrected for Q, DLco was lower at rest (DLco/Q:7.1±0.2 vs 5.7±0.2;p<0.01), but normalized to pre-race values during exertion (stage3 DLco/Q:4.0±0.1 vs 3.8±0.2;p<0.01). All values returned to baseline after 24-h of recovery. 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 reduced during light exercise and may contribute to the exertional decrease in lung diffusion after an ultramarathon.
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 function subscales were evaluated using the Piper Fatigue Scale (0-100; 0-10 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±0.47, p=0.13). Fatigue did not change over time in IE. Overall QOL differed between groups over time (p<0.05), where it was higher in IE versus DE post-chemo (mean diff: +6.2±3.0, p<0.05). No other group differences were found for QOL function subscales. The overall deterioration in QOL in DE during chemotherapy was a result of reductions in 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<0.05), cognitive function (mean diff: -16.0±5.8, p<0.01) and social function (mean diff: -17.4±7.4, p<0.04). Relative to post-chemo, the DE intervention significantly improved QOL by follow-up (mean diff: +20.2±3.5, p<0.01), such that DE and IE QOL did not differ at follow-up (mean diff: +4.6±3.7, 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.

It is unclear whether women at risk of breast cancer-related lymphedema can safely participate in heavy-load resistance exercise. **PURPOSE:** To evaluate the effect of heavy-load resistance exercise on lymphedema outcomes in pre-diagnosis physically inactive women at risk of breast cancer-related lymphedema during adjuvant chemotherapy. **METHODS:** Physically inactive women receiving anthracycline and taxane-based chemotherapy for breast cancer (n=153) were randomized to a HIGH (supervised multimodal exercise including heavy-load resistance exercise: 85-90% 1 repetition maximum [RM], 2-3 sets of 5-8 repetitions) versus LOW (walking supported by pedometer and one-on-one consultations) 12-week exercise intervention. **RESULTS:** Outcomes (assessed at baseline, 12- and 36-weeks follow-up) included lymphedema status (extracellular fluid [L-Dex, bioimpedance spectroscopy] and inter-arm volume % difference [dual energy X-ray absorptiometry]), lymphedema symptoms [numeric rating scale 0-10]), upper-extremity strength (1 RM), and quality of life domains (EORTC breast cancer specific questionnaire). Linear mixed models were used to evaluate equivalence between groups for lymphedema 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 (-0.7; -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 lymphedema risk. Supported by funding from the Danish Cancer Society, the Novo Nordic Foundation and Trygfonden (7-12-0401).

Exercise is a potential mechanism for mitigating some side effects caused by adrenocorticotropic hormone deprivation therapy (ADT) for metastatic castration-resistant prostate cancer (mCRPC).
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 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=0.002). 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.

PRE-SURGICAL EXERCISE IN MEN WITH PROSTATE CANCER UNDERGOING PROSTATECTOMY.

Favil Singh1, Robert U. Newton1, Dennis R. Taaffe, FACSM1, Jeffery Thavaseelan2, Matthew Brown2, Elayne Ooi2, Kazunori Nosaka, Daniel A. Galvao, FACSM1, Edith Cowan University, Perth, Australia. 1Pert Urology Clinic, Perth, Australia. 2Swan Urology, Perth, Australia. (Sponsor: Daniel Galvao, FACSM)
Email: f.singh@ecu.edu.au

(A No relevant relationships reported)

Traditionally, exercise interventions to improve recovery in prostate cancer patients following prostatectomy were limited to the post-surgical period with exercise protocols focusing on the pelvic floor muscles. However, emerging evidence indicates that a more opportune time to intervene to reduce the adverse effects of surgery and length of hospitalisation is the pre-operative period. PURPOSE: To evaluate the efficacy of exercise undertaken before surgery to enhance pre-surgical physical function and body composition, and improve recovery from surgery. METHODS: Twenty-two men with localised prostate cancer aged 50-73 years scheduled for surgery were randomised to exercise (EX = 12) or usual care (UC = 10). EX underwent a supervised 6-week progressive resistance and aerobic exercise program 3 times per week prior to surgery. Outcome measures included muscle strength and endurance, physical performance by a battery of tests, body composition by dual x-ray absorptiometry, and urinary incontinence. Measures were undertaken at baseline, pre-surgery, and 6 weeks post-surgery, with incontinence assessed following catheter removal and 6 weeks post-surgery. Data were checked for normality and analysed using two-way repeated-measures ANOVA. RESULTS: There were no differences between groups at baseline. Following exercise, there was a significant interaction (p < 0.05) for chest press, leg press and leg extension strength with strength increasing in EX prior to surgery and remaining at the pre-training values post-surgery. There was a significant time effect (p < 0.05) for 6 m fast walk, 6 m backwards walk, and 400 m walk following surgery improving over the study period. Following surgery, lean mass was reduced (time; p < 0.001) by ~1 kg and ~1.4 kg in EX and UC, respectively. Urinary incontinence was significantly reduced at 6 weeks post-surgery in EX and UC (time; p < 0.001). There was no difference in length of hospital stay (3:1 days for EX and UC) and there were no exercise-related adverse effects. CONCLUSIONS: A pre-surgical exercise program improves components of physical function prior to surgery which may enhance the patient’s fitness for surgery. Given the loss of lean mass following surgery, a longer period of anabolic exercise prior to surgery may prove useful in buffering post-surgical loss.

Thematic Poster - UCL Injuries in Overhead Athletes

Wednesday, May 29, 2019, 9:30 AM - 11:30 AM
Room: CC-102B

Board #7

Responders Versus Non-responders To Resistance-based Multimodal Exercise In Men With Prostate Cancer Undertaking ADT

Dennis R. Taaffe, FACSM1, Robert U. Newton1, Nigel Spry1, David Joseph1, Daniel A. Galvao, FACSM1. Edith Cowan University, Perth, Australia. 1Genesis Cancer Care, Perth, Australia.
Email: d.taaffe@ecu.edu.au

(No relevant relationships reported)

In the management of prostate cancer androgen deprivation therapy (ADT) is effective in delaying disease progression and enhancing survival, although it is associated with an array of adverse effects including reduced muscle mass, strength and physical function, and an increase in body fat. Exercise is one strategy to counter these musculoskeletal treatment-related toxicities resulting from ADT. However, to recommend and prescribe exercise, clinicians need to know the likelihood of a positive response. PURPOSE: To assess the prevalence of exercise responsiveness in men with prostate cancer undergoing ADT on body composition, muscle strength, and physical function. METHODS: Prospective analyses were undertaken in 152 men (43-90 years) with prostate cancer on ADT undertaking resistance exercise combined with aerobic and/or impact training for 3-6 months. Whole body lean mass (LM) and fat mass (FM), trunk fat mass, and appendicular skeletal muscle (ASM) were assessed by dual x-ray absorptiometry, upper and lower body muscle strength by 1-REPS, and physical function by a battery of tests (6-m usual, fast and backwards walk, 400-m walk, repeated chair rise, stair climb). RESULTS: There were significant improvements (P<0.01) in LM (0.4±1.4 kg, range -2.8 to +4.1 kg) and ASM (0.2±0.8 kg, range -1.9 to +1.9 kg), and all measures of muscle strength (chest press: 2.9±5.8 kg, range -12.5 to +37.5 kg; leg press: 29.2±27.6 kg, range -50.0 to +140.0 kg) and physical function (from -0.1±0.5 s, range +1.3 to -2.1 s for the 6-m usual walk, to -8.6±15.2 s, range +25.2 to -69.7 s for the 400-m walk). In addition, FM (0.6±1.8 kg, range -3.6 to +7.3 kg) increased (P<0.01). Twenty one men did not have a favourable response in at least one body composition component, 10 did not improve muscle strength, and 2 men did not improve physical function. However, all patients responded in at least one of the areas and 120 (79%) favourably responded in all three areas. For all 12 outcome measures, improvement was observed in 82% (range 2 to 12) measures. CONCLUSION: There were no non-responders to resistance-based multimodal exercise in men with prostate cancer undergoing ADT, and this form of exercise can be confidently prescribed to derive beneficial effects during active treatment.

Is Shoulder Joint Rom Or UCl Thickness A Predictor Of Medial Elbow Joint Space?

Shawn D. Felton1, Arie J. van Duijn2, Jacqueline van Duijn1, Mitchell L. Cordova, FACSM1. 1Florida International University, Miami, FL. 2Florida Gulf Coast University, Fort Myers, FL.
(Sponsor: Mitchell L. Cordova, FACSM)
Email: sfelton@fiu.edu

(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 (IRRM) 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 non-invasively. PURPOSE: To examine if shoulder joint motion (ERRM, IRRM, TROM), or the thickness of the UCL at the mid substance and apex of trochlea produces medial elbow joint space (MJS) in asymptomatic college pitchers. 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 Q ultrasound unit. Participants were placed supine with a wedge placed underneath their pitching hand to maintain elbow position at 30 degrees. A 3 kg valgus force, 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 measurements to evaluate 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. Number of innings pitched, holding all potential confounders constant. Linear regressions tested the effect of UCL reconstruction on changes in performance across those periods, holding all potential confounders constant. RESULTS: Among all 150 pitchers, during the first 2 seasons, they won 53.6% of games, struck out 0.88 ± 0.23 batters per inning, and had an earned run average (ERA) of 4.01 ± 1.14. Between the first 2 and last 2 seasons, REC subjects experienced a 5.7% decrease in win percentage (p=0.063) but struck out 4.7% more batters per inning (p=0.015). Linear regression, evaluating the change from first to last season, found UCL reconstruction to improve winning percentage by 14.4 percentage points (p=0.026); there was no effect on strikeouts per inning (p=0.339) or ERA (p=0.892). UCL reconstruction failed to elicit significance on the change in performance score between the first 2 and last 2 seasons in any variable. The ANOVA models found no group effect between first and last season with win percentage (p=0.190), strikeouts per inning (p=0.428), or ERA (p=0.600). Similarly, there was no group effect between the first 2 and last 2 seasons in win percentage (p=0.454), strikeouts per inning (p=0.961), or ERA (p=0.496). 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.
A-20 Thematic Poster - Walking Biomechanics

Wednesday, May 29, 2019; 9:30 AM - 11:30 AM
Room: CC-101B

84 Chair: Julia Freedman Silvernail. University of Nevada, Las Vegas, Las Vegas, NV
(No relevant relationships reported)

85 Board #1 May 29 9:30 AM - 11:30 AM
Pelvis and Trunk Motion Comparisons Between Male and Female Soldiers While Walking With Heavy Loads
Joseph F. Seay, Victoria G. Bode, Peter N. Frykman, Nathaniel J. Smith, Rebecca F. Tellin. U.S. Army Research Institute of Environmental Medicine, Natick, MA.
Email: joseph.f.seay.civ@mail.mil
(No relevant relationships reported)

With the recent decision permitting female soldiers to enter Combat Arms roles, knowledge of sex differences in military load carriage is more operationally relevant. Limited work comparing the effect of heavy carried loads (> 30 kg) in men and women has attributed differences in gait mechanics to sex without matching for anthropometrics that may contribute to differences. PURPOSE: To examine the effect of carrying light to heavy loads on pelvis and trunk range of motion (ROM) between anthropometrically matched male and female soldiers. METHODS: Four male and four 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 1.1 m s⁻¹, 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 frontal 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>
<thead>
<tr>
<th>Table 1. Pelvis and Trunk Frontal (Y) and Transverse (Z) plane ranges of motion for different loads among male and female Soldiers.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
</tr>
<tr>
<td><strong>Pelvis</strong></td>
</tr>
<tr>
<td><strong>Frontal</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Transverse</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Trunk</strong></td>
</tr>
<tr>
<td><strong>Frontal</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Transverse</strong></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

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

86 Board #2 May 29 9:30 AM - 11:30 AM
Logistic Regression Analyses Regarding Patient Dissatisfaction with Total Knee Replacement Outcomes
Kevin Valenzuela1, Songning Zhang, FACSM2. 1CSULB, Long Beach, CA. 2University of Tennessee Knoxville, Knoxville, TN. (Sponsor: Songning Zhang, FACSM)
Email: kevin.valenzuela@csulb.edu
(No relevant relationships reported)

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±.09m, 71.9±16.1kg), and were matched on sex to 10 obese controls (1.74±.08m, 108.0±13.2kg) and 10 lean controls (1.67±.06m, 65.3±7.16kg). Participants completed three maximal isometric knee extensor contractions using a dynamometer (1.49±.2kg, 100% of reported 1RM). Early (0-100 ms) and late (100-200 ms) rate of torque development (RTD100, RTD200) and peak torque were extracted. Gait biomechanics were collected as participants completed 5 walking trials over 2 force plates on a 10-m runway at self-selected speed. Peak knee flexion angle (KFA), excursion (KFE), and knee flexion moment (KFM) were extracted. To ensure 50% of stance phase was included, knee joint moments were normalized to lean mass and a product of body weight and height, respectively. One-way MANOVA was used to compare strength variables between groups. Partial correlation controlling for gait speed was used to determine the relationship between strength and gait variables. RESULTS: There were group differences in peak torque (p<.001), RTD100 (p<.010), and RTD200 (p<.002). Post hoc analyses showed that individuals with PWS had lower peak torque (p=.006, p=.001), RTD100 (p=.038, p=.015), and RTD200 (p=.003, p=.016) than obese and lean controls. There were no significant correlations in control groups (p>.05). Greater KFE was related to greater peak torque (r=-.71, p=.016), greater RTD100 (r=-.59, p=.049) KFA (r=.69, p=.019). CONCLUSIONS: Strength variables were associated with knee mechanics in the PWS group, indicating that aberrant gait in PWS may relate to muscle weakness. Adults with knee osteoarthritis (KOA) have a quadriceps avoidance gait pattern indicated by lower KFE. Individuals with PWS had lower quadriceps strength compared to controls, which was associated with lower KFE. Lower quadriceps strength and altered knee mechanics in individuals with PWS may contribute to KOA.
Medial contact force (MCF) is a measure of the internal loads contributing to 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 1.690.17 m; mass 72.3±1.8 kg) volunteered for this study. All analyses were completed on the non-modified limb. Participants completed 10 trials each walking with normal gait and MKT. The prescribed change in knee angle during the MKT trials was participant specific, using the mean and standard deviation (SD) from baseline trials. During MKT trials, visual real-time feedback was provided to ensure joint angles fell within 1-3 SD (1st 5 trials) and 3-5 SD (last 5 trials) from baseline average. KAM and KFM were computed on Visual 3D. To assess MCF, a linear regression equation was used: Coefficient values (c1, c2, and c3) were attained from prior studies that quantified MCF using instrumented knee implants. Changes in MCF during the 1st and 2nd half of stance were assessed using an ANOVA (P<0.05). **RESULTS:** MCF of the non-modified limb for the 1st half of stance was significantly greater during the MKT trials (F1, = 6.747, P<0.003). Participants had greater MCF during the 1-3 SD (α=0.36) and the 3-5 SD (β=0.44) compared to the baseline trials. No other statistically significant difference was found (P>0.05). **CONCLUSION:** Increased MCF in the non-modified knee is possibly explained by the lateralization of the force vector from the modified limb. As a result of the repetitive nature of gait, small increases in MCF over each step may instigate significant ramifications over time. Our results suggest that for individuals with bilateral knee osteoarthritis MKT may be contraindicated. Future studies implementing gait retraining within pathological populations should consider investigating biomechanical changes in the non-modified knee.

**Diabetes is Associated with Slow Walking Speed in People with Knee Osteoarthritis**

Aqeel M. Alenazi1, Mohammed M. Alshehri2, Shaima Alothman3, Corey Gray4, Abdalghani A. Yahya5, Jason Rucker6, Bader A. Alqahtani7, Saad M. Bindawas8, Patricia M. Kluding9.

1University of Kansas Medical Center and Prince Sattam Bin Abdulaziz University, Kansas City, KS. 2University of Kansas Medical Center, Kansas City, KS. 3Prince Sattam Bin Abdulaziz University, Alkhair, Saudi Arabia. 4King Saud University, Riyadh, Saudi Arabia. Email: aalenazi@kumc.edu

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 3 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.
A-21  Free Communication/Slide - Factors Influencing Work Capacity in the Heat

Wednesday, May 29, 2019, 9:30 AM - 11:00 AM
Room: CC-202C

93  May 29 9:30 AM - 9:45 AM
Relationship Between Muscle Oxygenation and Oxygen Uptake During Exercise in the Heat
Email: MARGARET.MORRISSEY@UCONN.EDU

Exercising in the warm environments increases thermoregulatory demand for skin blood flow, influencing oxygen delivery and oxygen consumption (VO\textsubscript{2}) systemically and to active muscle. Near infrared spectroscopy (NIRS) is a non-invasive technique that indirectly assesses local tissue oxygen delivery and VO\textsubscript{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\textsubscript{2} at different exercise intensities in the heat. METHODS: Six participants (4 males, 2 females, age:21±0.5 years, height: 173.4±1.84 cm, weight: 73.14±17.28 kg, VO\textsubscript{2max}: 46.41±3.53 ml·kg\textsuperscript{-1}·min\textsuperscript{-1}) performed a treadmill exercise protocol (30°C, 60% relative humidity) with 10 minutes each at 30%, 40%, 60%, 70%, and 80% of VO\textsubscript{2}max. NIRS (Moxif, FortiDesign LLC, Menasha, Minnesota, USA) was used to assess muscle oxygen saturation (Sm\textsubscript{O}2) of the vastus lateralis muscle and systemic VO\textsubscript{2} was measured using expiratory gas analysis. Pearson correlations coefficients were calculated to evaluate the relationship between average Sm\textsubscript{O}2, relative changes from baseline (Δ) in Sm\textsubscript{O}2, mean VO\textsubscript{2} at percent of peak velocity, and percent of VO\textsubscript{2}max. RESULTS: There was a positive correlation between ΔSm\textsubscript{O}2, VO\textsubscript{2} at 80% of peak velocity (r=0.857, p=0.029). There were no significant correlations between ΔSm\textsubscript{O}2, VO\textsubscript{2} at 30%, 40%, 60%, and 70% of peak velocity (0.483, p=0.332, 0.544, p=0.254, 0.653, p=0.160, 0.70, p=0.620, 0.189). There were no significant correlations between mean Sm\textsubscript{O}2, VO\textsubscript{2} at percent of peak velocity, or percent VO\textsubscript{2}max. CONCLUSION: At 80% of peak velocity, ΔSm\textsubscript{O}2, and VO\textsubscript{2} are positively correlated and may suggest this relationship exists while running at high intensities. Therefore, the relationship between NIRS measured Sm\textsubscript{O}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.

94  May 29 9:45 AM - 10:00 AM
Application of the Thermal-Circulatory Ratio to Individuals Without History of Exertional Heat Illness
Brad D. Endres, Luke N. Belval, Gabrielle E. W. Giersch, Rachel K. Katch, Margaret C. Morrissey, Rebecca L. Stearns, Dougins D. Casa, FACSM, Korey Stringer Institute, Storrs, CT. (Sponsor: Douglas J. Casa, FACSM)
Email: brad.endres@uconn.edu

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 provide evidence for the application of these 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\textsubscript{2max}: 46.83±3.59 ml·kg\textsuperscript{-1}·min\textsuperscript{-1}) completed a HTT composed of two hours of treadmill walking at a speed of 5 km·hr\textsuperscript{-1} at a 2% grade in 40°C and 40% relative humidity. Rectal temperature (T\textsubscript{R}) was assessed and heart rate (HR) was assessed. Data are presented as mean ± SD. The only differences in this data set were present in the maximum T\textsubscript{R} in the third block of exercise (male: 39.23 ± 0.40°, female: 38.82 ± 0.15°C, p=0.028). 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 at any blocks of exercise throughout the trials (Block 1 – male: 1.20 ± 0.39L·hr\textsuperscript{-1}, female: 0.58 ± 0.33L·hr\textsuperscript{-1}, p=0.693; Block 2 – male: 1.05 ± 0.20L·hr\textsuperscript{-1}, female: 0.88 ± 0.31L·hr\textsuperscript{-1}, p=0.373; Block 3 – male: 1.14 ± 0.47L·hr\textsuperscript{-1}, female: 0.65 ± 0.35L·hr\textsuperscript{-1}, 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. Further investigation will help to answer any questions about special military considerations for males and females during prolonged missions or training in the heat.

95  May 29 9:45 AM - 10:00 AM
Effects of Solar Radiation Exposure on Self-regulated Exercise Intensity and Thermoregulation in the Heat Outdoors
Hidenori Otani1, Mitsuharu Kaya2, Akira Tamaki2, Heita Goto2, Ronald J. Maughan, FACSM1, Himeji Dokkyo University, Himeji, Japan. 1Hyogo University of Health Sciences, Kobe, Japan. 2Kyushu Kyoritsu University, Kitakyushu, Japan. (Sponsor: Ronald J. Maughan, FACSM)

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 thermoregulation during the heat outdoors and fixed rating of perceived exertion (RPE). METHODS: Ten male participants completed 45-min 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 solar radiation exposure conditions: clear sky (mean±SD: 1072±91 W·m\textsuperscript{-2}; HIGH); thin clouds (592±32 W·m\textsuperscript{-2}; MID); and thick clouds (306±52 W·m\textsuperscript{-2}; LOW). Rectal and skin (chest, upper arm, thigh and calf) temperatures, heat 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 between moderate and heavy based on WHO definitions. METHOD: Sixteen young adult male participants (heterogenous 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 with no heat stress (15°C, 50% rh). The remaining nine trials were conducted at the same fixed target HR in WBGT ranges of 21 to 41°C (variations in both temperature and humidity). The total kilojoules of energy above resting, generated during treadmill work in each heat-stress combination of air temperatures and humidity, and how their use impacts physical work capacity (PWC) were reported in those with high aerobic fitness (≥ 60 ml/kg/min), whereas PWC threshold limit values for electric fan use during physical work. 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. 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 (V̇̇E*res) 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 (Ptt) from normoxia. PURPOSE: To determine the effect of reducing the work of breathing (ẆE) 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 Ptt from normoxia. METHODS: Fourteen trained male cyclists (V̇O₂max = 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 ẆE in each condition. Inspiratory capacity maneuvers were performed at each km, and flow-volume loop analyses were used to assess the %EFL and V̇E. The modified Borg scale (0-10) was used to assess RPB at each km. RESULTS: ẆE decreased from HYP to HYP+He by 30 ± 18% (p < 0.01). Despite a substantial V̇E*res throughout CON (52 ± 44 L·min⁻¹), V̇E was not different between CON and HYP (124.8 ± 17.9 L·min⁻¹) but increased during HYP+He (139.5 ± 22.0 L·min⁻¹; p < 0.01). Ptt decreased from CON to HYP by 10 ± 1% (p < 0.01), SaO₂ increased by 4 ± 1% from HYP to HYP+He (p < 0.01). Ptt decreased from CON to HYP+He (-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 Ptt (r = 0.69; p < 0.05) and SaO₂ and Ptt were unchanged from HYP to HYP+He (r = 0.6 ± 0.2). CONCLUSIONS: In moderate hypoxia, a low ventilatory reserve does not limit 5k 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.
102 May 29 9:45 AM - 10:00 AM Dysanapsis Ratio as a Predictor of Expiratory Flow Limitation in Endurance Trained Athletes
Joel T. Greenshields1, Benjamin C. Skutnik1, Daniel P. Wilhite2, Robert F. Chapman, FACSM3, Joel M. Stager, FACSM3. 1Indiana University, Bloomington, IN. 2Texas Health Presbyterian Hospital, Dallas, TX. (Sponsor: Joel M. Stager, FACSM). Email: jtgrens@indiana.edu

No relevant relationships reported

PURPOSE: 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 vs. 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/FVC (86.3 ± 7.8 vs 91.3 ± 5.7 %, p < .001), and FEV1/FVC was significantly lower 2.1 ± 0.7 vs. 2.3 ± 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 VO2 (67.1 ± 8.1 vs. 65.4 ± 4.5 ml·min−1·kg−1, p = .246), VE (155.9 ± 20.6 vs. 158.6 ± 26.6 ml·min−1, p = .59), or frequency of breathing (50.3 ± 5.8 vs. 53.6 ± 8.3 breaths per min, p = .242). A significant predictive relationship was observed between DR on EFL (Odd Ratio (OR): 0.55, 95% CI 0.36 to 0.81, p = .01). A multivariate analysis indicated that DR (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 0.75 to 0.23, 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 may provide a target for training to decrease the likelihood of flow limitation in highly trained athletes.

103 May 29 10:00 AM - 10:15 AM No Sex Differences In Diaphragmatic Fatigue When Matched For Absolute Force During Inspiratory Pressure-threshold Loading
Caitlin M. Geary, Joseph F. Welch, Malcolm R. McDonald, Carli M. Peters, Paige A. Reinhard, Michael G. Leahy, A William Sheel, FACSM. University of British Columbia, Vancouver, BC, Canada. (Sponsor: A. William Sheel, FACSM). Email: caitlin.geary@alumni.ubc.ca

No relevant relationships reported

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 = 6) and women (n = 8) performed a single bout of PTL for five minutes. Subjects were required to breathe against a pressure-threshold (Pth) of 92 cm H₂O. Fatigue of the diaphragm was assessed via twitch MIP, using cervical magnetic stimulation. Despite performing the same level of absolute diaphragmatic work and developing the same degree of DF, women demonstrated an attenuated inspiratory muscle metabolefactor. SUPPORT: Natural Sciences and Engineering Research Council of Canada, UBC Physical Activity and Precision Health Cluster

104 May 29 10:15 AM - 10:30 AM Effects of Acute Intermittent Hypoxia on Maximal Respiratory Ability after Spinal Cord Injury
Tommy W. Sutor1, Kathryn Cakva2, Shakel Ahmed1, David D. Fuller1, Gordon S. Mitchell2, Emily J. Fox1. 1University of Florida, Gainesville, FL. 2Brooks Rehabilitation, Jacksonville, FL. Email: tsutor@ufl.edu

No relevant relationships reported

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. The purpose of this study was to investigate 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+ 1 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 ± 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, 93.3 cmH2O +/- 17.6; pre-sham, 98.8 cmH2O +/- 21.3; post-sham, 85.2 cmH2O +/- 17.3; X̄ ± SD, p = .101). MEP did not differ at any point on either day (pre-AIH, 91.2 cmH2O +/- 25.1; post-AIH 93.4 cmH2O +/- 26.8; pre-sham 80 cmH2O +/- 25.6; post-sham 85.4 ± 21.1; X̄ ± SD, p < .494) Individually, 3 participants increased MEP 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.

105 May 29 10:30 AM - 10:45 AM Combined Influences of Inspiratory Loading and Subcostal Circulatory Occlusion on Blood Pressure Responses
Joshua R. Smith, Eric J. Bruhn, Jessica D. Berg, Thomas P. Olson, FACSM. Mayo Clinic, Rochester, MN. (Sponsor: Thomas Olson, FACSM). Email: smith.joshua1@mayo.edu

No relevant relationships reported

Group III/IV muscle afferent feedback from the respiratory and locomotor muscles influence the blood pressure response during exercise. Stimulation of these respiratory and locomotor muscle afferents (via inspiratory loading (IL) or subcostal circulatory occlusion (CUF)) may augment the blood pressure response during exercise. However, it is unknown if the combination of IL and CUF (IL+CUF) results in a greater blood pressure response than observed with IL or CUF alone. PURPOSE: To compare the blood pressure responses with IL, CUF and IL+CUF during exercise in healthy adults. METHODS: Nine adults (6M/3W; 29±6 yrs; BMI: 27±4 kg/m²) were recruited. Participants performed four 10 min cycling exercise bouts at 40% peak oxygen uptake. For each exercise bout, the first 5 min consisted of spontaneous breathing (SB). The second 5 min consisted of voluntary hyperventilation (i.e. breathing frequency of 40 breaths per minute with 50% duty cycle) with IL (50% maximum inspiratory pressure), CUF (80 mmHg), IL+CUF or no intervention (CTL) in randomized order. Systolic and diastolic blood pressure (SBP and DBP, respectively) were measured using manual sphygmomanometry. MAP was calculated as (SBP+DBP)/3. RESULTS: Compared to SB, MAP and SBP were greater with CTL, IL, and IL+CUF (all, p<0.01). During the second 5 min of exercise, there were significant increases across all conditions in MAP (CTL: 93±11; IL: 100±10; IL+CUF: 113±11 mmHg) (all, p<0.01). During the second 5 min of exercise, there were significant differences across all conditions in SBP (all, p<0.01) except IL was not different than CUF (p=0.09) (CTL: 134±20; IL: 144±20; CUF: 150±22; IL+CUF: 150±23 mmHg). During the second 5 min of exercise, there were significant differences across all conditions in DBP (all, p<0.01) except no differences existed between CUF and IL+CUF (p=0.15) (CTL: 73±8; IL: 79±8; CUF: 86±6; IL+CUF: 89±7 mmHg).

CONCLUSIONS: These data demonstrate that combined stimulation of respiratory
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).

**May 29 10:45 AM - 11:00 AM**
**Roles Of ROS and Akt In Reoxygenated Respiratory Muscle From PO2 Cycling-Treated Smoking Mice**
Li Zuo, FACSM. University of Maine, Presque Isle, ME. Email: zuo.4@osu.edu
(No relevant relationships reported)

**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 two hr per day, five days a week for three consecutive months. The smoking mice were then sacrificed, and their diaphragm was dissected out for muscle function analysis. Each muscle strip was mounted in a contractile chamber treated either treated with 5 cycles of P02 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 P02 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 electrically stimulated for five min using square-wave electrical pulses (70 Hz, 250-μs train duration, at 30 V) at 37 °C. Muscle force was recorded and end contractile force during the 5-min contraction was normalized by the maximal basal force to represent muscle function. Control muscles followed the same protocol but in the absence of P02 cycling or inhibitor treatment. Data were expressed as mean ± SE and statistically compared using one-way ANOVA. **RESULTS:** Our data indicate that PO2 cycling significantly improved diaphragm function during reoxygenation in smoking 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.

**May 29 11:00 AM - 11:15 AM**
**Does Acute Preprandial Exercise Attenuate Postprandial Airway Inflammation In Active Younger And Older Adults?**
William S. Wiseman1, Elizabeth S. Edwards1, Hannah Frick1, Morgan Medeiros1, Camden Sutton1, Michael White1, Steve Malin, FACSM2, Dave Edwards2, Stephanie P. Kurti1.1 James Madison University, Harrisonburg, VA. 2University of Virginia, Charlottesville, VA. (Sponsor: Steven Kenneth Malin, FACSM)
(No relevant relationships reported)

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 y/o) that habitually exceed physical activity (PA) guidelines completed exercise at a heart rate of 65% VO2peak to expend 75% of the caloric content of the HFM in sessions randomized in order. In exercise + HFM (EX+HFM), subjects performed exercise at a heart rate of 65% VO2peak to expend 75% of the caloric 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±15.9% 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 age. Supported by 4-V A grant

**May 29 9:30 AM - 9:50 AM**
**Unusual Wrist Injury Presentation in a Football Player**
Hamad Saleemi, Jill Sadoski. UHS Sports Medicine, Vestal, NY. (Sponsor: James Dunlap, FACSM)
Email: hamadsaleemi@gmail.com
(No relevant relationships reported)

**HISTORY:** 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 four 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 strain, Watson’s, and Finkelstein’s were equivocal. Sensation to light touch was intact. Radial 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 ulna 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.

**May 29 9:50 AM - 10:10 AM**
**Forearm Pain in a High School Weightlifter**
Matthew Seveson, Karen Newcomer, FACSM, David Sorna. Mayo Clinic, Rochester, MN. Email: matthewseveson@gmail.com
(No relevant relationships reported)

**HISTORY:** 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 moderate tenderness approximately at the junction of the proximal to mid-one third of the right ulna. There was very mild tenderness over the proximal extensor tendons and muscle bellies on the right forearm. He had subtle pain over the ulna with resisted elbow flexion but otherwise normal, pain free range of motion and full strength in the right upper limb. Reflexes and sensation were normal. **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
MRT of right forearm revealed isolated partial tear of the distal radius.

