A cadence of 100 steps/min has been associated with absolutely-defined moderate intensity (3 metabolic equivalents [METs]; where 1 MET = 3.5 mLO2/kg/min) in young and middle-aged adults. However, less is known about how cadence corresponds with relative intensity indicators, especially in older adults. PURPOSE: To investigate cadence thresholds associated with the lowest thresholds of relatively-defined indicators of moderate intensity provided in the 2011 ACSM Position Stand (i.e., 40-59% of heart rate reserve [%HRRR], 64-76% of maximum heart rate [%HRmax], and a Borg scale rating of perceived exertion [RPE] of 12-13) in healthy older adults. METHODS: Ninety-eight older adults (mean ± SD; age = 72.6 ± 7.0 years, BMI = 25.9 ± 3.5 kg/m²) completed a progressive treadmill walking protocol consisting of 5-minute bouts separated by 2-min rests increasing from 0.5 to 6.0 mph in 0.5 mph increments. The protocol concluded following the bout during which the participants naturally selected to jog or to reach 75% age-predicted HRmax, or reported a Borg scale RPE > 13. Cadence was calculated by dividing directly observed step counts by bout duration (5 min). Heart rate (HR) was measured using a chest-worn Polar HR monitor, and HR was averaged over the final 2-min of each bout. HRmax was estimated using the standard equation of 220 – age. Intensity indicators were analyzed using Receiver Operating Characteristic (ROC) curves and optimal cadence thresholds associated with moderate intensity were determined using Youden’s Index. RESULTS: The cadence threshold associated with 40% HRRR was 103 steps/min (sensitivity = 60%, specificity = 75%, area under the ROC curve [AUC] = 0.79). Additionally, an RPE ≥12 was associated with a cadence threshold of 101 steps/min (sensitivity = 63%, specificity = 75%, AUC = 0.77). CONCLUSION: Cadence thresholds of 100 - 104 steps/min were associated with relative indicators of moderate intensity in ostensibly healthy older adults. These results are consistent with the commonly reported heuristic (i.e., practical, rounded, evidence-based) threshold of 100 steps/min associated with absolutely-defined moderate intensity walking in healthy adults.

Supported by NIH/NIA Grant 5R01AG049024
Purpose In order to establish standards for cardiorespiratory fitness (CRF; peak VO₂), peak heart rate (HR) and peak oxygen pulse (O₂-pulse, a surrogate for stroke volume), we collated percentile data from maximal exercise testing from a sample of sedentary, overweight and obese adults in North Carolina. A second objective was to describe the relative role of declines in peak HR and peak O₂-pulse in the overall decline in CRF that occurs from ages 45-69 years. 

Methods A total of 669 sedentary adults, ages 45-69, with BMI 25-35 kg/m² from the three STRIDGE clinical trial cohorts were included in the analysis. All three cohorts used the same graded maximal treadmill test. Peak VO₂ was determined by the greatest two consecutive 15-sec collection periods. O₂-pulse was calculated as: peak VO₂ (mL/min) / peak HR (beats per min). Only subject’s data with peak RER ≥ 1.00 were included in the registry. Sex-specific percentile data for each half-decade of age are shown in Table 1 (only VO₂ Peak data shown below)

Results When assessing trends across the 25 year age range, we observed a 20.6%, 14.3% and 11.6% decrement in peak VO₂ (mL/kg/min), peak HR and peak O₂-pulse. In both women and men, the age-dependent decrements in peak HR were greater than the decrements in peak O₂-pulse. The trend for decrement in the weight-independent absolute peak VO₂ (L/min) was 24.1% in women and 19.7% in men across the 25-year period.

Conclusion This CRF registry represents sedentary, overweight or obese adults in North Carolina. As a majority of Americans are sedentary and have an elevated BMI, these data are also likely representative of the U.S. population. Further, these data suggest that the age-dependent decrements in peak HR play a greater role than the loss of stroke volume in the decrease of CRF with age.

Table 1. STRIDGE Cardiorespiratory Fitness Data Registry by Percentiles of Peak VO₂

<table>
<thead>
<tr>
<th>Percentiles</th>
<th>10</th>
<th>25</th>
<th>50</th>
<th>75</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women Age 45 - 49.9 (N=58)</td>
<td>17.9</td>
<td>19.8</td>
<td>23.6</td>
<td>25.8</td>
<td>27.9</td>
</tr>
<tr>
<td>Women Age 50 - 54.9 (N=91)</td>
<td>18.9</td>
<td>20.9</td>
<td>22.5</td>
<td>25.4</td>
<td>27.1</td>
</tr>
<tr>
<td>Women Age 55 - 59.9 (N=84)</td>
<td>18.0</td>
<td>20.5</td>
<td>23.0</td>
<td>25.6</td>
<td>27.8</td>
</tr>
<tr>
<td>Women Age 60 - 64.9 (N=60)</td>
<td>15.8</td>
<td>18.1</td>
<td>21.0</td>
<td>22.7</td>
<td>24.4</td>
</tr>
<tr>
<td>Women Age 65 - 69.9 (N=69)</td>
<td>15.0</td>
<td>16.7</td>
<td>18.8</td>
<td>20.1</td>
<td>21.7</td>
</tr>
<tr>
<td>Men Age 45 - 49.9 (N=50)</td>
<td>22.9</td>
<td>27.6</td>
<td>31.0</td>
<td>33.3</td>
<td>37.1</td>
</tr>
<tr>
<td>Men Age 50 - 54.9 (N=67)</td>
<td>21.2</td>
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<tr>
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<td>20.7</td>
<td>24.0</td>
<td>27.3</td>
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<td>33.5</td>
</tr>
<tr>
<td>Men Age 60 - 64.9 (N=68)</td>
<td>19.9</td>
<td>23.8</td>
<td>26.1</td>
<td>29.4</td>
<td>31.2</td>
</tr>
<tr>
<td>Men Age 65 - 69.9 (N=48)</td>
<td>19.6</td>
<td>22.9</td>
<td>26.2</td>
<td>29.4</td>
<td>30.5</td>
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</table>
Exercise-induced cardiac remodeling is influenced by sport-specific exercise characteristics, such as the isometric and isotonic components of the activity. Differences in cardiac dimensions and left ventricular (LV) systolic and diastolic function have been observed between short-(SS) and long-distance (LS) swimmers. Intensity and duration specific adaptations in LV mechanics may help to explain these differences in global function. PURPOSE: To examine whether there are event-specific differences in LV twisting mechanics between elite SS and LS athletes. METHODS: Data were collected during the 2019 FINA World Championships. SS were identified as open water swimmers competing in events 5-25 km. Fourteen SS (7 SS were identified as competing in pool events ranging from 50-400m; LS were identified as elite SS and LS athletes. Cardiac hypertrophy in both NTG and TG mice. Our data provides initial evidence that high intensity exercise training may result in physiologic hypertrophy. Biochemical analyses were undertaken to elucidate the underlying type of cardiac remodeling.

Naltrexone (NTX) is an opioid receptor blocker which can be prescribed for weight loss. To augment the effects of NTX on weight reduction, exercise (EX) is recommended as an adjunct therapy. There is prior evidence that NTX may interfere with the psychological benefits of EX. Despite a working knowledge of how NTX influences the psychological dynamics of EX investigations into how opioid receptor blockade may alter left ventricular function (LVF) following EX is lacking. PURPOSE: To determine the effect of NTX on LVF following EX in a rodent model. METHODS: Male 8 wk C57BL/6 mice were divided into 4 groups: control (CON), exercise (EX), naltrexone (NTX), exercise with naltrexone (EX+NTX). Mice that underwent EX performed 50 mins of forced swimming following a week of familiarization. NTX or saline was given (i.p.; 4 mg/kg), 15 min prior to EX or 65 min prior to echocardiography (ECHO). Mice were anesthetized using isoflurane (4-5% vol/vol) and echo gel was applied. LVF was assessed by ECHO using a VisualSonics Vevo 2100 ultrasound. LV internal dimensions (LVID) were measured in systole and diastole using Vevo 2100 for calculations. LV systolic function was estimated from LV dimensions by the cubed method. Results were quantified using a one-way ANOVA with a Tukey Post-HOC. RESULTS: Heart rate was elevated (p<0.05) in the EX group when compared to CON (CON = 275 ± 12 vs. EX = 360 ± 30 bpm; n = 8-9). This effect was abolished with the addition of NTX (EX vs. EX+NTX = 275 ± 36 BPM). Stroke volume (SV), was reduced in the NTX group compared to EX+NTX (p<0.05). Exercise mediated increase in SV was attenuated with pre-treatment of NTX (CON 128.8±15.0, EX 147.4±7.5, EX+NTX 143.1±17.7, NTX 76.9±19.0 ml, n = 7-8). Cardiac output was.

B-10 Thematic Poster - Cardiac
Wednesday, May 27, 2020, 1:00 PM - 3:00 PM
Room: CC-2000

595 Chairman: Eric J. Stohr, Cardifff Metropolitan University, Cardiff, United Kingdom.
(No relevant relationships reported)

596 Board #1 May 27 1:00 PM - 3:00 PM
Differences In Left Ventricular Twist In Elite Short And Long Distance Swimmers
Katharine D. Currie1, Jonathan A. Hamil1, Alexandra M. Coates1, Christian P. Cheung2, Trevor J. King3, Margo M. Mountjoy, FACSM2, Jamie F. Burr1. 1Michigan State University, East Lansing, MI. 2University of Guelph, Guelph, ON, Canada.
Email: currie4@msu.edu
(No relevant relationships reported)

598 Board #3 May 27 1:00 PM - 3:00 PM
Abstract Withdrawn

599 Board #4 May 27 1:00 PM - 3:00 PM
Naltrexone, Opioid Antagonist, Decreases Left Ventricular Function At Rest And Following Acute Exercise In Mice.
Sophie B. Green1, Candace Longoria1, Sara C. Campbell, FACSM1, John J. Guers2. 1Rider University, Lawrenceville, NJ. 2Rutgers University, New Brunswick, NJ.
(No relevant relationships reported)
reduced in NTX group when compared to EX and CON (p < 0.05). NTX+EX was also lower (p < 0.05) than the EX group (CON: 35.4 ± 4.3, EX: 52.5 ± 2.5, EX+NTX: 29.4 ± 6.5, NTX: 19.2 ± 4.5 L/min; n=7-8).

CONCLUSION: To our knowledge, this is the first study to examine the effects of NTX on LVF following acute exercise in a mouse model. These data suggest that NTX diminishes LVF following exercise. Being that exercise is a frontline therapy for weight loss the addition of NTX may alter LVF and ultimately negatively affect exercise recovery.

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Effects Of Very Low Volume, High-intensity Interval Training On Left Ventricular Volume And Systolic Function

Krisl Edman1, Meriam Astrom-Aneg1, Eva Nylander1, Karin Bouma2, Mikko Mandic2, Eric Rullman2. 1Linköping University, Linköping, Sweden. 2Karolinska Institutet, Stockholm, Sweden. (Sponsor: Jonathan Myers, FACSM)

Email: kristoffer.hedman@liu.se

(No relevant relationships reported)

PURPOSE: It is unknown whether exercise training of extremely low volume and high intensity is enough to elicit measurable changes in cardiac dimensions or function at rest. METHODS: Healthy, young subjects not performing regular training were recruited for six weeks of supervised exercise training, three times per week. Each of the 18 sessions consisted of three 30 seconds all-out sprints on a bicycle ergometer (breaking force 7.5% of the subject’s body weight), separated by two minutes of low intensity cycling. A maximal cardiopulmonary exercise test (CPX) and an echocardiographic examination (echo) at rest were performed before and the week after the last session. Left ventricular (LV) and left atrial (LA) volumes were determined with 4-D echo. LV systolic function was measured as ejection fraction (LVEF), global systolic longitudinal strain (GLS, 2-D speckle tracking), and mechanical dispersion (MD), standard deviation of time to peak systolic strain in all 17 LV segments.

RESULTS: Twenty eight subjects (27±5 yrs, 16 male) performed all sessions and echo at rest 

VO2max, predicted, in 27 subjects, increased from 3.0±0.8 L/min to 3.4±0.8 L/min post-training (mean ± SD, p < 0.001). LV end-diastolic volume and LV stroke volume were similar pre-/post-training (112±20 vs 115±24 mL, p=0.29; 55±13 vs 66±13 mL, p=0.64), as was LA end-systolic volume (47±9 vs 51±15 mL, p=0.26). LVEF and GLS were similar pre-/post-training (58±5 vs 58±6 %, p=0.89; -20±2 vs -20±2 %, p=0.60) while MD decreased from 30±6 to 27±7 ms, p=0.042. There was a significant association between the decrease in MD and increase in VO2max as well as between baseline GLS and VO2max (figure 1). CONCLUSIONS: Less than five minutes of high-intensity exercise training per week for six weeks increased VO2max, but not LV or LA volume at rest. Interestingly, LV longitudinal shortening was more synchronous following training, proportional to the increase in VO2max, which could indicate a more efficient LV contraction.