FINAL WORKING DIAGNOSIS:
Lunate fracture

TREATMENT AND OUTCOMES:
1. Rest from all activities
2. Modalities include ice, heat, and ultrasound
3. Activity restriction and physical therapy
4. Follow-up x-rays to monitor fracture healing

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

**WEDNESDAY, MAY 29, 2019**

**Elbow Pain in an Adolescent Pitcher**

Nicholas C. Canzanello, Brittany J. Moore, Karen L. Newcomer, FACS, Mayo Clinic, Rochester, MN. (Sponsor: Dr. Karen Newcomer, FACS)  
(cananzanello.nicholas@mayo.edu)  
(No relevant relationships reported)

**HISTORY:**
11-year-old male high school baseball player with a history of elbow pain following a fall on an outstretched arm. The patient was seen immediately following the injury.

**PHYSICAL EXAM:**
- Pain with resisted pronation and supination
- Limited elbow flexion and extension

**DIFFERENTIAL DIAGNOSIS:**
1. Olecranon bursitis
2. Osteochondritis dissecans
3. Lateral epicondylitis
4. Medial collateral ligament sprain
5. Radial nerve palsy

**TESTS AND RESULTS:**
- MRI of the right elbow revealed a complete radial head fracture.

**TREATMENT:**
- Immobilization
- Physical therapy

**Patient Outcome:**
The patient was able to return to all activities and declined physical therapy.

**Acute Bilateral Elbow Pain in a College Volleyball Player**

Jonathan Smith, Dennis Khalili-Borna, FACS. Kaiser Permanente Fontana Medical Center, Fontana, CA.  
(jonathan.smith@kp.org)  
(No relevant relationships reported)

**HISTORY:**
19-year-old college volleyball player presented to the athletic training room with a history of bilateral elbow pain following a fall on an outstretched arm.

**PHYSICAL EXAM:**
- Pain with resisted pronation and supination
- Limited range of motion

**DIFFERENTIAL DIAGNOSIS:**
1. Lateral epicondylitis
2. Osteochondritis dissecans

**TESTS AND RESULTS:**
- MRI of the bilateral elbows revealed complete radial head fractures.

**TREATMENT:**
- Immobilization
- Physical therapy

**Patient Outcome:**
The patient was able to return to all activities and declined physical therapy.

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

**WEDNESDAY, MAY 29, 2019**

**Acute Bilateral Elbow Pain in a College Volleyball Player**

Jonathan Smith, Dennis Khalili-Borna, FACS. Kaiser Permanente Fontana Medical Center, Fontana, CA.  
(jonathan.smith@kp.org)  
(No relevant relationships reported)

**HISTORY:**
19-year-old college volleyball player presented to the athletic training room with a history of bilateral elbow pain following a fall on an outstretched arm.

**PHYSICAL EXAM:**
- Pain with resisted pronation and supination
- Limited range of motion

**DIFFERENTIAL DIAGNOSIS:**
1. Lateral epicondylitis
2. Osteochondritis dissecans

**TESTS AND RESULTS:**
- MRI of the bilateral elbows revealed complete radial head fractures.

**TREATMENT:**
- Immobilization
- Physical therapy

**Patient Outcome:**
The patient was able to return to all activities and declined physical therapy.

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

**WEDNESDAY, MAY 29, 2019**

**Acute Bilateral Elbow Pain in a College Volleyball Player**

Jonathan Smith, Dennis Khalili-Borna, FACS. Kaiser Permanente Fontana Medical Center, Fontana, CA.  
(jonathan.smith@kp.org)  
(No relevant relationships reported)

**HISTORY:**
19-year-old college volleyball player presented to the athletic training room with a history of bilateral elbow pain following a fall on an outstretched arm.

**PHYSICAL EXAM:**
- Pain with resisted pronation and supination
- Limited range of motion

**DIFFERENTIAL DIAGNOSIS:**
1. Lateral epicondylitis
2. Osteochondritis dissecans

**TESTS AND RESULTS:**
- MRI of the bilateral elbows revealed complete radial head fractures.

**TREATMENT:**
- Immobilization
- Physical therapy

**Patient Outcome:**
The patient was able to return to all activities and declined physical therapy.

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

**WEDNESDAY, MAY 29, 2019**

**Acute Bilateral Elbow Pain in a College Volleyball Player**

Jonathan Smith, Dennis Khalili-Borna, FACS. Kaiser Permanente Fontana Medical Center, Fontana, CA.  
(jonathan.smith@kp.org)  
(No relevant relationships reported)

**HISTORY:**
19-year-old college volleyball player presented to the athletic training room with a history of bilateral elbow pain following a fall on an outstretched arm.

**PHYSICAL EXAM:**
- Pain with resisted pronation and supination
- Limited range of motion

**DIFFERENTIAL DIAGNOSIS:**
1. Lateral epicondylitis
2. Osteochondritis dissecans

**TESTS AND RESULTS:**
- MRI of the bilateral elbows revealed complete radial head fractures.

**TREATMENT:**
- Immobilization
- Physical therapy

**Patient Outcome:**
The patient was able to return to all activities and declined physical therapy.
MANAGEMENT OF A 58-YEAR OLD CROSSFIT ATHLETE WITH ELBOW PAIN USING MYERS FASCIAL LINES

M. L. Pfeffer, DC, ATC, Voodoo Chiropractic, Nashville, TN

ABSTRACT

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

EXAM: The patient was afebrile, well-appearing. Examination of the right upper extremity revealed limited extension secondary to pain at the elbow. He denied any related injuries.

TEST AND RESULTS:

1.Quadriceps strain
2.Myositis ossificans
3.Quadriceps hematoma
4.Lipoma
5.Occult tumor

FINAL/WORKING DIAGNOSIS: Elbow pain by treating the contralateral hip region

Thigh Pain In A Multi-sport Youth Athlete

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

Email: aloiya.earl@gmail.com

(No relevant relationships reported)

The patient was a 14-year-old adolescent multisport athlete (No relevant relationships reported) with a history of multiple years of participation in various sports. He presented with left thigh pain that 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 had not had 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-induced stress fracture of his left femoral neck and treated conservatively. EXAM: Afabrile. 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 AIIS. 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.

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 pain, 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.

Authors:

M. L. Pfeffer, DC, ATC, Voodoo Chiropractic, Nashville, TN

Email: drmegan13@gmail.com

(No relevant relationships reported)

Atraumatic Left Thigh Mass In An Adolescent Multi-sport Athlete

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

Email: mrriederer@med.umich.edu

(No relevant relationships reported)

Atraumatic left thigh mass in an adolescent multisport athlete (No relevant relationships reported) Mark F. Riederer, C.S. Mott Children’s Hospital/University of Michigan, Ann Arbor, MI

HISTORY: A 14-year-old adolescent volleyball, baseball, and soccer athlete presents for evaluation of a two month history of left mid-thigh tightness, discomfort and bulge.

Upon multiple attempts to elicit an injury mechanism, there was no single, discrete injury that he can recall. He experiences some tightness when running. He denies feeling weak in the hip or knee. He denies any bruising. He can feel a hard mass in the location of his symptoms.

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 fluctuation. 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. Occult tumor

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 cuneocaudal 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.

Authors:

Mark Riederer, C.S. Mott Children’s Hospital/University of Michigan, Ann Arbor, MI.
**Thigh Pain in a Baseball Player**

Valerie Rygiel, Hallie Labrador. NorthShore/University of Chicago, Chicago, IL. (Sponsor: Carrie A. Jaworski, FACSM)

**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 nontender to palpation but protruded with resisted knee extension. The remainder of the quadriceps muscle belly was nontender. 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:**
- XRAY Right Femur: No acute fracture
- MRI Right Femur w/wo 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.

---

**Hamstring Pain - Biker**

Kathleen Shaughnessy, Sean M. Harris. Memorial Hermann, Houston, TX.

**HISTORY:** A 53-year-old male reports to physical therapy with L posterolateral thigh pain. Three years prior, pt’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 right hip with small internal foci of hemorrhage/debris, and peripheral rim enhancement or soft tissue abnormalities. MRI of the right lower extremity showed a heterogeneous fluid collection measuring 22 x 4 x 6 cm (H W D 5, 28 cc) overlying the right hip with small internal foci of hemorrhage/debris, and peripheral rim enhancement without any areas of internal enhancement.

**FINAL WORKING DIAGNOSIS**
Mored-Lavallée lesion

**TEST AND RESULTS**
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.

---

**Thigh Injury- Lacrosse**

Timothy O. Boone, Jr. University Of Maryland, Baltimore, MD.

**HISTORY:** 20 year old sophomore lacrosse player sustained an acute injury to his right thigh while playing football during his senior year of high school. At that time, patient had reported immediate swelling of the thigh but had a delay in presentation to an outside sports medicine physician for about 3 months. Patient completed medical therapies outside of the recommendation of the sports medicine physician which allowed patient to play lacrosse during his senior year and throughout his freshman season of college. When completing off season workouts during his sophomore year, he complained of focal pain at his right thigh with his right knee giving out.

**PHYSICAL EXAMINATION:** His initial examination revealed a palpable mass over the right thigh with mild tenderness. When presenting 2 years later, his exam revealed no abnormality on inspection but there was a deep, immobile, nontender palpable growth over anterior right femur with full range of motion of the right knee, hip and back.

**DIFFERENTIAL DIAGNOSIS:**
1. Heterotopic Ossification
2. Parosteal osteosarcoma

**TEST AND RESULTS:**
- Right Femur X-ray (1/9/2017): 15.8 x 4.8 cm soft tissue calcification overlying the proximal femoral diaphysis with a 1.6 x 0.6 cm bone island in the distal femur.
- Right Femur X-ray (9/18/2018): 13.9 x 1.8 cm matured soft tissue calcification over the anterior lateral aspect of the femur with 1.3 cm oval sclerotic density in the distal femoral metaphysis
- MRI right thigh (10/2/2018): Mature heterotopic ossification that is contiguous with the anterolateral femoral diaphysis. Heterotopic ossification extends within the vastus intermedius muscle and measures 1.5cm x 6cm x 13cm.

**FINAL WORKING DIAGNOSIS:** Mature heterotopic ossification of the right thigh

**TREATMENT AND OUTCOMES:**
1. Referred for surgical resection of the mass from right thigh due to symptoms, which was completed 1 month after secondary presentation
2. Immediately after surgical intervention, patient was allowed partial right bearing x 1-weeks with knee locked in full extension and will continue Indomethacin for a total of 6 weeks
3. Patient about 7 days after from surgical intervention, patient advised by surgeon to begin work with physical therapy to wean off crutches and out of brace to work on knee ROM and quadriceps activation.
4. Pathology results pending at this time.

**A-25 Clinical Case Slide - Knee I**
**Wednesday, May 29, 2019, 9:30 AM - 11:10 AM**  
**Room: CC-105B**

**Chair:** William W. Dexter, FACSM. Maine Medical Center, Portland, ME.  
(No relevant relationships reported)

**Discussant:** Bryan W. Kaiser Permanente, Rancho Cucamonga, CA.  
(No relevant relationships reported)

**Discussant:** Beverly C. Land, FACSM. US Army Retired, Fairfax, VA.  
(No relevant relationships reported)

**May 29 9:30 AM - 9:50 AM**  
**Knee Pain - Baseball**  
(No relevant relationships reported)

**HISTORY:** A 16 year old high school hockey player and baseball pitcher noticed lateral knee pain and intermittent swelling for about 2 months prior to presentation. He does not recall any trauma or injury. He did have a viral URI and episode of strep lateral knee pain and intermittent swelling for about 2 months prior to presentation.

**PHYSICAL EXAMINATION:**  
Ligamentous testing was normal. He had full active and passive range of motion and full strength. There was tenderness at the lateral joint line and 1+ knee effusion. There was no erythema or warmth at the joint. He had full active and passive range of motion and full strength. Ligamentous testing was normal.

**DIFFERENTIAL DIAGNOSIS:**  
PVNS  
Rheumatologic condition  
Lymphoma/Lymphoma  
Lyme disease  
Tumoral hemarthrosis

**TEST AND RESULTS:**  
Repeat MRI with additional views: Complex loculated effusion, enlarged popliteal lymph nodes, and synovial thickening. There were no structural injuries appreciated.

**PHYSICAL EXAMINATION:** Initial exam in the sports medicine clinic revealed tenderness at the lateral joint line and 1+ knee effusion. There was no erythema or warmth at the joint. He had full active and passive range of motion and full strength. Ligamentous testing was normal.

**DIFFERENTIAL DIAGNOSIS:**  
Juvenile idiopathic arthritis (JIA)  
Osteochondritis dissecans  
Juvenile idiopathic arthritis  
Osteochondritis dissecans  
Pseudo-tumor synovitis  
Chondrolysis  
Pseudo-tumor synovitis  
Chondrolysis

**TREATMENT AND OUTCOMES:**  
1. ACL tear  
2. Meniscus tear  
3. Fracture  
4. Juvenile idiopathic arthritis

**FINAL WORKING DIAGNOSIS:**  
Joint aspiration: 20 cc cloudy yellow synovial fluid; TNC 37,270, Neutrophils 73%  
Cytology: No malignant cells  
ANA: 1:80 homogeneous  
Rheumatoid Factor: Negative  
Lyme: Negative  
ESR: 9  
CRP: 21.8  
CBC: WBC 5.9, Hgb 15.5, Hct 45.4, Pt 287  
FINAL WORKING DIAGNOSIS: Juvenile idiopathic arthritis (JIA)

**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 edema. 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  
6. TREATMENTS AND RESULTS:  
7. 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 abscess. CBC showed WBC 11.7, Hgb 10.5, Hct 32.2, Platelets 576. CRP 9.45mg/dL, ESR 57mm/hr. FINAL WORKING DIAGNOSIS: Osteomyelitis of the left distal femur with intraosseous and subperiosteal abscess TREATMENT AND OUTCOMES: 1. Taken to the OR for incision and drainage 2. Cultures returned positive for oxacillin sensitive staphylococcus aureus. Pediatric infectious disease was consulted. A PICC line was placed and he completed a 6-week course of IV clindamycin. 3. Follow up x-rays taken 1-month post-op were normal 4. A full return to sports is expected.

**HISTORY:** A 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. DPPT 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 stent.  

**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 fasciotoomy 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 and in physical therapy.  
5. 3 months post-injury, EMG for persistent foot drop with severe L peroneal neuropathy at knee.

Abstracts were prepared by the authors and printed as submitted.
History:
17 year old female status post left ACL reconstruction with hamstring autograft presents one week after surgery with pain and swelling over postero 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 postero 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. Hernatoma
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 has had no recurrent symptoms
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 general population.

136 May 29 9:40 AM - 9:50 AM

Patterns Of Change In Proteomic Markers Of Overreaching In Collegiate Swimmers

Amy M. Knab1, David C. Neiman, FACSMB, Arnaud J. Groen3, Artyom Pugachev4, Alexander Rakitko1, Ariel E. Blount4, McKenzie Stevens1, Lola Bulutova1. 1Queen’s University of Charlotte, Charlotte, NC. 2Appalachian State University, Boone, NC. 3ProteQi Biosciences, Berlin, Germany. 4Lomonosov Moscow State University, Moscow, Russian Federation.

METHODS: Thirty-five NCAA Division II swimmers were recruited to the study (male n=19, female n=16; Age 19.1±1.6 y). Every Monday prior to morning practice, athletes provided a blood sample (via fingerpick) using the Volumetric Absorptive ELISA processing system (Dynex Technologies, Chantilly, Virginia). Cardiorespiratory responses were taken from 30 elite American collegiate football players seven weeks before entering the NFL draft, and 15 weeks before entering the NFL draft. RESULTS: Of 74 analytes, results revealed mea 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 examination of molecular expression data indicates that the molecular deficits observed in this study have mechanistic correlations with concussion trajectory and outcome. A more thorough examination of molecular features 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 accelerated forces to the brain may be present.

Supported by WellnessFX

137 May 29 9:50 AM - 10:00 AM

The Association Between Sonographic Metrics of Shoulder Injury and Serum Biomarker Profile in Response to a Hand-Cycling Task

Prakash Jayabalain1, Dhruval Amin2, Hyungtaek Kim1, Julia Fram2, Yen-Sheng Lin1, Jennifer Soo Hoot1. 1Shirley Ryan AbilityLab, Chicago, IL. 2Rosalind Franklin University, Chicago, IL. 3Northwestern Feinberg School of Medicine, Chicago, IL. 4Weill Cornell Medicine, New York, NY.

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 there 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. We decided to investigate whether repetitive short-term hand-cycling would change the expression of BDNF and IGF-1. We also studied the associations between serum markers of molecular status and clinical countermeasures, not only in football, but in any sport in which accelerated forces to the brain may be present.

Supported by WellnessFX

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. Kunces1, John Keenan2, Amanda Carlson-Phillips2, Michael A. Schmidt1, Caleb M. Schmidt1, Zung V. Tran1. 1Thorne, Scottsdale, AZ. 2EXOS, Phoenix, AZ. 3Advanced Pattern Analysis & Countermeasure Group, Boulder, CO. 4MedAware Systems, Inc., Broomfield, CO.

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 there 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, ScienceCell Research laboratories, San Diego, California) and Dynex DS 2 ELISA processing system (Dynex Technologies, Chantilly, Virginia). Cardiorespiratory fitness (VO2 max) was determined using an indirect graded cycle ergometer test until exhaustion. Bilateral maximal isometric leg strength (4L) 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 BDNF and IGF-1 concentrations were 15.20±3.96 ng/ml, 25.0±6.9nmol/L, respectively, while VO2 max was 41.1±8.8ml/kg/min, MVCArm 3394±933N, MVCArm 871±216N, push-ups 281±43 reps/min, sit-ups 35±12 reps/ min, standing long jump 227±2.6cm. BDNF and IGF-1 correlated weakly with each

Supported by WellnessFX

Abstracts were prepared by the authors and printed as submitted.
other (r = −0.146, p = 0.003). Linear regression analysis (adjusted for age, smoking and education) revealed that associations between BDNF and physical fitness were weak for VO_{2,max} (r = −0.077, p = 0.006) and muscle fitness (r = −0.077, p = 0.095). This was also the case for IGF-1. CONCLUSIONS: The associations between peripheral BDNF, IGF-1 and physical fitness components were weak or non-existent at rest in the present cross-sectional design. Thus, it seems that only exercise-induced elevated values of BDNF and IGF-1 may associate with each other and physical fitness components. Therefore, their interactions should be investigated in future studies during acute and/or chronic exercises.

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, VO_{2}\text{max} 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.

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 RMR, T3 and increased cortisol levels were observed. These results indicate that 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.

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 (p = 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.

SUMMARY: Coaches and support staff in elite rugby environment should consider sIgA as a useful predictor for determining the likelihood of players contracting an URTI. This result provides 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. 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 (p = 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: 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 RMR, T3 and increased cortisol levels were observed. These results indicate that 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.

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 (p = 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.

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 (t = 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. No other relationships were evident.

CONCLUSION: The results show that sIgA is a useful predictor for determining the likelihood of players contracting an URTI. This result provides 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.

Week | Testosterone (pmM) | Cortisol (nmM) | SigA | Health Score | Anxiety | Mood
--- | --- | --- | --- | --- | --- | ---
1 Pre | 247.35 (131.34) | 4.49 (1.33) | NA | 7.67 (1.30) | 2.23 (0.83) | 3.08 (0.90)
Post | 229.26 (153.70) | 5.02 (1.07) | 111.84 (88.89) | 1.70 (1.17) | 2.20 (0.94) | 3.21 (0.80)
2 Pre | 202.34 (129.75) | 7.41 (4.84) | NA | 8.00 (1.62) | 2.07 (0.92) | 3.29 (0.83)
Post | 230.44 (151.69) | 6.05 (4.04) | 92.31 (54.18) | 7.83 (1.34) | 1.75 (0.62) | 3.45 (0.82)
3 Pre | 222.37 (165.02) | 5.18 (3.66) | NA | 7.73 (1.67) | 1.87 (0.64) | 3.36 (0.63)
Post | 257.36 (126.07) | 4.43 (1.95) | 81.55 (29.45) | 8.27 (1.27) | 1.55 (0.69) | 3.00 (0.45)
Isolated HRV data from synchronized swimmers may less accurately represent the physiological stress experienced during a training session compared to data from other populations. Future research should focus on validating isolated HRV data from synchronized swimmers to ensure accurate representation of physiological stress during training. This will help in the development of training strategies that are specific to synchronized swimmers and can potentially mitigate the physiological stress experienced by these 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 for the determination of maximal oxygen consumption (VO\textsubscript{2}\text{max}). Over the subsequent 5 days, post-waking measures of supine and standing natural logarithm of the root mean square of successive RR intervals (Ln RMSSD) 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\textsubscript{2}\text{max} (v\text{VO}\textsubscript{2}\text{max}), with two minutes of walking at 4 km·h\textsuperscript{-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 v\text{VO}\textsubscript{2}\text{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\textsubscript{2}\text{max} ranged from 32.5 - 54.4 ml·kg·min\textsuperscript{-1}. Baseline supine LnRMSSD was significantly associated with v\text{VO}\textsubscript{2}\text{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 (3.26 ± 0.67 vs. 3.26 ± 0.87, p = 0.98) LnRMSSD were observed between baseline and 1 day post-interval session. However, individual changes in standing LnRMSSD were significantly associated with their changes in HRex at 60% v\text{VO}\textsubscript{2}(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\textsubscript{2}\text{max} and changes in standing LnRMSSD (r = 0.69, p = 0.056) where those with a decrease in LnRMSSD relative to baseline at 24 h post-interval session tended to have lower VO\textsubscript{2}\text{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.
Heart rate variability (HRV) derives from the intricate relationship of sympathetic and parasympathetic autonomic regulation of heart rate. HR has been utilized as a marker of stress and recovery in traditional sports, however, to date no investigations examined the HRV response to esports. **PURPOSE:** To determine the HRV response during a competitive esports tournament in collegiate club esports competitors.

**METHODS:** Male members of the Ole Miss esports team (n=14; age = 19.8±1.0 years; BMI = 24.1±5.5; esport mean time per week = 19.8±11.6) participated in the study during a live esports tournament. A pre- and post-HRV t-test was used to examine differences between esport games and time durations.

**RESULTS:** R-R intervals during events were significantly lower than pre- and post- (pre: 643.6±43.1±138.54ms; during: 465.71ms ± 68.99ms; post: 516.07ms ± 109.98ms, p < 0.002). HF post competition was significantly decreased compared to pre (325.83ms ± 341.81ms vs. 494.55ms ± 526.84ms, p = 0.046). No significant differences were found for R-RSDPP (pre: 25.67±1.7±4.8ms; during: 15.50±1±13.2ms; post: 23.7±12.8±18.07ms; p = 0.223), RMSSD (pre: 3.0±0.7±0.77ms; during: 2.5±1.3±0.9ms; p = 0.249), or pre and post LF:HF ratio (pre: 4.4±7±2.96 vs. post: 5.5±3±2.6; p = 0.260). This is the first investigation to observe the HRV response to a live sport competition. Future investigations should examine differences between sport games and time durations.
active muscle mass, therefore, isometric leg exercise (ILX) (large muscle mass) may have greater potential than isometric hand grip exercise (IHGX) (small muscle mass) to evoke PEH. **PURPOSE:** To determine the impact of a large of ILX and small (IHGX) muscle mass isometric exercise on post-exercise blood pressure. **METHODS:** Twelve healthy males (23.7 ± 3.5yrs) completed 3 experimental visits (1 IHGX, 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 (IHGX)) 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, IHGX and ILX conditions (p=0.256). Control: baseline 110 ± 7.3 mmHg; average post 106.7 ± 8.6mmHg; IHGX: 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, IHGX 68.6 ± 7.9mmHg, ILX 72.3 ± 7.4mmHg) at any time point in any conditions (p>0.05). However, DBP 15 min post was higher in the ILX (73.4 ± 8.9mmHg) vs. the IHGX (68.3 ± 7.9mmHg) and Control (68.3 ± 8.6mmHg) conditions. **CONCLUSION:** PEH did not occur following a single session of either IHGX 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.

**The Effects Of Long-term Functional Training On VO2max**

Adrian Aron, Heather Cumbea, 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 (HIFT) 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 HIFT participation (Claudino et al., 2016). The purpose of this study was to investigate the VO2max changes of long-term participation in HIFT on subjects with previous training experience. **METHODS:** The subjects were 11 male, 34.7 years ± 8.3, with at least five months of HIFT training prior to enrolling in this study. While frequently participating in HIFT, they underwent two VO2max graded exercise maximal exertion tests using a modified treadmill protocol separated by at least 1 year. Subjects warmed up for 3 minutes at 8 km/h and 0% grade, then started running at 9 km/h with 0.5 km/h increase every 30 seconds until exhaustion. Exhaustion was defined as two of the four criteria: plateau of VO2 (≥ 1.1 and peak heart rate (HR) of at least 90% of age-predicted maximum HR. **RESULTS:** There was no statistically significant changes between pre and post VO2max (-2.02 ± 3.99 ml/kg/min). Similarly, weight (91.06 ± 13.41 vs 91.97 ± 14.07) and RER (-4.70 ± 10.08 vs. -0.76 ± 8.60 mmHg), and aDBP (-4.32 ± 7.93 vs -0.89 ± 6.86 mmHg) did not differ from baseline (Baseline DBP: 110 ± 7.3 mmHg; average post 106.7 ± 8.6mmHg; IHGX: 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, IHGX 68.6 ± 7.9mmHg, ILX 72.3 ± 7.4mmHg) at any time point in any conditions (p>0.05). However, DBP 15 min post was higher in the ILX (73.4 ± 8.9mmHg) vs. the IHGX (68.3 ± 7.9mmHg) and Control (68.3 ± 8.6mmHg) conditions. **CONCLUSION:** PEH did not occur following a single session of either IHGX 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.

**Heart Rate Variability in Elite Rugby Sevens Players**

Andrew A. Flatt1, Daniel Howelle2, Sean Williams2. 1Georgia Southern University, Savannah, GA. 2Rugby Football Union, Twickenham, United Kingdom. (Sponsor: Michael A. Welsch, FACSM2, Mary N. Woessner, FACSM2)

Email: aflatt@georgiasouthern.edu

(No relevant relationships reported)

Rugby sevens tournaments involve up to six matches within two days, are often held over consecutive weekends and frequently involve travel to and from international venues. The intense physical demands of competition, short recovery time between tournaments and the added stress of international travel warrant further investigation into recovery status monitoring among elite players. **PURPOSE:** To retrospectively evaluate heart rate variability and athlete self-report measures of recovery status (ASRM) in response to consecutive domestic and international tournaments among an elite rugby sevens team. **METHODS:** Olympic-level players (n = 10 males) recorded post-waking natural logarithm (Ln) of the root mean square of successive R-R interval differences (RMSSD) and ASRM (subjective ratings of Sleep, Energy, Soreness, Recovery and Mood) throughout a 1-week period prior to the domestic tournament to serve as baseline and daily thereafter until 2-days post-international tournament. Daily LnRMSSD and ASRM parameters were compared with baseline values. Total distance (TD), high speed distance (>18 km/h), and SERS score were compared with pre-expectation. The team advanced to the finals on both occasions. **RESULTS:** Relative to baseline (4.53 ± 0.40), large and moderate effect size reductions in LnRMSSD (p = 0.02 - 0.07) were observed on day-two of the international tournament (4.05 ± 0.36) and one day post-international tournament (4.06 ± 0.59), respectively. Travel to the international tournament (1650 km) involved an early departure time, missed flight connection and a 3 a.m. hotel arrival.
A-38 Free Communication/Poster - Monitoring

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 bras 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 Befree sports bra concurrently with the Polar H7 heart rate monitor (criterion 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 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>
<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>Befree</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, FACSMSM; Jeffrey Montes2, Nathaniel G. Bodell1, Jacob W. Manning2, Mark DeBeliso, FACSMSM; University of Nevada, Las Vegas, Las Vegas, NV; Southern Utah University, Cedar City, UT. (Sponsor: James W Navalta, FACSMSM)

(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). Reliability was determined via Bland-Altman analysis (mean agreement, MAPE, bias, ICC). A mean absolute percentage error (MAPE) lower than 10%, and IntraClass Correlation (ICC) greater than 0.70. Significance was accepted at the p < 0.05 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>
<thead>
<tr>
<th>Number</th>
<th>Device</th>
<th>PACE (%)</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>-145.82, -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 311</td>
</tr>
<tr>
<td>4</td>
<td>Fitbit Surge 2</td>
<td>16.1</td>
<td>0.741, &lt;0.001</td>
<td>-245.27, -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>0.586, 0.033</td>
<td>-240.65, -1522 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±271days). Lower body muscular strength was taken as the estimated 1-repetition maximum (IRM) using the Epley equation for the barbell back squat exercise. Participants must have had more than one estimated IRM to be included in the analysis during the period in which they progressed in a participatory, 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 = 9198.5, p<0.001). The mean±SE baseline IRM 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 (9.1±0.15 kg/month from 6 months to 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.

**218**  
**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  
(No relevant relationships reported)

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 Bra and 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 (7569 datapoints), MAPE = 3.11%, bias = 0.44±11.34 and LOA range ~21.75 to -102.63, and ICC = 0.902 (p<0.001). For the resting condition (549 datapoints), MAPE = 2.07%, bias = 0.08±3.64 and LOA range ~6.69 to 6.86, and ICC = 0.977 (p<0.001). The transition from rest to a walking warm up (1621 datapoints) yielded MAPE = 0.04%, bias =94.38±13.88 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 (2700 datapoints) MAPE = 5.60%, bias = 0.47±18.38 and LOA range ~35.55 to 36.49, and ICC = 0.768 (p<0.001). When the transition from running to walking was considered (2700 datapoints) MAPE = 1.09%, bias =0.11±19.76 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 should be viewed with caution, as heart rate measurements were not all valid in this condition.
PURPOSE: 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 provided higher EE estimates whereas the SWA overestimated 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, RTR (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 were within 90% CIs of the OM in the majority of intervals with the exception of HRmax measured by the FBS for RTR. 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.

PURPOSE: To test the absolute validity and test-retest reliability in two kinds of pram walking settings and help researchers and postnatal 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 rounds of 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 -49.1%. In one hand pushing setting, the average MAPE of step counts for wrist of dominant hand was -52.6%, and -5.1% 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.

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. Methods: wearable devices 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.Expired gases during these intervals were analyzed by two different portable metabolic carts (A&B). Data from approximately 6-9 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 VO2 max 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 ± 360.9 ml/min vs 3609.3 ± 317.5 ml/min) between carts A&B respectively when cycling at 85% 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.
Overall the Garmin fenix 3 HR fitness tracker was found to be reasonably inclined ground contact time. Differences (p < 0.05) were observed in inclined stride watch. There were no differences between the Garmin and the treadmill for flat motion capture system and instrumented treadmill to the data collected by the Garmin analysis was done via a 2-tailed paired t-test comparing the data taken from the data collected by the Garmin fenix 3 HR (Garmin Ltd., Olathe KS).

Methods:

Validation has become more important to drive accuracy in training decisions and as fitness trackers become more available, the need for independent validation has become more important to drive accuracy in training decisions and behavior changes in diverse populations by providing self-monitoring, motivation, and exercise enthusiast or the slow paced walker, ABM may be insufficient for accurate HR of 53.6 m/min, the ABM provides accurate HR measures, however for the novice min (r = .995, SE = .38) there was also a high correlation and low standard error. In addition, there was a high correlation and low standard error between the ABM and EKG, respectively. Only the 53.6 m speed revealed a significant difference in HR of .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), 107.2 (r = .992, SE = 1.31), 160.8 (r = .99, SE = .77), and 214.4 m/min (r = .995, SE = .38) there 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.

Results:

In addition, there was a high correlation and low standard error between the ABM and EKG, respectively. Only the 53.6 m speed revealed a significant difference in HR of ±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), 107.2 (r = .992, SE = 1.31), 160.8 (r = .99, SE = .77), and 214.4 m/min (r = .995, SE = .38) there 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 (%), 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 ± 6.8 kg, 174 ± 5.7 inches, 35.4 ± 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 data into the watch 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 GXT (91.87 ± 6.78 ml/kg/min) and the Garmin estimated value from the outdoor run (53.24 ± 1.41 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 differences (p ≈ .05) 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.

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 ± 6.8 kg, 174 ± 5.7 inches, 35.4 ± 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 data into the watch 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 GXT (91.87 ± 6.78 ml/kg/min) and the Garmin estimated value from the outdoor run (53.24 ± 1.41 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.
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 muscular strength and a decline in perceptual function are listed as causes of falls. As a countermeasure to fall risk the effect of various types of exercise training is implemented to lower the amount of concussions (and total injuries) for athletes in the coming years.

CONCLUSION: VEL appears to be more dramatically affected by age, and the age-related decrement was noted. Thus, VEL may help explain the differences of cognitive functions for VPT between age groups.

Supported by The Naito Research Grant.
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. Contra 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 80º (flexed) and 140º (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 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 and extended 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 synergetic 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 suggested that neuromuscular activation of RF and VM was independent, but activation of VI and VL is dependent, upon knee joint angle, which may, in part, explain joint-angle-specific muscle fatigue.

**Board #36**

**Joint Flexibility is Affected by Muscle Size in Human Planter Flexors**

Keigo Tomoo, Tadashi Suga, Hiromasa Terada, Akinori Nagano, Tadao Isaka. Ritsumeikan University, Kusatsu, Japan. Email: sh020261@ed.ritsumei.ac.jp (No relevant relationships reported)

**PURPOSE:** Only one study has reported that a larger muscle thickness may relate to a lower joint flexibility in the planter flexors (Kubo et al. Eur J Appl Physiol 85, 2001). Muscle volume (VM), compared to muscle thickness, is known to be more appropriate for evaluating muscle size. To further clarify the findings of the previous study, in this study, we examined the relationship between joint flexibility and VM in the planter flexors. METHODS: In study 1, we recruited 96 healthy young males (age: 21.6 ± 1.4 years). The planter flexor muscle thickness was measured using ultrasonography (US). The planter flexor VM was estimated using lower leg length and muscle thickness based on a multiple regression equation, which was reported in previous study (Miyatani et al. Eur J Appl Physiol 91, 2004). In study 2, we recruited 38 healthy young males (age: 21.5 ± 2.2 years). The planter flexor VM was calculated by multiplying the sum of successive cross-sectional areas measured using magnetic resonance imaging (MRI), and included VMs of the soleus (SOL), gastrocnemius medialis (GM), and gastrocnemius lateralis (GL). In both studies, to evaluate plantar flexor flexiblity, dorsiﬂexion angle (DAN) and plantar flexor passive stiffness were measured using a dynamometer system. The dorsiﬂexion ROM was deﬁned as dorsiﬂexion angle (i.e., end-ROM) which was reached by maximal effort during active dorsiﬂexion. The plantar ﬂexor stiffness was calculated from the linear slope of the torque-angle curve between 10º and 40º dorsiflexor angles during passive dorsiﬂexion. In study 1, US-estimated planter flexor VM was signiﬁcantly correlated with dorsiﬂexion ROM (r = 0.431, P < 0.001) and planter ﬂexor stiffness (r = 0.474, P < 0.001). In study 2, MRI-measured plantar flexor VM was signiﬁcantly correlated with dorsiﬂexion ROM (r = 0.484, P < 0.002) and plantar ﬂexor stiffness (r = 0.592, P < 0.001). Furthermore, all three VMs among plantar ﬂexors were signiﬁcantly correlated with dorsiﬂexion ROM (r = 0.481, P < 0.002 for SOL, r = 0.436, P = 0.027 for GM; r = 0.432, P = 0.007 for GL) and plantar ﬂexor stiffness (r = 0.559, P < 0.001 for SOL, r = 0.502, P = 0.001 for GM, r = 0.510, P = 0.001 for GL). CONCLUSION: The present ﬁndings suggest that joint ﬂexibility of planter ﬂexors is affected by their VMs in healthy young males.
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 creatinine kinase (CK) in the bloodstream.

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

**Methods:** ten male college students (age: 20.6 ± 1.8 years, body mass: 75.9 ± 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. The normality of the sample data was verified using the Shapiro-Wilk test and Pearson’s correlation was applied between peak CK and significance level of 5%.

**Results:** There was a significant correlation (p = 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.

The shoulder joint is naturally instable because of anatomic structure, and depends of passive and active elements, ligaments and muscle, respectively, for proper stability. The shoulder joint is naturally instable because of anatomic structure, and depends of passive and active elements, ligaments and muscle, respectively, for proper stability. The shoulder joint is naturally instable because of anatomic structure, and depends of passive and active elements, ligaments and muscle, respectively, for proper stability. The shoulder joint is naturally instable because of anatomic structure, and depends of passive and active elements, ligaments and muscle, respectively, for proper stability. The shoulder joint is naturally instable because of anatomic structure, and depends of passive and active elements, ligaments and muscle, respectively, for proper stability. The shoulder joint is naturally instable because of anatomic structure, and depends of passive and active elements, ligaments and muscle, respectively, for proper stability.

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

**Methods:** ten male college students (age: 20.6 ± 1.8 years, body mass: 75.9 ± 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. The normality of the sample data was verified using the Shapiro-Wilk test and Pearson’s correlation was applied between peak CK and significance level of 5%.

**Results:** There was a significant correlation (p = 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 ± 5 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 probe. 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 = 1098.55 ± 242.10 W; CSA = 10.69 ± 2.47 cm²) and middle-aged (Pmax = 1958.20 ± 341.87 W; CSA = 18.05 ± 4.24 cm²) and the middle-aged compared to the old (Pmax = 0.001; CSA = 0.003). 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 (r = 0.830; P < 0.001) and a significant negative relationship between Pmax and EI (r = −0.442; P = 0.013). CONCLUSION: 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 perhaps 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.

Rapid contractile measures such as rate of velocity (RVD), torque (RTD) and power (RPD) development dramatically decrease with age, but have rarely been concurrently investigated. Further, few studies have examined the relationship between these parameters and functional performance. PURPOSE: To compare rapid contractile parameters of the knee extensors in middle-aged and older males, and examine correlates of 5-chair rise (5CR) performance. METHODS: As part of a larger ongoing investigation, twelve healthy untrained, middle-aged (n = 6, age = 46 ± 2.90 yrs) and older (n = 6, age = 69 ± 3.10 yrs) males completed a familiarization visit followed by one testing visit. Using a Biodex System 4 dynamometer, participants performed three maximal voluntary isometric contractions of the right knee extensors followed by three maximal isotonic contractions at 40% of isometric peak torque. Participants were instructed to “kick out as hard and fast as possible” prior to each contraction. The torque and velocity signals were acquired and the power curve was derived as the linear slope of the velocity- and power-time curve, respectively. RTD was calculated for the first 50 ms of the isometric-torque time curve. In addition, 5CR, the time to rise 5 times from a chair as quickly as possible was recorded. Groups were compared with independent samples t-tests, while Pearson correlation coefficients were used to examine relationships between age, RVD, RP0, RTD, and 5CR. RESULTS: RVD (32.15%; p = 0.004) and RPD (53.27%; p = 0.03) were decreased in older males, but not RTD (p = 0.497). In addition, only RVD was correlated with 5CR (r = −0.588; p = 0.044). CONCLUSIONS: While preliminary, these data suggest that dynamic, rapid contractile measures are preferentially affected by age as compared to RTD, and only RVD was related to 5CR performance.

Purpose. The forward lunge is a common exercise used in strength training and rehabilitation to improve lower extremity strength. In other lower extremity exercises, fatigue from high repetitions has been shown to alter biomechanics and increase injury risk. Moreover, fatigue responses appear to be gender specific. 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 fatigue. 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. A 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 fatigue × gender 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.

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 (CMJs 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 1RM combining 55% of IRM using weight-plate and 29.7± 2.04% of the athlete’s IRM in fully erect position (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 potentiation 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 height at 4-, 6-, and 8-minute postCMJs. 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.

Knee Extensor Torque Is Increased By Far-Infrared Emitting Fabric
Manoel Silva¹, Antonio C. Morares¹, João Barbieri², Renato Barroso¹, Gabriel Figueiredo¹, Leonardo Motta¹, Rômulo Bertuzzi², Arthur Gáspari². ¹University of Campinas, Campinas, Brazil. ²University of São Paulo, São Paulo, Brazil.

Far-infrared (FIR) emitting materials can increase the availability of nitric oxide and calcium in cell culture, and delay fatigue during ex vivo skeletal muscle contractions. However, FIR effects on humans' neuromuscular performance remains unknown.

Purpose: To verify the effects of FIR emitting fabric on knee extensors torque and electromyography activity.

Methods: Fourteen healthy strength trained men (24.3 ± 4 years; 82.8 ± 11.3 kg; 176.3 ± 4.2 cm, 7.3 ± 2.9 years of training experience) participated in one familiarization and two experimental sessions. Experimental sessions occurred two weeks apart and after 96 hours of continuous FIR or Placebo fabric usage, in a randomized, crossover, double-blind, placebo-controlled design study. Isometric and dynamic torques were assessed using isokinetic dynamometer. The best result out of 3 maximum ballistic knee extension contractions (MBC) was recorded pre- and post-dynamic test. Dynamic test was composed by 30 maximum repetitions of knee flexion and extension at 180°/s. Peak torque (PT) of each repetition, total work (TW) and fatigue index (FI) of knee extensors were recorded. The mean RMS was calculated from electromyography activity records of superficial quadriceps muscles. Mean quadriceps temperature was assessed pre-protocol with a thermal camera.

Results: One-way repeated measures ANOV A indicated a significant effect of position (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 potentiation stimulus.

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.
Board #50  May 29 11:00 AM - 12:30 PM Evidence Of A Ceiling Effect For Training Volume In Muscle Hypertrophy And Strength In Trained Men Matheus Barbalho¹, Victor Silveira Coswig¹, James Steele³, James P. Fisher¹, Jurgen Giessing¹, Paulo Gentili.¹ Federal University of Goiás, Goiânia, Brazil. ¹Federal University of Pará, Castanhal, Brazil. ²Southampton Solent University, Southampton, United Kingdom. ³University of Koblenz-Landau, Landau, Germany. (No relevant relationships reported)

Purpose: To compare the effects of different resistance training (RT) volumes on muscle performance and hypertrophy in trained men.

Methods: The study included 37 volunteers that performed RT for 24 weeks and were divided into groups that performed five (G5), 10 (G10), 15 (G15) and 20 (G20) sets per muscle group per week. Ten repetition maximum (10RM) tests were performed for the bench 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 (mid) 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.

Board #51  May 29 11:00 AM - 12:30 PM Effects Of An 8-week Mixed-methods Strength Training On Maximal Strength Of Weightlifting Athletes. Gianpiero Greco, Francesco Camporeale, Francesco Fischetti. University of Study of Bari, Bari, Italy. Email: gianpierogreco@hotmail.it (No relevant relationships reported)

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 strength training of a Mixed-methods Strength Training (MST) or Pyramidal Training (PT) on maximal strength performance in weightlifting athletes.

METHODS: Study participants (20 men, age: 23.9 ± 2.05 years, body mass: 75.6 ± 21.2 kg) 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 pyramidal training alone (90-sec rest) for three sessions per week. Both groups trained for 8 weeks using a 3:1 loading structure. Measures pre-intervention and post-intervention included one-repetition maximum [1-RM] bench press, barbell deadlifts, lat pull-down, and standing barbell military press. Repeated-measures ANOVA and a paired t-test were used to assess differences in outcome variables across conditions (p < 0.05). RESULTS: The MST group showed significantly greater improvements than PT in bench press (13.1 ± 0.91 vs. 13.7 ± 0.47 kg, p < 0.0001), barbell deadlifts (19.3 ± 1.27 vs. 5.3 ± 0.97 kg, p < 0.0001), lat pull-down (17.2 ± 1.72 vs. 2.8 ± 0.79 kg, p < 0.0001), and standing barbell military press (13.1 ± 1.54 vs. 1.9 ± 0.59 kg, p < 0.0001). CONCLUSIONS: These findings suggest that a Mixed-Methods Strength Training characterized by two sessions with maximal loads interspersed with a pyramidal training session may be more effective than the pyramidal training alone for enhancing the maximal strength in weightlifting athletes. It could therefore be considered a valid and motivating alternative to the traditional strength training methods.

Board #52  May 29 11:00 AM - 12:30 PM Temporary Increasing in Muscle Thickness and Upper Arm Circumference Immediately After Resistance Exercise Masahiro Goto¹, Yoshihiro Yamashina¹, Yousuke Yamato¹, Hiroto Honda¹, Hiroshi Sakai¹, Shigeru Terada¹, Takafumi Hamaoka¹, Aino University, Osaka, Japan. Tokyo Medical University, Tokyo, Japan. Email: m-goto@pt-aino.ac.jp (No relevant relationships reported)

Temporary Increasing in Muscle Thickness and Upper Arm Circumference Immediately After Resistance Exercise Masahiro Goto, Yoshihiro Yamashina, Yousuke Yamato, Hiroto Honda, Hiroshi Sakai, Shigeru Terada, and Takafumi Hamaoka. Aino University, Osaka Japan, Tokyo Medical University, Tokyo Japan. Temporary muscle thickness and limb circumference increased immediately after resistance exercise are strongly affected by reactive hyperemia, which is different from muscle hypertrophy induced by resistance exercise. This study is necessary for determining condition of measuring muscle cross sectional area as a muscle hypertrophic effect induced by resistance exercise. Furthermore, this is useful for bodybuilding and physique contexts where muscle volume affects results.

PURPOSE: The purpose of this study was to investigate the duration of temporary increasing in muscle thickness and upper arm circumference induced by resistance exercise in the triceps brachii for resistance-trained and untrained subjects.

METHODS: Four kinds of resistance exercises were performed on 28 healthy adult males (26 ± 3 yrs), resistance-trained (n = 14) and untrained (n = 14). The extracellular water content, muscle thickness, upper arm circumference, oxygenated hemoglobin (oxy-Hb) were examined before exercise, within 5-minute, 30-minute, and 60-minute after exercise respectively. Two-way analysis of variance was used to confirm acute effects.

RESULTS: The extracellular water content of upper arm (+0.22 L), triceps brachii muscle thickness (+ 3 mm), upper arm circumference (+2 cm) increased only in the resistance-trained subjects 5-minute after exercise compared with before exercise. However, there was no difference between before exercise and 30-minute after exercise values. The oxy-Hb increased immediately after exercise in both resistance-trained (> 42%) and untrained subjects (> 33%), but no significant difference was observed between resistance-trained and untrained subjects. CONCLUSION: Temporary increasing in muscle thickness and upper arm circumference within 5minute after resistance exercise was a response occurred only in the resistance-trained subjects, and it was confirmed that the response disappeared within 30-minute.

Board #53  May 29 11:00 AM - 12:30 PM The Effect Of Strength Training On Physical Performance In Adolescent Female Soccer Players ELENA PARDOS MAINER, LUCIA SAGARRA ROMERO, OLIVER GONZALO SKOK. Universidad San Jorge, Zaragoza, Spain, Villanueva de Gállego, Zaragoza, Spain. Email: emainier13@gmail.com (No relevant relationships reported)

Strength training (ST) is amongst the most frequently used strategies to improve soccer performance and it has been used to obtain significant increases in the levels of maximum strength and muscle hypertrophy. Therefore, using appropriate ST programs could enhance several explosive actions that are crucial to the outcome of the game. ST is a method that has shown to be effective in male soccer players, but the scarce studies of ST on female soccer players must also be pointed out. PURPOSE: To examine the effects of ST on physical performance after a 12-week training period in adolescent female soccer players.

METHODS: 37 adolescent female soccer players from Spanish soccer team (age: 16±1.1 years; height: 159.7±7.1 cm; body mass: 55.5±7.1 kg) were randomly assigned to an experimental (EG, n = 19) or a control group (CG, n = 18). All players underwent a regular soccer training 3 times per week. Participants in the EG received ST program (12 weeks, 2 times per week, 20 min per session). The ST program included lower limb strength and core muscle. The players were tested at the beginning and the end of the intervention on bilateral countermovement jump (CMJ) test, unilateral CMJ test, 40m sprint, 180º COD test and V-cut test. Paired t-test was conducted to detect significant differences between the pre and post-tests in both groups. Statistical significant was inferred from p<0.05. RESULTS: EG made significantly greater improvements than CG did on CMJ (GE pre 23.5±3.10cm vs post 25.6±3.6cm, p<0.001; GC pre 23.3±3.7cm vs post 23.9±4.5cm), right CMJ (GE pre 12.9±1.95cm vs post 14.3±2.44cm, p<0.005; GC pre 12.1±1.77cm vs post 13.1±2.63cm), 40m sprint (GE pre 6.51±0.26s vs post 6.24±0.25s, p<0.01; GC pre 6.24±0.25s vs post 6.29±0.25s), left 180º COD (GE pre 2.96±0.11s vs post 2.89±0.18s, p<0.05; GC pre 2.93±0.15s vs post 2.91±0.11s) and V-cut (GE pre 8.05±0.38s vs post 7.81±0.27s, p<0.01; GC pre 7.98±0.38s vs post 7.97±0.39s). CONCLUSIONS: Twelve weeks ST could improve bilateral and unilateral muscular power, speed and...
Aging imposes a gradual deterioration of brain function and cognitive abilities, which hinder older adults' daily activities and limit their independence and safety. There is a 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 healthy older adults. METHODS: Participants were randomly assigned to one of three possible groups (n = 15 in each group): a) high-intensity RT: 3 sets, 8 repetitions at 70% 1-RM, 2-min rest between sets (G1), b) low-intensity RT: 4 sets, 14 repetitions at 30% 1-RM, 2-min rest between sets (G2), or c) Inactive control (G3). Before and after the experimental intervention, participants completed a comprehensive battery of cognitive tests assessing processing speed, visuospatial processing, executive function, and cognitive control, working memory and immediate memory. Following a familiarization phase to RT exercises, participants in G1 and G2 performed 1-RM needed to define the exercise intensity. The intervention session consisted of the cognitive battery tests and five-minute warm-up on a stationary bicycle, followed by the exercise training protocol (knee extension, chest press, knee flexion, seated row, leg press, biceps curl). Immediately after finishing, the cognitive post-test was applied. The control group remained seated on a chair for 30-min and then performed the post-test. A two-way (group x measurement) ANCOVA was carried out using education level as a covariate. RESULTS: Significant improvements were found on visuospatial processing in G1 (Pre = 61.6 ± 2.1 vs. Post = 69.4 ± 2.4 pts.; CI95% = 4.8, 11.4; p = 0.001) and G2 (Pre = 62.4 ± 2.2 vs. Post = 67.0 ± 2.5 pts.; CI95% = 1.2, 8.1; p = 0.009). Processing speed, executive function and cognitive control, working memory and immediate memory were unchanged by acute exercise or rest. CONCLUSION: Acute RT enhanced or maintained cognitive performance in older adults. Repetitive acute bouts of RT might chronically improve or retard the aging effects on cognition in older adults.
A three-dimensional assessment of push-pull power ratios across various loads

Gianna D. Maragliano1, J. Mark VanNess2, Maggie E. Bristow3, Nathaniel J. Holmgren1, Joseph Arbello4, David J. Jensen1

University of the Pacific, Stockton, CA. 1CSU Chico, Chico, CA.
Email: g_maragliano@u.pacific.edu

(No relevant relationships reported)

Capturing a true assessment of power in upper body motions 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 greatest push and pull exercises across various loads. METHODS: 64 subjects performed a total of 1,145 sets on Protesus (Boston Biomotion, Inc.): 370 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 ± 103.0 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 ± 210.8. Similarly, for mean power, at 5lb, subjects achieved 26.8 ± 10.2 while at 25lb, it was 335.1 ± 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 25lb, it was 0.98:1. At 15lb, 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 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.

Board #60
May 29 11:00 AM - 12:30 PM
A Three-Dimensional Assessment of Push-Pull Power Ratios Across Various Loads

Gianna D. Maragliano1, J. Mark VanNess2, Maggie E. Bristow3, Nathaniel J. Holmgren1, Joseph Arbello4, David J. Jensen1

University of the Pacific, Stockton, CA. 1CSU Chico, Chico, CA.
Email: g_maragliano@u.pacific.edu

(No relevant relationships reported)
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.

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 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±1.04; body mass: 87.8±13.3 kg; Group 2 (Local Muscular Endurance): n=12; age: 21.1±1.10; 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 1-RM HPC. RESULTS: Our results showed significant differences among the power output and the percentages of the BM. Briefly, 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.

PRIORITY: In powerlifting, each lifter is given 3 attempts to contest the barbell squat, bench press, 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 12 lifts successfully were included in the analysis. A Welch’s t-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 (females: 4.33±2.01%; males: 3.75±1.84%). However, relative attempt progression was greater for females compared to males between attempt 1 and 2 on BP (6.50±2.10% vs 5.35±2.11%, p=0.008) 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 key factor for success in sports is the athletes’ capacity of producing mechanical power output. Implementation of weightlifting derivatives such as the hang power clean (HPC) in training programs have been utilized and substantial increases in muscle power are reached when the athletes train at the load at which they produce the peak power output, also defined as the optimal load. The optimal load is commonly determined as a relative percentage of the maximum weight one can lift a single time during a specific exercise, defined as the 1-repetition maximum (1RM) for that exercise. Given the disadvantages of 1RM tests utilization such as risk of injuries and excessive amount of time invested, it has become apparent the need for alternative strategies for the optimal load identification. PURPOSE: To estimate the optimal load of the HPC from body mass (BM) percentages. METHODS: Nine healthy young men (age: 21.3±1.8, height: 174.6±6.8 cm, weight: 80.6±6.2 kg, 1RM HPC: 90.8±9.6 kg, 1RM to weight ratio: 1.13±0.07) participated in this study. Subjects performed a 1RM in the HPC in the first session and during the second session the peak power was calculated across loads of 30, 40, 50, 60, 70, 80, and 90% of their BM in the HPC in a randomized order. RESULTS: Our results showed significant differences among the power output and the percentages of the BM. Briefly, power output at 30% of the BM was similar in relation to 40% and 50% of the BM, whilst significantly lower than 60%, 70%, 80% and 90% of the BM. For 60% of the BM, similar result it was observed only 60% of the BM, while lower power output it was observed in comparison to 70%, 80% and 90% of the BM. For 80% of the BM, lower
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 difference 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 trunk 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.

The search of non-invasive and easy-to-monitor variables is essential to improve the athlete performance. The assessment of neuromuscular characteristics, such as velocity, with a linear position transducer (LPT), allows training optimization and just like heart rate variability (HRV) guarantees an adequate athlete monitoring. The autonomic nervous system (ANS) and Sympathetic nervous system (SNS) exert an important influence on skeletal muscle functions. However, there are no studies that correlate the activity of SNS with current technologies such as LPT to calculate several neuromuscular performance variables. Otherwise, the results of HRV assessment could be related to a TLP strength test performance. 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 +/-2.62, Weight 60.9 kg +/-4.4), we analyzed HRV during standing, we also evaluated the velocity of a half squat movement with a LPT, 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/s/s) (R²=0.31), 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.

The search of non-invasive and easy-to-monitor variables is essential to improve the athlete performance. The assessment of neuromuscular characteristics, such as velocity, with a linear position transducer (LPT), allows training optimization and just like heart rate variability (HRV) guarantees an adequate athlete monitoring. The autonomic nervous system (ANS) and Sympathetic nervous system (SNS) exert an important influence on skeletal muscle functions. However, there are no studies that correlate the activity of SNS with current technologies such as LPT to calculate several neuromuscular performance variables. Otherwise, the results of HRV assessment could be related to a TLP strength test performance. 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 +/-2.62, Weight 60.9 kg +/-4.4), we analyzed HRV during standing, we also evaluated the velocity of a half squat movement with a LPT, 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/s/s) (R²=0.31), 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.

The search of non-invasive and easy-to-monitor variables is essential to improve the athlete performance. The assessment of neuromuscular characteristics, such as velocity, with a linear position transducer (LPT), allows training optimization and just like heart rate variability (HRV) guarantees an adequate athlete monitoring. The autonomic nervous system (ANS) and Sympathetic nervous system (SNS) exert an important influence on skeletal muscle functions. However, there are no studies that correlate the activity of SNS with current technologies such as LPT to calculate several neuromuscular performance variables. Otherwise, the results of HRV assessment could be related to a TLP strength test performance. 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 +/-2.62, Weight 60.9 kg +/-4.4), we analyzed HRV during standing, we also evaluated the velocity of a half squat movement with a LPT, 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/s/s) (R²=0.31), 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.
Pre-stretch augmentation (PAI) and reactive strength (RSI) indices have been used to assess the stretch-shortening cycle (SSC) contribution to vertical jumping. SSC activation is also a part of many upper extremity (UE) activities, however quantification of SCC contribution to UE function largely remains unknown. Furthermore, based on differences in UE muscle-tendon properties, the SSC effect is likely different between men and women.

**PURPOSE:** To assess the reliability of velocities recorded with the GymAware linear position transducer (LTP) during the squat and bench press exercises. METHODS: Thirteen resistance-trained men (age: 21.7±0.4 years; height: 1.74±0.07 m; mass: 82.9±9.5 kg; 1-repetition maximum (IRM) back squat: 149.9±20.7 kg; bench IRM: 114.8±18.5 kg) performed three trials of squat and bench press using the following percentages of IRM: 20, 30, 40, 50, 60, 70, 80%. The order of the loads was counterbalanced across the participants. The mean vertical velocity of the barbell in the concentric phase of each repetition was recorded using a 3-D motion analysis system (Vicon; 200 Hz) and the GymAware LTP. Reliability of the GymAware was determined using intraclass correlations (ICC) and coefficients of variance (CV%). RESULTS: The GymAware showed high inter-session 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: 3.6%-5.8%; bench press: 4.9%-7.4%). CONCLUSION: The GymAware LTP shows high inter-session reliability for recorded velocities during the squat and bench press exercises.

---

**Board #73**

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

**Muscle Excitation During A Weighted And Unweighted Supine Bridge (a Pilot Study)**

Kelsey Lewis1, Wenhui Mao2, Sydni Wilhoite1, Li Li, FACSM1.

1 Georgia Southern University, Statesboro, GA. 2 Nanjing Normal University, Nanjing, China. (Sponsor: Li Li, FACSM) Email: kl06040@georgiasouthern.edu

(No relevant relationships reported)

Previous studies have examined the relationship between muscle activities during a single leg bridge (SLB) without including the glutaeus maximus muscle (Gmax). Similarly, few studies have evaluated the influence of additional loading during a SLB.

**PURPOSE:** To examine muscle activation levels of the Gmax, semitendinosus (ST), and the biceps femoris long-head (BFL) during SLB and weighted single leg bridge (wSLB). METHODS: Two recreationally active college students (1 male; 1 female) were recruited for the study and were free of any muscle or orthopedic injuries. Surface electromyography (sEMG) were used to collect muscle activities. Maximal voluntary contractions (MVC) were collected for each muscle group prior to testing. Each participant performed three repetitions of both SLB and wSLB, following a pattern of 60 beats per minute (~2 beats up, ~3 beat hold, and ~2 beats down) which was verified using an electronic metronome. Data was collected and analyzed using a commercially available sEMG package. MVCs of each muscle were used to normalize the observed peak sEMG during the exercise. Peak root mean square (RMS) was obtained for each muscle and the peak RMS in SLB was set to 100% to provide a means of comparison. Burst threshold was defined as 10% of the observed peak value. This value determined the onset and offset of the muscle excitation.

**RESULTS:** There was a 37.0 +/- 1.7 average difference in magnitude between the two exercises. The duration of activity of the Gmax, BFL, and ST during the unweighted trials were 4.0 +/- 1.25 seconds, 3.5 +/- 0.75s and 4.2 +/- 0.45s, respectively. Muscle activity duration remained unchanged in the wSLB in the Gmax and STN. However, there was an increase in BFL activity during the wSLB trials (4.0 +/- 1.25 seconds. 3.5 +/- 0.75s and 4.2 +/- 0.45s, respectively. Muscle activity duration remained unchanged in the wSLB in the Gmax and STN. However, there was an increase in BFL activity during the wSLB trials (4.0 +/- 1.25s). **CONCLUSION:** In the male participant, it was concluded that the main muscle activated during the original single leg bridge and the weighted single leg bridge was BFL. However, for the female participant, the main muscle was the STN. Muscle activation of the hamstring muscles increased as a whole from the unweighted exercises to the weighted exercise. As well as the duration of BFL activity. This study is preliminary and will be conducted at a larger scale in the future to enhance credibility and reliability.

---

**Board #74**

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

**The Influence of Menthol on Joint Range of Motion**

William Staffiere, Jason Gillis, Michelle Varnell, Joseph Gallo, Kevin Silva, Jacob Moriarty. Salem State University, Salem, MA.

Email: staffiere.w@husky.neu.edu

(No relevant relationships reported)

**PURPOSE:** To use the known topical analgesic menthol to explore the influence of one’s perception of muscle tension on joint range of motion (ROM).

**METHODS:** This study received approval from the Salem State University Institutional Review Board. In a familiarization session, 15 participants first completed weight-bearing lunge (WBLT) and active ankle dorsiflexion (AADF) tests (Pre-test) to assess ROM in the soleus-gastrocnemius complex. Participants were always instructed to stretch to a ‘maximal tolerable stretch’. They immediately then completed a 6x60s static stretching routine as for the ankle plantarflexors, and again completed the WBLT and AADF tests (Post-test). These testing conditions established a control (CONTROL). On two separate occasions participants returned to complete the aforementioned pre-tests, immediately after which they had 5ml of a 4 % menthol gel (M) applied to their soleus-gastrocnemius complex on one visit, and on the other visit they had 5ml of a Placebo gel (P) spread over the same area. Participants then...
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 vs. P), and any interaction, with post-hoc testing used to indicate directionality (alpha=.05).

RESULTS: Menthol significantly improved AADF ROM by 2.67 degrees compared to P (p<.001), coinciding with significantly cooler sensations (p=.01) and a loss of thermal comfort (p=.05) with menthol. Similarly, menthol improved WBLT ROM by 2.98 degrees compared to P (p=.01), coinciding with a significant loss of thermal comfort (p=.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 sub-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 comfort categories (Overall Comfort, Genital Sensation, Genital Comfort, Sit Bone Comfort, Buttocks Comfort, Stability on the Saddle, Off Saddle Comfort). The protocol required subjects to complete one week of regular cycling training in each chamois design and were asked to complete the same comfort questionnaire 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 each comfort category 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 each comfort category 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 each comfort category 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 each comfort category of each week.

CONCLUSIONS: There was a significant main effect of Sex on Genital Sensation and Genital Comfort as well as ‘Buttocks Comfort’ (A>B, p<.05). Peak saddle pressures were significantly higher in Chamois B than Chamois A (B=24.5±3.54 vs. A=23.06±3.53, p<.05). There was a significant main effect of Sex on Genital Sensation and Genital Comfort (Males>Females, p<.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.
Cycling is one of the most popular exercises for knee osteoarthritis (OA) or total knee replacement (TKR) rehabilitation. It is known for reducing load to lower extremity joints comparing 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 biocap) 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 moment, peak knee extension moment, and peak knee flexion moment (all p < 0.012). The post hoc comparisons showed that the knee extension moment 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 knee 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 for 20° saddle height (19.9 Nm) was different from 30° and 40° saddle heights (22.6 Nm and 23.6 Nm, respectively). Overall, cycling posture varied significantly between all saddle heights and workrates. There was no significant effect of saddle height or workrate on the knee abduction moment.