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Board #6 May 27 1:00 PM - 3:00 PM

Time-frequency Analysis Of The Seismocardiogram

William J. Armstrong. Western Oregon University, Monmouth, OR.

(No relevant relationships reported)

PURPOSE: The present study compares the features of the seismocardiograph (SCG) resolved in the time-frequency domain to the features of a single-lead electrocardiogram (ECG). METHODS: SCG and ECG signals were obtained from the combined measurement of ECG, breathing and seismocardiogram (CEBS) database. Baseline signals (b001 to b020) were selected from the data base and trimmed to include a minimum of ~10 beats (range: 8-12 beats; 50,000 samples). The analyzed data included lead II ECG with a bandwidth between 0.05 Hz and 1.50 Hz and SCG acquired using a triaxial accelerometer with a bandwidth between 0.5 Hz and 100 Hz, sampled at 5000 Hz. Time values for the peak P- and T-waves and the Q, R, and S of the ECG were identified and recorded. The SCG was subjected to an adaptation of the von Tscharnier intensity analysis for accelerometry (r=1.959, q=1.45, scale = 1.0), and total intensity (sum of the intensities over the set of I = 11 Cauchy wavelets for each sample in time) was calculated. The peaks (P1 & P2) and valleys (V1 & V2) of the total intensity for each cardiac cycle (10 per sample) were determined and compared to the ECG. Correlation coefficients were determined and P1-P1 and R-R intervals were compared using a paired t-test in R. Statistical significance was set at an alpha-level of 0.05. RESULTS: Correlations were consistently strong among the variables (range: 0.971 to 0.999). There were no significant differences between the rate intervals for P1-P1 and R-R (p = 0.60). CONCLUSION: This preliminary analysis suggests that the SCG intensity analysis may be a suitable alternative when EMG signals are not feasible. Visual analysis and these results suggest that SCG intensity provides reliable heart rate data and may offer further insight into the nature of the cardiac cycle (e.g., pre-ejection period, left ventricular ejection time, etc.), however, the CEBS database lacked data (e.g., heart sounds) that would permit more thorough analyses. Additional study is, therefore, warranted.
Aging shows muscular contractile and mitochondrial dysfunctions, as well as muscle hypoxia. **PURPOSE:** To investigate how aging affects contractile function during fatigue and contraction-induced mitochondrial activation at near-physiological oxygen tensions (PO2). **METHODS:** Flexor digitorum brevis muscles were dissected from young (4-mo old, YM) and old (21-25 mo-old, OM) C57BL/6J mice. Single myofibers were perfused with Tyrode’s solution (22ºC), pre-equilibrated with 5% or 1% or 0% O2, which produced an extracellular PO2 of ~40, 10, or 5 Torr, respectively. To measure fatigue resistance, myofibers (n=5 for YM and OM) were repetitively contracted (100 Hz) with progressive increases in train frequency every 2 min until fatigue (30% of initial tension) at 5% O2. The myofibers rested for 1h, perfused with 1% O2, and the previous contractile protocol was repeated. To measure NAD(P)H changes during contractions, myofibers (n=4 for YM and OM) were equilibrated at 5% O2, then at 1% O2, and then at 0% O2, with 1h rest between conditions. For each PO2 condition, myofibers contracted repetitively for 2 min at a fixed train frequency (0.5 trains per second). **RESULTS:** At 5% O2, time to fatigue was significantly higher in myofibers from OM (509 ± 93 sec) vs YM (207 ± 38 sec, p<0.01). At 1% O2, time to fatigue was not different to 5% O2 in YM (4 ± 11% decrease, p=0.87), but showed a trend to be decreased in OM (16 ± 7% decrease, p=0.06). Relaxation time (%RT) at 5% O2 was higher in OM (122 ± 17 ms) compared to YM (77 ± 4 ms, p<0.05) before fatigue contracting, but showed a similar slowing in relaxation at fatigue (103 ± 30 vs 117 ± 33% increase, respectively, p=0.05). At 1% O2, %RT was further increased at fatigue (154 ± 39%) compared to 5% O2 (p=0.05) in YM. %RT changes with fatigue were not different in OM at 1% O2 (151 ± 31%) vs 5% O2 (p=0.05). Contractions produced a transient (for ~30-40 s) increase in NAD(P)H fluorescence in YM at 5% O2, which was enhanced at 1% and at 0% O2. However, the increase in fluorescence at 1% O2 was minimized in OM. **CONCLUSION:** These data suggest that myofibers from old mice have a higher fatigue resistance during repetitive contractions under “near-physiological” PO2 conditions, although mitochondrial NAD(P)H responses were lower and relaxation was slower in aged myofibers. **FUNDING:** NIAMS AR069577

With age, skeletal muscles lose their oxidative capacity and have a reduced mitochondrial fusion leading to fragmentation. These phenomena can lead to a reduction in oxygen consumption, atrophy, and an increased risk of developing age-related diseases such as sarcopenia. Skeletal muscle cells derived from humans can be used to investigate these physiological capacities in primary culture. **PURPOSE:** Investigate mitochondrial morphology and maximal oxygen consumption rates (OCR) of skeletal muscle cells derived from healthy young and old men. **METHODS:** Primary skeletal muscle cells derived from the Rectus abdominis muscle of healthy active eighteen and sixty-nine year old men (SKM18M and SKM69M, respectively) were obtained from Cook MyoSite Inc. (Pittsburgh, PA). Cells were stained with MitoTracker Red (Cell Signaling; Danvers, MA) and mitochondria morphology was observed using a Zeiss LSM 710 AxiObserver confocal scanning microscope. The mitochondrial network was analyzed using the Mitochondrial Network Analysis tool in ImageJ (MINA, FJII) to estimate mitochondrial footprint from a binarized image. Oxygen consumption rates were measured in intact cells using Seahorse Cell Mito Stress Tests on a XFp extracellular flux analyzer (Agilent Technologies, Santa Clara, CA). **RESULTS:** Primary cells derived from the young donor (SKM18M) had a larger mitochondrial footprint, longer branch length, and a greater number of network branches compared to SKM69M (Footprint: 34.65 ± 25.30 vs. 11.64 ± 9.53 µm2; Branch Length: 20.59 ± 7.23 vs. 12.10 ± 6.84 µm; Network: 17.25 ± 0.16 vs 7.67 ± 4.97 counts). SKM18M also showed higher Basal and Maximal OCR compared to SKM69M (Basal: 38.78 ± 13.34 vs 12.2 ± 2.07; Maximal: 60.90 ± 18.84 vs. 20.52 ± 2.36 pmol/min/protein). **CONCLUSIONS:** We observed differences morphologically and metabolically between the primary skeletal muscle cells derived from young and old donors. These preliminary results give us an insight into human skeletal muscle-derived cellular physiological capacity. Technology to observe human muscle mitochondrial fragmentation in vitro will help us elucidate the effects of aging on skeletal muscle mitochondrial fragmentation and loss of metabolic flexibility in aging.

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

**Board #1**

**Title:** Mitochondrial Metabolism in Skeletal Muscle of Mice and Human Subjects

**Authors:** Leonardo Nogueira, Kristoffer Svensson, Simon Schenk, Michael C. Hogan, FACSM. University of California San Diego, La Jolla, CA. (Sponsor: Michael C. Hogan, FACSM)

**Email:** lnogueira@ucsd.edu

**Affiliation:** University of California San Diego, La Jolla, CA.

**Purpose:** Mitochondria play a principal role for metabolism and have a primary role in regulating respiration in myocytes. Recently, we have shown that the muscle-specific protein myoglobin (Mb) interacts with complex IV to augment mitochondrial respiratory capacity in skeletal muscles. However, the precise mechanism for the Mb-mediated upregulation remains unclear. The present study has focused on effect of the endurance training (eTR) on Mb within the mitochondria. **Methods:** Vistant male...
rats aged 10-week, were subjected to eTR sessions for 4 weeks (25 min/min X 60 min X 5-day/week, n=6). Muscle specimen from the deep portion of m. Gastrocnemius was taken and homogenized. Crude mitochondria were isolated by differential centrifugations and washed with the mitochondrial isolation buffer. The isolated mitochondria were treated with proteases K (PK), osmotic shock (OS), and SDS (or Triton X) in order to digest proteins on the outer membrane and in the intramembrane. The final samples were subjected to SDS-PAGE and immunoblotting using antibodies to localize the proteins in the mitochondria. Results: The eTR increased VDAC-1 and COX-IV around +80~+130% as compared with non-exercise control (p<0.05). Mb increased by +50% (p<0.05). Western blotting analysis revealed that the PK digested Tom20, and Tom20 band intensity decreased with the amount of PK used. PK treatment, however, did not affect Mb found in the mitochondrial fraction. Combining treatment with PK, OS and SDS (or Triton X) allowed immunoblotting detection of the mitochondrial proteins localized in specific regions of the mitochondria. Mb was detected with either PK or OS treatment. But it cannot be detected with a combined PK/OS treatment, suggesting that Mb associated with the inner membrane (intramembrane side, not matrix side) of the mitochondria. The Mb content inside the mitochondria in eTR rat was similar with that in the control muscles (n.s.). Conclusion: The present results suggest that Mb in muscle cells localizes both in the cytosol and in the mitochondrial intermembrane space. Although eTR elevates mitochondrial volume and Mb content but does not change Mb content in the mitochondria. Therefore, the observation might imply that the dynamic flux of Mb from cytosol to mitochondria has greater importance than just the amount found in the mitochondria skeletal muscle fat oxidation in healthy humans and to what extent exercise regulates ETF remains largely unknown. PURPOSE: To determine the relationship between skeletal muscle ETF protein abundance and mitochondrial fat oxidation capacity in healthy adult humans at rest and after acute aerobic exercise. METHODS: Sedentary lean adults (n=14 [10F/4M], age 28±7 years, BMI 22.2±2.1 kg/m²) completed two studies involving 1-hour of cycle ergometry (65% VO₂max) or sedentary rest in a randomized cross-over design. Vastus lateralis muscle biopsies were collected at rest and 15 minutes after exercise. High-resolution respirometry was performed on isolated mitochondria using palmitoyl-carnitine (lipid substrate, ETF-linked) and glutamate- succinate (non-lipid substrate, N and S-linked). ETF protein abundance and methylation status were determined via western blot. RESULTS: Exercise did not alter ETF-linked oxidative phosphorylation or leak respiration compared to rest. Acute exercise did not stimulate N or S linked respiratory states. Oxidative phosphorylation was lower for ETF substrates (p<0.0001), but with greater electron leak to H₂O₂ than N or S substrates (p<0.0001). Acute exercise did not alter protein abundance of ETF-beta subunit or trimethylation (p=0.41 and 0.28, respectively). CONCLUSION: Moderate intensity aerobic exercise did not alter mitochondrial respiration for either lipid or non-lipid substrates. ETF proteins did not undergo acute regulation to a single session of aerobic exercise. The lower capacity for lipid oxidation indicates factors upstream to ETF may regulate muscle lipid oxidation to acute exercise.
Conclusion
There is a strong correlation between mitochondrial content and VO2max and VO2max per LBM in both type 1 and type 2 fibers, while this was only the case for content. Also, there is a clear correlation between total and IMF mitochondrial content per LBM, however, VO2max and relative VO2max

Introduction
The purpose of this study was to explore the relationship between human fiber type specific mitochondria volume density and VO2max. Methods

The Associations Of Mitochondrial Content And Maximal Oxygen Uptake

Yiheng Liang1, Rasmus Ortenblad2, Guoqiang Geng1, Junqiang Qiu1, Niels Ortenblad2, Joachim Nielsen2. 1Beijing Sport University, Beijing, China. 2University of Southern Denmark, Odense, Denmark.

(No relevant relationships reported)

Results
The total, IMF and SS mitochondrial content in type 1 are 0.059±0.018 μm^3/μm^3, 0.065±0.014 μm^3/μm^3, and 0.451±0.159 μm^3/μm^3, respectively, and in type 2 are 0.087±0.021 μm^3/μm^3, 0.046±0.012 μm^3/μm^3, and 0.271±0.129 μm^3/μm^3, respectively. Total mitochondrial volume content was a strong predictor of VO2max per LBM. Further, IMF mitochondrial content is a better predictor of a subject’s VO2max per LBM than SS mitochondrial content. The fiber type specific correlation coefficient.