**CONCLUSIONS:** Although decreased saddle height increased the knee extension 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 knee 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 for 20° saddle height (19.9 Nm) was different from 30° and 40° saddle heights (22.6 Nm and 23.6 Nm, respectively). Overall, cycling posture varied significantly between all saddle heights and workrates. There was no significant effect of saddle height or workrate on the knee abduction moment.
for either muscle was influenced by wetsuit condition (p<0.05). PD EMG patterns were moderately correlated between conditions (NWS-FSW NWS-SLW FSW-SLW: r=0.65±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.

**Board 82**
May 29 9:30 AM - 11:00 AM
**Comparison Of Torques And Positions Of The Half And Full Golf Swing - A Pilot Study**
Audrey L. Millar, FACSM, Chris Wendt, Dexter Perkins, Justin Sellers. Winston-Salem State University, Winston-Salem, NC. Email: millaral@wssu.edu

(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 handcaps ≤ 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 ± 17.5 years. The highest torques for the full swing were produced for extension of the trail leg (10.32 ± 1.48), 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 full 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 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**
May 29 9:30 AM - 11:00 AM
**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. Email: bed0012@auburn.edu

(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 Awinda inertial motion capture system. Data were then imported into Visual3D where estimated ground reaction force and subsequent leg spring parameters were computed. For each 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 = .023, r² = .58), with pairwise comparisons revealing vertical stiffness on turf 3 (183.6±3.6 kN/m) to be significantly less than on turf 2 (206.6±2.2 kN/m; p = .023) and natural turfgrass (211.6±2.4 kN/m; p < .01). Hopping frequency was not significantly different between surface conditions. 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**
May 29 9:30 AM - 11:00 AM
**Injuries In Lower Legs Related To The Unipodal Dynamic Stabilization**
Alba Lopez1, Rodrigo Argothy1, Jennifer Cubides2, Daniel Cohlen1. Rosario University, Bogota D.C., Colombia. 1Biomechanics Laboratory - Sports Science Center - Codopagos, 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 train 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. PURPOSE: To determine the risk of lower train injury in Colombian military personnel by analyzing the dynamic stability.

METHODS: cross-sectional study in a cohort of 124 cadets. Of the participants in the study 87 (70.2%) were men and 37 women (29.8%), with an average weight of 62 ± 9.2 kg, age 18 ± 1 years, height of 1.70 ± 0.08 meters, which was admitted in the military school in 2017. The measurement of the unipodal dynamic stability was made by using uniaxial force platforms. The variables were measured as a percentage of asymmetry of the dynamic stabilization time (26.24 ± 18.86 %) and percentage of asymmetry of the force peak in the landing (28.59 ± 17.62%).

RESULTS: Of the total number of subjects, 41 presented lesions in the lower limbs during follow-up, corresponding 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 1.155 - 6.37), the difference of the right-left stabilization time (OR 0.66, 95% CI 1.13 - 32.14), the percentage of asymmetry of the stabilization time (OR 1.021, 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 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**
May 29 9:30 AM - 11:00 AM
**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. 1Virginia Commonwealth University, Richmond, VA. 2University of Memphis, Memphis, TN.

(no relevant relationships reported)

Regulatory statistics have been previously used to quantify nonlinear characteristics of gait and infer 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 quantify changes in complexity during running and an incremental running test to max 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, BTS 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, Dunnett’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; A1.1±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).
**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 muscles active. 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 no conditions was always land followed by water. **Results:** 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 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:** AVG (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, BFAV was different for jumps regardless of environment (p<0.05). **Conclusion:** Muscle activity magnitudes appear to not be influenced between environments for CMJ and DJ for any of the four muscles measured.

The relationship between hip extension, 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. **Result:** Greater torque was seen during hip extension at 0 (0.44±0.15Nm/kg*m) and 45 (0.50±0.19Nm/kg*m) degrees of flexion (p<0.001). A significant decrease 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 abduction kinematics at 90 degrees of hip flexion (r=544, p=0.016) compared to 0 (r=-490, p=0.033) and 45 (r=-477, p=0.039) degrees of hip flexion. No significant correlations were seen between squatting kinematics and hip abduction or external rotation torque. **Conclusion:** Testing position 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 subject (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). **Results:** Movement performance was reported 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 peak force. **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, enhance 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.

### 252 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**

Navpyret Kaur, Kunal Bhanot, Germaine Ferreira. University of Saint Augustine for Health Sciences, AUSTIN, TX. (Sponsor: Dr. John Mercer, FACSM)

Email: nkaur@usa.edu

(No relevant relationships reported)

Anterior (A), postero-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 (GMD), 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 statistical differences in EMG of anterior tibialis and vastus medialis between 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 at PL 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 PL (64.15 vs 47.14 %MVIC; P=0.02) directions on the unstable surface and MG in PM (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 GMD, 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.

### 253 Board #91 May 29 9:30 AM - 11:00 AM

**Influence of Turf Surface on Change of Direction Parameters**

Wendi Weimar, Brandi Decoux, Nicholas Moore, Christopher Wilburn. Auburn University, Auburn, AL.

Email: weimawh@auburn.edu

(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, as quickly as possible. A Fitlight® timing tool was used to collect the performance measure of time to complete the task. The segment positions were collected using the Xensor MNV. A 3D motion capture system and the variable angle between sacrum, heel and ground (SHAng) was determined through Visual3D for the plant leg. **RESULTS:** The data from three trials for each participant, for each surface, was included in the statistical analysis. The repeated measures ANOVA for each variable yielded significant differences between surfaces. Pairwise comparisons indicated that change of direction time on AS1 (4.70 ± 0.14 s) was significantly less than on AS3 (4.83 ± 0.28 s; p=0.007) and NS (4.83 ± 0.30 s; p=0.004). In addition, SHAng 5 on NS (39.0 ± 4.7 deg) was significantly larger than on all artificial surfaces (AS1: 35.1 ± 3.8 deg; p=0.041; AS2: 34.9 ± 2.5 deg; p=0.023; AS3: 35.4 ± 3.6 deg; p=0.019). Last, SHAng 10 on NS (38.5 ± 4.5 deg) was significantly larger than on all artificial surfaces (AS1: 35.7 ± 2.9 deg; p=0.024; AS2: 35.7 ± 2.4 deg; p=0.022; AS3: 36.1 ± 2.5 deg; p=0.028). **CONCLUSION:** This project indicates that these participants adopted a different stopping strategy on the natural surface than the artificial surfaces. To mitigate the lower resistance to shear forces offered by natural grass, the participants adopted a more upright body position, presumably increasing the normal force as well as the friction utilized at the foot-to-ground interface. Assuming adequate friction is maintained, a smaller SHAng and thus lower body position will provide for an increase in propulsive forces resulting in a faster change in direction and better performance outcome.

Funded by Shaw Industries Group, Inc.
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, 77.3 ± 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. A one-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=0.05.

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 (R2=0.811, Adj R2=0.656, SSE=1.95, 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.
was different between chokehold techniques \( F=6.20, p=0.012 \). Maximal force conditions were significantly different from the others.

between conditions \( (\alpha=0.05) \). Planned comparisons were performed to assess which for each repetition was used for analysis. Within each condition, the 5 repetitions

x 10cm instrument \( \text{(Loadpad, Novel Electronics USA, St.Paul, MN)} \) secured to the neck portion of the training dummy using elastic bandages. The greatest 1 s average

minute recovery period was required between conditions. The order of conditions in MMA training. A 30 s rest period was required between each repetition, and a 5

Guillotine \( (G) \). Subjects completed 5 repetitions per technique and held each hold for at least 5 s. Each choke was performed on a grappling dummy commonly used

movement of mass distal to the throwing elbow, two segments were included as levels

directions. To evaluate the movement of mass proximal to the throwing elbow, twelve

CoM and whole-body CoM. Two one-way ANOVAs were performed on RMSE position data, segmental and whole-body CoM were computed for body mass

application to assess which conditions were significantly different from the others. RESULTS: Maximal force was different between chokehold techniques \( (F=6.20, p=0.012) \). Maximal force was different between the RNC \( \text{(avg=457.37±220.51N)} \) which produced a higher maximal force than AB chokehold \( \text{(avg=192.73±80.05N)} \) \( (p=0.015) \). No other

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 movements, 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 the throwing elbow. 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 positioned proximal and distal to the throwing elbow. Root Mean Squared Error \( \text{(RMSE)} \) values were computed using time-series position data between each segment CoM and whole-body CoM. Two one-way ANOVAs were performed on RMSE values in the \( x \) (direction of throw), \( y \) (perpendicular to the throw), and \( z \) (vertical) directions. To evaluate the movement of mass proximal to the throwing elbow, twelve body segments were included as levels within a single segment factor. To evaluate the movement of mass distal to the throwing elbow, two segments were included as levels within a single segment factor. RESULTS: Main effects of segment were observed for RMSE in the \( x \), \( y \), and \( z \) directions \( (p<0.001-0.001) \). Trunk RMSE in the \( x \), \( y \), and \( z \) directions \( (x:40.5±7.4 \text{ mm}, y:28.9±5.2 \text{ mm}, z:9.5±4.0 \text{ mm}) \) was significantly
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: 28.9 ± 3.5 mm, y: 22.6 ± 2.3 mm, z: 31.7 ± 1.9 mm) was significantly lower versus the right hand (p = < 0.001 - 0.001).

**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.

**RESULTS:** 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_15, %C was significantly lower during B (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.

**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_15, %C was significantly lower during B (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.

**PURPOSE:** Examine the effect of bracing on lower extremity contributions to the support moment (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_15, %C was significantly lower during B (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.

**Table 1.**

<table>
<thead>
<tr>
<th>Source</th>
<th>Composite</th>
<th>Power</th>
<th>Functional Strength</th>
<th>Dysfunction</th>
<th>Vulnerability</th>
<th>Exercise Readiness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100.0±0.0</td>
<td>100.0±0.0</td>
<td>100.0±0.0</td>
<td>0.0±0.0</td>
<td>0.0±0.0</td>
<td>0.0±0.0</td>
</tr>
<tr>
<td></td>
<td>100.0±0.0</td>
<td>100.0±0.0</td>
<td>100.0±0.0</td>
<td>0.0±0.0</td>
<td>0.0±0.0</td>
<td>0.0±0.0</td>
</tr>
<tr>
<td></td>
<td>100.0±0.0</td>
<td>100.0±0.0</td>
<td>100.0±0.0</td>
<td>0.0±0.0</td>
<td>0.0±0.0</td>
<td>0.0±0.0</td>
</tr>
</tbody>
</table>

**Groin Injury in an Upright Standing Position**

Maria C. Herrera1, Tal Amasy1, Zacharias Papadakis1, Ana Castillo1, Samantha Day1, Noah Padgett2, Barry University, Miami, FL. 2Baylor University, Waco, TX.

Email: maria.herrera5@mymail.barry.edu

**PURPOSE:** The purpose of this study was to examine the test-retest reliability of a markerless motion capture system (MCS) for six performance (PERF) scoring scales using a performance motion analysis protocol (PMA) across multiple visits. METHODS: Healthy, recreationally active men (n=11; 15±3.2 yrs, height=180.3±3.48 cm, weight=80.4±7.3 kg) were screened once a week for 4 weeks using the PMA protocol, consisting of 19 motions. These include shoulder ranges of motions, trunk rotation, five types of squatting motions, single leg balances, and six types of vertical jumps and depth jumps. A three-dimensional markerless MCS using the DARI Motion Software (Scientific Analytics, Lincoln, NE) was used to analyze the kinetic and kinematic data, from which 192 variables were calculated to determine the PERF scores. The PERF scores evaluated included Composite, Power, Functional Strength, Dysfunction, Vulnerability, and Exercise Readiness. One-way repeated measures ANOVAs (performance scores x visit) (p<0.05), and intraclass correlation coefficients (ICCs) were determined to compare performance scores. RESULTS: Results are shown in the table. Excellent test-retest reliability was observed for composite, power, functional strength, and exercise readiness scores (ICCs >0.8) across all 4 visits. The vulnerability scores displayed fair test-retest reliability, while the dysfunction score exhibited poor reliability. No significant differences were observed for any performance scores on any visits. CONCLUSION: These results indicated excellent reliability for all PERF scores except vulnerability and dysfunction scores. It is possible that the vulnerability and dysfunction scores require several visits to establish a consistent baseline and may require 1-2 familiarization visits. Further study is needed to determine the magnitude of change for any score that is meaningful.
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 1.0 ±0.19 in LR group. Lower 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.

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 as 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<0.03), ankle dorsiflexion (LSI=94%, p<0.03), and ankle inversion (LSI=30%, p=0.001) external 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>0.05).

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 Vx (visual) stimulus following ACL rehabilitation may increase the difficulty of the task from either a cognitive or biophysical perspective. The results suggest that adding stroboscopic vision to plyometric movements and neuromuscular ACL-prevention programs.

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) 3.8-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 is a variable that can quantify the elasticity and stiffness capacity of muscle during rapid changes from eccentric to concentric contraction. PURPOSE: To evaluate the differences in RSI, joint absorption strategies for knee joint displacement (KD), and ankle joint displacement (AD) among soccer and volleyball female athletes during a landing task. METHODS: A total of 30 (Soccer=21, Volleyball=9) healthy, NCAA Division III female athletes (19.76 ± 1.24 years) volunteered for this study. The subjects jumped over a hurdle with subsequent maximal vertical jump measured on EZE jump mat (swift performance). The maximal vertical landing jump was video recorded and joint angle displacements (KD and AD) analyzed using Hudl technique application on iphones. 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 RSI H and RSI L. Further, two-way ANOVA with replication was used to examine the differences between joint angular displacements (KD and AD) at RSI H and RSI L. RESULTS: There was significant difference in (p<0.187) between soccer (1.9±0.44) and volleyball (1.67±0.39) athletes for RSI H. There was a statistically significant interaction (p=0.043) between the effects of levels of RSI on joint angular displacements.

A-44 Free Communication/Poster - Team Sports

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

268 Board #106 May 29 9:30 AM - 11:00 AM Effects Of Stroboscopic Vision On Reactive Strength Index Scores In Female NCAA Division I Volleyball Players
Talin Louder, Melissa Kroll, Jordan Preuss, Jake Rosburg, Lara Boman. The University of South Dakota, Vermillion, SD. Email: talin.louder@usd.edu

(No relevant relationships reported)

It is believed that ACL injury risk is multifaceted and includes structural, biomechanical, and cognitive factors. Recently, it is observed that overreliance on Vx (visual) stimulus following ACL rehabilitation may increase the difficulty of the task from either a cognitive or biophysical perspective. The results suggest that adding stroboscopic vision to plyometric movements and neuromuscular ACL-prevention programs.

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) 3.8-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 is a variable that can quantify the elasticity and stiffness capacity of muscle during rapid changes from eccentric to concentric contraction. PURPOSE: To evaluate the differences in RSI, joint absorption strategies for knee joint displacement (KD), and ankle joint displacement (AD) among soccer and volleyball female athletes during a landing task. METHODS: A total of 30 (Soccer=21, Volleyball=9) healthy, NCAA Division III female athletes (19.76 ± 1.24 years) volunteered for this study. The subjects jumped over a hurdle with subsequent maximal vertical jump measured on EZE jump mat (swift performance). The maximal vertical landing jump was video recorded and joint angle displacements (KD and AD) analyzed using Hudl technique application on iphones. 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 RSI H and RSI L. Further, two-way ANOVA with replication was used to examine the differences between joint angular displacements (KD and AD) at RSI H and RSI L. RESULTS: There was significant difference in (p<0.187) between soccer (1.9±0.44) and volleyball (1.67±0.39) athletes for RSI H. There was a statistically significant interaction (p=0.043) between the effects of levels of RSI on joint angular displacements.

n=30 RSI H (mean±SD) RSI L (mean±SD)
KD 32.9±11.3 35.2±11.5
AD 36.5±10.4 33.9±8.6

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, RSI H 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 bigger sample size, NCAA Division I or II athletes, and comparing genders during sport-specific tasks.

270 Board #108 May 29 9:30 AM - 11:00 AM Differences in Lower-Extremity Kinematics Among Female Collegiate Soccer and Volleyball Players
Anjuli Gairola, Dustin Malandra, Marisa J. Christensen. Calvini University, Radnor, PA.

(No relevant relationships reported)
how knee confidence and age influences 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: 48.8±4.9kg, age: 14±1.1yrs) 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 (4.92±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.

273 Board #111 May 29 9:30 AM - 11:00 AM Evaluation Of A Novel Acl Injury Prevention Technique:can Martial Arts Fall Training (break-falling And Rolling) Alter The Lower Extremity At-risk Biomechanics In Soccer Athletes? Karen M. Myrick1, Zobian John Edward Franklin1, Conor Kasabo1, Thomas Martin1, Michael Golden1, Darin Reisler1, Richard Feint1, Juan Garbalosa1. Quinipiu European University, Hamden, CT. 2Custom Nervous Solutions, West Hartford, CT. 3Plus One Defense Systems, West Hartford, CT. Email: karen.myrick@quinipiu.edu

(No relevant relationships reported)

Purpose We propose that by introducing martial arts fall training (specifically break-falling and rolling), the neuropathways in these athletes will be trained to recognize and avoid at risk postures by having an alternative response. Given the absence of research utilizing martial arts falling techniques in other sports, this study aims to compare lower extremity biomechanics and risk factors in soccer athletes with fall training compared to those without. Methods: 5 youth premier soccer athletes between the ages of 9 and 16 were recruited for participation. Subjects were randomly divided into a control group and an intervention group. All subjects continued their usual soccer training. The intervention group completed a twice weekly 10-week training program in addition to their usual training, taught by a karate and aikido expert at the level of 3rd degree black belt. At baseline and after the 10 week program was completed, all subjects underwent a biomechanical evaluation that measured hip and knee movement position in frontal, transverse, and sagittal planes at 4 different time points during a drop fall. A mixed factorial ANOVA model was used to determine the effects of the intervention training on the kinematic variables of interest. The between subjects’ factor was treatment group (intervention and control) and the within subjects factor was time point (pre-intervention and post-intervention). The test of the interaction between group and time point was used to determine if the intervention produced change in the variables of interest. The alpha level of significance for this study is set at the 0.05 level. Summary of Results: There was a significant decrease in knee flexion in the sagittal plane at initial contact when comparing pre and post-intervention (-4.02 degrees, p<0.001). There was also a significant decrease in knee flexion in the sagittal plane at heel strike 33ms (-7.34 degrees, p<0.001). There was no significant change in any of the other motion points examined. Conclusion: There was a statistically significant change in body mechanics when comparing pre and post-break fall intervention. Prior research has shown that neuromuscular programs decrease ACL injury rates when they are started at an early age and continued with strong compliance.

274 Board #112 May 29 9:30 AM - 11:00 AM Isokinetic Strength and Symmetry Averages of Lower Extremities in Professional Soccer Players Tomas Maly1, Frantisek Zahalka1, Kevin R. Ford, FACSM1, Dai Sugimoto1, Lucia Malá1, Tomas Gric1, Veronika Mikesova1, Mikulas Hank1, Egon Kunzmann1. 1Charles University, FEPES, Prague, Czech Republic. 2High Point University, High Point, NC. 3Harvard Medical School, Boston, MA. (Sponsor: Kevin R. Ford, FACSM) Email: maly@ftvs.cuni.cz

(No relevant relationships reported)

Muscle strength (MS) is an important component of physical fitness in soccer players (SP). Side-to-side differences may be evaluated 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 (PTf) in both legs, hamstrings and quadriceps strength ratio of muscle torque for both preferred and non-preferred extremities (H:Q-pre and H:Q-npre) respectively, bilateral ratio between the exerted strength of knee extensors (Q:E) and flexors (H:H) were calculated. Mixed-design RM ANOVA, Bonferroni’s post hoc tests and partial eta square (η²) were used for statistical assessment. RESULTS: Knee flexors showed significantly higher SA (H:Q-pre = 9.77±0.40 %) compared to the extensors (Q:E-pre = 58.10±0.63 %) (F2,588=4.01, p=0.04, η²=0.01). Greater hamstrings and quadriceps strength ratio was found in preferred leg (H:Q-npre = 59.89%) compared to non-preferred (H:Q-npre = 58.10±0.63 %) (F1,294=20.49, p=0.00, η²=0.07). Greater hamstrings and quadriceps strength ratio was found in preferred leg (H:Q-npre = 59.89%) compared to non-preferred (H:Q-npre = 58.10±0.63 %) (F1,294=20.49, p=0.00, η²=0.07). Greater hamstrings and quadriceps strength ratio was found in preferred leg (H:Q-npre = 59.89%) compared to non-preferred (H:Q-npre = 58.10±0.63 %) (F1,294=20.49, p=0.00, η²=0.07).

Wednesday, May 29, 2019

Abstracts were prepared by the authors and printed as submitted.
increasing velocity in both: extensors (F_{ext}=4218.92, p=0.00, η²=0.94) and flexors (F_{flex}=2932.69, p=0.00, η²=0.91). At the highest velocity (300°·s⁻¹), MS achieved ~55% (PT) respectively ~53% (PTF) of MS exerted at the lowest velocity (300°·s⁻¹).

CONCLUSIONS: Greater SA was found in knee flexion (EH) rather than knee extension (Q-Q) in a group of professional male SP. Also, greater hamstrings and quadriceps strength ratio was found in preferred leg (H:Qp) compared to non-preferred leg (H:Qn). The findings of this study will be useful in the design of injury prevention and performance enhancement programs.

PREVIOUS GROIN PAIN

Board #113  May 29 9:30 AM - 11:00 AM

Effect of Previous Groin Pain on Sagittal Plane Joint Moments During Soccer Instep Kicks

Anna C. Severin¹, Daniel B. Mellifont², Mark GL Sayers²
¹University of Arkansas for Medical Sciences, Little Rock, AR.
²University of the Sunshine Coast, Sippy Downs, Australia.

Email: aseverin@uams.edu

(No relevant relationships reported)

Previous groin pain is common in male soccer players, often results in re-injury,¹,² has been linked to maximal instep kicks.¹,³ Research has shown aberrant kinematics during the instep kick in players with previous groin pain.¹

PURPOSE: To quantify differences in sagittal plane joint moments during maximal instep kicks between players with and without previous groin pain.

METHODOLOGY: Data were collected from 12 experienced male soccer players who reported nonspecific groin pain in the last 12 months, and 11 controls who had performed six maximal instep kicks. 10-camera Qualisys motion capture system (500 Hz) and two Bertec force platforms (2000Hz.) collected data that were then processed using standard software (Visual 3D). Bilateral normalized joint moments of the hip, knee, and ankle were quantified at stance limb plant (PL), swing limb peak knee flexion (PKF) and at ball contact (BC). The foot speed of the swing limb at impact was considered an indication of kicking performance. The two-tailed alpha level was set to 0.05 and Cohen’s d was used to quantify the magnitude of differences between groups.

RESULTS: A moderate difference in foot velocity existed between the groups (C: 15.5 m·s⁻¹, PGP 14.8 m·s⁻¹, p=0.087, D=0.77). Differences in stance limb joint moments were evident throughout the kick, while the swing limb only displayed differences at BC (Figure 1).

CONCLUSION: The PGP group often utilized lower sagittal plane joint moments about the hip, knee, and ankle of the stance limb but without evidence of a matching decrease in foot velocity at BC. This suggests that compensations occurred elsewhere in the kinetic chain to make up for the reduced joint moments. The stance hip flexion moment in the PGP group at PL is atypical and further supports the presence of aberrant motor patterns.

¹Walden, M. ²BJSM. ³Werner, J. BJSM. ⁴Rahnama, N. BJSM. ⁵Esteve, E. BJSM. ⁶Severin, AC. SMF.

Board #115  May 29 9:30 AM - 11:00 AM

Biceps and Triceps Contribute to Pitching Performance in College Baseball

Marie R. Acosta¹, J. Mark Van Ness¹, William P. Lydon¹, Brian G. Graham¹, Alexis C. King², Courtney D. Jensen³
¹University of The Pacific, Stockton, CA. ²University of Illinois at Urbana-Champaign, Champaign, IL.
³University of Illinois at Urbana-Champaign, Champaign, IL.

(No relevant relationships reported)

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 curls 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=0.490, 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 understand the role of biceps and triceps function in throwing mechanics.

¹,²Samson J. Abernathy, William P. Lydon¹, J. Mark VanNess¹, J.P. Wong¹, Alexis C. King², Courtney D. Jensen³
¹University of the Pacific, Stockton, CA. ²University of Illinois at Urbana-Champaign, Champaign, IL.
(No relevant relationships reported)
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. We used Proteus (Boston Biomotion, 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 arm length. Simple linear regressions quantified non-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 raises (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, Alicja B. Stannard. Sacred Heart University, Fairfield, CT. Email: jessica.trapp15@gmail.com

Non-contact anterior cruciate ligament (ACL) sprains are becoming increasingly problematic for athletes, especially females. Running performance factors related to 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 fatigue 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. For 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 an 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±1.3 ° vs. 18.9±5.5 °, 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±16.4 ° vs. 7.4±11.3 °, p=0.037) In HF, supporting leg’s ankle was more dorsal flexion(0.4±14.9 ° vs. -14.1±14.5 °, p=0.010), more valgus(26.3±12.4 ° vs. 11.5±11.1 °, p=0.001) 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.

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 Takei1, Michio Tojima2, Shuji Takeomi3, Suguru Torii4. 1Graduate School of Medicine, The University of Tokyo, Tokyo, Japan. 2Tokyo International University, Saitama, Japan. 3Waseda University, Saitama, Japan. Email: saranaga0330@hotmail.com

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.

281 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 Bailey1, 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. 5North Carolina FC, Cary, NC. Email: bsmith2@highpoint.edu

Relationship Between Core Endurance and the Landing Error Scoring System in Youth Soccer Players

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 Bailey1, 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. 5North Carolina FC, Cary, NC. Email: bsmith2@highpoint.edu

Non-contact anterior cruciate ligament (ACL) sprains are becoming increasingly problematic for athletes, especially females. Running performance factors related to 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 fatigue 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. For 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 an 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±1.3 ° vs. 18.9±5.5 °, 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±16.4 ° vs. 7.4±11.3 °, p=0.037) In HF, supporting leg’s ankle was more dorsal flexion(0.4±14.9 ° vs. -14.1±14.5 °, p=0.010), more valgus(26.3±12.4 ° vs. 11.5±11.1 °, p=0.001) 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. Identifying 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 (LESS). 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±1.8). 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 male, 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 young male soccer players. More work is needed to identify the modifiable factors that increase the risk of injury in youth female soccer players.
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 (Hedges' 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.

<table>
<thead>
<tr>
<th>Effect Size (ES)</th>
<th>ES (hedges g)</th>
<th>IC 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES T7</td>
<td>Injury x ES T4</td>
<td>Injury 0.854 0.757 0.950</td>
</tr>
<tr>
<td>ES T7</td>
<td>Notinjury x ES T4</td>
<td>Notinjury -1.104 -1.150 -1.059</td>
</tr>
<tr>
<td>ES T7</td>
<td>Injury x ES T7</td>
<td>Notinjury 0.276 0.214 0.338</td>
</tr>
<tr>
<td>ES T4</td>
<td>Injury X ES T4</td>
<td>Notinjury 2.698 2.632 2.764</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

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

Room: CC-Hall WA2

### Board #121 May 29 11:00 AM - 12:30 PM

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

Chen Liang1, Can Gao2, Jianhong Zhang3, Qin Ye, Lindan Zhai1, Fenrong Zhao*1. National Institute of Sports Medicine, Beijing, China. *Beijing University of Chinese Medicine, Beijing, China.

Email: lclc3@163.com

(No relevant relationships reported)

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

**METHODS:** This study was a randomized controlled trial to screen 112 patients with coronary heart disease related to musculoskeletal injuries in soccer.

**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 (Hedges' 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.

<table>
<thead>
<tr>
<th>Effect Size (ES)</th>
<th>ES (hedges g)</th>
<th>IC 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES T7</td>
<td>Injury x ES T4</td>
<td>Injury 0.854 0.757 0.950</td>
</tr>
<tr>
<td>ES T7</td>
<td>Notinjury x ES T4</td>
<td>Notinjury -1.104 -1.150 -1.059</td>
</tr>
<tr>
<td>ES T7</td>
<td>Injury x ES T7</td>
<td>Notinjury 0.276 0.214 0.338</td>
</tr>
<tr>
<td>ES T4</td>
<td>Injury X ES T4</td>
<td>Notinjury 2.698 2.632 2.764</td>
</tr>
</tbody>
</table>

### Board #123 May 29 11:00 AM - 12:30 PM

**Effects Of Intra-dialytic Exercises On Physical Fitness And Health Related Quality Of Life (HRQOL).**

Aashish Contractor, Jaimi Patel. Sir H.N. Reliance Foundation Hospital, Mumbai, India.

Email: aashish.contractor@rfhospital.org

(No relevant relationships reported)

**PURPOSE:** Patients undergoing dialysis have low levels of physical activity compared to their age matched healthy sedentary adults (Kidney International, Vol. 57 (2000), 2564-2570). It is observed that there is continuous decline in physical function and associated increased mortality and morbidity, in these patients. In 2016, the American College of Sports Medicine stated that intradialytic exercise is medicine for haemodialysis patients. Exercise during haemodialysis has been shown to benefit muscle strength and bone demineralization, reducing cardiovascular risk factors (compared to no exercise). Exercise during haemodialysis has been shown to improve physical and psychological health of dialysis patients. Exercise during haemodialysis has been shown to improve physical and psychological health of dialysis patients.

**RESULTS:** In this on-going project, we have completed a low intensity walking exercise program (30 minutes/session; three sessions/week for eight weeks) in 5 ischemic stroke survivors (4 males, mean age 63.8±14.8 years). Before and after the intervention, a glycated hemoglobin (HbA1c) was measured using A1CNow+™ Systems, and vital capacity (VC) and forced vital capacity (FVC) were measured using a spirometer according to the guideline from American Thoracic Society/European Respiratory Society. **RESULTS:** HbA1c decreased from 5.7±0.2% to 5.4±0.2% from before to after the intervention. Pre- and post-intervention VC increased from 2.69±1.01 L to 2.85±0.82 L; FVC increased from 2.65±1.08 L to 2.72±0.97 L, respectively. **CONCLUSIONS:** The results are promising and suggest that the low intensity aerobic walking exercise may improve blood glycemic control by decreasing HbA1c in non-ambulatory stroke survivors. Also, the results suggest that the low intensity aerobic walking exercise may improve lung function by increasing VC and FVC. This is an ongoing study; we anticipate recruiting 20 study participants for the study.
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 ± 20 cm² vs. 370 ± 125m, p=0.025), WQ distance score (10.23 vs. 30.46, p=0.002), WQ speed score (17 ± 2 vs. 28 ± 27, p=0.001), WQ stairs score (21 ± 42 vs. 42, p=0.024), WELCH total score (20 ± 26 vs. 40 ± 42, p=0.060) 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 (10.23 vs. 15.99 y 98.51± 37.37cm) 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 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.
Basic health information and services needed to make informed decisions about their health care. The role of cardiac rehabilitation (CR) in the primary prevention of cardiovascular disease and the secondary prevention of cardiac events underscores the importance of ensuring that all patients with cardiac disease have access to high-quality CR programs. The American Heart Association (AHA) and the American College of Cardiology (ACC) have published guidelines for the delivery of CR services, which include both in-hospital and outpatient settings. The importance of CR in reducing the risk of mortality and morbidity in patients with cardiovascular disease is well established. CR programs are designed to provide a comprehensive approach to the management of cardiac disease, which includes education, exercise training, and lifestyle modification. Exercise training is a key component of CR programs, as it has been shown to improve cardiovascular function, reduce the risk of mortality and morbidity, and improve quality of life in patients with cardiovascular disease. The type of exercise training used in CR programs can vary, but typically includes aerobic exercises such as walking, running, and cycling, as well as resistance exercises such as strength training and resistance training. CR programs are typically delivered in a group setting, with the supervision of trained exercise professionals. The duration and frequency of exercise training can vary, but typically ranges from 30 to 60 minutes, 3 to 5 times per week. The intensity of exercise training is typically determined by the patient’s cardiovascular function and risk status, and is adjusted as needed to ensure safety and effectiveness. In addition to exercise training, CR programs also provide education on a variety of topics, including risk factor modification, medication management, and lifestyle changes. Education on these topics is typically provided in a group setting, and is tailored to the individual needs and preferences of the patient. Overall, cardiac rehabilitation is an important component of the management of cardiovascular disease, as it provides a comprehensive approach to the prevention and treatment of cardiac events, and helps to improve the quality of life and functional capacity of patients with cardiometabolic disease.
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 stable spasticity 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 HIT (OG1), then 20 minutes of treadmill HIT, followed by another 10 minutes of overground HIT (OG2). Short interval HIT involved 30s bursts at maximum safe speed and 30-60s 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 34% 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.

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 paucy 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).

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 alphas = 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 ±177; 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 ±17; 17 bpm) for the C was significantly 12% higher than the average heart rate (146 ±17; 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 cardiorespiratory 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.
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 75% bodyweight with an additional 15% bodyweight added every 2 sets of climb until exhaustion, 10 sets/day, 5 day/week, 4 weeks) or 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 ischemic infarct volumes when compared to those in MCAO group (31.97±6.6% 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 (2.40±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 difference 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**

**Room: CC-Hall WA2**

**Board #135 May 29 11:00 AM - 12:30 PM**

**The Effect of Physical Activity on Hemodynamic Response to Angiotensin Converting Enzyme Inhibition in Hypertension**

Stephen A. Maris, Jonathan S. Williams. Brigham and Women’s Hospital & Harvard Medical School, Boston, MA. Email: stephen.a.maris@gmail.com

(No relevant relationships reported)

**PURPOSE:** Physical activity (PA) can reduce blood pressure (BP) in hypertensive populations. Although underlying mechanisms remain unclear, an interaction with the renin-angiotensin-aldosterone system (RAAS) is a logical focus of exploration. We conducted a nested cohort analysis to determine if reported level of PA was associated with systolic BP and when compared to the general population. It is common for patients with chronic kidney disease to be physically inactive, therefore patients with CKD in their different stages, present reduced physical capacity around 60% to 70% of the level expected for the age. **OBJECTIVE:** Evaluate the effects of previous aerobic exercise on oxygen consumption (peak VO2), renal function and glomerulus sclerosis index in rats with CKD due to nephrectomy. 5/6 (Nx5/6). **METHODS:** Adult Wistar rats were divided into groups (n = 8): Sedentary +Nx5/6+Sedentary (Sed), Sedentary + Nx5/6 + Exercise (Sed-Exe), Exercise + Nx5/6 + Sedentary (Exe-Sed) and Exercise + Nx5/6 + Exercise (Exe). The exercise was performed on treadmill, the intensity of 40% to 60% of the maximum load test, 60 minutes a day and 5 times a week, during the total period of 8 weeks of training. Nx5/6 was performed in the 4th week of the training protocol. Blood pressure (BP), oxygen consumption (VO2 peak), proteinuria, nitrogen urea base (BUN), and glomerulus sclerosis index were evaluated in the hematoxylin-Eosin staining.

**RESULTS:** There was an increase in the Sed-Exe and Exe groups in relation to the Sed group (34.2 ± 2.1; and 37.9 ± 1.7 vs. 24.8 ± 0.6, p<0.05, respectively). The Exe group presented a significant reduction in proteinuria when compared to the Sed-Exe group (176.6 ± 39.2 vs 61.1 ± 20.9, p<0.05, respectively). The BUN of the Exe-Sed group was inferior to Sed group (31.7 ± 2.3 vs 65.6 ± 7.8, p<0.05, respectively). There was a decrease in BP in the Sed-Exe and Exe groups when compared with the Sed group (215 ± 1 and 212 ± 2 vs 231 ± 1, p<0.05, respectively), but the BP values still remained high. The glomerulus sclerosis index was classified as follows: the Exe group presented the mild degree index (23%), the Sed-Exe and Exe-Sed groups moderate degree (50%), and the sedentary group presented degree high (75% injury). **CONCLUSION:** The exercise minimizes the impact of Nx5/6, attenuating proteinuria, important analysis of progressive loss of renal function. Increasing physical capacity and VO2. Finally, previous exercise indicates protection for CKD, especially under this experimental protocol. Thus, it is reasonable to suggest that exercise may be an additional strategy to be employed in CKD.
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 metabolites and maximal ATP production (ATP<sub>max</sub>) are altered in muscle from older adults. However, it is unclear whether resting phosphorus metabolites and ATP<sub>max</sub> are associated with skeletal muscle mass, strength, and function in older adults. METHODS: In vivo metabolites and ATP<sub>max</sub> 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 lateralis were obtained to determine fiber type proportion and cross-sectional area of muscle fibers by immunohistochemistry. RESULTS: Several resting phosphorus 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 resting phosphorus metabolites. PDE<sub>2</sub> was negatively correlated to 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<sub>max</sub> was not different between sarcopenic and non-sarcopenic individuals. At the cellular level, PDE2 was negatively correlated to myofiber area (r = -0.51, p < 0.03) 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<sub>max</sub> was not related to the sarcopenic phenotype, our results reveal that resting <i>In vivo</i> phosphorus metabolite profiles may be a viable cellular marker of muscle quality in older adults. Supported by NIH Grants K01 AG04437 and R01 AG021961.

**Board #138**

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

**Skeletal Muscle Phosphodiesters Content is Related to Muscle Mass and Strength in Older Sarcopenic Adults**

J. Matthew Hinkley, Heather H. Cornnall, 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)

**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/m²) 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 (cm<sup>3</sup>), and fat fractions (fat/total*100%). The location (% muscle length) of peak muscle volume and fat fraction, as well as the deviation from the line of best fit (2<sup>nd</sup> order polynomial) of these variables were 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 cm<sup>3</sup>, 75 ± 26 cm<sup>3</sup> 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 RO1 AG047245
S58  Vol. 49  No. 5  Supplement

303  Board #141  May 29 11:00 AM - 12:30 PM
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 (PTpass), and the dissipative coefficient (DC), and the relationship between PTpass, loading, 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 PTpass and MROM. ANALYSIS: Two analyses were performed to determine age-related differences in MROM and PTpass, one for the participants maximally tolerated ROM. PTpass, loading, 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 PTpass and MROM. RESULTS: The PTpass, 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 MROM, differences between groups for the DC remained (P = 0.028), while there were no differences between groups when accounting for EI (P = 0.120). PTpass was also strongly related to MROM (r = 0.775, 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.

304  Board #142  May 29 11:00 AM - 12:30 PM
Longevity and Physical Vitality during Aging Altered by Adipose-derived Mesenchymal Stem Cell-Lysate Injection
Chia-Hua Kuo, FACSM. University of Taipei, Taipei, Taiwan. Email: kuochiahua@gmail.com  
(No relevant relationships reported)

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-related 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 subserved 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 implicate that simply enhancing regenerative signals from MSC does not beneficial and appear to be harmful for physical vitality and longevity.

305  Board #143  May 29 11:00 AM - 12:30 PM
Aging Alters NAD+, Sirtuins and Targeted Protein Levels and Acetylation in the Mouse
Dongwook Yeo¹, Choughun Kang², Li Li Ji, FACSM³. ¹University of Minnesota Twin Cities, Minneapolis, MN; ²Inha University, Incheon, Korea; ³University of Minnesota Twin Cities, Minneapolis, MN. (Sponsor: Ph.D., FACSM) Email: yeoxx039@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 (young, Y; 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. SIRT7 was increased by 4.8-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 Q and G, 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 < 0.05) in G. 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.

306  Board #144  May 29 11:00 AM - 12:30 PM
Comparison of Strength and Cognitive Performance in Elderly Individuals Aged 60 To 70 Years
Andre de Camargo Smolarek¹, Luis H. Ferreira², Steven R. McAnulty³, Alan C. Utter, FACSM⁴, Luis P. Marenchonas¹, Tacito P. Souza-Junior⁵. ¹UNICENTRO, Itabira, Brazil; ²UFPR, Curitiba, Brazil; ³Appalachian State University, Boone, NC; ⁴Texas Woman’s University, Denton, TX. (Sponsor: Alan C Utter, FACSM) Email: andreossk@gmail.com  
(No relevant relationships reported)

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 ULS, 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.
A-48 Free Communication/Poster - Joint Health and Arthritis

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

309 Board #147 May 29 11:00 AM - 12:30 PM
Bone Health of Patients Diagnosed With Rheumatoid Arthritis
Sebastien Beauregard, Adriana De la Parra-Solomon, Nathan Chiariotti, Alexe Sirois, Susan Bartlett, Ross Andersen, FACSFM. McGill University, montreal, QC, Canada.

(Related relationships reported)

Rheumatoid arthritis (RA) is the most common type of chronic inflammatory disease in adults and often is associated with bone health problems. It is estimated that poor bone health may occur in 50% of patients. PURPOSE: First, to explore bone health among sedentary patients diagnosed with RA. Secondly, to explore the relationship among regional bone mineral density (BMD) with age, weight, and height.

METHOD: Twenty-one sedentary participants with diagnosed RA whose mean age was 39±9.1 years, height was 162.5±7.8 cm, and weight averaged 66.67±9.07 kg. Dual energy x-ray absorptiometry (DXA) was used to measure bone health. Linear regression was used to explore relationships among age, height, weight, and BMD in RA patients.

RESULTS: BMD of the FN and L1-L4 averaged 0.12±1.29 SD and 0.38±1.57 SD, respectively. Mean Z-scores were 0.72±1.43 for TB, 0.38±1.57 for LV, and 0.12±1.29 for the FN. In the FN region 25% of patients had Z-scores below -1 SD and 5% were below -2 SD. In the LS 20% has Z-scores below -1 SD and 45% were below 0 SD. Additionally, no significant relationships were observed among BMD, age, weight, and height. CONCLUSION: These findings suggest that a great range of variability in bone health exists in RA patients. Furthermore, healthcare professionals should monitor bone health in the RA population and future interventions should explore the effects of tailored exercise programming to simultaneously improve bone health and well-being.

310 Board #148 May 29 11:00 AM - 12:30 PM
Cells Progenitors Potential In Cartilage: Changes From Moderate To Severe Oa
Mariana Mazor1, Annabella Cesaro1, Thomas M. Best, FACSFM, Mazen Ali2, Eric Lespessailles3, Hechmi Touni1. 1Orleans University, I3MTO, Service de Rhumatologie, Centre Hospitalier Régional d’Orleans, Orleans, France. 2Orleans University, I3MTO, Service de Rhumatologie, Centre Hospitalier Régional d’Orleans, Orleans, France. (Sponsor: Thomas Best, FACSFM)

Email: mazor.mariana@gmail.com

(Number of related relationships reported)

Cells progenitors potential in Cartilage: Changes from moderate to severe OA. PURPOSE: Recent data suggests that osteoarthritic (OA) cartilage contains mesenchymal progenitor cells (MPC) with multi-differentiation potential. Yet, there is limited information concerning how their prevalence changes with disease stages. Herein, we explore presence, prevalence and differentiation potential of MPC cells isolated from different OA grades. METHODS: Human osteoarthritic tibial plateaus were obtained from 25 patients undergoing total knee replacements. Each sample was classified as mild, moderate or severe OA according to OARSI scoring. The mRNA expression levels of CD105, CD166, Notch-1, Sox9, Acan, Col II A1 and Col I A1 were measured at day 0, day 14 (2 weeks in vitro) and day 35 (after chondrogenesis). At D35, the pellets matrix composition was tested on formation of proteoglycan, collagen II and I by HES and Immunofluorescence. RESULTS: Cells from all OA grades significantly increased MPC markers mRNA with in vitro expression. Proliferated cells expressed MPC specific antigens: CD105, CD166, CD73, CD90, Notch-1 and Nucleostemin. The chondrogenesis induced decrease in CD105, Notch 1 and Sox9 mRNA only in mild and moderate OA. Yet, only moderate OA – derived pellets revealed significantly high levels of proteoglycans and hyaline cartilage marker – collagen II and low expression of fibrocartilage marker – collagen I at both mRNA and protein level. CONCLUSION: A novel finding emerges from our data confirms that the prevalence of frailty in female mice increases across the lifespan. In addition to predicting mortality, this frailty phenotype has potential to yield information about underlying mechanisms contributing to frailty.
Correlation between Generalized Joint Hypermobility and Chronic Musculoskeletal Pain in College Students

Kaylee R. Fichthorn, Peter R. Reuter, Florida Gulf Coast University, Fort Myers, FL
Email: kfichthorn9132@eagle.fgcu.edu

(No relevant relationships reported)

The main complaint of patients with benign joint hypermobility syndrome (BJHS) is chronic musculoskeletal pain (MSP) that may affect their daily activities, leading to a decreased quality of life. While some studies support an association between generalized joint hypermobility (GHJ) and MSP in children and adolescents, there is no published study yet looking into a correlation of GHJ and MSP in a college-aged population. In this study, we determined whether young adults with generalized joint hypermobility are more likely to suffer from chronic musculoskeletal pain. METHODS: Undergraduate students studied the general structure of joints and range of motion, including joint hypermobility, before completing a survey that included questions about chronic musculoskeletal pain and the severity of pain. They worked in groups to evaluate each other’s joints for hypermobility under supervision by the research team. RESULTS: Overall, 20.8% of 634 participants showed GHJ based on a cutoff Brighton score of ≥ 4. Women had statistically significant higher rates of GHJ (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 (14.4%) 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 GHJ reported higher rates of chronic joint pain than participants without GHJ. There was, however, no significant difference (Pearson Chi-square Test, Chi-square = 1.386, p = 0.9501, n = 650). The prevalence of chronic neck/back pain in our study was 20.8%. Participants with GHJ had higher rates of chronic back/neck pain, yet, the difference was not statistically significant (Pearson Chi-square Test, Chi-square = 3.850, p = 0.4059, 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 GHJ. The ranges for the reported pain intensity as well as the standard deviations for all averages were also very similar. CONCLUSION: Young adults with GHJ 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 GHJ.
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 rats did not differ for diaphragm muscle fibrous fractions (in %: lean 3.4±0.8, HFHS 2.7±1.7), type I fiber CSA (in μm²: lean 1954±121, HFHS 2174±103), type IIa fiber CSA (in μm²: lean 2062±329, HFHS 2412±155), or type IIb fiber CSA (in μm²: lean 4165±1232, HFHS 4523±526). Additionally, no shifts in fiber type occurred. Interestingly, HFHS diaphragm demonstrated a trend toward a lower succinate-induced increase in ROS emission (in 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.

315 Board #153 May 29 11:00 AM - 12:30 PM Anabolic Signaling Phosphorylation Does Not Explain Differential Muscle Protein Synthesis with Intra-Set Rest Manipulation Colleen F. McKenna1, Amadeo F. Salvador1, Andrew T. Askow2, Sarah S. Burke1, Scott A. Paluska, FACSM3, Jonathan M. Oliver4, Nicholas A. Burd1. 1University of Illinois Urbana-Champaign, Urbana, IL. 2Texas Christian University, Fort Worth, TX. (Sponsor: Scott A. Paluska, FACSM) (No relevant relationships reported)

Power development is imperative for dynamic sport athletes. Cluster sets (CLU) are an effective method to allow the progressive decrement in power output normally observed in a traditional (TRD) resistance exercise strategy. CLU configurations involve 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 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 observation.

Purpose: To elucidate anabolic signaling mechanisms driving differential MPS rates observed between CLU and TRD paradigms of the barbell back squat in trained men and women.

Methods: In randomized crossover design, 8 resistance-trained adults (7M, 1F; 23 ± 4 y; LBM, 63 ± 9 kg; bar squat 1RM, 150 ± 26 kg) performed an acute bout of either CLU (4 sets x (2 x 5) repetitions, 30s intra-set rest, 90s inter-set rest) or TRD (4 sets x 10 repetitions, 120s inter-set rest) barbell back squats at ~70% 1RM. Volume load and total rest were matched between bouts. Participants ingested 20g of whey protein immediately before and after exercise. Muscle biopsies were collected at rest and at 0, 2, and 5 h-post-exercise during primed-continuous L-[ring-13C]phenylalanine infusions. Total and phosphorylated states of targeted proteins were assessed through immunoblotting. Data was normalized to an internal loading control.

Results: The phosphorylation of focal adhesion kinase (FAK) was doubled with TRD, but not significantly different, from CLU (TRD 2.1 ± 0.9-fold increase from baseline; CLU 1.3 ± 0.9-fold; p=0.05). Downstream targets of mTORC1 also showed no differences in phosphorylation between paradigms (4E-BP1: TRD 1.6 ± 0.3-fold, CLU 0.4 ± 0.2-fold; p70S6K: TRD 1.5 ± 0.4-fold, CLU 0.9 ± 0.4-fold). Similarly, there was no difference in AMPK phosphorylation between conditions (TRD 1.3 ± 0.9-fold; CLU 0.9 ± 0.7-fold).

Conclusion: Our data demonstrated that changes in protein phosphorylation as noted by various readouts within the mTORC1 pathway do not underpin the greater post-exercise muscle protein synthetic response with TRD versus CLU-style in resistance trained men and women. 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.

317 Board #155 May 29 11:00 AM - 12:30 PM Contralateral Repeated Bout Effect of Elbow Flexors Not Observed in Young Women Bailey A. Brown, Xin Ye, Ling Xin. University of Mississippi, Oxford, MS. (No relevant relationships reported)

Near-infrared spectroscopy (NIRS) is a non-invasive method for measuring tissue hemodynamics of skeletal muscle and prefrontal cortex is related to rowing time trial performance.

Mauricio Martinez, Matthew Dove, Leilani Madrigal, Joshua Cotter. California State University of Long Beach, Long Beach, CA. Email: mauricio.martinez01@student.csulb.edu (No relevant relationships reported)
the 2,000 m ergometer test and VO2max (Pearson r = -0.523; p = 0.045). Exercise reduced HB02 (p = 0.0063) and increased HB (p=0.0038) compared to baseline in the VL with HB remaining unchanged (p = 0.0677). No changes were observed during exercise in the PFC except for an increase in HB (p < 0.0001). The magnitude of change in VL tissue oxygenation (HB02) was correlated with the time to complete the time trial with a faster rate leading to a greater reduction in VL HB02. Similarly, the magnitude of change in VL deoxygenated hemoglobin (HB) trended towards a greater increase in concentration with a faster time trial (Pearson r = -0.4422, p = 0.0661). CONCLUSION: Exercise during a 2,000 m rowing time trial test resulted in decreased HB02 and increased HB levels in the VL compared to baseline which was correlated with performance on the time trial. Total hemoglobin was found to increase in the PFC which may represent increased fatigue that occurs due to the maximal nature of the time trial.

319 Board #157 May 29 11:00 AM - 12:30 PM Calf Muscle Endurance and Gait Variability among Older Adults
ADEOLA A. SANNI, Kevin McCully, FACSM. UNIVERSITY OF GEORGIA, Athens, GA. (Sponsor: Kevin McCully, FACSM) Email: aas56767@uga.edu

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 on the calf muscle of the participant’s right leg at 2Hz, 4Hz and 6Hz using previously established protocol. Selected gait measurements (stride length, right/height ratio, step width, %CV of step length, stride width) were recorded on three trials at self-selected speed on a 20foot gait mat (Protekinetics Zeno walkway). Pearson’s r was used to test the relationship between the selected gait variables and endurance index at 6Hz. ANOVA Levene’s test of covariation 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 steps width (r = 0.43, p = 0.11). Levene’s test verified equality of variances in step length %CV of both legs (p = 0.84). CONCLUSION: Muscle endurance in the calf was associated with selected gait parameters which have been shown to predict increase fall risk among older adults.

320 Board #158 May 29 11:00 AM - 12:30 PM Effects Of Rate Of Force Production On Vastus Lateralis Pennation Angle During Isometric Squats And Knee Extensions
Cody L. Diehl, Michael J. Luera, Jesus A. Hernandez-Sarabia, Carlos Estrada, Tyler W.D. Muddle, Jason M. Defreitas. Oklahoma State University, Stillwater, OK.

Email: cody.diehl@okstate.edu

Previous literature has shown that force exerted by muscle is closely related to its size, length (i.e. joint angle) and pennation angle (PA). For a mono-articular muscle such as the vastus lateralis (VL), its ability to produce maximal force is dependent on the joint angle of the knee. However, since the VL shares a joint action with a bi-articular muscle, the rectus femoris (RF), it’s possible that its performance may be joint angle dependent, which may influence VL performance as well). It is unknown how the pennation angle of the VL during contraction differs between maximal multi- and single-joint exercises, such as the isometric squat (SQ) and knee extension (KE), and whether those changes are dependent on the rate of the force production. PURPOSE: To examine the pennation angle of the VL during slow and rapid maximal force production of the isometric SQ and KE exercises. METHODS: Fifteen lower-body resistance trained males (mean ± SD age = 32 ± 3 yrs) performed two maximal voluntary contractions (MVC) for both SQ and KE exercises. The first MVC (MVC1) cue was used to elicit peak force, with no instructions on the rate, while the 2nd (MVCR) was used to elicit rapid force production. RESULTS: A two-way (MVC speed (slow vs. rapid) × exercise (SQ vs. KE)) repeated measures ANOVA indicated no significant differences in pennation angle of the VL between slow vs. rapid MVCs of the squat (mean MVC1 = 16.19 ± 3.18°, MVCR = 16.13 ± 3.26°) and knee extension exercises (mean MVC1 = 16.21 ± 2.23°, MVCR = 16.08 ± 2.34°), nor were there any differences between the exercises (p > 0.05 for all analyses). CONCLUSION: When knee angle is controlled for, the pennation angle of the VL during isometric squats and knee extensions do not differ. Furthermore, neither the rate of force, nor the slightly different hip angles had an effect.

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 mitochrondria 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 24.2 ± 0.6 kg/m²). EPS was applied to pooled muscle cells and cells were cultured for 24 hours or 48 hours and biweekly pulses of 1 Hz for 2 ms; 30V) and were harvested after stimulation. Control cells were maintained simultaneously and harvested alongside EPS treated cells. Lipid and Mitochondrial content were measured by fluorescent histochemistry techniques, and quantified using Image J software.

Results: Myotubes cultured from athletes had a significantly greater lipid (35.68 ± 5.78 vs 0.51 ± 0.08 AU; p<0.0001) and mitochondrial content (108.3 ± 18.9 vs 0.69 ± 0.87 AU; p<0.03) content compared to lean donors at baseline. Lipid and mitochondrial content were significantly greater in lean after 24 hours (both p<0.05), but not after 48 hours (both p>0.05) of EPS compared to control of EPS (Lipid: control 0.8 ± 0.0 AU, 24hr. 101.5±49.7 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, 24 hr. 35.43 ± 5.12 AU, 48 hr. 25.9 ± 2.6 AU) whereas mitochondrial content was significantly greater after 24 hours EPS (p=0.0004) but not after 48 hours (p=0.08) of EPS (control 108.3 ± 18.9 AU, 24 hr. 239.1 ± 25 AU, 48 hr. 125.1 ± 15.3 AU).

Conclusion: 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.

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), the normal body temperature contusion group (NTC n=4), or sham (n=3). Under anesthesia, the in vivo torque-frequency relationship (Hz-300Hz) of the anterior tural muscular 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 dropped through a tube from an 115 cm onto an impactor directly striking the tibialis anterior) or no contusion (sham); all mice were then allowed to recover. Following 5 days of normal cage activity (5-d recovery), in vivo torque-frequency relationships were measured in all mice. Data were analyzed using an factorial ANOVA with an a priori level of significance of 0.05. Fisher’s LSD pair-wise comparisons were made post hoc. 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
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. 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.
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 the contribution of motor nerve dysfunction (#1,#2). This paper aims to examine the electromyographical activity of the lower limb musculature of the amputated limb 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 the contribution of motor nerve dysfunction. In the present study, we aimed to establish prediction equations for predicting skeletal muscle mass index (SMI) in Japanese university women. METHODS: A total of 193 Japanese university freshmen women (ages 18-25 years) volunteered to participate in this study. A stepwise multiple-regression analysis (method of increasing and decreasing the variables, criterion set at p<0.05) was performed to SMI and 17 variables (body mass index, % body fat, waist-hip ratio, girth (mid-thigh and lower-leg), muscle thickness (anterior and posterior mid-thigh and posterior lower-leg), handgrip, knee extension, standing long jump, vertical jump, sit-to-stand test, 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 one 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 (%) + 0.22 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). CONCLUSIONS: 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.

Eccentric contractions (ECCs) cause muscle damage indicated by loss of muscle strength, limited range of motion (ROM), and development of delayed-onset muscle soreness (DOMS). Previously, we showed that ECCs induce nerve dysfunction and damage motor nerves and humans. In a human study, the M-wave latency of the biceps brachii increased by 12-24% at 1-2 days after eccentric exercise of the elbow flexors in women. However, whether ECCs cause a decrease in motor nerve conduction velocity (MCV) is unknown. PURPOSE: In the present study, we aimed to establish a new ECC model for the flexor pollicis brevis muscle (FPBM) and evaluate MCV. METHODS: Twelve men (age, 19.8 ± 1.7 y; height, 172.4 ± 7.0 cm; weight, 64.0 ± 8.6 kg) performed 100 maximal ECCs at 60 deg/sec with the FPBM of the non-dominant arm (ECC) with a custom-made torque dynamometer. The dominant arms were the controls (CON). Maximal voluntary contraction (MVC), ROM, DOMS, and MCV were assessed before, immediately after, and 1, 2, and 5 days after the ECCs. MCV was calculated as the distance by stimulation divided by the latencies of the waveforms generated. Values were statistically analyzed, and the significance level was set at p values of <0.05. RESULTS: MVC, ROM, and DOMS of the ECCs significantly increased as compared with their values before the ECCs (MVC: post, 67.1%; day 1, 73.8%; ROM: post, 83.4%; day 1, 92.1%; DOMS: day 1, 178.8%; day 2, 181.0%; p < 0.05) and as compared with those of the CON (MVC: post, 67.1%; day 1, 73.8%; ROM: post, 83.4%; day 1, 92.1%; DOMS: day 1, 178.8%; day 2, 181.0%; p < 0.05). The MCV of the ECCs decreased significantly immediately after exercise (63.6%, p < 0.05) and as compared with that of time-matched CON. The M-wave latency of the ECCs delayed significantly immediately after exercise (127.3%, p < 0.05) and as compared with before exercise. CONCLUSIONS: Our new ECC model leads to muscle damage similar to those reported in previous studies that used other muscles and motor nerve dysfunction.
Environmental Enrichment Increases Spontaneous Locomotor Activity In Rats

Mizuki SUDO, Soichi ANDO.1 ‘Meiji Yasuda Life Foundation of Health and Welfare, Hachioji, Tokyo, Japan. 1University of Electro-Communications, Chofu, Tokyo, Japan.

Purpose: Environmental enrichment (EE) involves housing conditions that facilitate enhanced sensory, cognitive and motor stimulation. EE is beneficial to brain functions, probably due to increases in spontaneous locomotor activity. However, actual spontaneous locomotor activity has not been directly measured because of the technical difficulties involved in housing rats in groups. The purpose of this study was to assess spontaneous locomotor activity in the EE using a recently developed three-axis accelerometer. We also examined whether wheel running is the key to increase spontaneous locomotor activity housed in the EE.Methods: Thirty-two Wistar rats were divided into four different housing groups (standard environment: SE; only running wheel group: W; EE without running wheel group: EE-S and EE). The present EE contained running wheel, slope, three tunnels, and small rat. Locomotor activity of each was continuously recorded using a three-axis accelerometer, which was embedded in the back. After exposure to each environment for 6 weeks, the tibialis anterior (TA), extensor digitorum longus (EDL) and soleus (Sol) muscles were removed and immediately weighted. Results: Locomotor activity was higher during the W (TA: 1.60 ± 0.23, mg/g; EDL: 1.60 ± 0.24, mg/g; Sol: 0.41 ± 0.51) groups significantly higher in the T group than in the C group (p<0.05). CONCLUSIONS: Combined exercise and leucine supplementation significantly ameliorated skeletal muscular protein deposition in C26 tumor bearing mice, which may be through down-regulating the inflammatory response. (Supported by Research Foundation of Sichuan Provincial Department of Education grant #18ZB0106).

Abstracts were prepared by the authors and printed as submitted.
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 and improve performance. The beta-endorphin concentration was also reduced with RSE (CON: p=0.03, ES:1.8; SUP: p=0.005, ES:1.4) and in the thigh extensors (CON: p=0.048, ES:0.6; PLA: p=0.048, ES:0.7). However, no significant differences were observed when compared to the CON. CONCLUSIONS: The supplementation with 8g of CM 60min before a RTS that consisted in 3 sets until concentric muscle failure with 80%1RM 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 analyses and effect size (ES) was calculated by using Cohen d. RESULTS: There were no significant differences in total training load among the ET (CON: 471±14±26kg; PLA: 475±82.4±26kg; SUP: 482±68.9±26kg). 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=0.001, ES:1.2; SUP: p=0.01, ES:1.4), however, no significant differences were observed when compared to the CON. 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.

**Boards #175 and #176**

**Ergogenic Effect of Citrulline Malate Supplementation on Total Training Load and Muscle Thickness in Trained Women.**

Tatiana G. Pinto, Siddhie Deyoo Tamura, Luis Felipe Milano Teixeira. NEPECE- HOSBOS/UNISO, Sorocaba, Brazil. Email: luis.teixeira@prof.unisb.br

Practitioners of physical activity, to improve performance in training sessions, commonly use pre-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 resistance-trained women. METHODS: Six women (27.8±3.5 y; 67.8±6.6 kg; 164±5.3 cm) experienced in RT (36.1±19.5 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 96h 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%1RM 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 analyses and effect size (ES) was calculated by using Cohen d. RESULTS: There were no significant differences in total training load among the ET (CON: 471±14±26kg; PLA: 475±82.4±26kg; SUP: 482±68.9±26kg). 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=0.001, ES:1.2; SUP: p=0.01, ES:1.4), however, no significant differences were observed when compared to the CON. 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.
METHODS: 12 male, physically active participants were randomized in a double-blind fashion to placebo (PL; n=6, 23±2 years) or creatine (CM; n=6, 21±2 years) groups. Subjects received 0.3 g/kg/day creatine monohydrate or placebo in gelatin capsules for 7 days. Ultrasoundography of the carotid artery, applanation tonometry, submaximal exercise tests (10 minute treadmill activity at 3.7 mph and 9% incline), and lower leg pain (analog visual scale and pain test algometer) assessments were conducted at baseline and on day 7 of the study period. RESULTS: There were no significant differences between PL and CM in carotid-dorsal pulse wave velocity (CF PWV) (460±10.42 vs. 271±21.20 % change), β-stiffness index (5.81±26.3 vs. 1.65±1.35 % change), central pulse pressure (CPP) (-17.38±16.31 vs. 6.05±24.61 % change), and arterial compliance (AC) (19.79±37.50 vs. 12.48±53.89 % change) (all P>0.05). There were no significant changes in SmO2 (7.95±20.24 vs. 29.94±36.13 % change) and peak pain (-6.55±29.87 vs. -12.5±30.62) between PL and CM, respectively (all P>0.05). Finally, there were also no significant differences in body weight (0.53±1.79 vs. 0.20±1.87 % change), fat mass (-3.30±3.49 vs. -0.23±1.18 % change), and free mass (1.12±0.98 vs. 0.23±0.80 % change) between PL and CM, respectively (all P>0.05). CONCLUSIONS: Using a randomly controlled, double-blind trial with validated measurements of AS and SmO2, acute creatine supplementation does not appear to impact vascular compliance or oxygen saturation in skeletal muscle in young, otherwise healthy males.