Methods
Data are presented as means ± SD. Associations were evaluated using Pearson’s correlation coefficient. Results The total, IMF and SS mitochondrial content in type 1 are 0.087±0.021 μm^3/μm^3, 0.065±0.014 μm^3/μm^3, 0.451±0.159 μm^3/μm^3, respectively, and in type 2 are 0.059±0.018 μm^3/μm^3, 0.046±0.012 μm^3/μm^3, 0.271±0.129 μm^3/μm^3, respectively. Total mitochondrial volume content was determined by recalculating the SS subfraction to myofibrillar volume density. Fibre type was determined by z-disk widths. Lean body mass(LBM) was determined by DXA. All data are presented are means ± SD. Associations were evaluated using Pearson’s correlation coefficient. Results The total, IMF and SS mitochondrial content in type 1 are 0.087±0.021 μm^3/μm^3, 0.065±0.014 μm^3/μm^3, 0.451±0.159 μm^3/μm^3, respectively, and in type 2 are 0.059±0.018 μm^3/μm^3, 0.046±0.012 μm^3/μm^3, 0.271±0.129 μm^3/μm^3, respectively. Total mitochondrial volume content was a strong predictor of VO2max per LBM. Further, IMF mitochondrial content is a better predictor of a subject’s VO2max per LBM than SS mitochondrial content. The fiber type specific correlations revealed that, total, IMF and SS in different fiber types are associated with VO2max per LBM, except SS mitochondrial content in type 2 is not associated (Fig 1).

Conclusion
There is a strong correlation between mitochondrial content and VO2max per LBM, however, VO2max and relative VO2max are not associated with mitochondrial content. Also, there is a clear correlation between total and IMF mitochondrial content and VO2max per LBM in both type 1 and type 2 fibers, while this was only the case for SS in type 1 fibers.

Board #8 May 27 1:00 PM - 3:00 PM
The Associations Of Mitochondrial Content And Maximal Oxygen Uptake

Yiheng Liang1, Rasmus Ortenblad2, Guoqiang Geng1, Junqiang Qiu1, Niels Ortenblad2, Joachim Nielsen2. 1Beijing Sport University, Beijing, China. 2University of Southern Denmark, Odense, Denmark.

(No relevant relationships reported)

PURPOSE: High blood pressure (BP) is a heritable risk factor for cardiovascular diseases (CVD). Whether muscle strength, a modifiable environmental trait, is associated with risk of mortality and CVD independently of genetic risk for high BP is unknown. The purpose was to investigate the associations of genetic risk for high BP and muscle strength with mortality from all causes and CVD, and incidence of myocardial infarction (MI) and stroke. METHODS: This study is based on data from UK Biobank, a prospective cohort containing >500,000 adults aged 40-69 years. We included 304,020 individuals of European ancestry without 2nd-degree genetic relatedness and prevalent CVD at baseline. Polygenic risk scores (PRS) for high BP were determined by averaging the standardized calculated risk scores for systolic BP (using 274 single-nucleotide polymorphisms [SNPs]), diastolic BP (278 SNPs) and pulse pressure (231 SNPs). Muscle strength was assessed through grip strength tests. The average grip strength values from both hands were divided by measured fat-free mass. Independent and stratified associations were estimated using Cox regression. RESULTS: Compared with the bottom muscle strength tertile, hazard ratios of the top tertile were 0.72 (95% Confidence Interval: 0.69-0.76) for all-cause mortality, 0.66 (0.59-0.75) for CVD mortality, 0.84 (0.78-0.90) for MI, 0.81 (0.74-0.89) for stroke, 0.79 (0.72-0.88) for ischemic stroke and 0.80 (0.67-0.96) for hemorrhagic stroke after adjusting for confounders and PRS. Higher PRS was associated with higher hazards of each disease outcome. At all tertiles of genetic risk for high BP, higher muscle strength was associated with lower hazard of mortality due to all causes and CVD (except at low genetic risk), MI, stroke, ischemic and hemorrhagic stroke (except for high muscle strength at median genetic risk), compared with low muscle strength: no additive and multiplicative interactions detected. CONCLUSION: Individuals with higher levels of muscle strength have lower rates of mortality from all causes and CVD, and incidence of MI and stroke, independent of genetic risk for high BP. Increased muscle strength is, in general, protective against mortality and CVD in the whole population including those at increased genetic risk for high BP.
The relationship between aerobic physical activity (PA) and all-cause mortality risk is well documented. However, the combined effects of sufficient aerobic PA and muscular strengthening activity (MSA) on all-cause mortality risk need further exploration. Moreover, the 2018 PA guidelines suggest that effects of race-ethnicity on this relationship need to be examined. PURPOSE: To examine the independent and joint relationship between meeting the current aerobic PA and MSA recommendations and all-cause mortality while considering potential effect modification by race-ethnicity. METHODS: This study sample (n=14,384), included adults (20-79 years of age), who participated in the 1999-2006 NHANES. Participants self-reported participation in aerobic PA (leisure-time, transportation, household, and MSA). PA was categorized into 6 categories based around the 2018 PA guidelines: category 1 (no aerobic PA and no MSA), category 2 (insufficiently active and no MSA), category 3 (active and no MSA), category 4 (no PA and meeting the MSA recommendations), category 5 (insufficiently active and meeting the MSA recommendations), and category 6 (meeting both the aerobic and MSA recommendations). All-cause mortality was the dependent variable. Race-ethnicity groups examined included non-Hispanic White (NHW), non-Hispanic Black (NHB) and Mexican American (MA). Cox-proportional hazard models were used for the total sample and for individuals by race-ethnicity. A significant interaction was found between aerobic PA and race-ethnicity (p<0.0001) and MSA and race-ethnicity (p<0.0005). Significant risk reductions were found for categories 2, 3 and 6 among NHW (cat 2: HR 0.76, 95% CI 0.64-0.91; cat 3: HR 0.63, 95% CI 0.52-0.74; cat 6: HR 0.58, 95% CI 0.44-0.76) and NHB (cat 2: HR 0.63, 95% CI 0.52-0.74; cat 3: HR 0.51, 95% CI 0.41-0.65; cat 6: HR 0.54, 95% CI 0.38-0.77). Among MA, only those meeting both guidelines had significant reductions in all-cause mortality risk (HR 0.54, 95% CI 0.32-0.92). CONCLUSIONS: In support of the most recent PA guidelines, participation in sufficient volumes of both aerobic PA and MSA lead to significant reductions in risk for all-cause mortality across race-ethnic groups. The positive effects of aerobic PA alone seem to be isolated to NHW and NHB.
Silent lacunar infaracts by definition, lack clinically overt stroke-like symptom, are occasionally found by brain magnetic resonance imaging (MRI) scan in asymptomatic elderly individuals. A previous study revealed that more than 25% of elderly people have silent lacunar infarcts. The main risk factors for lacunar infarcts and stroke were reported as aging, hypertension, and smoking. While a recent study showed that low muscle strength is also a risk factor for cerebrovascular events, it remains unclear whether low muscle strength is a risk factor for silent lacunar infarcts. PURPOSE: To investigate the association between muscle strength and silent lacunar infarcts in the elderly people living in urban community. METHODS: This study included 1,536 elderly people without past history of cerebral vascular events, aged 65-84 years living in an urban area of Tokyo, Japan (Bankyu Health Study). All participants underwent brain MRI scan and silent lacunar infarcts were defined as the presence of 1 or more lacunar infarcts. Isokinetic muscle strength of knee extensors was evaluated at angular velocity of 60 degree per second using dynamometer. Subjects were categorized tertiles (high, medium, and low) by muscle strength, and compared the prevalence of silent lacunar infarcts. RESULTS: Mean age of subjects was 73.0±5.4 years old and 58.9% were female. Two hundred fifty-two (16.4%) subjects were diagnosed as silent lacunar infarcts, and the subjects categorized as lower muscle strength showed higher prevalence of silent lacunar infarcts (high: 12.3%, medium: 17.7%, and low: 19.3%, p for trend 0.003), while skeletal muscle indices among the groups were similar. After multivariate adjustment by age, sex, body mass index, smoking status, physical activity, hypertension, diabetes, and dyslipidemia, the trend was still significant and the odds ratio for having silent lacunar infarcts was significantly higher in the lowest muscle strength tertile compared to the highest tertile [(high: 1.00 (reference), medium: 1.42 (95%CI: 0.98-2.04), low: 1.48 (1.02-2.14), for trend 0.043]. CONCLUSIONS: In the elderly people living in urban community, lower muscle strength of knee extensors was associated with higher prevalence of silent lacunar infarcts independent of other established risk factors.

**Purpose:** Little is known about whether the beneficial impacts of increased muscle strength are consistent across all levels of genetic predispositions to stroke. The purpose was to examine whether the associations between muscle strength and stroke are independent of or vary by genetic risk for stroke. METHODS: We included 312,398 individuals of European ancestry in UK Biobank (a prospective cohort of >500,000 adults aged 40-69 years) who had no stroke at baseline and genetic relatedness. Genetic risk was assessed using polygenic risk scores, calculated by multiplying the sum of risk-increasing alleles at a given locus by the known effect estimates. Muscle strength was assessed through grip strength tests via a hand dynamometer. Values from both hands were averaged, then divided by fat-free mass. The outcome variables included incidence of overall (n=3,356), ischemic and hemorrhagic stroke, although for hemorrhagic stroke, confidence intervals were wider and inconclusive for some of the associations. CONCLUSIONS: Higher muscle strength was associated with lower risk of stroke, independently of genetic risk for stroke. The increased genetic risk of overall and ischemic stroke was partly attenuated through increased muscle strength.
BACKGROUND: The “Deep Squat” (DS) is a qualitative functional test that integrates muscle strength, neuromuscular control, mobility and joint stability. This test has been frequently used to identify risk of musculoskeletal injury in varied populations. The active joint range of motion (AROM) is the arc of mobility that an individual performs during a voluntary movement, measured objectively by goniometer. PURPOSE: Identify the relationship between the DS and the AROM of the ankle measured by goniometer in young female hockey players who belong to Gimnasia Esgrima Rosario Club. METHODS: Twenty young and healthy female hockey players (age: 16.12 ± 1.16 years; Weight: 57.40 ± 6.32 Kg; Height: 161.42 ± 6.14 cm), participated in this study. Asymptomatic subjects were included, with no history of lumbar spine, hip, knee or ankle injuries. The functional DS test was measured by goniometer in angular degrees of movement for knee flexion, and three bilateral tests for the AROM of knee or ankle injuries. The functional DS test was measured by goniometer in angular degrees of movement for knee flexion, and three bilateral tests for the AROM of dorsiflexion of the ankle (a- Bipedal position with partial load; b- Seated with knee at 0º of flexion (gastrocnemius vs. tibialis anterior); c - Seated with knee at 0º of flexion). The Intraclass Correlation Coefficient (ICC: 0.832-0.993) and the Standard Error of Measurement (SEM: 0.803-0.971) were established by analysis of variance one way for each variable measured. We have applied matched t-test differences to determine statistical differences (SD) between dominant and non-dominant leg at p<0.05. Correlations were calculated between dominant and non-dominant leg at p<0.05. Correlations were calculated through Pearson coefficient (r) between DS and right and left AROM mean values.

RESULTS: No difference was noted between ISO and CON. However, ISO and CON were lower than ECC muscle strength at 120°/s and 180°/s (P < 0.01). Conclusion: A greater muscle strength for ECC relative to CON or ISO which is site-dependent. Whether this is dictated by maturation associated site-specific neuromuscular inhibition remains to be investigated.

Conclusion: As children become older, core and upper-body strength seems playing a positive impact on children’s gross motor function in both boys and girls.
Cross-country (XC) skiers frequently perform low intensity training sessions to improve their endurance capacity or for recovery purposes. It is well known that exercise performed below a certain threshold intensity, adaptional responses will only occur after a certain duration. Rating of perceived exertion (RPE) scale may be helpful to identify reference markers for intensity-duration relationship. Such reference markers, especially during low intensity trainings, could help to improve exercise training in XC skiers' performance.

PURPOSE: To investigate adaptation of low intensity sessions, by means of session RPE (sRPE) in two groups of adolescent XC skiers with different RPE on double poling performance after 1-week pre-competitive season training camp.

METHODS: Thirty-six national level XC skiers (13.4±1.9 yrs; VO2max 51.2±8.0 ml·min⁻¹·kg⁻¹) participated in a 1-week camp in preparatory period. Pre- and post-camp double poling performance was measured with incremental exercise test on the ski ergometer. All XC skiers trained with the same training program. Based on the athletes’ RPE values they were divided into two groups. Group1, who rated their trainings lighter and a Group2 who rated trainings harder compared to the median rating of all trainings.

RESULTS: After excluding the intensive training session, Group1 average RPE rating was significantly higher compared to Group2 (3.09±0.90 vs 4.94±1.84, respectively) and total sRPE was also higher in Group2 compared to Group1 (4010±765 vs 2499±193 AU, respectively), while total training time was not different (796±41 vs 786±55 min, p<0.05). No significant differences were found in time spent in different HR zones between the two groups. Progression in ski ergometer performance in Group1 was 10.0% (ES=0.18, small), while in Group2 the progression was 12.0% (ES=0.39, moderate).