339  

Board #177  
May 29 9:30 AM - 11:00 AM  
Exhaustive Resistance Exercise Alters Serum Creatine and Guanidinoacetic Acid in Active Men  
Zoran S. Milosevic1, Patrik Drif1, Saad Al Fazzazi2, Valdemar Stajer1, Nebojsa Maksimovic1, Sergej M. Ostojic1.  
1University of Novi Sad, Novi Sad, Serbia. 2University of Granada, Granada, Spain.  
(No relevant relationships reported)  

Exhaustive exercise adversely affects biomarkers of creatine metabolism yet it remains unknown when the values back toward pre-disturbance conditions. PURPOSE: To evaluate a 24-hour post-exercise response in serum guanidinoacetic acid (GAA), creatine and creatinine in young active men subjected to a single session of exhaustive resistance exercise and matched it with exercise-induced changes in serum cortisol, interleukin 6 (IL-6), creatine kinase (CK), and lactate dehydrogenase (LDH). 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, 9.1 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 creatinine 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).
docosahexaenoic acid (DHA)) and performed progressive RT including lat pull-down, seated row, biceps curl, leg press, and calf raise (2 sets of 10 repetitions; 2x/week for 12 weeks). Muscle strength, physical function, and RMR were evaluated pre- and post-intervention. Data were analyzed using 2 x 2 (group x time) repeated-measures ANOVA. RESULTS: There were significant group x time interactions for muscular strength (p < 0.01), physical function (p < 0.05), and RMR (p < 0.01). There were significant increases in muscle strength; lat pull-down (+22%), seated row (+45%), biceps curl (+36%), leg press (+54%), and calf raise (+43%) (p < 0.01) in FRT with no detectable changes in CON. In addition, there were great improvements in physical function; five-stand chair (+22%) and 30-sec chair stand (+22%) in FRT (p < 0.05) with no changes observed in CON. RMR significantly increased in FRT (+6%, p < 0.05), while remarkably decreased in CON (-6%, p < 0.05). CONCLUSION: 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.

344 Board #182 May 29 9:30 AM - 11:00 AM Antioxidants Supplementation Hamper Muscle Growth after 10 Weeks Strength Training Sávio Alex1, Maurilio Dutra2, Alysson Silva1, André Martorelli1, Flávia Espírito Santo1, Lee E. Brown, FACSM5, Martim Bottaro1, 1University of Brasilia, Brasilia, Brazil, 2Federal Institute of Brasilia, Brasilia, Brazil, 3Federal Institute of Goiás, Valparaiso, Brazil, 4University of West Florida, Pensacola, FL, 5(Please provide Lee Brown’s address). Email: savioalex@outlook.com (No relevant relationships reported)

Strength Training (ST) is recommended for increased muscular mass. It has been suggested that reactive oxygen species (ROS) produced by a ST session may play a positive role in the hypertrophic process. However, there is some evidence that chronic antioxidant supplementation may indeed reduce ROS and play a negative role in protein synthesis. Few studies have investigated the effects of ST combined with antioxidants supplementation on muscle hypertrophy. However, results are still controversial. PURPOSE: To investigate the effects of ST combined with Vitamin C and E supplementation on muscle thickness (MT). METHODS: Thirty-three untrained women (22.9±2.5 years, 57.7±8.4 kg, 1.60±0.6 m) were allocated into three groups: Vitamins (VG, n=12), Placebo (PG, n=11) and Control (CG, n=10). Participants of VG and PG groups underwent lower-body (lunge and deadlift exercises) periodized ST, two-times a week, for 10 weeks. VG group was supplemented with vitamins C (1g/day) and E (400IU/day) during the training period. PG ingested placebo pills and CG did not perform training or supplementation. Muscle thickness (MT) of the quadriceps femoris of the dominant limb was analyzed by ultrasound. RESULTS: Both VG (+ 11.6%, P < 0.05) and PG groups (+ 17.1%, P < 0.05) presented increased values of MT after 10 weeks of ST. However, there was no difference between the VG and PG groups, only the PG presented a significant gain of MT when compared to CG (17.1% vs 2.0%; P < .05). CONCLUSIONS: The results of this investigation suggest that chronic antioxidants supplementation may mitigate improvements in muscle hypertrophy, after 10 weeks of ST in untrained young women.

345 Board #183 May 29 9:30 AM - 11:00 AM Combination Polyphenol and MSM Supplementation Alters Post Half Marathon Systemic Inflammatory Response Melody A. Gary, Elizabeth A. Tanner, Ashlea A. Davis, Brian K. McFarlin, FACSM. University of North Texas Applied Physiology Lab, Denton, TX. (Sponsor: Brian McFarlin, FACSM) Email: melody.gary@unt.edu (No relevant relationships reported)

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; Pomella), 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 24-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 FM3D). 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 tolerate 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\textperiodcentered{peak}, 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 kg.m\textsuperscript{-1} min\textsuperscript{-1} ) indicated that soy supplementation resulted in lower values of cardiac output (-1.6 ± 0.8 L.min\textsuperscript{-1}), stroke volume (-5.4 ± 3.1 ml beat\textsuperscript{-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.

It appears that 3g/day of spirulina cannot completely cope with oxidative stress in hypoxic condition. Therefore, these findings could have implications for dosage strategies currently used by athletes.

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/m\textsuperscript{2}, age 30.4±3.6 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±4 vs. 158±4 bpm; p=0.518) and ratings of subjective difficulty post-exercise (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 it being marketed as a cognitive enhancer. Because of its inability to enhance cognitive function, its inclusion in pre-workout supplements warrants reconsideration. Other more practical and effective strategies should be considered.
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 supplements 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 were 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 ectysterone concentrations in serum. Effects on endocrine parameters were detectable. Serum IGF1 concentrations increased in comparison to placebo intervention, while CRP levels were decreased by 1.0 mg/L and 0.7 mg/L after placebo intervention (P = 0.04). Baseline CRP levels were decreased by 1.0 mg/L and 0.7 mg/L after placebo intervention (P = 0.04).

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”.

CITRUS ACTIVE SUBSTANCES COULD MAINTAIN THE NUMBER OF ATHLETES LEUCOCYTES.

CITRUS SUBSTANCES COULD MAINTAIN THE NUMBER OF ATHLETES LEUCOCYTES.

Repetitive exercise on consecutive days is a key component of many long-term training plans. This type of training results in muscle inflammation and soreness that limits the capacity to sustain exercise at a high intensity. Several dietary polyphenols have the capacity to manage inflammation and thus supplementation may be an effective component of a long-term training plan. PURPOSE: The purpose of this study was to investigate the effect of combined oral supplementation with curcumin and boswellia serrata prior to and following three consecutive days of intense interval exercise. METHODS: All protocols were approved by the University IRB committee and participants gave written informed consent. Participants were supplemented with either combined active (N=10; 95% full spectrum curcumin=400 mg/d and 90% boswellia serrata extract standardized for AKBA=100 mg/d) or placebo (rice flour; N=7) for 7-d prior to and immediately following each exercise session. Each exercise day consisted of 45-min of interval exercise (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 for serum prior to and 1-h after each of the three exercise days and 24-h after the final exercise day. Samples were analyzed in duplicate using separate head-
based assays to measure cytokines and myokines (Milliplex; Millipore-Sigma). Sample analysis was performed on a multiplex analyzer (Lumines LX200). RESULTS: Active resulted in trends toward reduced muscle soreness and improved muscle strength compared to placebo. Active was also associated with transient reductions in serum creatine kinase, MIP-1β, and IL-6. CONCLUSIONS: These data support the notion that combined supplementation with curcumin and boswelia serrata may represent an effective means to manage systemic inflammation during consecutive days of training. More research is needed to understand how curcumin and boswelia 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, Ashael 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.

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 phase 1 purpose was to evaluate different doses of a curcumin supplement following a bout of eccentric leg exercise. This type of exercise results in phase 2 purpose to determine if the effective curcumin dose 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 1, 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 acid resistant probiotic strain (NZBC) extract would accelerate recovery after a half-marathon race. NZBC and PLA = 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 effect only induced modest changes in the indices of EIMD in the days after the event. Acknowledgement: We thank Health Currancy Ltd (UK) and CurraNZ (NZ) for supplements.

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 Myers2, Nathan A. Lewis3, Sam D. Blacker1. 1University of Chichester, Chichester, United Kingdom. 2University of Portsmouth, Portsmouth, United Kingdom. 3English 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 determine 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) and previous half-marathons 7 ± 2, finishing time 1:56:33 ± 0:18:08 h:min:s) 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 immediately 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 effect only induced modest changes in the indices of EIMD in the days after the event. Acknowledgement: We thank Health Currancy 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, Elsa F. Walker1, Lucy Wheeler2, Kimberly M. Ashdown1, Mark ET Willems1, Matthew R. Kuenen1. 1University of Chichester, Chichester, United Kingdom. 2High Point University, High Point, NC. Email: b.lee@chi.ac.uk

(No relevant relationships reported)

Extracellular heat shock protein 72 (hHSP72) 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 (hHSP32) protects the vasculature and suppresses inflammation. Each are elevated following exertional heat stress. Polyphenols are proposed to have anti-inflammatory properties, so may affect hHSP responses to exercise. Purpose: To determine the effects of 7-days supplementation with New Zealand blackcurrant (NZBC) extract on hHSP72, hHSP90α, and hHSP32 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⋅min−1) completed 2 trials. Participants ingested 2x300 mg day−1 capsules of CurraNZ™ (each containing 105 mg anthocyanin) or a visually matched placebo for 7 days (washout 4 days). On day 7, participants ran 60 minutes at 65%VO2max in hot ambient conditions (34°C and 40% relative humidity). hHSP72, hHSP90α, and hHSP32 were measured in EDTA plasma at rest and 20 and 60 minutes after exercise. Results: Post exercise hHSP72 concentrations were elevated after the placebo [by 1.98 ng.mL−1 (95% CI: 0.65 - 3.33 ng.mL−1)] and NZBC trials [by 1.59 ng.mL−1 (95% CI: 0.03 - 3.15 ng.mL−1)] and remained elevated 60 minutes after exercise [Placebo: by 0.68 ng.mL−1 (95% CI: -0.07 - 1.46 ng.mL−1); NZBC: by 0.51 ng.mL−1 (95% CI: -0.37 - 1.40 ng.mL−1)]. Basal hHSP90α concentrations was increased following NZBC supplementation [by 5.60 ng.mL−1 (1.85 - 9.51 ng.mL−1), trial x time interaction, F = 3.57, p = 0.046, np2 = 0.25], and were elevated at 20 and 60 minutes post exercise in both conditions. Similarly, basal hHSP32 was elevated after NZBC supplementation [by 3.9 ng.mL−1 (95% CI: 0.37 - 7.42 ng.mL−1)], trial x time interaction F = 5.62, p = 0.01, np2 = 0.34], and 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 hHSP32 and hHSP90α, with no effect on hHSP72 before or after exercise. Further research is required to determine the functional relevance of these increases. Acknowledgement: We thank Health Currancy Ltd (UK) and CurraNZ (NZ) for supplements.

357 Board #195 May 29 9:30 AM - 11:00 AM Does Supplementation With Pedicoccus Acidilactici Probiotics Alter Inflammatory Response To Exercise On Consecutive Days? John H. Curtis, Ashael 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-sphere forming high temperature (up to 85°C) and acid resistant probiotic strain (Pedicoccus 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 (Pedicoccus acidilactici; NRRL B-50517, 8 billion cfu per day; N=6) or placebo condition (maltodextrin; N=5) for 14 days prior to two consecutive days of 45-min of intense, interval exercise (intervals of ladder climbing, cycling, and downhill running). Subjective muscle soreness and muscle strength were

Abstracts were prepared by the authors and printed as submitted.
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 multiplexer analyzer (Luminex LX200). 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.

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 no supplement (N=6). Venous 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 Immunoassay Panel on a NanoString nCounter platform. Data were normalized to housekeeper genes and reported as log2 fold change. Detailed pathway and interaction analysis was conducted using NanoString nSolver software to identify RNA that were significantly affected by the supplement. RESULTS: Analysis revealed significant down regulation of nine pro-inflammatory associated mRNA at 4-h post-race with supplementation compared to control. CONCLUSIONS: Combined curcumin and pomegranate extract supplementation altered expression of inflammation associated mRNA prior to and following a half marathon race. Based on these findings, it appears that curcumin and pomegranate extract supplementation may positively affect short-term inflammatory response and recovery in endurance athletes and recreationally active individuals participating in half marathon races. More research is needed to determine how to best use these dietary polyphenols as part of a long-term training plan.

Prolonged exercise may cause Gastrointestinal Symptoms (GIS) as well as rise some negative effects, which may be mitigated by probiotics according to evidences. PURPOSE: Investigate the probiotic effect on mood and GIS after a marathon race. METHODS: Twenty seven marathonists were double-blind randomly assigned to either a probiotic group (PR) (35.96 ± 5.81 years, 79.30 ± 10.99 kg) or placebo (PL) (35.86 ± 5.79 years, 72.67 ± 10.20 kg). PR consumed during 30 days a schematic containing Lactobacillus Acidophilus and Bifidobacterium Lactis (10x10^9 UFC + maltoextrin 5g/day) while PL received a sachet with maltoextrin 5g/day. GIS were evaluated before the supplementation period (B) and one day before the race (1D) by questionnaires. Brunel Mood Scale (BRUNS) was applied at the B, immediately after the race (AR) and one hour after the race (1H). The data were analyzed in SPSS version25® using ANOVA two way with repeated measures, “group” and “time” as factors, and Tukey’s post-hoc test (p<0.05). Results were expressed as means ± standard deviation (SD). RESULTS: GIS were not different after the supplementation period or between groups. According to BRUNS, PL group showed significant increase of depression (B: 0.23 ± 0.43; AR: 1.30 ± 0.21; 1H: 1.60), anger (B: 0.00 ± AR: 6.61 ±1.51; 1H: 5.31 ± 1.33), fatigue (B: 0.69 ± AR: 12.15 ± 0.98; 1H: 7.70 ± 0.75), tension (B: 1.46 ± 2.06; AR: 6.38 ± 0.65; 1H: 3.84 ± 0.37) and mental confusion (B: 0.53 ± 0.77; AR: 4.46 ± 0.51; 1H: 2.92 ± 0.27) and decrease of vigor (B: 10.30 ± 2.25; AR: 2.01 ± 0.91; 1H: 6.76 ± 1.30) when compared with B, AR and 1H. Probiotic group shown significant increase of anger (B: 0.21 ± 0.42; AR: 1.21 ± 0.89; 1H: 0.14 ± 0.36), fatigue (B: 1.01 ± 8.7; AR: -0.28 ± 1.43; 1H: 0.71 ± 0.72), tension (B: 2.92 ± 1.20; AR: 1.42 ± 0.64; 1H: 0.71 ± 1.13) and mental confusion (B: 2.80 ± 0.46; AR: 4.02 ± 0.51; 1H: 0.62 ± 0.64) when compared B, AR and 1H. Between groups, for all mood parameters, PL showed significant increase at AR and 1H compared to PR (p<0.05). CONCLUSION: *Lactobacillus Acidophilus* and *Bifidobacterium Lactis* (10x10^9 UFC/day) consumption did not seem to have effect on GIS, but it plays a positive role on mood affects in order to attenuating the increase of negative affects and maintaining the vigor state which may influence sport performance. Financial Support: CNPq, CAPES/PROEX.
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 allowed a more reliable measurement of the real dimension of the placebo effect.

---

**Effects of Nutritional Supplementation on Body Composition and Bio-markers during Army Initial Entry Training**

Jeremy McAdam1, Kaitlin McGinnis2, Darren Beck3, Andrew Frugé4, Michael Roberts4, JoEllen Setton5. Auburn University, Auburn, AL. "Edward Via College of Osteopathic Medicine-Auburn Campus, Auburn, AL. Email: jsm0039@auburn.edu

*No relevant relationships reported*

**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 = 24 ± 2.7 y) were randomized to two groups participating in Army IET were supplemented with one 38.6 g protein (from WP hydrolysate; WP, n = 45) or energy, fat and taste matched CHO (n = 51) for 30 days. Measures were taken pre- and post supplementation. Resting energy expenditure (REE) was measured 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 was beneficial in maintaining/improving health. EDs had the highest response for adverse reactions including jitters, shakiness and increased heart rate, with 17% of Students indicating taking EDs was harmful. Whey protein and MVM are safe and effective for athletes that can use muscle hypertrophy/strength (WP) and supplementing the diet (MVM).

**Summary of Results:**

- *Subjects were allowed to select more than 1 response. CONCLUSION: SQT students reported taking WP was beneficial (75%) in increasing muscle mass/strength and improving recovery. MVM supplements had the lowest reported adverse reactions and was beneficial in maintaining/improving health. EDs had the highest response for adverse reactions including jitters, shakiness and increased heart rate, with 17% of Students indicating taking EDs was harmful. Whey protein and MVM are safe and effective for athletes that can use muscle hypertrophy/strength (WP) and supplementing the diet (MVM). Supported by ONR N00014-11-04929.*

---

**Adverse Reactions and Perceived Benefits of Dietary Supplements used by SEAL Qualification Training Students**

Kim Beals, Mita Lovalekar, Bradley C. Nindl, FACSM. University of Pittsburgh, Pittsburgh, PA. (Sponsor: Bradley C. Nindl, FACSM)

Email: beals.kim@pitt.edu

*No relevant relationships reported*

**Sea, Air, and Land (SEAL) Qualification Training (SQT) students must successfully complete several months of advanced tactical training in order to become a NAVY SEAL Operator. During SQT training students are discouraged from consuming any dietary supplements (DSs). PURPOSE: Evaluate the DS habits of SQT Students. METHODS: 282 male Students (Age 24 ± 2.7 y) completed a detailed DS questionnaire. RESULTS: Ninety percent of SQT students reported consuming at least one DS on a consistent basis during the previous 12 months. Of these, 59% consumed whey protein supplements (WP), 47% multivitamin and mineral supplements (MVM) and 31% energy drinks (EDs) (Table 1). Table 1: Common dietary supplements, purpose for use, perceived benefits and adverse reactions among SQT students (top 3 responses reported as % Students).

<table>
<thead>
<tr>
<th>Supplement Category</th>
<th>Purpose of Use*</th>
<th>Adverse Reactions</th>
<th>Perceived Benefits*</th>
<th>Impact*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whey</td>
<td>Increase muscle mass, strength, recovery 88% Supplement diet Improve health 23% Improve performance 23%</td>
<td>None 98% Bloating, gas, lactose intolerance 2%</td>
<td>None benefit 40% Improved recovery 41% Increase muscle mass/ strength 34%</td>
<td>Beneficial 85% Neither harmful or beneficial 15%</td>
</tr>
<tr>
<td>Multivitamin &amp; Mineral Supplement</td>
<td>Improve diet: Improve Health 97% Improve performance 15% Increase muscle mass, strength, recovery 6%</td>
<td>None 99% Upset stomach 1%</td>
<td>None benefit 74% Stayed healthy/ Improved immunity 14% Better energy/ feel better 8%</td>
<td>Beneficial 63% Neither harmful or beneficial 36% N/A 1%</td>
</tr>
<tr>
<td>Energy Drinks</td>
<td>Improve cognitive function 50% Improve performance 35% Tastes Good 8%</td>
<td>None 85% Jittery/ Shaky 7% Increased heart rate 3%</td>
<td>None benefit 23%</td>
<td>Awake/ Alert 48% More energy 31%</td>
</tr>
</tbody>
</table>

*Subjects were allowed to select more than 1 response. CONCLUSION: SQT students reported taking WP was beneficial (75%) in increasing muscle mass/strength and improving recovery. MVM supplements had the lowest reported adverse reactions and was beneficial in maintaining/improving health. EDs had the highest response for adverse reactions including jitters, shakiness and increased heart rate, with 17% of Students indicating taking EDs was harmful. Whey protein and MVM are safe and effective for athletes that can use muscle hypertrophy/strength (WP) and supplementing the diet (MVM). Supported by ONR N00014-11-04929.*

---

**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

*No relevant relationships reported*

**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 consisting of cycling for 20 min, 10 min at 50 watts (EEE-50) and 10 min at 100 watts (EEE-100). Upon completion of the 30 day supplementation, subjects repeated the assessment for REE, EEE-50, and EEE-100. All data are presented as mean (SE).

**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.
PURPOSE: Disuse condition results in impaired capillary network of skeletal muscle. Capillary regeneration appears to be an adaptation to a reduction in blood flow to the skeletal muscles caused by a decrease in oxidative demand. Increased blood flow leads to angiogenesis via increases in angiogenic factors in skeletal muscles. A probiotic strain of lactobacillus affects autonomic nerve activity has been reported. The purpose of the present study was to investigate the amelioration of enterococcus faecium strain R30 (R30) supplementation on the capillary regeneration and fatigue of skeletal muscle under disuse condition. METHODS: Thirty-six male Sprague-Dawley rats were assigned randomly either to a control, control with R30 supplementation, hindlimb unloaded or hindlimb unloaded with R30 supplementation group for 14 days. 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 plantar muscles was generated by successive electrical stimulations were measure in vivo. RESULTS: The capillary volume and diameter in disuse muscle were lower than those in control. R30 supplementation attenuated the decrease of capillary volume and diameter in disuse muscle. 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 a chronic decrease in muscle activities on the microcirculation and endurance in skeletal muscle.

Circulating microRNAs (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
\text{2}\text{max} 50 ± 4 mL/kg/min) completed 3 trials, each consisting of 4 sets of 3-min intervals (90% VO
\text{2}\text{max}) flanked by 30-sec Wingate intervals. Placebo (PLA; water), carbohydrate (CHO; 65 g), and carbohydrate (65 g) + protein (20 g) (PR0) beverages (600 mL) to which ci-miRNA were added immediately following exercise. Serum levels of 9 miRNA (miR-1, -21, -126, -146a, -150, -221, -222, and -486) were measured pre-exercise (Pre), immediately post (Post-0), Post-1hr, and Post-4hr. miRNA levels were expressed as fold changes relative to baseline and analyzed with repeated measures ANOVAs. Results: With the exception of a 13-fold increase (p<0.05) in ci-miRNA-486 there was no main effect of time for any of the target ci-miRNA from Pre to Post-0 (i.e. prior to any nutritional intervention). There was a main effect of time for Ci-miRNA-150 from Pre to Post-1hr (0.6 fold-change, p<0.05) and from Pre to Post-4hr (0.7 fold-change, p<0.05), but there were no detectable nutritional effects. Further, miRNA-1 increased from Pre to Post-4hr (4.1-fold-change, p<0.05) but again with no nutritional effect. No other differences, across time or between treatments, were detected. Conclusion: In general, high-intensity cycling had a subtle impact on serum levels of miRNA. However, miRNA associated with skeletal muscle (miRNA-1 and -486) and cardiac physiology (miRNA-1 and -150) were affected by exercise. Post-exercise nutrition had no consequences on any of the targets of interest. However, the extent to which ci-miRNA reflects intracellular miRNA activity is poorly understood and future work should investigate how nutrition may influence intracellular miRNA levels.

Exercise transiently increases several leukocyte populations in peripheral blood in an intensity-dependent manner, with numbers returning to baseline or lower during recovery. This mobilization of immune cells is explained in part by sympathetic activity and the release of stress hormones (catecholamines and cortisol). The literature examining immune responses to exercise has by and large failed to control for the presence of a warm-up prior to the experimental bout. Gradually increasing exercise intensity over a period of minutes may reduce the stress of the exercise bout and thus may influence the immune response to a given exercise protocol.

PURPOSE: To compare the mobilization of leukocyte subpopulations following a bout of high intensity aerobic exercise with and without a dynamic pre-exercise warm-up.

Methods: 8 physically active adults (4 women, 27±4 years) cycled 30 minutes at 80% heart rate maximum with and without warm-up in a randomized, counter-balanced order. Warm-up was provided immediately prior to the exercise, and involved increasing wattage by 10% each minute for 10 minutes starting at 10% of desired exercise intensity. Blood collected pre-, post- and 1-hour post-exercise was analyzed by flow cytometry to characterize cell populations. Differences in cell concentrations across time points and conditions were assessed by maximum likelihood linear mixed models.

Results: Exercise transiently increased lymphocyte concentration in blood, and the number and proportion of late differentiated CD8 T cells (main effects of time; p<0.001). Inclusion of warm-up diminished these post-exercise increases in lymphocytes (pre- to post-change with warm-up: 45±19 cells/μl; representing a 2% increase; change with no warm-up: 93±11 cells/μl; a 42% increase; p<0.05) and in late differentiated CD8 T cells (pre- to post-change with warm-up: 1±5 cells/μl; representing a 2% increase; change with no warm-up: 10±4 cells/μl; a 46% increase; p<0.05).

Conclusions: Including a dynamic warm-up prior to vigorous aerobic exercise lessens the exercise-induced mobilization of lymphocytes and late differentiated T cells. Athletes should include a dynamic warm-up to reduce immune perturbations during high intensity exercise.

Natural killer (NK) cells are the most responsive lymphocytes during acute exercise, with increased concentrations. After exercise, NK cell levels drop below their resting levels if the exercise intensity was high, but values usually recover within 1-3 hours. NK cells may be divided into CD56
\text{dim} and CD56
\text{bright} subsets. The CD56
\text{dim} subset is the major population, representing about 80% of NK cells. Smaller subpopulations were recently studied for cell developments and diseases. We previously reported that exercise decreased the expression of Fcγ-receptor III (CD16); however, it is not yet understood how exercise affects these small subsets.

Purpose: To clarify the effect of acute exercise on the mobilization and expression of CD16 on the six different NK cell subsets.

Methods: Healthy male students (n=6, 22.8±0.8 years old) exercised on a cycle ergometer for 30 min at intensities corresponding to the individual’s onset of blood lactate accumulation (70-85% maximum oxygen consumption). Venous blood samples were collected at rest (PRE), just before the end of exercise (END), 30 (POST 0), 60 (POST 60), 120 (POST 120), and 180 (POST 180) min after exercise. Cell counts and proportions of total lymphocytes expressing CD16 CD56
\text{dim} (R1), CD16CD56
\text{bright} (R2), CD16CD56
\text{dim} (R3), CD16
\text{dim}CD56
\text{bright} (R4), CD16
\text{dim}CD56
\text{dim} (R5) and CD16
\text{dim}CD56
\text{bright} (R6) subsets were determined. CD16 expressions of these subsets were also examined by flow cytometry. ANOVA was used for statistical analyses.
RESULTS: Exercise induced changes in NK cell concentration in CD56bright (R3, p=0.04; R4, p<0.01; R5, p<0.01) and CD56dim (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 (108±27 cells/µL, p<0.01) and POST 60 (106±70 cells/µL, p<0.01). There were no changes in CD56dim (R1, R2) subsets. These cell mobilizations were reflected in proportions to the total lymphocyte count. Expression of CD16 in CD56dim were down-regulated at END in R5 (p=0.02; 0.15; p<0.01) and R6 (-416.99, 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.

369 Board #207 May 29 9:30 AM - 11:00 AM Tumor Necrosis Factor-alpha, TNFR, And STNFR Relationships to Body Temperature Elliott Arroyo, Brittany N. Followlay, Jeremiah A. Vaughan, Joseph A. Lau dado, 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 STNFR relationships to body temperature in response to heat. METHODS: 12 recreationally active men (24±3.1 yrs; 181±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%RH; and 35°C/45%RH. The protocol consisted of a 60-minute cycling trial at 60% VO2max (T1 to T3) (p=0.002). There were no changes in CD56bright (R1, R2) subsets. These cell mobilizations were reflected in proportions to the total lymphocyte count. Expression of CD16 in CD56dim were down-regulated at END in R5 (p=0.02; 0.15; p<0.01) and R6 (-416.99, 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.

370 Board #208 May 29 9:30 AM - 11:00 AM Monocyte Adhesion Molecule Expression Following an Acute Bout of Moderate Intensity Cycling Natalie J. Bohnhke, Lindsay M. LaFratta, Lauren N. Pedersen, Anson M. Blanks, Virginia L. Mihalick, Morgan B. Senter, R. Lee Franco. Virginia Commonwealth University, Richmond, VA. (No relevant relationships reported)

Monocyte adhesion to the endothelium is a key step in the development of atherosclerosis. It is well established that higher CV fitness is associated with a reduced risk for CV disease. PURPOSE: To investigate the impact of fitness on monocyte surface receptor expression of CD11c and VLA4 following an acute bout of exercise. METHODS: 9 fit (VO2 peak: males = 45 mL·o2/kg·min, females = 35 mL·o2/kg·min) and 13 unfit (VO2 peak: males = 40 mL·o2/kg·min, females = 30 mL·o2/kg·min) subjects performed a 30 min of moderate intensity (60% VO2peak) cycling. Blood samples were obtained pre-exercise, immediately, and 1 h post-exercise. Monocytes were stained with antibodies against CD14, CD16, VLA4, and CD11c and were analyzed via flow cytometry. A mixed between-within repeated measures ANOVA was used to determine the impact of fitness on VLA4 and CD11c following a submaximal bout of exercise. RESULTS: There were no significant between-subjects main effect for groups in either of the monocyte subsets (p>0.083). A main effect for time was significant in VLA4 (p<0.004) and CD11c (p<0.014) expression in non-classical and classical monocytes, respectively. A profile plot suggested that VLA4 was increased 1 h post-exercise and CD11c was reduced immediately post-exercise. CONCLUSIONS: Monocyte receptor expression does not appear to be impacted by physical fitness in young, apparently healthy adults. Nevertheless, an acute bout of cycling altered the expression level of monocyte adhesion molecules to varying degrees depending on the specific monocyte subset.

371 Board #209 May 29 9:30 AM - 11:00 AM Aerobic Capacity And LPS-induced iNOS mRNA Expression In Leukocytes Of Healthy College-aged Males Tiffany M. Zuniga1, Aaron L. Slussher2, Ryan S. Garten2, Edmund O. Acvedo, FACSM1, 1The University of Arizona, Tucson, AZ, 2University of Michigan, Ann Arbor, MI. 1Virginia Commonwealth University, Richmond, VA. (Sponsor: Dr. Edmund O. Acvedo, FACSM)

(No relevant relationships reported)

PURPOSE: Inducible nitric oxide synthase (iNOS) is an enzyme expressed in leukocytes that supports innate immune function. While iNOS expression is low-to-undetectable in leukocytes under normal resting conditions, LPS-stimulated overexpression of iNOS increases indices of pro-inflammatory, oxidative stress, and apoptosis. Aerobic exercise is a known anti-inflammatory mechanism shown to regulate iNOS expression. Therefore, this study examined the relationship between LPS-induced iNOS mRNA expression and indices of pro-inflammatory, oxidative stress, and apoptosis in isolated leukocytes of acutely fit (AF) and unfit (UF) males. METHODS: iNOS mRNA expression and TNF-α, MDA, and p33 concentrations were measured at baseline (PRE) and following 3-hour LPS stimulation and unstimulated whole blood. RESULTS: iNOS mRNA expression was maintained following LPS stimulation in AF and UF subjects (p = 0.146). However, LPS stimulation significantly lowered MDA concentrations to a greater extent in UF compared to AF subjects (p = 0.001), whereas LPS stimulation increased TNF-α and lowered p33 to a similar extent in both groups (p ≥ 0.002, p = 0.022, respectively). Interestingly, change in relative iNOS mRNA expression was not associated with the percent change (control vs. LPS stimulation) in the concentrations of MDA, TNF-α, and p33.

CONCLUSIONS: Findings suggest that although aerobic fitness did not alter iNOS mRNA expression following LPS stimulation and may not directly impact indices of pro-inflammation or the pro-apoptotic marker p33 in healthy, young males, fitness may impact LPS-induced oxidative stress.