CONCLUSION: Despite training with similar training plan, adolescent XC skiers experience training load differently. This leads to differences in performance changes, highlighting the importance of individual-volume intensity description. Supported by NRC Grant no. PUT1395G.

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A Method To Estimate Free-living Physical Behaviors From A Wrist-Worn ActiGraph™ Accelerometer

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BACKGROUND: Despite the proliferation of body-worn sensors to assess physical behaviors (e.g. physical activity and sedentary behavior; PBs), processing accelerometer data collected from free-living (FL) individuals remains a challenge.

PURPOSE: To develop a method to estimate FL PBs from wrist-worn ActiGraph accelerometer count data.

METHODS: Forty-nine participants (mean ± SD: age 20.4±1.3 yrs, 45.8% male) wore an Actigraph wGT3X-BT on their non-dominant wrist during four, 1-hour FL sessions. Sessions were video-recorded and coded using a direct observation (DO) system that provided criterion measures, including intensity category. All steps in the novel method were developed using a subset (n=44) of participants and tested on the remaining (n=5). The first step identifies inactive bouts (e.g. sedentary and standing behaviors) using a vector-magnitude threshold, chosen via a grid-search to maximize the positive predictive value (PPV) of inactive classification. The second step uses statistical features of the count data and bout length (seconds) as inputs to random forest models to estimate active (light, moderate, vigorous) vs inactive periods. Percent agreement between criterion-measured (DO) and method estimated PB was evaluated using a 90-10 sample split was used for SojWrist development (N = 44) and cross-validation (N=5).

RESULTS: Deep learning networks resulted in high performance in recognizing physical activity type and estimating energy expenditure. The balanced accuracy was: 88%, 93%, and 92% for recognizing locomotor, lifestyle and sedentary activities, respectively. Random forest resulted in a slightly lower accuracy for the same set of tasks (78%, 91%, and 86%). The root mean square error for estimating energy expenditure using deep learning networks was slightly lower at 0.74 compared to 0.78 using random forest.

CONCLUSIONS: Deep learning models built using raw data from wrist-worn accelerometer data outperformed conventional machine learning algorithms such as random forest. These results show the efficacy of deep learning in extracting representation from the raw data without the need to relying on first creating a feature set that requires domain expertise.

A Method To Estimate Free-living Behaviors Using High-frequency Wrist Accelerometer Data

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PURPOSE: To develop a novel method to estimate free-living sedentary behavior and activity intensity using high-frequency wrist-worn accelerometer data.

METHODS: Forty-nine participants (mean ± SD: age 20.4±1.3 yrs, 45.8% male) completed four, 1-hour sessions of free-living behaviors in home, school, community, and exercise environments. Each session was video-recorded (DO) and participants wore an Actigraph wGT3X-BT (AG) accelerometer on the non-dominant wrist. Videos were coded for whole body movement, contextual activity type, and activity intensity from the Compendium of Physical Activities (e.g. walking, shopping, 2.8 METs). The novel two-step method (SojWrist) first segments AG data into bouts, or “sojourns”, of inactivity (i.e. sedentary and standing behaviors) or activity using an acceleration standard deviation threshold and random forest model. The second step estimates the intensity of inactive (sedentary, light) and active (light, moderate, vigorous) sojourns. Separate inactive and active sojourn RF models were fit to estimate intensity using bout duration and time- and frequency-domain AG signal characteristics. A 90-10 sample split was used for SojWrist development (N = 44) and cross-validation (N=5).

RESULTS: Deep learning networks resulted in high performance in recognizing physical activity type and estimating energy expenditure. The balanced accuracy was: 88%, 93%, and 92% for recognizing locomotor, lifestyle and sedentary activities, respectively. Random forest resulted in a slightly lower accuracy for the same set of tasks (78%, 91%, and 86%). The root mean square error for estimating energy expenditure using deep learning networks was slightly lower at 0.74 compared to 0.78 using random forest.

CONCLUSIONS: Deep learning models built using raw data from wrist-worn accelerometer data outperformed conventional machine learning algorithms such as random forest. These results show the efficacy of deep learning in extracting representation from the raw data without the need to relying on first creating a feature set that requires domain expertise.
An accelerated ageing process places those with type 2 diabetes mellitus (T2DM) at risk of physical functional impairments at a younger age. Although the importance of moderate-to-vigorous physical activity (MVPA) is acknowledged, emerging research suggests that sedentary time may be also be important. Therefore, the aim was to examine cross-sectional associations between device-assessed sedentary time and markers of physical function in a population with T2DM and to determine whether associations were modified by the recommended levels of MVPA.

METHODS: Participants with T2DM (n=6 months), aged 18-75 years were recruited as part of an ongoing, cross-sectional study (CODEC) conducted in the Midlands, UK. Participants were asked to wear an accelerometer (GENEActiv, ActivInsights Ltd, Kimbolton, UK) on their non-dominant wrist for 7 days to quantify habitual levels of sedentary time and MVPA. Generalised linear models examined the associations between sedentary time, the short physical performance battery (SPPB), the sit-to-stand 60 second test (STS60) and 4 metre timed walk. Interaction terms determined whether results were consistent across MVPA categories (active [>150 min/wk of MVPA] vs. inactive [<150 min/wk of MVPA]).

RESULTS: 621 participants had valid accelerometer and physical function data (age 63.6±8.4 years, 34.5% female, BMI=31.0±5.0 kg/m²). Following adjustment for various covariates, including age, sex, ethnicity, medication and MVPA, sedentary time was detrimentally associated with SPPB score, STS60 reps and walk time. When results were stratified by MVPA (active [24.5%] vs. inactive [75.5%]), each 60 minutes of sedentary time and MVPA. Generalised linear models examined the associations between sedentary time, the short physical performance battery (SPPB), the sit-to-stand 60 second test (STS60) and 4 metre timed walk. Interaction terms determined whether results were consistent across MVPA categories (active [>150 min/wk of MVPA] vs. inactive [<150 min/wk of MVPA]).

CONCLUSIONS: Sedentary time is adversely associated with markers of physical function, but associations were only present in those individuals who do not meet current physical activity recommendations for health. Along with promoting MVPA, future therapeutic interventions that focus on reducing sedentary time in those with T2DM and impaired physical function may be warranted in inactive individuals. Supported by NIHR Leicester BRC.

PURPOSE: To compare estimates from a wrist-worn Fitbit Flex 2 to a waist-worn Actigraph GT9X Link in young children. Methods: Forty children aged 6-10 years wore a Fitbit Flex 2 (on a non-dominant wrist) and an Actigraph GT9X Link (on waist) for up to two weeks while school was in session. Children were instructed to wear the Fitbit continuously and to wear the Actigraph during all waking hours. Parents were given wear reminders via text each morning. For each device, an adapted Choi algorithm was used to flag non-wear periods (defined as ≥90 consecutive 60 second steps) and non-wear-specific estimates of daily PA from each device were averaged across time periods when both devices were worn simultaneously, and estimates were compared using days with 10+ h of concordant wear and using all available data. RESULTS: Across 91 days with concordant device wear of 10+ h, Fitbit estimates were 25% higher for steps (Mean±SD = 10318 ± 3846 steps) and 44% higher for vigorous intensity PA (16.2 ± 22.1 min) compared to the Actigraph GT9X Link (8260 ± 3614 steps; 11.3 ± 15.9 min). In contrast, Fitbit estimates of moderate intensity PA (26.8 ± 21.1 min) were 20% lower than Actigraph estimates (33.3 ± 24.3 min). Pearson correlations between device estimates were higher for steps (r=0.62) than for moderate (r=0.55) or vigorous (r=0.28) intensity PA. Similar patterns were observed when all available concordant data were analyzed (r=0.77 days), with the Fitbit recording 20% more steps, 28% less moderate PA, and 36% more vigorous PA than the Actigraph. CONCLUSIONS: Wrist-worn consumer wearables may produce higher estimates of steps and vigorous intensity PA, and lower estimates of moderate intensity PA, in elementary school children. Additional evidence, consumers and researchers should be cautious when using wrist-worn consumer devices to assess absolute levels of PA in youth. Supported by a grant from NHLBI (R01HL135359).

PURPOSE: While emerging approaches for defining physical activity and sedentary behavior using accelerometry exist, cutpoint-based definitions remain a frequent convention. We explored whether a calibration study could contribute to wrist-worn accelerometer count cutpoints among women 60-90 years. METHODS: Women (n=199) 60-91 years wore an ActGraph GTX+ accelerometer on their left wrist while performing eight structured activities. Intensity was continuously measured using an Oxycon portable indirect calorimeter. Accelerometer data were analyzed in 15-second epochs with both normal and low frequency extension (LFE) filters. Receiver operating characteristic (ROC) curves were used to calculate cutpoints for sedentary behavior, light (low and high), and moderate to vigorous physical activity (MVPA) using vertical axis and vector magnitude (VM) counts. Cutpoints were selected that balanced the number of false positives and false negatives using three different classifications: one based on specific activities and two based on measured metabolic equivalents (e.g., 1 MET=3.0 or 3.5 ml/kg/min). Area under the ROC curves (AUC) were interpreted as excellent (0.90-1.00), good (0.80-0.89), fair (0.60-0.79), poor (0.60-0.69), and failure (<=0.59).

RESULTS: Average VM counts/15 sec varied by activities: 76 watch DVD, 675 assemble puzzle, 836 mopping, 1875 wash/dry dishes, 2180 laundry, 570 walk.

Commercial wearables are used to track physical activity (PA) levels in children and as tools for increasing PA participation in youth. However, few studies have examined the agreement between commercial and research grade devices in assessing PA in children.

PURPOSE: To compare estimates from a wrist-worn Fitbit Flex 2 to a waist-worn Actigraph GT9X Link in elementary school children. METHODS: Forty children aged 6-10 years wore a Fitbit Flex 2 (on a non-dominant wrist) and an Actigraph GT9X Link (on waist) for up to two weeks while school was in session. Children were instructed to wear the Fitbit continuously and to wear the Actigraph during all waking hours. Parents were given wear reminders via text each morning. For each device, an adapted Choi algorithm was used to flag non-wear periods (defined as ≥90 minutes of continuous 60 second step values) and non-wear-specific estimates of daily PA from each device were averaged across time periods when both devices were worn simultaneously, and estimates were compared using days with 10+ h of concordant wear and using all available data. RESULTS: Across 91 days with concordant device wear of 10+ h, Fitbit estimates were 25% higher for steps (Mean±SD = 10318 ± 3846 steps) and 44% higher for vigorous intensity PA (16.2 ± 22.1 min) compared to the Actigraph GT9X Link (8260 ± 3614 steps; 11.3 ± 15.9 min). In contrast, Fitbit estimates of moderate intensity PA (26.8 ± 21.1 min) were 20% lower than Actigraph estimates (33.3 ± 24.3 min). Pearson correlations between device estimates were higher for steps (r=0.62) than for moderate (r=0.55) or vigorous (r=0.28) intensity PA. Similar patterns were observed when all available concordant data were analyzed (r=0.77 days), with the Fitbit recording 20% more steps, 28% less moderate PA, and 36% more vigorous PA than the Actigraph. CONCLUSIONS: Wrist-worn consumer wearables may produce higher estimates of steps and vigorous intensity PA, and lower estimates of moderate intensity PA, in elementary school children. Additional evidence, consumers and researchers should be cautious when using wrist-worn consumer devices to assess absolute levels of PA in youth. Supported by a grant from NHLBI (R01HL135359).

Do GPS Capable Fitness Watches Accurately Measure Exercise Distances?

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Fitness watches have become popular for assessing activity habits. Manufacturers of these devices claim their devices provide valid and reliable estimates of distances traveled. PURPOSE: To determine if six popular physical activity watches provide accurate measures of GPS recorded distances. METHODS: An Apple Watch (AW), Fitbit Ionic (FI), Fitbit Versa (GV), Garmin VivoSport (GVS), Garmin Vivofit (GV), and a Garmin Forerunner 35 (GF) were all tested on indoor and outdoor oval tracks, an outdoor walking trail and a zig-zag pattern course. Twenty trials were performed on each course by the same researcher. An industrial TR 88016 FX Series collapsible measuring wheel established actual distance (200 m). Two watches were worn at the same time on the left arm. Each watch was set to walking and their GPS signal was turned on and connected. Distance measured by the wheel and each watch was recorded. Means, standard deviations, and percent relative error were calculated for the GPS distance of each watch. RESULTS: For the outdoor trail condition, the results showed distances ranging from 180.0 to 204.4 m (FI: 180.2 m, 10.4%, GF: 186.6 m, 7.6%, GVA: 200.7 m, 4.0%, AW: 201.1 m, 4.2%, GV: 204.4 m, 4.8%, GV: 204.4 m, 4.4%). For the zig-zag course condition, the range was from 184.2 to 204.4 m (GVS: 184.2 m, 4.1%, FI: 189.0 m, 6.0%, GV A: 189.8 m, 5.6%, GV F: 197.9 m, 4.0%, GV A: 197.9 m, 4.0%, GA: 204.4 m, 4.1%). For the outdoor track, the range was from 179.3 to 204.4 (FV: 179.3 m, 10.8%, AW: 189.8 m, 5.6%, FI: 195.5 m, 4.8%, GVS: 200.3 m, 4.0%, GV A: 202.8 m, 4.0%, GV: 204.4 m, 4.1%). For the indoor track, the range was from 164.2 to 169.0 (FI: 164.2 m, 18.3%, AW: 169.0 m, 16%). All Garmin devices failed to record an indoor measurement. CONCLUSIONS: The least and most accurate measurements for each condition were: trail (FI and GVA), zig-zag (GVS and GV), outdoor track (GVS and FI) and indoor track (FI and AW), respectively. The Garmins were the most accurate for the outdoor track with all exhibiting a 4.0% error. Indoor, all devices were less accurate. Only AW and FI had functioning GPS indoor and showed their most error in this setting. Caution must be used when relying on physical activity monitors if accuracy is desired in measuring distance via GPS.
1.5 mph, 637 walk 2.0 mph, 1132 walk 2.5 mph, and 1094-400 meter walk. Of the three cutpoint classifications, activity types performed best based on sensitivity and specificity. Using the normal filter, the AUC was good for sedentary cutpoints (vertical axis 0.88; VM 0.88), but was fair to poor for light high intensity (vertical axis 0.74; VM 0.64) and failed for MVPA (vertical axis 0.50; VM 0.50). Findings were similar when using the LFE filter, with only sedentary results indicating good to excellent results (vertical axis 0.90; VM 0.89).

CONCLUSION: This approach provided useful sedentary but not physical activity indicators for wrist-worn accelerometry counts. Further research is needed to understand whether wrist-worn accelerometry can accurately measure higher intensity physical activity in older adults.

B-15 Free Communication/Slide - Clinical Exercise Testing

Wednesday, May 27, 2020, 1:00 PM - 3:00 PM
Room: CC-2005

639 Chair: Jonathan Myers, FACSM. Veterans Affairs Palo Alto Health Care System, Palo Alto, CA.
(No relevant relationships reported)

640 May 27 1:00 PM - 1:15 PM

Calf Muscle Oxygenation Limits Maximal Respiratory Performance During Incremental Walking Test In Obese Children

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(No relevant relationships reported)

PURPOSE: To study the interrelationship between respiratory and muscle haemodynamic responses during an incremental exercise in overweight children and confirm the limitations clinically observed that lead to the premature termination of an aerobic fitness test.

METHODS: Twenty-four overweight children (12 girls and 12 boys) performed a progressive maximal treadmill test during which the slope increases every minute. Changes in muscle oxygen (O2) supply were continuously assessed using near-infrared spectroscopy. Pulmonary gas exchanges and heart rate (HR) were measured. For each participant, changes in deoxyhemoglobin level (Δ[HHb]) in the medial head of the calf muscle were recorded. The influence of the sex, BMI and maturation on breath the onset of BP HHb was assessed with linear model effects.

RESULTS: Girls reach lower VO2 peak than boys (p = 0.07). A BP HHb occurred during the test in 9 girls and 6 boys and was strongly correlated with VO2 peak (r = 0.80, p < 0.001).Expressed as a percentage of maximal theoretical value, HR peak tended to be higher in non BP HHb (94.7 ± 5) than in BP HHb (89.9 ± 8) participants (p = 0.1). Current data suggests that a lower maturation and lower BMI are the two main factors that delay the onset of BP HHb.

CONCLUSIONS: Oxygenation of the calf muscle could limit maximal respiratory performance during an incremental walking test with a slope, especially in prepubertal obese children who have lower BMI. Muscle limitations should be considered when choosing a protocol to assess VO2 peak in this population.

641 May 27 1:15 PM - 1:30 PM

High Peak Exercise Blood Pressure In Athletes Is Proportional To Exercise Capacity.

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(No relevant relationships reported)

An abnormal blood pressure (BP) response to exercise is an important physiological variable associated with a risk of sub-clinical hypertension. Reference values are poorly defined and lack contextualization to physiological demands that can be obtained among very active populations.

PURPOSE: To assess the relationship between systolic BP (SBP) and workload and to determine reference values of SBP response to exercise in endurance athletes.

METHODS: We recruited 123 current and former endurance athletes (76% male), aged 16-80 years. BP was measured every 2 min during a maximal bicycle cardiopulmonary exercise test using a TangoM2 automated BP monitor. Relationship between SBP measured at 25%, 50%, 75% and 100% of maximum workload and power output during exercise were determined by linear regression analysis using STATA software.

RESULTS: SBP increased from 128 ±13 mmHg in males (age 40±18 years) and 116 ±12 mmHg in females (age 35±14 years) to peak 223 ± 27 mmHg and 203 ± 19 mmHg, respectively (P<0.0001). The majority of participants demonstrated an exaggerated SBP response to exercise (72% of males and 82% of females) as defined by the American Heart Association guidelines. There was a strong correlation between power output and SBP (r² = 0.67, P<0.001, Figure 1). Males achieved 123±18% and females 134±26% of their predicted VO2 max (P<0.01). There was no statistical difference in exercise SBP response according to age or BMI. Gender and hypertensive medication did have a statistically significant, but weak correlation to SBP (P<0.01 and P<0.001 respectively r²=0.03 for both).

CONCLUSION: High SBP values are observed in athletes at peak exercise, frequently exceeding ‘normal value’ definitions. However, SBP increases can be explained by the supra-normal exercise capacity, thus, should be considered in the context of exercise capacity.

Abstracts were prepared by the authors and printed as submitted.
Exercise can exacerbate concussion symptoms, even when symptoms are not apparent at rest. Whether this relates to a physiologic response to exercise remains unknown. PURPOSE: To examine symptom and physiologic responses to a stationary bike exercise protocol among participants with concussion and uninjured controls.

METHODS: To examine symptom and physiologic responses to a stationary bike exercise protocol among participants with concussion and uninjured controls.

RESULTS: Those who participated in sports 2-3 days/week or more had a significantly higher \( \text{VO}_{2\text{peak}} \). \( \text{Z-score}, \text{GET} \), and \( \text{O}_2 \) Pulse than those with 0-1 day/week (Table 1). There were no differences between those who participated in sports 2-3 days/week compared to ≥4 days/week. \( \text{VO}_{2\text{peak}} \) was similar between CHD cohorts (p=0.21). Conclusions: \( \text{VO}_{2\text{peak}} \) is higher in those who participate in sports compared to those who do not. It is unclear whether those who have a higher \( \text{VO}_{2\text{peak}} \) are more inclined to participate in sports or whether sports participation leads to a higher \( \text{VO}_{2\text{peak}} \) these CHD patients. The role of exercise rehabilitation in the 0-1 day/week group needs to be explored.

Ahmad et al 2001

May 27 1:45 PM - 2:00 PM

Symptom And Physiologic Response To Exercise Following Concussion

David R. Howell1, Danielle Hunt1, Stacey E. Aaron1, J Andrew Taylor2, William P. Meehan3, Can Ozan Tan1.1 Children’s Hospital Colorado, Aurora, CO. 2Boston Children’s Hospital, Boston, MA. 3Spaulding Rehabilitation Hospital, Cambridge, MA. (Sponsor: Louis Osternig, PhD, ATC, ACSM)

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(No relevant relationships reported)

Exercise can exacerbate concussion symptoms, even when symptoms are not apparent at rest. Whether this relates to a physiologic response to exercise remains unknown. PURPOSE: To examine symptom and physiologic responses to a stationary bike exercise protocol among participants with concussion and uninjured controls. METHODS: 32 concussed individuals (age=16.9±2 years; 55% female; 12.4±5 days post-injury) and 22 healthy controls (age=18.3±2 years; 59% female) completed a modified YMCA branching exercise protocol. After warmup (3 mins; 50 watts), participants progressed to Stage 1 (3 mins; 100 watts). Stage 2 was based on Stage 1 HR (2 mins; 175 watts if <60% age predicted HR; 150 watts if 60-70% age predicted HR; 125 watts if >70% age predicted max HR). Stages 3-5 lasted 2 mins, and increased by 50 watts/stage. Stopping criteria were symptom worsening (visual analog scale [VAS, 0-100] change≥30) or 85% age-predicted HR. We assessed changes (end - baseline) for VAS, HR, systolic/diastolic blood pressure (SBP/DBP), rating of perceived exertion (RPE), carbon dioxide output (VCO2), respiratory exchange ratio (RER), and oxygen consumption (VO2).

RESULTS: The concussion group reported significantly higher symptom severity at rest than controls (21.0±19.6 vs. 5.6±5.6; p=0.002). Resting HR (63.4±7.9 vs. 64.6±11.5±1.3 minutes) were similar between groups. 22% of concussed participants stopped due to symptom exacerbation. Symptom change was not significantly different between groups (VAS= 10.4±16.1 vs. 4.7±11.2; p=0.18). The control group had significantly lower increase in DBP than the concussion group (6.1±5.7 vs. 1.4±4.8; p=0.003). VAS change was significantly associated with HR change among concussed (\( r=0.45; 95\% \text{CI}=0.37, 0.27; p=0.004 \)) and control groups (\( r=0.47; 95\% \text{CI}=0.15, 0.78; p=0.001 \)) and for control subjects, VAS change was associated with RPE (\( r=0.29; 95\% \text{CI}=0.55, 0.22; p=0.02 \)) and SPB (\( r=0.73; 95\% \text{CI}=-0.97, -0.48; p=0.001 \)) changes.

CONCLUSIONS: Using a branching bike-based exercise protocol, most participants achieved 85% age-predicted maximum HR, rather than symptom exacerbation. The amount of symptom provocation between groups was similar. Greater HR changes during exercise were associated with greater symptom provocation independent of group.

May 27 2:15 PM - 2:30 PM

Optimal Distance For Normal Gait Speed Testing

Rosalba Saavedra, Brian Bischoff, Steven Kim, Eric Martin. California State University, Monterey Bay, Seaside, CA. (Sponsor: Kent Adams, ACSM)

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(No relevant relationships reported)

PURPOSE: Walking speed tests are valid tools for predicting functional independence outcomes, however research has not yet agreed on their predictive ability for cardiovascular disease events. There are a range of distances used for walking speed tests, which generates a gap in knowledge and questions the test’s accuracy and clinical significance. The purpose of the current study was to determine an optimal distance to calculate gait speed that can be used to standardize walking tests in clinical settings.

METHODS: Participants walked at their normal gait speed for 20m through Brower timing gates set up at the starting line and at 5m, 10m, and 20m. Speeds from 0-5m, 5-10m, and 10-20m were compared using a linear mixed effect model.

RESULTS: The average speed for 0-5m segment was 1.36±1.12 m/s, 5-10m was 1.44±1.37 m/s, and the 10-20m average speed was 1.38±0.75 m/s. The estimated difference was 0.088 m/s with a 95% CI between 0.062-0.079 m/s with a
646 May 27 2:30 PM - 2:45 PM
The Predictive Value Of The SF-36 Questionnaire In Determining CPET Performance In Patients With ME/ CFS
Jeffry Cournoyer, Elizabeth Balbin, Precious Leaks-Gutierrez, Fanny Collado, David Freeman, Arnaldo Tercero, Nancy Klimas. 1 Nova Southeastern University, Miami, FL. 2 Miami Veteran’s Affairs Hospital, Miami, FL. Email: jcournoyer@nova.edu
(No relevant relationships reported)

Introduction
Patients diagnosed with Myalgic Encephalomyelitis (ME/CFS) tend to have difficulties with higher-intensity exercise, and usually show diminished maximal exercise capabilities when compared to their sedentary healthy counterparts (sHC). Thus, it is important to find new ways to identify patients most at risk for diminished exercise performance as soon as possible.

Purpose
The present study seeks to determine the predictive validity of the Short Form Health Questionnaire (SF-36) and its subscales as a non-exercise component in patient evaluation.

Methods
18 male patients diagnosed with ME/CFS (Age: 39.2 ± 12.8 years) and 18 male sedentary healthy controls (Age: 39.9 ± 13.4 years) were asked to fill out the SF-36 health survey before participating in a symptom-limited maximal exercise test (CPET). CPET was performed on a cycle ergometer, and initial resistance was set at 30 Watts with a 30 Watt increase every 2 minutes. Subjects were asked to maintain a cycling cadence of 60-70 RPM for as long as possible, or until they experienced any of the predetermined symptoms. Maximal exercise data and ventilatory efficiency measures were recorded and used in correlative analyses.