372 Board #210 May 29 9:30 AM - 11:00 AM 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)

(No relevant relationships reported)

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 during cycling. METHODS: 12 recreationally active men (24±3.1 yrs; 181±0.07m; 81.5±8.0kg; 47.2±4.8 ml/kg·min) completed five 34°C/45% RH, 23°C/70%RH, 23°C/45%RH, 35°C/20%RH, and 35°C/45%RH trials. Within each trial, participants completed a 60-minute cycling trial at 60% VO2max. Blood samples were taken prior to cycling (PRE), immediately after (60), and after TTE. Rectal temperature (Tre) and skin temperatures (chest, triceps, forearm, thigh and calf) were monitored continuously during trials. Total skin (Tsk) and whole body temperature (Twb) were calculated using weighted averages. The Area Under the Curve with respect to increase in (AUCi) was calculated for Tsk, Twb, and TNFR and STNFR, and TNFR and STNFR using stepwise linear regression. RESULTS: Tre was correlated with the change in STNFR1 from T1 to T3 (r=0.34, p<0.048) and with the change in STNFR2 from T1 to T3 (r=0.340, p=0.028). Tre was correlated with both the change in STNFR1 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 STNFR2 from T1 to T3 (r=0.430, p=0.004); and with the change in TNFR from T1 to T2 (r=0.357, p<0.020). Time spent with a Tre above 38.5°C was related to the change in STNFR1 from both T1 to T2 (r=0.877, p<0.001) and from T1 to T3 (r=0.773, p<0.001); and to the change in TNFR from T1 to T2 (r=0.426, p=0.050) and from T3 to T5 (r=0.415, p<0.006). CONCLUSIONS: Changes in circulating levels of TNFR and STNFR 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.
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 stressors 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 sAMP concentrations and secretion rates (r=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 V1, and 3 fold at V2, 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 V1 (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.

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

**Board #211**
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 Vagiakos2, Markos Mantalouf1, George Chrousos1, Michael Koutsilieris1, Theodoros Platanou1, 1National And Kapodistrian University Of Athens, Athens, Greece. 2National Technical University Of Athens, Athens, Greece. 3National And Kapodistrian University Of Athens, Biomedical Research Foundation Of The Academy Of Athens, Athens, Greece.

Email: nafpaktitou@cosmotemail.gr

(No relevant relationships reported)

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 (14.0±1.0 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-, 1 hour post and maximal, 400nm swimming testing. Serum IL-1ra and IL-4 levels were measured by ELISA. Adjustment for exercise-induced plasma volume changes was performed before all data analyses. Two-way ANOVA with repeated measures was used for statistics. **Results:** Significant pre-post testing differences for IL-1ra (p<0.001) and IL-4 (p<0.05), were found throughout the experimental period. Pre-post testing differences were greatest at T5 for IL-1ra (0.9±1.1 vs 0.1±0.4 pg/ml) and IL-4 (0.06±0.04 pg/ml). Both IL-1ra and IL-4 had similar, no significant (p<0.05) pre-testing responses, exhibiting an increase from T1 to T2 (IL-1ra: 200.04±14.73 vs 250.76±73.56 pg/ml and IL-4: 0.08±0.02 vs 0.11±0.03 pg/ml) and from T3 to T5 (IL-1ra: 171.15±1.85 vs 187.66±19.89 pg/ml, IL-4: 0.08±0.03 vs 0.09±0.03 pg/ml) and a decrease from T2 to T3 for IL-1ra (230.76±73.56 vs 171.15±11.85 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.**
home to parents of the students to be completed. Upon completion, parents returned the FNP A 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 FNP A and PAQ-A, HEI-2010, and total screen time. Logistic regression was used to determine differences in FNP A score by weight categories. RESULTS: Mean BMI (22.3 ± 4.6 kg/m²) approximated the 65th percentile, with 18.3% of the sample being overweight and 11.4% being obese. No significant relationships were found in the linear regression analyses between the FNP A, PAQ-A, HEI-2010, or total screen time (F=0.49, p=0.83, Adjusted R² = 0.018). When controlling for age, sex, and race, these relationships remained non-significant. Logistic regression analyses showed no significant associations between the FNP A and weight status (OR = 1.21, CI = 0.62-2.36) or overfatness (OR = 1.91, CI = 0.92-3.95).

CONCLUSION: This study highlights that the FNP A Screening Tool may not be associated with health behaviors or obesity risk in an adolescent population. Further research is needed to explore the utility of the FNP A Screening Tool in adolescents.

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

Georges Jabbour, Lina Majed. 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 was watt (W), 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=0.80, 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 excess 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=−1.1 [1.8, 4.0]), 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.

A-53 Free Communication/Poster - Exercise & Neuroscience

Researchers have consistently observed a positive relationship between physical activity (PA) and alcohol consumption (AC). Additionally, 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: Preliminarily 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).

Free Communication/Poster - Exercise & Neuroscience

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

Social Media-Based Physical Activity Promotion by Craft Brewing Establishments Located in Knoxville, Tennessee

Paula-Marie M. Ferrara, Eugene C. Fitzugh, Cory T. Beaumont, Kelley Strohhacker, FACSM. University of Tennessee, Knoxville, TN.

Email: pferraa1@vols.utk.edu

No relevant relationships reported
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=101.13) over one year, and pertained to fitness classes (29.25%), bicycling (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 ($\chi^2$(2, 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 ($r=0.36$, $p=0.18$), drinking and dining ($r=0.46$, $p=0.08$), 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.

381 Board #219 May 29 9:30 AM - 11:00 AM Pre- and Post-Season Electroencephalography Measures of Brain Vital Signs in Youth Football Players Thayne A. Munce, FACSM1, Shaun D. Fickling2, Daniel N. Poel1, Jason D. Dormain1, Ryan C.N. D’Arcy1. 1Sanford Sports Science Institute, Sioux Falls, SD. 2Simon Fraser University, Metro Vancouver, BC, Canada.

Email: thaynemunce@sanfordhealth.org

(No relevant relationships reported)

Amid growing concern of potential brain trauma caused by repetitive head impacts (RHI) in youth football, there is an emerging need to develop objective, physiologic assessments of brain function that can identify sub-concussive impairment. Electroencephalography (EEG) may be a viable tool to evaluate neurologic dysfunction associated with RHI.PURPOSE: To evaluate the neurophysiologic activity of youth football players in association with RHI.

METHODS: EEG data were captured from nine middle school football players (13.± 0.5 yr) before (PRE) and after (POST) one season using a portable 8-channel EEG cap with three electrodes (Fz, Cz and Pz) while subjects listened to an auditory stimulus sequence (∼5 min). Amplitudes (A) and latencies (L) of event-related potentials (ERP) corresponding to auditory sensation (N100A, N100L), basic attention (P300A, P300L), and cognitive processing (N400A, N400L) were converted to normalized brain vital signs scores (0.100 scale). Larger ERP amplitudes equate to higher scores and delayed latencies equate to lower scores. RHI were measured during the season via accelerometer (Head Impact Telemetry System). EEG data from three subjects were of insufficient quality for analysis; thus, results were limited to the six remaining subjects. RESULTS: Scores for N400L decreased significantly ($p=0.031$) from PRE (63.9 ± 7.6) to POST (50.0 ± 0.3) during SWRs sleeping in summer, 0.50±0.03 vs. 0.55±0.04, p<0.01 during the theta rhythms awaking and slow gamma power (0.33±0.05 vs. 0.51±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 (0.50±0.03, p<0.05) in 3Tg mice. Furthermore, these disturbances were observed to be consistent with $\eta$ pathological deposits (AS, 1.42±0.21, p<0.01 vs. CS; AS: 0.52±0.09, p<0.01 vs. AS).

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

Supported by the National Natural Science Foundation of China (31571229).

383 Board #221 May 29 9:30 AM - 11:00 AM Aerobic Exercise Regulates Gamma Oscillation in Hippocampal CA1 of APP/PS1 Tau Mice Yan Li1, Cui Li1, Lianwei Mu1, Ziqi Zhao2, Li Zhao1. 1Beijing Sport University, Beijing, China. 2Beijing Jiao Tong University, Beijing, China. Email: zhaoliziping@126.com

(No relevant relationships reported)

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

384 Board #222 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: Glycogen synthase kinase 3 beta (GSK3β) is involved in hyphophosphorylated 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 phosphorylating 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/ AE) and sedentary group (CS/AS) respectively. Animals
were subjected to treadmill exercise for 12 weeks. The changes in behavior were detected by eight arm maze. The phosphorylation levels of AKT, GSK3β and Tau were measured by using 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±0.4 vs 4.3±0.2; p<0.05; 6.0±0.7 vs 8.4±0.9; p<0.01; 109±3 vs 256±4.25; p<0.05), indicating that aerobic exercise improved behavioral and cognitive response ability. The levels of pTau ser262 and pTau ser396 were significantly increased at hippocampus in AS compared with those of control groups (C) (0.98±0.09 vs 0.82±0.09; p=0.05; 0.89±0.06 vs 0.73±0.11; p<0.05). Aerobic exercise could decrease pTau ser262 and pTau ser396 (0.69±0.08 vs 0.98±0.09; p<0.01; 0.67±0.02 vs 0.89±0.06; p<0.05). In case as of GSK3β, the levels of pGSK3β ser9 were significantly decreased, while the levels of GSK3β tyr216 were significantly increased in hippocampus of AS compared with those of C (0.51±0.08 vs 0.69±0.08; p<0.05; 0.67±0.09 vs 0.70±0.08; p<0.01), and the levels of GSK3β tyr216 were increased (0.79±0.09 vs 0.51±0.08, p<0.01). Furthermore, the levels of pAKT ser473 were significantly decreased in hippocampus of AS compared with those of C (0.69±0.07 vs 0.73±0.13; p<0.05). Aerobic exercise induced to increase the activity of pAKT ser473 (0.74±0.13 vs 0.49±0.07; p<0.05). CONCLUSION: 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), control group (CS) and 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 levels of Aβ oligomer (AβO), Aβ and soluble oligomers (sO). 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±3 vs 30±6%; 72±2 vs 54±1%; p<0.01). The AE performed better than AS (22±1 vs 39±3%; 55±3 vs 71±2%; p<0.05). AβO was aggregated at hippocampus in AS, accompanied with an increase of AβO (1.1±0.1 vs 1.0±0.05; p<0.05). A decreased was detected in Aβ plaque and Aβ content in CE as AS (0.61±0.1 vs 1.5±0.1; 0.9±0.1 vs 1.1±0.01; p<0.05). There was an increase in AS compared with CS in the mPTP opening (0.07±0.002 vs 0.08±0.002; p<0.01), and which was decreased after aerobic exercise training (0.08±0.002 vs 0.07±0.001; p<0.05). The activity of COXIV and ABAD in the hippocampus of AS were decreased compared with those of the CS (3.3±0.1 vs 3.7±0.2; 0.5±0.1 vs 1.0±0.2; p<0.01), and aerobic exercise caused an increase of their activities (3.3±0.1 vs 5.6±0.2; 0.5±0.1 vs 8.0±0.1; p<0.01). CONCLUSIONS: Aerobic exercise attenuates the AβO deposition and the opening of mPTP, then regulates the mitochondrial oxidative phosphorylation for energy production in AD animals. 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 Ctgf-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 Ctgf 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 + EC 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 fourth day, the escape latency of M group was significantly longer than that of rats in the C and EC groups (P < 0.05). On the fifth day, the escape latency in M group was significantly longer than that in C and EC 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 EC groups (P < 0.01). Compared with EC and M group, the morphological structure of neurons in ec group was better. The expression of TGF-β1 mRNA in hippocampus of EC and ec 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 ec group (P < 0.01). The expression of TGF-β1 protein in M rats was significantly higher than that in EC and C 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.
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: A significant increase in 2PD was observed after completing the ultra-marathon across all caliper distances (p<0.05). While the 2PD across all caliper distances increased in accuracy only the two widest caliper settings 20mm and 25mm were significantly more accurate (p<0.05). CONCLUSION: The increased 2PD suggests an increase in cutaneous sensitivity after 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.
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 electrophysiology 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.

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-months old Sprague-Dawley rats were divided randomly into three groups: Control group (C), moderate load exercise group (M), overload exercise group (O). 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 quantitative real-time PCR were used to determine the expression levels 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 the navigation experiment, the time of through the area of the original platform, Group C and Group O (p<0.05) which were expressed moderate by hippocampus (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 (p>0.05). We found a negative relationship between reaction time and T7/T5 (r=-0.43, p>0.05) which was expressed 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 concussions or no such long-term deficits exist in young adults. It is worth further studying the inverse relationship between reaction time and time to diameter recovery, providing a possible link between an involuntary process supporting vision with visual-sensory task performance.

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 show that aerobic exercise has anti-inflammatory and neuroprotective effects. We hypothesized that aerobic exercise could attenuates 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 an 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, a decline in memory performance was ameliorated 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 (18YJIC1355).

Microglia has been shown to play a pivotal role in the pathogenesis and prognosis 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 by β-amyloid (Aβ), but this 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: Health 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 m/min 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 staining. The expression of nuclear factor-kappa B (NFκB), 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+Nos2+ 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 higher than that of group A (P<0.01), but that of M2 microglia was increased (P<0.01). WB and qRT-PCR analysis suggested that the expression of NFκB 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.

395 Board #233 May 29 9:30 AM - 11:00 AM Brain Modulation For Perceived Exertion Processing After Different Cycling Exercise Intensities: An fMRI Study Henrique Bortolotti1, Eduardo Bodnarie Fontes1, Kell Grandjean Costa1, Bruno Campos2, Timothy Noakes3, Maria Augusta Peduti Dal Molin Kiss4, Li Li Min5, 1Federal University of Rio Grande do Norte, Natal, Brazil, 2University of Campinas, Natal, Brazil, 3University of Cape Town, Cape Town, South Africa. 4University of São Paulo, São Paulo, Brazil.

Email: henriquebortolotti@gmail.com

(No relevant 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 (insula cortex) and cognition for executive functions (dorsolateral and anterior prefrontal cortex), 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.

396 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 Keying Zhang1, Chunmei Cao2, Weimo Zhu, FACSM3, 1Tsinghua University, Beijing,China. 2University of Illinois at Urbana-Champaign, Urbana, IL, Urbana, IL. (Sponsor: Weimo Zhu, FACSM)

Email: bsuzky0812@163.com

(No relevant 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 regional 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 Trio 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 between the groups.

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)


Email: bsned@leeds.ac.uk

(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 of 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 ± 12.63g) underwent seven weeks of moderate intensity continuous training (MCT), high intensity interval training (HIIT), intermittent hypoxia (IH), IH and IHIT 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. MCT 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. HI+IHIT increased the expression of CSPGs in the CA1 (300%) and CA3 (27%) regions and reduced the expression of CSPGs in the DG (77%) compared to CON. HIIT reduced the intensity of CSPGs in the DG (73%), 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.

398 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 Alexandre L. Roy, Zachary L. Roy, Steven B. Hammer, James W. Agnew. Indian River State College, Fort Pierce, FL.

Email: alexandroy1011@yahoo.com

(No relevant relationships reported)

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

PURPOSE: We examine pressure pain threshold (PPT) and condition pain modulation (CPM) in older versus younger age groups during an ultra-marathon.

METHODS: Informed consent was obtained from all subjects prior to their participation. Age groups were formed from the mean age of 41-year-olds in our subject population: n=21 for <40 years and n=23 for >40 years. PPT was measured using a Baseline© Dolorimeter. The dolorimeter was placed equidistant to the radial and the ulna styloid processes for 1 minute in the same technique while subjects placed the opposite hand in cold water (20°C). During this process neither the technician nor the subjects were able to see the dolorimeter.

RESULTS: Median PPT at baseline for the younger group was 7.8±1.2 kgF and 15.8±2.2 kgF for the older group. PPT was measured using the Baseline© Dolorimeter. The dolorimeter was placed equidistant to the radial and the ulna styloid processes.

CONCLUSIONS: These results show that MICT and HIIT have the capacity to reduce inhibitory molecules within the brain which may contribute to enhancing plasticity.
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 kPa, Mean Delta >40 years = 48.38 kPa) (r2=2.69; p<.05). A similar decrease was found in Delta CPM. (Mean Delta <40 years = 31.75 kPa, Mean Delta >40 years = 11.69 kPa) (r2=2.05; p<.05). PREVIOUS RESEARCH: 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.

INTRODUCTION: A single application of transcranial direct current stimulation (tDCS) delivered to motor cortex improves skill acquisition in relatively simple motor tasks performed unilaterally with the hand and arm.

PURPOSE: The purpose of this study was to examine the acute effects of tDCS on skill acquisition in a complex motor task.

METHODS: The study employed a double-blind, sham-controlled, between-subjects experimental design. Twenty-two right-handed adults were randomly assigned to two groups: an active group (active tDCS) or a sham group (sham tDCS). Each group was further divided into two subgroups: a training group and a control group. The training group received 5 minutes of tDCS over the FDI muscle while performing a practice session. The control group received sham tDCS over the FDI muscle while performing the practice session. The two groups were compared with an unpaired t-test. Similarly, percent change in MEP amplitude before and after the 5 minutes of tDCS for the two groups was compared with an unpaired t-test.

RESULTS: The percent change in endpoint error (decrease) was greater for the tDCS 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 tDCS group compared to the sham group (49.7 vs. -13.5%; P = 0.012).

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

FURTHER RESEARCH: 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.

400

Board #238

May 29 9:30 AM - 11:00 AM

The Influence Of Transcranial Direct Current Stimulation On Skill Acquisition In A Complex Motor Task.

Milan Pantovic1, Austin Pomerantz2, Sierra Kreamer-Hope2, Lidio L. Albuquerque2, Matt C. Pettit3, Michael Zuorowski3, Mark A. Guadagnoli1, Zachary A. Riley4, Brach Poston1

1University of Nevada, Las Vegas, Las Vegas, NV; 2Brigham Young University, Provo, UT; 3Indiana University-Purdue University Indianapolis, Indianapolis, IN.

No relevant relationships reported

INTRODUCTION: A single application of transcranial direct current stimulation (tDCS) delivered to motor cortex improves skill acquisition in relatively simple motor tasks performed unilaterally with the hand and arm.

PURPOSE: The purpose of this study was to examine the acute effects of tDCS on skill acquisition in a complex, multi-joint arm movement in healthy young adults.

METHODS: The study employed a double-blind, sham-controlled, between-subjects experimental design. Twenty-two right-handed adults were randomly assigned to two groups: an active group (active tDCS) or a sham group (sham tDCS). Each group was further divided into two subgroups: a training group and a control group. The training group received 5 minutes of tDCS over the FDI muscle while performing a practice session. The control group received sham tDCS over the FDI muscle while performing the practice session. The two groups were compared with an unpaired t-test. Similarly, percent change in MEP amplitude before and after the 5 minutes of tDCS for the two groups was compared with an unpaired t-test. Similarly, percent change in MEP amplitude before and after the 5 minutes of tDCS for the two groups was compared with an unpaired t-test.

RESULTS: The percent change in endpoint error (decrease) was greater for the tDCS 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 tDCS group compared to the sham group (49.7 vs. -13.5%; P = 0.012).

CONCLUSION: These findings indicate that a single-session of tDCS enhances cortical excitability and appears to improve motor skill, although there was high inter-individual response variability to tDCS for this difficult motor task.
Exercise is specifically linked to at least three phenomena that are likely to involve opioid release; the ‘athlete’s high’, increased pain tolerance, and addiction to exercise. 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; 40 mg/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: NIXT injection decreased 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 NIXT (p<0.05), verifying an increase in opioid mediated hypophagia. An increase in hot water tail immersion time following forced swimming (S = 2.72 ± 0.13 vs. FS = 4.28 ± 0.19; p<0.05) demonstrated an improvement in pain tolerance. Pain tolerance decreased by 20% ± 0.5 with the addition of NIXT (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 NTX (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 endogenous opioids in mice.
Screen time in children with ADHD can exacerbate symptoms and affect self-regulation and attention. **PURPOSE:** To test relationships between device-based ST and children’s executive function (EF) with behavior disorders. **METHODS:** Eleven African-American girls and 12 boys (mean age = 9.3 ± 1.9-years) wore a triaxial accelerometer for 5-consecutive-days at the beginning of an intervention trial. Evenson (2008) cut-points were used to determine ST (min/day), sedentary breaks (min/day), and ST (% per day) during weekdays and a filter to remove intervention time and non-wear time during the night was applied. Data was included if a participants wore the accelerometer ≥ 3 weekdays for ≥ 8 hrs/day. EF was assessed through parent-report of behavioral manifestation of EF (BRIEF-GEC score) and children underwent neuropsychological tests of verbal and visuospatial working memory (AWMA verbal and AMWA visuospatial scores). ST (min/day) was reciprocal by 100 transformed to achieve normality. Bivariate correlations and multiple regression analyses tested relationships between EF and ST, controlling for wear-time and moderate-to-vigorous physical activity. **RESULTS:** On average, children spent 295.60±67.17 min/day on sedentary breaks, and 417.60±120.78 min/day in sedentary breaks (min/day), and ST% (5% per day) during weekdays and a filter to remove intervention time and non-wear time during the night was applied. Quality of sleep during the night was not improved, though most patients mentioned feeling much less sleepy during the daytime. **Conclusions:** Exercise could potentially help number of outcomes for older adults with mental illness. It has been shown to significantly improve depressive symptoms, and qualitative results show improvement in general well-being. Our results and future research in this field will help establish an evidence base to tailor this promising intervention to this vulnerable population of older adults with mental illness.
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 F, 20.5 ± 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 time 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 sizes (ES; Cohen’s d) changes in the post to 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.

**Evidence** supports positive effects of exercise on mental health outcomes among people with Multiple Sclerosis (PwMS). However, non-traditional exercise modes like yoga, tai chi, and Pilates remain understudied. **Purpose**: Nineteen (No relevant relationships reported) PwMS were recruited, ten randomized to group (n=5), two weekly home-based Pilates sessions guided by a DVD (n=6), or wait-list control (n=6). Pilates sessions involved 60-min sessions of 14 mat-based beginners’ level exercises; repetitions progressed from 4-10 for each exercise across eight weeks. Feasibility was assessed relative to recruitment, retention, compliance with the mat-based intervention, and the presence/absence of adverse events. Well-validated questionnaires assessed symptoms of anxiety, depression, and fatigue, and mood states at baseline and weeks two, four, and six. Differences in outcome change were examined with 3 group x 4 time ANCOVAs adjusted for baseline. Significant interactions were decomposed with simple effects analysis. **Hedges’ d** effect sizes quantified magnitudes of change. **Results**: Attrition was high for supervised Pilates (n=2 of 5; 40%); no home-based or wait-list participant withdrew. Compliance was high across groups (96%). No adverse events were reported. Group x Time interactions were significant for feelings of depressed mood (F = 2.80, p < 0.03), physical symptoms of fatigue (F = 4.92, p < 0.001), and total fatigue (F = 3.76, p = 0.06). Compared to wait-list, scores for home-based Pilates were significantly lower (all p ≤ 0.02) for feelings of depressed mood at weeks 4 (d = 1.25, 6 (p = 0.47), and 8 (p = 0.90), physical symptoms of fatigue at weeks 4 (d = 0.84) and 8 (d = 0.82), and total fatigue at weeks 4 (d = 0.60) and 8 (d = 0.57). **Conclusions**: Findings support the feasibility of home-based Pilates to improve mental health outcomes in people with MS. These results support development of larger randomized controlled trials to better understand Pilates’ clinical effectiveness and plausible mechanisms of action.
The regression models indicated that the predictors significantly explained outcome variables, respectively. Walking, MPA, VPA, and sleep quality were predictor variables. Those involved in the screening, prevention, and treatment of at-risk athletes should 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. Significant differences were found with the highest prevalence within equestrian (16%, n=20/28) and ballet (13.6%, n=17/29). Sport type and exercise to control weight more than 50-100% of the time were associated with higher levels of life satisfaction (β = 0.37, p < 0.001), happiness (β = 0.36, p < 0.001), and positive affect (β = 0.43, p < 0.001), and lower levels of negative affect (β = 0.47, p < 0.001). For college students, better sleep quality and regular participation in VPA are beneficial for SWB while increased levels of walking and MPA might not be helpful in improving SWB.

PURPOSE: Increasingly, mental health is a concern among young adults. It is known that physical activity 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 21) and the Leisure and Physical Activity Survey (LPA). Data were analyzed for associations between sex, physical/ sedentary activities, body composition and mental health via multiple linear regression analysis. RESULTS: Female participants (n=50) reported less weightlifting exercise (p=0.01, 55% 0-2 days, 41% 3-5 days, 4% 6-7 days) compared to males (23% 0-2 days, 61.3% 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 21. Significant interactions were noted between sex and min/day of aerobic exercise (F=6.26, p<0.001) 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; 15-30 min per session: 4.65±4.74; >30 minutes per session: 4.47±2.87), male students who engaged in more aerobic exercise (3-5 days: 4.65±4.74; >30 minutes per session: 4.47±2.87) 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, focus on time engaged in aerobic exercise may 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.

It is well known that moderate exercise can positively modulate mood states; however, few studies have shown the effects of intense exercise. PURPOSE: Compare the impact of moderate and intense exercise on anxiety, affective, and positive subjective experience answers in healthy adults. METHODS: Ten healthy male subjects (28.70±6.25yrs; 72.51±10.68kg; 175±43cm; 23.0±6%body fat mass), were submitted to two intensities based on maximal treadmill test separated by 7 days: 1) 60%; 2) 85%. For these conditions, the subjects answered a Subjective Exercise Experiences Scale (SEES) and IDEATE-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).

RESULTS: We didn’t observe differences in anxiety comparing groups or time courses, however, SEES Positive well-being subscale show lower scores at IA during 85% when compared with 60% (19.00±2.33 vs 17.48±2.95; p=0.02). The increase of fatigue was observed at B when compared IA in 60% (6± 3.83vs11.0±7.64; p=0.01). Similar data was observed in 85%, with increase in B when compared to IA (8.80±6.39 vs 14.40±7.41; p=0.006) and remain higher at R (p=0.03). The FS on 60% show a significant decrease at last minute compared to 1 (p=0.002), 5 (p=0.002) and 10 (p<0.009) minutes; on 85%, similar data was observed. The last minute was lower when compared to 1 (P<0.001), 5 (p<0.001), 10 (p<0.001); but the 10 minute was
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 sitting. Heart rate (HR) was measured during the sitting time, and heart rate variability (HRV) was analyzed to evaluate sympathetic and parasympathetic nerve 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⁻¹ vs. 0.189 ± 0.075 mg dl⁻¹ without stockings at pre vs. post; 0.267 ± 0.100 mg dl⁻¹ vs. 0.186 ± 0.081 mg dl⁻¹ with stockings at pre vs. post). Wearing stockings supported a subjective comfortable 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 (0.15-0.4 Hz) showed higher values with than without stockings throughout the 3 h sitting period, and it was significantly higher at 1h (229 ± 169 sec without vs. 324 ± 251 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 nerve activity.

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. Herring, 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 ≥5d/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 (F(2,378)=4.69, p<0.001, η²=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. Ellingston, FACSM1, Dane Cook, FACSM2, Jacob D. Meyer1, Iowa State University, Ames, IA. *University of Wisconsin-Madison, Madison, WI. Email: gcruz@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 hard (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. Predictors of post-exercise mood and habitual factors related to these effects were 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

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 ≥5d/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 (F(2,378)=4.69, p<0.001, η²=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. Ellingston, FACSM1, Dane Cook, FACSM2, Jacob D. Meyer1, Iowa State University, Ames, IA. *University of Wisconsin-Madison, Madison, WI. Email: gcruz@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 hard (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. Predictors of post-exercise mood and habitual factors related to these effects were 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
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, 53.8±8.5 yr, 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 (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 between SIT-STAND compared to SIT. In contrast, a small increase in AHI (i.e., worsening of OSA) was observed following SIT-STAND compared to SIT (g=0.31). The change in AHI was associated with the change in actigraph WASO (r=0.63, P=0.09). Four of the 8 adults had clinically significant OSA (i.e., mean AHI≥10 (g=0.31). The change in AHI was associated with the change in actigraphic WASO (r=0.63, P=0.09). Four of the 8 adults had clinically significant OSA (i.e., mean AHI≥10 (g=0.31). The change in AHI was associated with the change in actigraphic Waso (r=0.63, P=0.09). Four of the 8 adults had clinically significant OSA (i.e., mean AHI≥10 (g=0.31). The change in AHI was associated with the change in actigraphic WASO (r=0.63, P=0.09). Four of the 8 adults had clinically significant OSA (i.e., mean AHI≥10 (g=0.31). The change in AHI was associated with the change in actigraphic WASO (r=0.63, P=0.09). Four of the 8 adults had clinically significant OSA (i.e., mean AHI≥10. Mean AHI was 25.3±11.8 breaths/h (range 8.0 to 46.2 breaths/h)). Mean AHI was 25.3±11.8 breaths/h (range 8.0 to 46.2 breaths/h)). Mean AHI was 25.3±11.8 breaths/h (range 8.0 to 46.2 breaths/h)). Mean AHI was 25.3±11.8 breaths/h (range 8.0 to 46.2 breaths/h)). Mean AHI was 25.3±11.8 breaths/h (range 8.0 to 46.2 breaths/h)).
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 for DEP (P<0.01) with significant interactions for perceptions by gender (F1,208 = 5.896, P< .016, n2=.023), perceptions by meta-perceptions and gender (F1,208 = 5.896, P< .016, n2=.023), and perceptions by meta-perceptions and gender (F1,208 = 5.896, P< .016, n2=.023). The conclusion is that in the C group.

**CONCLUSION:** Although there was a relatively low number of male athletes at risk 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*
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)

Abstract:
Depression is a common health problem and a major cause of agrypnia and disability. Recent evidence supports an anti-depressive 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 (Beclin 1, 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 Beclin 1 (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-depressive effect of aerobic exercise.

Exercise is Medicine®/Poster - EIM - Mental Health

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

Exercise and Physical Activity Promotion Improves Cardiorespiratory Fitness, Symptoms Of Disease And Well-being In Patients With Schizophrenia

Mirko Brandes1, Sirka Ginsel2, Christian Figge3, Alexandra Philipsen1. 1Leibniz Institute for Prevention Research and Epidemiology, Bremen, Germany. 2Oldenburg University, Oldenburg, Germany. 3University Hospital for Psychiatry and Psychotherapy, Oldenburg, Germany. *University Hospital for Psychiatry and Psychotherapy, Bonn, Germany.

Email: brandes@leibniz-bips.de

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-59, and symptoms of PTSD, measured with the PCL-5. RESULTS: Participants improved their peak oxygen uptake, expressed as ml/min/kg (t0: 29.0 ± 7.0, t2: 30.5 ± 8.7, p<.05). Six month after the intervention, only improvements in severity of SZ, well-being and psychological distress remained statistically significant (PANSS: 38.0 ± 9.0; 36-52 ± 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.

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 to relate 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 but 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 to 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.
research should aim to investigate the dose-response effect on dependent variables based on varying physical activity intensity levels, duration of intervention, and the duration of acute bouts of physical activity.

**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 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. Through the development of new connections, with the increase of density of neural network could have a positive impact in attention, cognition and academic performance.

**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 health, 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 health, fell better and improve your GPA.

**Purpose:** Mild cognitive impairment, Alzheimer’s disease (AD) 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 treatments on behavioral outcomes in patients with mild cognitive impairment, 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 for matches (or mismatches) are calculated as the MedAware Standardized Index of treatment effect (MSI-E).

**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 (3 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±0.001), 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.

**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 for matches (or mismatches) 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 89 studies reporting anxiety and depression outcomes in patients with mild cognitive impairment, Alzheimer’s Disease and Dementia: A Comprehensive Summary of Evidence and Meta-analysis. 

**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 health, 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 health, fell better and improve your GPA.
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

(No relevant relationships reported)

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).

RESULTS: Among students with age-estimated CRF, those who were more fit had a lower GPA. Estimated CRF could provide a simple method to identify students at-risk for depression.

CONCLUSION: Students with low fitness are at a higher risk for depression. However, fitness above age-estimated 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.

Comparison Between Pilates And Home-exercises On Health-related Outcomes In Individuals With Chronic Low Back Pain

Caroline Ribeiro Tottoli, Yara Marques, Katharina Mascarhenas, Lais Medeiros, Isabela Costa, Elaine Oliveira, Wagner R. Martins, Everton Nunes, Universidad de Brasilia (UnB), Brasilia, Brazil.