Results
Significant differences were observed between ME/CFS and sHC in all relevant subscales of the SF-36 (p < 0.005 in all cases). The Physical Functioning, Vitality and Physical Health subscales were all positively correlated with maximal oxygen uptake (VO2 Max) in the ME/CFS group (r = 0.67, p < 0.005; r = 0.59, p < 0.05; and r = 0.65, p < 0.005 respectively), but showed poor correlations in the sHC group (r = 0.28, p = 0.24; r = 0.16, p = 0.51; r = 0.31, p = 0.65 respectively). Although there were significant differences in VE/VCO2 slopes between the groups (p < 0.05), neither group showed strong correlations between subscales and ventilatory efficiency.

Conclusions
The SF-36 and its subscales showed strong correlations with maximal exercise performance in subjects diagnosed with ME/CFS. These results were not observed in sHC, possibly due in part to the large percentage of “perfect” scores recorded in this group. While the SF-36 did not show any significant correlations with inter-test ventilatory efficiency measures, it might still hold some value in predicting outcomes of maximal CPETs in subjects with diminished exercise capacity.

647 May 27 2:45 PM - 3:00 PM
Serial Assessment Of The Cardiorespiratory Fitness Vital Sign: Prognostic Significance One Year Post Cardiac Rehabilitation
Cemal Ozemek, FACSM, 1 Deepika Laddu, 1 Trina Hauer, 1 Codie Rouleau, 2 Tavis Campbell, 2 Stephen Wilton, 1 Sandeep Aggarwal, 1 Leslie Austford, 1 Tamara M. Williamson, 1 Hongwei Liu, 1 Danielle Chirico, 2 Ross Arena, 2,3 FACSM, 4 University of Illinois Chicago, Chicago, IL. 5 TotalCardiology Research Network, Calgary, AB, Canada. 6 University of Calgary, Calgary, AB, Canada. 7 TotalCardiology Rehabilitation, Calgary, AB, Canada. Email: ozemek@uiuc.edu
(No relevant relationships reported)

Cardiorespiratory fitness (CRF) consistently demonstrates robust prognostic value in apparently healthy individuals and in those at risk for or diagnosed with one or more chronic conditions. While CRF at baseline and immediately following cardiac rehabilitation (CR) hold prognostic value, little is known about the significance of serial CRF assessments over a prolonged period. PURPOSE: Assess the prognostic utility of serial CRF assessments in patients completing CR.

METHODS: 3,185 patients (mean age = 62 ±10 years, 82% male) with cardiovascular disease (CVD) that were referred to and completed a 12-week exercise-based CR program were included. All patients completed a symptom-limited treadmill exercise test at baseline, immediately following CR and at 1-year follow-up. Peak metabolic equivalents (METs) were determined at each exercise test from treadmill speed and grade. The difference between peak METs at baseline and immediately post CR and between baseline and 1-year post CR were also calculated. Patients were subsequently tracked for all-cause mortality.

RESULTS: 206 subjects died during the tracking period (mean tracking = 79 ±14 months). Peak METs at baseline (Mean = 7.7 ±2.0 METs; HR: 0.66, 95% CI: 0.62- 0.71, p<0.001), immediately following CR (Mean = 8.7 ±2.0 METs; HR: 0.65, 95% CI: 0.60-0.69, p<0.001) and 1-year post CR (Mean = 8.6 ±2.2 METs HR: 0.65, 95% CI: 0.61-0.69, p<0.001) were all significant predictors of survival. The mean change in peak METs from baseline to immediate post CR (0.88 ±1.1 METs) and from baseline to 1-year post CR (0.88 ±1.3 METs) was significant (p<0.001). However, only the change in peak METs from baseline to 1-year post CR was a significant predictor of survival (HR: 0.73, 95% CI: 0.66-0.80, p<0.001).

CONCLUSIONS: The current findings again demonstrate the prognostic significance of the CRF vital sign in patients with CVD undergoing CR. Our results indicate continued serial assessment of the CRF, in this analysis 1-year following completion of CR, provides important prognostic information. In particular, maintenance of CRF improvement following CR over the long-term is clinically important and should be monitored.

B-16 Free Communication/Slide - Nutritional Ergogenic Aids

648 May 27, 2020, 1:00 PM - 3:00 PM
Room: CC-2016

649 May 27 1:00 PM - 1:15 PM
The Impact Of Placebo Caffeine Dose On Cognitive Performance And Endurance Running In Recreational Athletes.
Ben Desbrow, 1 Chris Irwin, 1 Nathan Delang, 1 Gregory R. Cox, 2 Griffith University, Gold Coast, Queensland, Australia. 3 Bond University, Gold Coast, Queensland, Australia. (Sponsor: Louise Burke, FACSM)
Email: b.desbrow@griffith.edu.au
(No relevant relationships reported)

PURPOSE: A caffeine-mediated dose-response placebo effect has previously been observed in trained cyclists. The current study aimed to determine if perceived caffeine dose influences cognitive and/or running performance in recreational athletes.

METHODS: Twenty-nine healthy individuals (23.7±5 y) (Mean±SD; 16 males) completed two morning trials (repeated measures design, separated by 1 week), involving a choice reaction time (CRT) test followed by a 10km performance run. Prior to the first trial, participants indicated their beliefs of caffeine’s effects on performance and any previous experience using caffeine as an ergogenic aid. On arrival to the testing facility, participants randomly received (and were told they were getting) “Low dose (100mg)” or “High dose (300mg)” of caffeine capsules (all contained placebo, (psyllium husk powder)) prior to commencing the CRT test (30min post capsule ingestion). Paired samples t tests were used to determine differences between trials and CRT latency (employing Ex-Gaussian analysis) and running performance using the entire participant sample and for the sub-groups exhibiting strong “beliefs” +/- prior experience.

RESULTS: Perceived caffeine dose did not influence CRT (μ-, σ- and τ-components of placebo effects of perceived caffeine-dose ingestion on cognitive performance and any previous experience using caffeine as an ergogenic aid. On arrival to the testing facility, participants randomly received (and were told they were getting) “Low dose (100mg)” or “High dose (300mg)” of caffeine capsules (all contained placebo, (psyllium husk powder)) prior to commencing the CRT test (30min post capsule ingestion). Paired samples t tests were used to determine differences between trials and CRT latency (employing Ex-Gaussian analysis) and running performance using the entire participant sample and for the sub-groups exhibiting strong “beliefs” +/- prior experience.

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Table 1. Probability estimates of elevating blood bicarbonate above 5 mmol·L\(^{-1}\) (%)

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POURPOSE: To describe the reliability of bicarbonate pharmacokinetics to sodium bicarbonate (SB) supplementation and, based on those data, to estimate probabilities of SB ingestion before exercise using currently accepted threshold.

METHODS: Thirteen males (age 27±5 y; body mass (BM) 77.4±10.5 kg; height 1.75±0.06 m) ingested 0.3 g·kg\(^{-1}\)BM dose was shown to create a long-lasting window of ergogenic potential, which has practical utility for athletes and suggests that individually tailored timings are not required.

RESULTS: Time-to-peak (Tmax), absolute peak (Cmax), absolute peak change (∆Cmax) and area under the curve (AUC) were determined and analysed using mixed models, as was the intraclass correlation coefficient (ICC), coefficient of variation (CV) and typical error (TE). Individual variation in pharmacokinetic responses was assessed using a Bayesian simulation approach using multilevel models with random intercepts.

RESULTS: No significant differences between sessions were shown for blood bicarbonate regarding Cmax, AUCmax or AUC (all p>0.05), although Tmax occurred significantly earlier in SB2 (127±36 min) than in SB1 (169±54 min, p=0.0088) and SB3 (159±42 min, p<0.05). ICC, CV and TE showed moderate to poor reliability for these variables. Bayesian modelling estimated that over 80% of individuals from the population experience elevated blood bicarbonate levels greater than +5 mmol·L\(^{-1}\) between 75-240 min after ingestion, and between 90-225 min for elevations greater than +6 mmol·L\(^{-1}\). (Table 1).

CONCLUSIONS: Assessing SB supplementation, using discrete values showed only moderate reliability at the group level, and poor reliability at the individual level, while Tmax was not reproducible. However, when analysed as modelled curves, a 0.3 g·kg\(^{-1}\)BM dose was shown to create a long-lasting window of ergogenic potential, which has practical utility for athletes and suggests that individually tailored timings are not required.

PURPOSE: To determine if nutritional supplementation with vitamin C-enriched collagen improves RFD compared to placebo (PLA) with an explosive power-based training regime.

Methods: Healthy male collegiate football players (18-25 years) were enrolled in a 3-week double-blind, parallel design study. Athletes were randomly assigned to the intervention group (COLL; 15g hydrolyzed collagen with 50mg vitamin C) or placebo group (PLA; 15g rice flour). All supplements were ingested 60min prior to training 5 days per week and with breakfast on rest days. Athletes completed the same training program and progression. RFD was measured from the best of three maximal isometric squats, countermovement jumps and squat jumps (Kistler, Novi, MI) performed at the same time on each testing day (baseline and after 1.2 and 3 weeks of training). Two-way ANOVA (nutrition intervention and time) was used to compare RFD between groups.

Results: At time of analysis there were no significant differences for maximal RFD in the maximal isometric squat between the interventions. RFD data from CMJ and SJ are yet to be determined.

Conclusion: Supplementation with vitamin C-enriched collagen prior to training throughout a 3-week explosive power-based training program does not improve maximal RFD compared to exercise alone. More comprehensive analysis of all RDF parameters is required to fully interpret results from this study and will be completed prior to abstract presentation.

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The use of water-loading to enhance weight cutting is getting increasingly popular in combat and weight category sports. Athletes are overdrinking water in order to increase urine production before engaging in a fluid restriction period in the belief that it will maximise fluid driven body mass loss. Research into this practice is lacking and further investigation is needed.

**PURPOSE:** Determine the impact of a water-loading protocol in combination with dietary adjustments on acute body mass loss, natriaemia, urinary markers of hydration and arm cramp performance in elite judo athletes.

**METHODS:** Using a crossover design, 18 elite male judo athletes underwent 2, 6 days interventions interspersed by a washout period of 2 weeks. While following a controlled diet, athletes consumed either 40 mL/kg (control condition (CON)) or 80 mL/kg (water loading condition (WL)) on days 1-3, followed for both conditions by a fluid intake of 20 mL/kg on day 4. On day 5, fluid was restricted until 1100h, body mass was then measured and for the remaining of the day athletes consumed 60 mL/kg of fluid. On day 6, fluid was consumed ad libitum and arm cramp performance measured between 9h00-12h00.

**RESULTS:** Water-loading (2.4 ± 0.5%) produced a significantly (p = 0.03, effect size = 0.7) greater decrease in body mass, compared with CON (1.8 ± 0.5%). Urine specific gravity and osmolality became progressively lower over time with WL (p = 0.05), compared with CON. However, whole blood sodium concentration remained within the physiological range of 135-145 mmol/L throughout the WL condition. There were no significant differences in arm cramp performance for maximum power (CON: 663 ± 335, WL: 663 ± 335 W) and mean power (CON: 330 ± 35, WL: 335 ± 35 W).

**CONCLUSION:** Our results indicate that the water-loading protocol used in this study (1) improves acute body mass loss without affecting health or arm cramp performance and, 2) should be considered by combat sports athletes looking to improve their weight cutting practices.

**Funding information:**
1) Own the Podium i4G applied research program 2) INS Quebec PRIDI research grant
Clinical Case Slide - Head Injury and Concussion
Wednesday, May 27, 2020, 1:00 PM - 3:00 PM
Room: CC-3014

Chair: John Leddy, University at Buffalo Sports Medicine Institute, Buffalo, NY.
(No relevant relationships reported)

Discussant: Julie Wilson, Children's Hospital Colorado, Aurora, CO.
(No relevant relationships reported)

Discussant: Eugene Hong, Medical University of South Carolina, Newton Square, PA.
(No relevant relationships reported)

May 27 1:00 PM - 1:20 PM
Oh Snap! I Got Hit In The Face.
Christina S. Gutta, Prisma Health, Greenville, SC. (Sponsor: Dr. Franklin Sease, FACSM)
(No relevant relationships reported)

May 27 1:40 PM - 2:00 PM
Eye Injury- Baseball
Erika Leigh Cohron, Lisa Odendal, Danielle Hirsch, Johns Hopkins All Children's Hospital, Saint Petersburg, FL. (Sponsor: Dilipkumar R Patel, MBBS, MBA, MPH, FACSM)
Email: erika.shuster@jhmi.edu
(No relevant relationships reported)

May 27 2:00 PM - 2:20 PM
Eye Injury- Baseball
Oh Snap! I Got Hit In The Face.
Christina S. Gutta, Prisma Health, Greenville, SC. (Sponsor: Dr. Franklin Sease, FACSM)
(No relevant relationships reported)

May 27 2:40 PM - 3:00 PM
Concussion: Bouncy House
Angela Rufo, Maine Dartmouth, Augusta, ME. (Sponsor: James Dunlap, FACS/M)
(No relevant relationships reported)

May 27 3:40 PM - 4:00 PM
Concussion: Bouncy House
Angela Rufo, Maine Dartmouth, Augusta, ME. (Sponsor: James Dunlap, FACS/M)
(No relevant relationships reported)
A 16-year-old male presented to an outpatient sports medicine clinic one month after a head-to-head collision during a soccer match with concern for concussion. There was no loss of consciousness, and he continued to play the rest of the game with a mild headache. He felt normal and asymptomatic that evening and was able to complete homework. The following morning he felt tired, but was able to perform adequately at school. Over the coming weeks, he noticed progressive worsening of his cognitive symptoms and tiredness. His athletic trainer became concerned for a concussion and held him from practice. One week prior to presentation he noted midline lower lip numbness, teeth pain while chewing, hearing his pulse in his left ear, and poor sleep due to sweating. He also felt progressive lethargy and difficulty concentrating and missed the last three days of school due to these symptoms. His medical history was significant only for a recently diagnosed inguinal hernia.

**PHYSICAL EXAMINATION:**
Mild cognitive deficits in attention and memory, impaired balance on BESS, normal motor strength. Cranial nerve exam showed ptosis of the left eye, mild left facial nerve palsy, decreased hearing in the left ear, and altered sensation to light touch over the middle lower lip. There was no focal tenderness or deformity of the skull or scalp.

**DIFFERENTIAL DIAGNOSES:**
- Mild traumatic brain injury
- Intracranial hemorrhage
- Cerebral mass
- Bell’s palsy

**TESTS AND RESULTS:**
- MRI Brain with and without contrast: Asymmetric enhancement of the left 7th cranial nerve, asymmetric nodular enhancement along the left 5th nerve with enhancement of muscles of mastication, diffuse bilateral pachymeningeal enhancement.
- Complete Blood Count: WBC 19k, platelets 80, hematocrit 30.4
- CT Chest, Abdomen, Pelvis: Large abdominal soft-tissue mass herniating through the inguinal canal, most consistent with a lymphoma
- CSF Cytology: Enlarged B-cells most consistent with Burkitt lymphoma.

**FINAL DIAGNOSIS:**
Stage IV Burkitt lymphoma, with primary lesion in abdomen, and perimeningeal absorption and rebleed.

**TREATMENT AND OUTCOMES:**
1. Hospitalized for two days with evaluation by neurosurgery, trauma surgery, plastic surgery, and neurology
2. 5-day course of oral steroids
3. School accommodations given related to concussion symptoms
4. Right-sided facial droop fluctuated and persisted for 2 weeks with subsequent resolution
5. Cleared to start return to play protocol by neurosurgery at 3 weeks once exam returned to baseline
6. Finished seasons with no additional issues related to injury

**HISTORY:**
History and Physical Examination: A 50-year-old competitive marathoner presented with sudden onset right buttock pain that started while sprinting during a pub run 3 days prior to presentation. He described the pain as a deep ache that localized just medial to the right ischial tuberosity. Pain was worse with truncal flexion and knee flexion. It was most apparent when walking, but improved when he applied pressure over his ischial tuberosity while walking. He denied weakness and numbness/tingling that radiated down the leg.

**PHYSICAL EXAMINATION:**
- On examination, gait was not antalgic. There was no bruising, swelling, or change in muscle bulk of the right buttock and posterior thigh.
- Right hip range of motion was full but end range hip flexion induced pain. He was tender to palpation in the medial and cephalad aspect of the ischial tuberosity with no tenderness over the conjoint tendon or hamstring head of the adductor magnus at the ischial tuberosity. Strength was 5/5 in the bilateral lower extremities, but he had pain with resisted right knee flexion. Sensation was intact in the bilateral lower extremities.

**DIFFERENTIAL DIAGNOSIS:**
- Hamstring tear or tendinopathy
- Piriformis syndrome
- Tear or tendinopathy of the deep hip internal rotators (obturator internus, superior gemellus, inferior gemellus)
- Gluteus maximus muscle injury
- Sacrotuberous ligament strain or tear
- Ischial femoral impingement
- Sacroiliac joint disease
- Atypical L5 radiculopathy

**TEST AND RESULTS:**
- Limited diagnostic ultrasound of the right ischial tuberosity region was performed with a 15-6 MHz linear array transducer and showed a normal hamstring without sonopalpation tenderness. The area just proximal and medial to the ischial tuberosity showed symmetric and normal cranial nerve exam, no C-spine tenderness, and symmetric upper and lower extremity strength and sensation. He exhibited dizziness with VOMS testing but no irregular eye movements. In the ED, he had right-sided facial droop, decreased sensation in the right cheek and jaw, and an otherwise normal exam.

**DIFFERENTIAL DIAGNOSIS:**
- Intracranial hemorrhage
- Cranial nerve palsy
- Cervical neuropraxia
- Concussion
- Bell’s palsy
- Cerebral mass
- Intracranial hemorrhage
- Mild traumatic brain injury
- Bell’s palsy

**TREATMENT AND OUTCOMES:**
- He was referred to physical therapy for right sacrotuberous ligament strain focusing on core strengthening and frequent gentle hamstring stretching.
- He was pain free after one month and was able to return to running.
BACKGROUND
The Achilles tendon is a common site for chronic tendinosis, a condition characterized by overuse and degeneration of a tendon due to repeated micro-trauma and eccentric overuse and degeneration of a tendon due to repeated micro-trauma and eccentric injuries. The foot was neurovascularly intact.

HISTORY: A 14-year-old female middle-distance athlete presented with a history of unilateral (right) foot pain, diagnosed as a navicular stress fracture which was managed non-surgically and made a full clinical recovery. Nine months later she sustained a suspected traumatic spring ligament injury on the opposite side, with subsequent recurrence of pain in the right foot due to overload from the non-weight bearing management of the left foot injury. She therefore presented with bilateral athletics-related foot pain, one-sided apparently traumatic in nature and the other an overload injury.

RESULTS
The Achilles tendon initial injury was treated non-surgically with regenerative injections and physical therapy. The athlete returned to sport and reinjured the same tendon. The subsequent MRI read that the tendon had been surgically repaired.

CONCLUSION
Regenerative injection therapy results in MRI changes that appear to be of surgical repair imaging. Re-injury rates need to be evaluated in regards to return to play and rehabilitation. Protocols for regenerative injections with the inclusion of eccentric rehabilitation. True tissue healing, without scar tissue repair, has been discussed at the cellular level of healing for soft tissue injuries with the use of regenerative injections.

BACKGROUND
The Achilles tendon is a common site for chronic tendinosis, a condition characterized by overuse and degeneration of a tendon due to repeated micro-trauma and eccentric injuries commonly used in athletic demands such as running. This can lead to pain and functional limitations for an athlete. There is a growing interest in non-surgical forms of treatment for this condition including provision of regenerative injection therapy (autologous blood and platelet rich plasma injections, PRP). In this case study, a runner with an Achilles tendon injury treated with PRP later underwent an MRI after her re-injury. The MRI finding corroborate healing and in this case read as a “surgical repair” when surgery had not been performed.

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HISTORY: A 15-year-old cross-country runner presented with 6 months of bilateral foot pain. Patient described “burning” pain over lateral aspect of both feet that would occur predictably after running 1-2 miles, then gradually resolve with rest within 2 hours. No symptoms reported at rest. She denies any associated back pain, lower extremity numbness or weakness. Prior treatments included changing shoes, orthotics, therapy for plantar fasciitis, and extended rest without any improvement.

DIFFERENTIAL DIAGNOSIS:
1. Bilateral S1 radiculopathy
2. Lateral plantar nerve compression
3. Chronic exertional compartment syndrome
4. Bilateral bone stress injury
5. Intermetatarsal neuroma

TREATMENT AND OUTCOMES:
1. Activity modification and relative rest
2. Continued to recommend manual therapy and subtalar joint mobilization
3. Neuro re-education and therapeutic exercise program
4. Return to run protocol

BACKGROUND
The Achilles tendon is a common site for chronic tendinosis, a condition characterized by overuse and degeneration of a tendon due to repeated micro-trauma and eccentric injuries commonly used in athletic demands such as running. This can lead to pain and functional limitations for an athlete. There is a growing interest in non-surgical forms of treatment for this condition including provision of regenerative injection therapy (autologous blood and platelet rich plasma injections, PRP). In this case study, a runner with an Achilles tendon injury treated with PRP later underwent an MRI after her re-injury. The MRI finding corroborate healing and in this case read as a “surgical repair” when surgery had not been performed.

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PHYSICAL EXAMINATION: On clinical examination she was noted to have bilateral mild cavus feet with an antalgic gait pattern. Right foot: Calf and Achilles tendon did not reveal any abnormalities (Silfverskiold negative). Ankle was asymptomatic. The hindfoot joints were mobile and non-tender. There was significant tenderness over the talar navicular bone (“N” spot). The mid and forefoot examination did not reveal any abnormalities. The foot was neurovascularly intact. Left foot: Calf and Achilles tendon did not reveal any abnormalities (Silfverskiold negative). The ankle was asymptomatic. The hindfoot joints were mobile and non-tender. There was once again significant tenderness over the talar navicular bone with mild swelling. The spring ligament was not tender. The mid and forefoot examination did not reveal any abnormalities. The foot was neurovascularly intact. DIFFERENTIAL DIAGNOSIS: Navicular stress fractures, tendinopathy of the posterior tibialis tendons, tear of the spring ligament, separation of an accessory navicular

TEST AND RESULTS: Imaging with MRI revealed bilateral navicular stress fractures (figure 1), as indicated by bony edema and a fracture line. On close inspection, the navicular fracture lines were visible on x-ray (Figure 2). Further imaging with CT scans confirmed the navicular fractures and demonstrated sclerosis along the fracture borders with no cross trabeculation, suggestive of a non-union (figure 3).

FINAL WORKING DIAGNOSIS: Bilateral navicular stress fractures

TREATMENT AND OUTCOMES: Open reduction and internal fixation (ORIF) and bone grafting. Postop rehabilitation and graded return to activity. Back to sports with no pain or swelling in her feet 1 year post surgery.

HISTORY: 14 yo CC runner in for RTP recommendation 3 wks following collapse during 1st race. 15 min into the race his legs felt tingly & he collapsed to the ground; he could feel the grass on his face & had a hard time opening his eyes; his breathing was labored & shallow; skin was blotchy & pale. His parents transported him car to the local hospital. The ED team started cooling immediately. He was confused, combative, swirling profusely, and throwing punches at staff. As his rectal temp decreased from 41.2°C to <39°C, his behavior improved, his skin color returned to NNR, & his HR dropped from 170 bpm to NNR. ED labs were Na 140, K 4.2, & glucose 89. When he arrived at Children’s Hospital by helicopter, his rectal temp was 37°C. He felt a little groggy his first day back to school, but quickly returned to baseline.

He participated in a low level flag football game during gym class & was told that his cheeks became flushed & blotchy. He returned to cross country practice doing the ground; he could feel the grass on his face & had a hard time opening his eyes; his breathing was labored & shallow; skin was blotchy & pale. His parents transported him car to the local hospital. The ED team started cooling immediately. He was confused, combative, swirling profusely, and throwing punches at staff. As his rectal temp decreased from 41.2°C to <39°C, his behavior improved, his skin color returned to NNR, & his HR dropped from 170 bpm to NNR. ED labs were Na 140, K 4.2, & glucose 89. When he arrived at Children’s Hospital by helicopter, his rectal temp was 37°C. He felt a little groggy his first day back to school, but quickly returned to baseline.