(No relevant relationships reported)

Chronic non-specific low back pain (CNLBP) is a major cause of disability and can be associated with strength deficits and postural instability. Pilates exercises are deemed to be useful in the management of CNLBP and improvement of outcomes such as flexibility and postural control, though evidence is controversial.

Purpose: To compare the efficacy of Pilates and home-exercises on kinesiophobia and postural balance. Method: Randomized controlled trial with blind assessor and concealed allocation. Thirty-one participants of both sexes, with CNLBP for at least 12 weeks were randomly assigned to Pilates (PT; n=16) or Home-Exercise (HE; n=15) groups. PT group was composed by sessions of fifty-minutes (seven to ten exercises; two sets of 8 to 12 repetitions). The HE was prescribed to the participants at baseline, post-intervention and follow-up. Significance was set at 5%. Dropouts were included by multiple imputation. Results: No significant differences were found between PT vs HE (global effects). Likewise, no separate effects were found for balance and kinesiophobia. Conclusion: An intervention of Pilates and home-exercises did not improve the balance and kinesiophobia.

### Table. Effects of PT (Pilates) and HE (Home Exercises)

<table>
<thead>
<tr>
<th></th>
<th>PT</th>
<th>HE</th>
<th>Effects</th>
<th>B (C195%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>26.6 (2.9)</td>
<td>28.0 (2.9)</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-intervention</td>
<td>11.9 (3.2)</td>
<td>13.3 (3.6)</td>
<td>-14.7 (-20.8; -2.6)</td>
<td>&lt;0.02</td>
<td></td>
</tr>
<tr>
<td>Follow-up</td>
<td>15.2 (4.3)</td>
<td>16.6 (4.6)</td>
<td>-11.4 (-21.4; -1.9)</td>
<td>&lt;0.01</td>
<td></td>
</tr>
<tr>
<td>Global Effect</td>
<td>n.a</td>
<td>n.a</td>
<td>-3.3 (-10.0; 3.2)</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Utility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>0.60 (0.04)</td>
<td>0.61 (0.04)</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-intervention</td>
<td>0.67 (0.05)</td>
<td>0.68 (0.04)</td>
<td>0.06 (-0.003; 0.13)</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>Follow-up</td>
<td>0.62 (0.05)</td>
<td>0.63 (0.06)</td>
<td>0.02 (-0.08; 0.13)</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>Global Effect</td>
<td>n.a</td>
<td>n.a</td>
<td>-0.01 (-0.13; 0.11)</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>Ste: standard error</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abstracts were prepared by the authors and printed as submitted.
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, 86.5% in group C. There is a significant difference between group A and B (p<0.01). There is no significant difference between group B and C (p>0.05). The difference indicates that the improvement of this index in group A is better than others. 2: JOA score: There is no significant difference before intervention. The average of group A decreased by 6.74 points, 4.34 points in group B, 4.16 points in group C. After 8 weeks, there is a significant difference between group A and B (p<0.01). There is no significant difference between group B and C (p>0.05). 3: VAS score: There is no significant difference before intervention. The VAS scores of group A decreased significantly by 4.68 points, 3.77 points in group B and 3.81 points in group C. There is a significant difference in three groups (p<0.01), while there is no significant difference between group B and C (p>0.05). The difference indicates that the improvement of this index in group A is better than others. 3: JOA score: There is no significant difference before intervention. After intervention, the VAS scores are significantly reduced. The score of group A decreased by 6.74 points, 4.34 points in group B, 4.16 points in group C. After 8 weeks, there is a significant difference between group A and B (p<0.01). There is no significant difference between group B and C (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.

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 rehabilitation 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 core strength training group, regular gymnastics group and general treatment group (40 in each) by using randomized, controlled, single-blind experimental methods. The patients in the first group (group A) use basic treatment (acupuncture, massage, TDP irradiation) and core strength training. Basic treatment and gymnastics training are applied for the patients in the second group (group B), while basic treatment is used for the third group (group C). All the trainings continue 8 weeks. Spss 19.0 is used for statistics analyses. Efficiency, VAS score, JOA score are measured at baseline (day 0), 5- and 30-min post wk) and high dose groups (127.9±19.3 vs. 46.6±14.6%baseline, p<0.01) for constant pressure unpleasantness rating (F3,36=6.4, p<0.01). There is no significant difference between group A and B (p>0.05). After 8 weeks, there is a significant difference between group A and B (p<0.01). There is no significant difference between group B and C (p>0.05). CONCLUSIONS: After 8 weeks intervention, basic treatment and core strength training can significantly improve the rehabilitation of patients with chronic low back pain.

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 (no pain) 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 < .05. Within group analysis revealed that the experimental group improved WCP by 35% (p<.01), SD by 34% (p<.01), CF by 30% (p<.05) and HS by 31% (p<.01). The control group only presented significant improvement in HS by 21% (p<.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.

PURPOSE: To observe the effect of core strength training on rehabilitation 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 by using randomized, controlled, single-blind experimental methods. The patients in the first group (group A) use basic treatment (acupuncture, massage, TDP irradiation) and core strength training. Basic treatment and gymnastics training are applied for the patients in the second group (group B), while basic treatment is used for the third group (group C). All the trainings continue 8 weeks. Spss19.0 is used for statistics analyses. Efficiency analysis, VAS score and core strength are tested before treatment, after 3 and 8 weeks of treatment. The efficiency is calculated by Ridit analysis. RESULTS: 106 patients participate the whole process and the baseline data before intervention are basically same, and there is no difference in three groups. After 8 weeks training, all the test indicators have changed as follows: 1: Efficiency: The total effective rate is 94.1% in group A, 88.6% in group B, 86.5% in group C. There is a significant difference between group A and B (p<0.01). There is no significant difference between group B and C (p>0.05). 2: VAS score: There is no significant difference between group A and B (p>0.05). There is no significant difference between group B and C (p>0.05). 3: JOA score: There is no significant difference before intervention. The efficiency is calculated by Ridit analysis.

CONCLUSIONS: After 8 weeks intervention, basic treatment and core strength training can significantly improve the functional and rehabilitation of LBP patients.
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 (6MTT), and 6-min walk time trial (6MTT), respectively. PA and SB were recorded using an activPAL3 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: 102 (44.5%) participants were defined as MM. Participants with MM had higher waking SB (9.3 ± 1.8 vs 9.9 ± 1.9 hrs/d, p < .013), lower MVPA (0.3 ± 0.2 vs 0.4 ± 0.2 hrs/d, p < .001) and daily step count (6185 ± 3016 vs 7270 ± 3196 steps/d, p < .009) compared with SCD. MM had higher BMI (31.6 ± 7.3 vs 28.0 ± 5.3 kg/m²), (p < 0.00001) for all). MM achieved significantly poorer results for the STS (23.8 ± 9.6 vs 21.2 ± 7.3 s, p=0.01), and 6MTT (453.3 ± 118.9 vs 514.4 ± 132.2 m, p=0.000). 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. Secondary, 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 (64y±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 and Quality of Life (PAQLQ) questionnaire to investigate 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<.01) and with pain QOL (r = -.326, p<.01). A significant difference was found (6MTT score) in general health QOL for patients who met the PA guideline of 150 minutes per week (M=68.81, SD=.2299) versus those who did not meet the guideline (M=53.71, SD=17.382); t(54)=2.827, p=.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 (Pittsburgh 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 = 0.0030), with 25% resolving below clinical delineation.

CONCLUSION: These findings suggest that the combination of cooling and compression exercise may be an effective intervention method to address symptoms in veterans and other individuals living with insomnia, post-traumatic stress, chronic fatigue, and depression.
**Purpose:** To assess the feasibility and acceptability of two common types of exercise programs—high-intensity interval training (HIIT) and moderate-intensity continuous training (MCT)—in adults with Crohn’s disease (CD).

**Methods:** In this mixed-methods pilot trial, participants were assigned to either HIIT or MCT based on their preference.

**Results:** A total of 25 participants enrolled, 13 in the HIIT group and 12 in the MCT group. The HIIT group completed a median of 24 sessions (range, 11-36) with an average of 34 minutes per session. The MCT group completed a median of 24 sessions (range, 11-36) with an average of 30 minutes per session. Both groups showed improvements in physical fitness and health-related outcomes, with no adverse events reported.

**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.
completed and cardiac frequency), IRM bench press and leg press, the maximum number of push-ups and sit-ups that could be performed in 1 minute, and flexibility between evaluations. There was a statistically significant difference (p<0.05) between CD4 count from evaluation 1 (695:318.58) to evaluation 4 (945.57:433.12) and the most significant mean difference was noted between evaluation 1 (695:318.58) to evaluation 3 (932.85:408.42). The data showed the steady improvement in strength (bench press, leg press, push-ups, and sit-ups) occurred between evaluation 1 and evaluation 3; however, the gains were not statistically significant (p>0.05). Time completed during the submaximal test improved most between evaluation 1 and evaluation 2 but did not demonstrate the statistically significant mean difference (p>0.05).

**CONCLUSION**: Participation in a community-based exercise program can help significantly improve immunity (increase CD4 count) in people with HIV. Therefore, clinicians should encourage people with HIV to participate in regular exercise and introduce them to community/recreational programs.

---

**455 Board #293 May 29 11:00 AM - 12:30 PM**

**Web-based Individualized Exercise Intervention Improves Physical Performance and Hepatic Inflammation in Patients with NAFLD**

Perikles Simonı, Yvonne Huber2, Daniel Pfrirrmann1, Beate K. Straub1, Jörn M. Schattenberg1, Institute for Sports Science, Johannes Gutenberg-University Mainz, Mainz, Germany.

1University Medical Centre, Johannes Gutenberg-University Mainz, Mainz, Germany. 2Institute of Pathology, Johannes Gutenberg-University Mainz, Mainz, Germany. Email: simonpe@uni-mainz.de (No relevant relationships reported)

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**: We studied the impact of regular physical activity promoted and controlled by a novel web-based approach on 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 (NCT02326732). Peak oxygen uptake (VO2peak) was measured by spiroergometry from baseline (T0) to post intervention (T1) and laboratory parameters for liver function (AST, ALT) and inflammation (CRP and Ferritin) as well as liver fibrosis non-invasively by Vibration Controlled Transient Elastography (VCTE) were also measured after follow-up (T2). Training consisted out of combined endurance and strength exercise 3-5 times a week under qualified instruction. Via an online support platform, weekly bidirectional feedback was provided. Differences between groups were calculated by Mann-Whitney-U-rank test.

**RESULTS**: A total of 44 patients with NAFLD were assigned and 41 patients, including 29 patients with NASH, completed the study protocol. Median VO2peak increased significantly 6.6% from 27.0 ml/kg/min at T0 to 30.3 ml/kg/min (p<0.001) at T1. All laboratory values decreased significantly from T0 to T1 and T0 to T2. Median pressure measured by VCTE improved significantly from 7.4 kPa at T0 to 1.0 kPa (p<0.05) and also from T0 to T2 by 1.9 kPa (p<0.05). Interestingly, the subgroup of patients with NASH achieved better improvements of effect sizes for all measured parameters at all points in time. **CONCLUSIONS**: The current study demonstrates the feasibility and effectiveness of a Web-based individualized exercise program in patients with NAFLD. More severe liver inflammation and damage (NASH) does not compromise treatment effects. Sustained improvement in liver function tests and fibrosis marker support the concept of fibrosis resolution through decreasing hepatic inflammation during and following exercise intervention in this patient population.

---

**456 Board #294 May 29 11:00 AM - 12:30 PM**

**Exercise is Medicine®: Physical Activity Prescriptions and Behavior During Pregnancy**

Ariel A.B. Cruz1, Kara Whitaker2, Jennifer West1, Mark Stoutenberg1, Emily A. Weible1, Christopher P. Connolly1.

1Washington State University, Pullman, WA. 2University of South Carolina, Columbia, SC. (Sponsor: Sara Wilcox, FACSM)

Physical activity (PA) is beneficial to the health of both pregnant mother and unborn child, particularly when current PA guidelines are met (e.g., 150 min/week of moderate-intensity PA). The impact of PA prescriptions given by prenatal physicians, following the Exercise is Medicine® program, is currently unclear. **PURPOSE**: This study examined the relationship between healthcare provider PA prescriptions given at two prenatal healthcare visits and subsequent PA behavior of pregnant women. **METHODS**: Prenatal healthcare providers in Cabarrus County, North Carolina assessed physical activity days/week and minutes/day among all prenatal patients (N=965) at two prenatal visits (V1: 20 weeks gestation; V2: 28 weeks gestation).

Minutes/week of physical activity were calculated, and providers were trained to provide physical activity prescriptions if the patient was not meeting current guidelines. Wilcoxon-Mann-Whitney tests were used to determine the association between healthcare provider PA prescription and self-reported physical activity from V1 to V2. **RESULTS**: The frequency of PA assessment at visits decreased as pregnancy progressed (V1=82.1%; V2=45.9%). Median PA minutes reported increased from V1 (25.0 min/wk) to V2 (60.0 min/wk). Likewise, the percentage of pregnant women receiving a PA prescription decreased from visit to visit (V1=68.6%; V2=56.3%). Women who received a PA prescription reported a greater increase in PA from V1 to V2 (117 min/wk) compared to women who did not receive a PA prescription (72 min/wk) (p<0.001). However, only 18.1% of PA prescriptions were consistent with current PA guidelines at prenatal visits. **CONCLUSIONS**: PA among pregnant women appears positively influenced by PA prescriptions provided by healthcare individuals. Further training of healthcare providers is needed to increase the prevalence of prenatal exercise prescriptions consistent with PA guidelines.

---

**457 Board #295 May 29 11:00 AM - 12:30 PM**

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

Kara M. Whitaker1, Meghan Baruth2, Rebecca A. Schlafl3, Christopher P. Connolly3, Jihong Liu2, 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. (No relevant relationships reported)

**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. Women who were not on bedrest (15%) reported recommendations to engage in light- or moderate-intensity activities like walking or swimming, but cautioned to avoid overexertion. Advice on HE included recommendations to increase consumption of protein, fruits, vegetables and vitamins/minerals, with emphasis on increasing caloric intake. As seen in Table 1, compared to women who reported GWG advice within IOM guidelines, women who reported advice below guidelines or who reported no advice were 7.23 and 2.76 times more likely to gain less than recommended, respectively. Women who reported provider advice above guidelines were 5.05 times more likely to exceed guidelines (all p<0.05).

**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.

---

**458 Board #296 May 29 11:00 AM - 12:30 PM**

**Healthy Eating and Exercise in Twin Pregnancies**

Ariel A.B. Cruz1, Kara Whitaker2, Jennifer West1, Mark Stoutenberg1, Emily A. Weible1, Christopher P. Connolly1. 1Washington State University, Pullman, WA. 2The University of Tennessee Chattanooga, Chattanooga, TN. 3University of South Carolina, Columbia, SC. (Sponsor: Sara Wilcox, FACSM)

Participation in a community-based exercise program can help significantly improve immunity (increase CD4 count) in people with HIV. Therefore, clinicians should encourage people with HIV to participate in regular exercise and introduce them to community/recreational programs.
The study also included InBody570 body composition measurements, pelvic alignment defined by 3 assessments (the Pelvic Floor Distress Inventory [PFIQ-7], the Oswestry +: The five-week IRB-approved study included 23 female subjects aged 43.0 ± 9.0 years (Mean ± S.D.) who exhibited symptoms of pelvic floor dysfunction as defined by 3 assessments (the Pelvic Floor Distress Inventory [PFQ]-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 non-parametric 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, r(23) = −3.67, p < 0.05), significant improvements of the quality of life subjective emotional gauge (PFDI−20, z(23) = −4.11, p < .05), and significant improvements of bladder, bowel, and prolapse symptoms (PFQI − 7, r(23) = −3.74, p < .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.

Table 1: Association Between Provider Advice on Gestational Weight Gain (GWG) and Compliance with the Institute of Medicine (IOM) Guidelines*

<table>
<thead>
<tr>
<th>Provider Advised GWG</th>
<th>GWG Below IOM Guidelines</th>
<th>GWG Above IOM Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adjusted OR†</td>
<td>95% CI</td>
</tr>
<tr>
<td>Below IOM guidelines</td>
<td>7.23</td>
<td>3.20, 16.33</td>
</tr>
<tr>
<td>Above IOM guidelines</td>
<td>0.64</td>
<td>0.07, 5.81</td>
</tr>
<tr>
<td>Within IOM guidelines</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Did not discuss</td>
<td>2.76</td>
<td>1.32, 5.78</td>
</tr>
</tbody>
</table>

*Due to differences in gestational age at delivery, a GWG ratio was calculated by dividing the lower and upper bounds of the IOM guidelines by 37 (guidelines created for women undergoing delivery ≥ 37 weeks gestation), to estimate GWG/week. The GWG ratios consistent with IOM guidelines for normal weight, overweight, and obese women were calculated as 1.00-1.46, 0.84-1.35, and 0.68-1.14 pounds per week, respectively.
†Model adjusted for maternal age at delivery, education, parity, twin type (dichorionic/diamniotic vs. dichorionic/monoamniotic or monochorionic/monoamniotic), assisted reproductive technologies (yes/no), and pre-pregnancy BMI category. Bolded values are statistically significant (p<0.05).

Introduction: Patients with peripheral arterial disease (PAD) and symptoms of intermittent claudication present reduced mobility and decreased ability to exercise activities of daily living due to atherosclerotic plaques in the lower limbs that limit blood flow to the muscles. Because it is a systemic disease, PAD has been associated with cognitive decline, however, as far as functional impairment is related to cognitive impairment is still uncertain. Purpose: To analyze the association of cognitive function with the overall functional capacity and fragmented in three factors: (walking speed, muscle strength and balance) of patients with PAD. Methods: Two hundred and nineteen patients with PAD and symptoms of intermittent claudication were submitted to the MoCA test to evaluate cognitive function. Functional ability was assessed by the Short Physical Performance Battery consisting of balance tests, sit-up and stand-up tests, and 4-meter walk test. For analysis of the associations, the binary logistic analysis was used, using the sex and age adjustment of the patients. Results: There was no association between MoCA and sit-up (OR = 0.099, P = 0.780) as well as the test and balance (OR = -0.084, P = 0.832). The MoCA score was associated with performance on the test regardless of gender and age (OR = 1.186, P = 0.007). Despite the non-association in the first two tests, we found that cognitive function is associated with walking capacity. Conclusion: The cognitive function is associated with the ability to mobility in patients with PAD, based on these results we can assume that individuals physically active, yet affected by the disease, can slow cognitive decline.
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. Fifty and sixty-eight hypertensive patients (67.4±8.8 years; BMI, 26.4±3.1 kg/m²; systolic BP (SBP), 146±9 mmHg and diastolic BP (DBP), 95.5±7 mmHg; 18% Indigenous, 23% Colombian-African and 59% Hispanic) finalized the study (EG, n= 307 and CG, n= 261). EG participated in 3 weekly exercise training sessions (30 to 60 minutes of moderate-to-vigorous 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 alcoholic habits were recorded by questionnaires during clinical 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 28.7% (P=0.008) in the EG. 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 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 factors. However, the main findings were that either ethnicity 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 reluctant 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 Spanish were included when they involved healthy adults, reported pre- and 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 31 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) and had prehypertension (systolic BP [SBP] 136.9±15.2/diastolic BP [DBP] 83.4±8.7 mmHg). Tai Chi was practiced 4.0±1.6 sessions/week for 54.0±10.6 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 trials 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.

PURPOSE: Persons with chronic medical conditions, such as obesity and asthma, may be at higher risk for physical inactivity. In this analysis, we evaluated objectively-measured physical activity (PA) in a population of patients with asthma to determine whether physical activity varied by body mass index (BMI) or asthma control.

METHODS: We used data from a prospective cohort of English and Spanish speaking adults ≥21 years of age with physician diagnosis of asthma recruited from the outpatient practices of two health care systems located in New York, NY and Denver, CO. Exclusion criteria included history of other chronic pulmonary conditions or smoking >15 pack-years. Physical activity was objectively measured using Actigraph wGT3X-BT accelerometers. BMI (kg/m²) was measured by trained research staff and the Asthma Control Questionnaire (ACQ) was used to assess asthma control. We used Kruskal-Wallis tests to compare physical activity measures among obese (>30 kg/m²) overweight (<30-25 kg/m²) and normal or underweight (<25 kg/m²) and -18.5 kg/m²) individuals, as well as among subgroups by asthma control: good (ACQ ≤ 0.75), poor (ACQ > 0.75, but ≤ 1.5) and very poor (ACQ > 1.5). RESULTS: Of the 125 participants, 103 (82%) were female. 56 (45%) were white; 52%, 30% and 18% were obese, overweight and normal/underweight, respectively. Half reported very poor asthma control. Mean (SD) sedentary time/day was 406.5 (114.1) minutes/day and did not vary by BMI or ACQ. Mean light activity was 397.4 (95.4) minutes/day and moderate-vigorous activity (MVA) was 38.9 (28.5) minutes/day. Patients with obese or overweight BMI had somewhat lower MVA than those with normal BMI (35.7, 39.9, 46.2 minutes/day; p<0.09) and significantly lower daily steps (5670, 7105, 7727; p<0.004). Similarly, patients with very poor asthma control had non-significantly lower MVA than those with poor or good control (34.1, 39.4, 49.0 minutes/day; p=0.08) and significantly lower daily steps (5690, 6742, 7910; p=0.003). CONCLUSIONS: Overall, activity levels in these patients with asthma were not lower than the general adult population. However, those with higher BMI and worse asthma control were less active (respectively), suggesting that interventions to increase PA in patients with asthma should consider addressing body weight and asthma control.

PURPOSE: To investigate the exercise habits of those with primary open angle glaucoma (POAG) and its associations with the progression of glaucomatous visual field (VF) loss. METHODS: Daily PA was monitored by an accelerometer (ActiGraph wGT3x-BT, which patients were for 24-hours on their waist (right) for 1 week. main outcome measures are daily PA, such as calories (kcal), light PA time, moderate PA time, and MVA was moderate to vigorous physical activity (MVPA) and step counts. Progressive VF loss is defined as the same three or more points in pattern deviation change probability maps in at least two consecutive visits detected by Glaucoma Progression Analysis. RESULTS: No Analyzable data was found for daily PA between the 76 non-progressive and 22 progressive patients who wore the device for more than 10 hours per day (P>0.05 for all). Better eye VF mean deviation (MD) averaged -3.1 dB in non-progressive group and -4.1dB in progressive group. 88 (89.8%) participants who had worn an accelerometer for an entire day were analyzed for their 24-hour exercise habits. PA was preferred to exercise more often during 07:00-09:00 am, 15:00-17:00 pm, and 18:00-20:00 pm. Additionally, MVPA in the time of non-progressive group is significantly higher than the progressive group at 18:00-20:00 pm (25.0±3.3) min VS 18.9±17.6 min, P=0.002. Binary logistic
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 intro-ocular pressure (mIOP), age, and gender were significantly correlated with POAG patients’ progressive VF damage. Multivariate analysis showed that MVPA (odds ratio, OR (95% confidence intervals, CI) = 0.96 (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) = 0.44 (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 Larson3, Max Conserval1. Kansas State University, Manhattan, KS; Pittsburg State University, Pittsburg, KS; Movement Rx Integrated Health, San Diego, CA; Adaptive Athletic, San Francisco, CA.
Email: victorandrews1@k-state.edu
(No relevant relationships reported)

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 lying flat, ΔM = 1.1 [-0.1, 2.3], (N = 8, 5), t (7) = 2.3, p < .051, SE = - .4; squatting, ΔM = 1.7 [-1.1, -1.9], (N = 7, 5), t (10) = 2.1, p = .06, SE = .8; and walking long distances, ΔM = 1.7 [4.3, 3.7], (N = 7, 5), t (10) = 2.2, p = .06, SE = .8. Confidence ratings were significant for grasping, ΔM = .6 [-.3, .9], (N = 8, 5), t (7) = 2.4, p = .05, SE = .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 HIFT programs to 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.
(No relevant relationships reported)

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 > 50% of estimated maximum (moderate to vigorous intensity) and > 70% 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 > 50% 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 with heart rate (M=6.5 minutes, SD=5.7).

Conclusion
This pilot study provides evidence that endurance stair climbing represents an alternative form of moderate-to-vigorous intensity exercise, as characterized by percent of estimated maximum heart rate and perceived level of exertion. Elite athletes achieved vigorous intensity activity levels for a greater duration than did novices, although a larger scale study is needed to confirm this trend. Next steps include assessing the health benefits of sustained daily stair climbing across the continuum of age and baseline activity level.
Exercise is Medicine® 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; 5=very much) indicated that participants reported high levels of enjoyment related to the event (Mmean=4.6, SD=0.78). They also reported that they found the event largely beneficial for improving their physical activity and nutritional habits (Mactivity=4.4, SD=0.97; Mnutritional=4.3, SD=0.99). Participants also expressed strong intentions to revisit the event in the future (Mfuture visit=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 < 0.05) more helpful for improving their nutritional habits. Of the motives for participation, 87.5% of the participants reported that they participated because they expected the event to be fun. Finally, with regards to participants’ recommendations two themes emerged from the qualitative content analysis: (1) additional activities to include in the event and, (2) greater variety of food and beverage options to offer throughout the event. 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**

Kristen Lagally, FACSM¹, Jacqueline Sherman¹, Anthony J. Amorose¹, Anna Rinaldi-Miles¹, Carena S. Winters, FACSM², Illinois State University, Normal, IL; Jacksonville University, Jacksonville, FL.

Email: kmlagal@ilstu.edu (No relevant relationships reported)

**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 obstacles. 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.
PURPOSE: Pennsylvania State University has been promoting Exercise is Medicine (EIMOC) since 2010 and has expanded the year-round program to include events, student and employee-focused initiatives, numerous on- and off-campus partnerships, and more. A recent focus of the EIMOC program has been expansion to other Penn State campus locations. As a University, Penn State operates 24 campuses throughout the state, with over 84,000 undergraduates enrolled. The wide array of locations, sizes, and educational foci present opportunities and challenges as EIMOC at Penn State attempts to expand beyond its founding campus. METHODS: The central EIMOC program conducts year-round activities the main campus, while providing assistance and guidance to commonswealth campuses when appropriate. Several times per year the EIMOC team travels to commonswealth campuses to assist on-site in the development and execution of EIMOC commonwealth programs, in partnership with local EIMOC committees at each campus. Program components are adjusted based on campus location, setting, size, partners, and available funding. Counts are conducted at each event for participation and engagement; lessons learned are reviewed to ensure the successful progression and expansion of future initiatives. Reviews are shared with other campuses to inform program development. RESULTS: EIMOC at Penn State has expanded to six commonswealth campuses, with four locations earning official EIMOC recognition. In 2017, Penn State University Park, the largest commonswealth campus earned Gold. Penn State Berks and Hamden earned Silver, and Penn State Hershey School of Medicine earned Bronze. Three other campuses are currently pursuing official EIMOC status. Larger campuses benefited from higher levels of available resources and partnerships, though struggled spreading awareness. Smaller institutions had greater success with awareness and engagement, though had smaller scopes. Additional differences were noticed between rural and urban settings.

CONCLUSIONS: The current study offered insights on the challenges and successes in leveraging a large university network to expand EIMOC programming across a diverse array of campuses. EIMOC programming has proven successful across a broad range of campus settings and sizes.

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. 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 >/= 4 weeks that were published in 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 calculated to rank each exercise intervention for improving fat mass and fat-free weight being more active extremely 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<.004). VO2max was associated with club sport participation as a freshman (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 freshman 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 freshman 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.

More than half of all Ugandan children under the age of 5 are anemic. The consequences of anemia are amplified during this period as it is critical to cognitive and physical development. Adequate physical play may bolster hematological health, and in turn cognitive and behavioral development, but this has not been previously explored. PURPOSE: Examine the effect of play on serum hemoglobin (Hb) among children under the age of 5 in Uganda, and to test the effect of Hb on cognitive and behavioral development. METHODS: We analyzed the 2016 Demographic Health Surveys of Uganda, Children’s Records dataset. Anemia testing was performed on children age 6-59 months whose parents or guardians consented (N=3,944). Hb levels were collected to determine the incidence and severity of anemia. Children with Hb ≥11 g/dL were not considered anemic. One-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, 0.0; fat mass, 2.1, 2.3 to -1.0 kg; percent fat, -1.5, -2.2 to -0.9%) and combined aerobic and strength vs. control comparisons (BMI, -0.7, -1.4 to -0.1; fat mass, 2.5, -4.1 to 1.0 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 ranked as having the best effects 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.

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 28.07 ± 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 ± 3.21 cm to 84.3 ± 33.7 cm (p<0.05). No other measures (BMI, body fat, VO\textsubscript{max}, RHR, 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/m\textsuperscript{2}, 24.27 ± 4.11 kg/m\textsuperscript{2}, 25.46 ± 3.71 kg/m\textsuperscript{2}; 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 or improve health/fitness outcomes is needed to positively influence these factors and increase the likelihood of resident physicians promoting PA to their patients.

Exercise referral within the United Kingdom (UK) offers individuals an opportunity to take part in physical activities 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 5,221 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. Results showed meaningful change in MET-minutes, which resulted in participants moving from ‘moderate’ to ‘high’ on the IPAQ, suggesting that a scheme length of 12 weeks is sufficient for changing PA levels.

**Table 1**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Adults</th>
<th>“Lack of Physical Exercise”</th>
<th>“Exercise Counseling”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 2 Diabetes</td>
<td>ICD-9 V69.0</td>
<td>581</td>
<td>160</td>
</tr>
<tr>
<td>Hypertension</td>
<td>ICD-10 Z72.3</td>
<td>1,577</td>
<td>299</td>
</tr>
<tr>
<td>Insomnia</td>
<td>ICD-9 V65.41</td>
<td>392</td>
<td>38</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>ICD-10 Z71.82</td>
<td>611</td>
<td>134</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>ICD-10 Z71.82</td>
<td>116</td>
<td>38</td>
</tr>
<tr>
<td>BMI 25-29.9</td>
<td>ICD-9 V69.0</td>
<td>104</td>
<td>10</td>
</tr>
<tr>
<td>BMI 30.0-34.9</td>
<td>ICD-10 Z72.3</td>
<td>284</td>
<td>10</td>
</tr>
<tr>
<td>BMI 35.0-39.9</td>
<td>ICD-9 V65.41</td>
<td>352</td>
<td>12</td>
</tr>
<tr>
<td>BMI &gt; 40</td>
<td>ICD-10 Z71.82</td>
<td>425</td>
<td>20</td>
</tr>
</tbody>
</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 (WAwD) program was established in a family medicine clinic. Patients were referred to attend the monthly program during clinical encounters. The four phases of the IHI 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 WAwD 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 interdisciplinary 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+), days of tennis per week, self-reported ability, National Tennis Rating Program (NTRP) score, smoking status, BMI and sex. The following SF-36 outcomes domains were included for analysis: Physical Functioning (PF), Role Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Role Emotional (RE), Mental Health (MH). Physical Component Summary (PCS) and Mental Component Summary (MCS) scores were calculated. Norm-Based Scores (NBS) were computed for these domains using an algorithm provided by Optum Health (Eden Prairie, MN); general population mean of 50; standard deviation of 10. 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 categories (all p<0.003). 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.

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 (WAwD) program was established in a family medicine clinic. Patients were referred to attend the monthly program during clinical encounters. The four phases of the IHI 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 WAwD 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 interdisciplinary 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+), days of tennis per week, self-reported ability, National Tennis Rating Program (NTRP) score, smoking status, BMI and sex. The following SF-36 outcomes domains were included for analysis: Physical Functioning (PF), Role Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Role Emotional (RE), Mental Health (MH). Physical Component Summary (PCS) and Mental Component Summary (MCS) scores were calculated. Norm-Based Scores (NBS) were computed for these domains using an algorithm provided by Optum Health (Eden Prairie, MN); general population mean of 50; standard deviation of 10. 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 categories (all p<0.003). 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.