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ACSM May 26 – May 30, 2020
San Francisco, California
A loss of strength and explosive capacity (the ability to produce force as quickly as possible) may be risk factors for falls in older individuals. However, it is poorly understood if the explosive capacity of an older individual correlates with the reaction time (RT) of a predictable or unpredictable response. PURPOSE: Our primary aim was to investigate the relationship between rate of torque development (RTD100) of the hip abductors and adductors with anticipatory postural adjustments (APA) and RT to a simple (SRST) and choice reaction step (CRST). METHOD: Nine older adults (5 females; 73 ± 4 y; 1.66 ± 0.07 m; 74 ± 12 kg; X ± SD) performed maximal voluntary contractions (MVC) in a standing position at 30° hip abduction. Participants performed the test as hard and fast as possible and held for ~5 s. RTD was measured for both 100, 200, and 300 ms from torque onset (RTD100, RTD200, and RTD300) and normalized to body weight and height. For the SRST and CRST a visual stimulus was displayed at eye level in front of the participants indicated when to step laterally as fast as possible. APA was calculated as the first time when the difference in vertical force under the feet increased by 5% of body weight while RT was the time between the visual stimulus and removal of the foot from the force plate. RESULTS: No significant correlations were found between RTD100 and APA or RT. Hip abductors APA did not correlate with RTD while hip adductors APA correlated with RTD100 and RTD300 for both SRST and CRST (r = -0.71, P<0.002). Hip abductors RT correlated with RTD100, RTD200, and RTD300 during CRST (r = 0.73, P<0.025; r = -783, P<0.013 and r = -0.74, P = 0.025; respectively) which was similar between hip adductors RTD200 and RTD300 during CRST (r = 0.85, P<0.004; r = 0.93, P<0.001; respectively). Hip abductors RT at RTD100 correlated with SRST (r = -0.70, P = 0.036). CONCLUSION: Older adults hip abductors and adductors explosive capacity may be important when responding rapidly to an unpredictable stimulus while hip adductors also appear important in reacting to an expected stimulus. Therefore, older individuals that are not able to produce torque as fast as possible, especially during the late phase of contraction, in order to initiate the step possibly present larger risk of falls.
The attentional demand of postural control is greater for older adults and increases further for older adults with balance impairments or who experienced a recent fall. Training interventions have examined balance and fall risk in older adults; focusing on improving physical factors related to balance. Further benefit to these interventions may be observed by incorporating cognitive factors such as attentional focus. It has been proposed that external focus (EF) of attention uses automatic processing, reducing the attentional demand of postural control. This may be reflected in the mental workload (MWL) required for task execution. PURPOSE: This study investigated if EF of attention reduces MWL during balance training in older adults with fall risk.

METHODS: Older adults (N = 15, 4 males; 78.5 ± 7.0 yrs) who reported a fall in the past year were randomly assigned to either an EF group (N = 9) or internal focus (IF) group (N = 6). Participants completed 12 weeks of balance training on balance boards, twice per week for 20 minutes (30s balance, 30s rest). Prior to each trial, groups received respective attentional focus cues. At weeks 1, 3, and 6, heart rate variability (HRV) during balance training, and the NASA Task Load Index (NASA-TLX) were used as an assessment of MWL. HRV, R-R interval data was collected using a heart rate monitor chest strap.

RESULTS: Two-way repeated measures ANOVA's revealed a significant effect of time on four HRV outcomes: SDNN (F(2, 10) = 6.66, p = 0.015, partial η² = 0.571), RMSSD (F(2, 10) = 9.8, p = 0.01, partial η² = 0.621, p = 0.001), and DFA short term fluctuation slope (F(2, 10) = 6.84, p = 0.013, partial η² = 0.516). A significant interaction effect was observed for the NASA-TLX (F(2, 10) = 4.22, p = 0.047, partial η² = 0.455), and DFA short term fluctuation slope (F(2, 10) = 6.84, p = 0.013, partial η² = 0.578). A significant interaction effect was observed for the NASA-TLX (F(2, 10) = 4.22, p = 0.047, partial η² = 0.455). Follow-up analysis revealed no significant main effects due to a cross over interaction with EMG changes decreasing and IF increasing from week 1 to 6. CONCLUSIONS: Preliminary findings suggest objective measures of MWL represent a practice effect of balance training with attentional cues. Additionally, the observed cross over interaction for MWL proposes that an external focus of attention may be an advantageous training strategy for reducing perceived MWL.

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679 May 27 1:30 PM - 1:40 PM
Mental Workload During Balance Training In Older Adults With Fall Risk
Lauren Q. Higgins. University of North Carolina at Greensboro, Greensboro, NC. Email: lqhiggin@uncg.edu
(No relevant relationships reported)

Alterased gait mechanics and longer time to complete a 3-meter timed up and go (TUG) task are risk factors for falls in older adults. While acute change in posture influences static balance, it remains unclear if a supine resting position alters gait patterns, compared to seated rest in older adults. PURPOSE: The purpose of the present study is to explore the effects of resting postures on TUG performance and gait features during the TUG task. METHODS: In this within-subject design study, thirty-eight older adults (73.55 ± 1.04 yrs, 71.89 ± 2.31 kg, 1.64 ± 0.01 m) completed the TUG under two randomly ordered resting conditions; following 10 minutes of seated rest (SEAT) and following 10 minutes of supine rest (SUP). Participants were instructed to begin on “go” and “begin when they are ready,” with time stopping when they reached a seated position in SEAT and SUP conditions respectively. Total time (TUG, s), averaged gait velocity (TUG, cm/s), cadence (TUG, cad/min), and active propulsion (TUG, %): the percentage of gait time when the center of gravity extends beyond the base of support until contralateral heel contact) over the single stance phase were calculated. TUG trials were calculated using Tekscan Walkway system. Paired sample t-tests were used to determine gait differences between the two resting conditions. RESULTS: TUG, s was significantly longer after the SUP compared to the SEAT (12.18 ± 4.15 vs. 10.52 ± 2.67; p<0.001) and active propulsion (TUG, %): the percentage of gait time when the center of gravity extends beyond the base of support until contralateral heel contact) over the single stance phase were calculated. TUG trials were calculated using Tekscan Walkway system. Paired sample t-tests were used to determine gait differences between the two resting conditions. Results indicated that a sudden postural change from supine resting position results in increased falls risk. These findings have potential to inform patient, provider, and caregiver efforts to lower risk of falls in older adults.

680 May 27 1:40 PM - 1:50 PM
Effects Of Resting Posture On Gait Features During Timed Up And Go In Older Adults
Eryn N. Murphy. New Mexico State University, Las Cruces, NM. (Sponsor: Joseph Berning, FACSM) Email: emurphy2@nmsu.edu
(No relevant relationships reported)

681 May 27 1:50 PM - 2:00 PM
Rate Of Force Development Parameters In Young And Older Males During A Chair Rise
(No relevant relationships reported)

Assessing vertical ground reaction forces (VGRF) during a chair rise may yield insight regarding age-related differences in physical function, but a comprehensive assessment of rate of force development (RFD) during this task is lacking. PURPOSE: To compare RFD parameters during a chair rise in young (YM) and older (OM) males, and examine correlates of chair rise time. METHODS: Healthy, YM (n=15, age=20.7±2.2 yrs) and OM (n=15, age=71.6±3.9 yrs) performed a single chair rise as quickly as possible on a force plate without upper-body assistance. Peak VGRF (PF), as well as peak (highest 100 ms rolling average), early (minimum VGRF to 50% PF), late (50% PF to PE), and overall (minimum VGRF to PF) RFD were recorded. RFD was calculated as the linear slope of the force-time curve (Δforce/ Δtime) during the corresponding time spans. All force measures were derived from the normalized (body mass) force signal. Chair rise time was also obtained and the trial with the shortest time was used for subsequent analysis. Independent samples t-tests were used for group comparisons, and Pearson correlation coefficients were calculated for each group to examine select relationships. RESULTS: Chair rise time was similar between groups (p>0.256). Early RFD was similar (p=0.051), while PF (YM=1.57±0.13 vs. OM=1.33±0.10 N/kg; p<0.001), peak (YM=12.60±1.56 vs. OM=9.05±1.46 N/kg; p<0.001), late (YM=8.12±1.63 vs. OM=4.97±1.10 N/kg; p<0.001), and overall RFD (YM=7.57±2.14 vs. OM=5.49±1.6 N/kg; p=0.001) were lower in the OM. For OM, only PF (r=0.875; p<0.001) and peak RFD (r=0.783; p=0.001) were correlated with chair rise time, while no correlations were present in YM. CONCLUSION: PF and RFD, especially peak and late RFD, were dramatically diminished during a chair rise in OM. PF and peak RFD demonstrated a strong inverse relationship with chair rise time in OM.

682 May 27 2:00 PM - 2:10 PM
Comparison Of Age, Gender, And Sport On Performance Of Stability Test In Senior Participants
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(No relevant relationships reported)

PURPOSE: The purpose of this study was threefold: to observe the differences in performance variables of the Modified Clinical Test of Sensory Interaction in Balance in elderly participants and to compare results by age (50-59, 60-69, 70-79, 80+), sports (acrobic, basketball, golf, tennis, volleyball, and none), and gender. METHODS: Anaylzed were based on a sample of 525 World Senior Games attendees who were age 50 and over. Data were obtained from voluntary participation in balance and mobility screening as part of the health fair offered to all participants at the annual Huntsman World Senior Games. Of the 525 participants tested, 383 were participants in at least one sporting event at the games and 142 were non-participants. All modified CTSIB were performed on the NeuroCom Balance Master. The measured variables (center of gravity sway (degrees/sec)) were: firm surface with eyes open, firm surface with eyes closed, foam surface with eyes open, and foam surface with eyes closed. RESULTS: All data were analysed using SAS, version 9.4. An initial analysis of gender and age category was performed. A final model was run with the significant variables from the initial analysis plus sports category. Post hoc Tukey pairwise comparisons were also performed. A significant difference *(p<0.0001) was found between stratified age groups in all balance test variables. No significant differences were found between gender nor sports categories for the 4 balance variables. CONCLUSION: While balance sway significantly increases with age in all 4 variables, they remain similar when comparing between gender and sports. This test may not be sensitive enough to detect differences between sports in our participants. Also,
Balancing in older adults.

**PURPOSE:** Identify the effects of the military parachuting course on good stability at the knee and a good distribution of the energy at the time of contact.

**METHODS:** Fourteen participants (3 men, 11 women, aged 77.53 +/- 7.28 years) were randomized to one of three walking groups: Control (C) (n=4), Walking Poles (WP) (n=5), or Gait Trainer (GT) (n=5). The gait trainer is a new device aimed at preventing age-related gait decline. Assessments were performed at three separate times: prior to the intervention (Pre-test), immediately after the intervention (Post1), and six weeks after Post1 (Post2). Each assessment included subjective measures of balance confidence during activities of daily living (Falls Efficacy Scale International and Activities-Specific Balance Confidence), kinematic and physical measures of balance (Berg Balance Scale (BBS) and the Timed Up and Go (TUG)). For the six-week intervention, all participants walked three times per week for 30 minutes in their assigned walking group.

**RESULTS:** An ANOVA showed there were no statistically significant differences between the groups at Pre-test for all metrics (p > 0.05). All groups were below the cut off score of a high fall risk (≥14 s) for the TUG at Pre-test: C 9.00 ± 2.18 s, WP 9.41 ± 2.41 s, and GT 11.29 ± 4.99 s. All groups were above the cut off score (>45 out of 56) for greater risk of falls on the BBS at Pre-test: C 51.5 ± 1.29, WP 52 ± 5.00, and GT 48.4 ± 5.03. Between group measurements across time were analyzed using linear regression models for all metrics, with an alpha set at p < 0.05. There were no statistically significant differences between groups across time.

**CONCLUSION:** This study found that the walking group did not improve balance measurements over time with the six-week walking intervention. All three groups were relatively high-functioning compared to age norms, which may have impacted scoring sensitivity on the TUG and BBS. Future studies may consider using more challenging interventions and balance assessments for higher-functioning older adult populations.

**CONCLUSIONS:** There is an impact on neuromuscular performance that affects the strength of the lower limbs, and increases the ground reaction forces in the landing phase. It could become a risk factor for injuries due to a change in the mechanism of acceptance of load at the landing stage.
Military personnel performs in combat and physical training with extensive external loading from combat gear that may increase risk for lower extremity musculoskeletal injury. Lower extremity musculoskeletal injury risk is high in this population and can threaten deployment, completion of duty, and quality of life. However, there is limited research determining the effects of external loading on landing biomechanics in military situations. PURPOSE: To determine if external loading affects lower extremity landing biomechanics during a jump landing task in ROTC cadets. METHODS: Twenty five ROTC cadets (age: 20.2±1.3yr; height: 174.4±11.3cm; mass: 77.0±5.1kg) were recruited and performed two conditions of three jump landings (baseline vs loaded landings with with 20-kg and 35-kg load carriage). Peak PFJS and PFJS loading rate were estimated with a musculoskeletal model and analyzed via repeated measure ANOVA using multiple mixed model (2 x 3) ANOVA. RESULTS: The loaded landing compared to baseline landing, resulted in decreased knee and hip flexion at IC, and increased maximal joint flexion displacements for ankle (36.0±11.5° and 31.4±9.9°), knee (56.2±7.2° and 49.0±6.5°), and hip (23.8±5.6° and 18.5±4.9°). Furthermore, loaded landings, compared with baseline landings, exhibited significantly lower vertical GRF (2.3±0.5 N/kg and 2.7±0.5 N/kg) and posterior GRF (0.6±0.1 N/kg and 0.7±0.1 N/kg). CONCLUSION: Loaded landings increased key injury risk landing biomechanics. Less knee and hip flexion at IC have been associated with potential anterior cruciate ligament (ACL) injury risk and may increase ACL loading during landing. However, the less peak vertical and posterior GRFs with greater displacement of all three lower extremity joints on during loaded landing suggests cadets employed a compensation strategy that may reduce ACL loading after IC.

**RESULTS**

### Table: Mean and standard deviations (SMD) of PFJS metrics in females versus males with added load carriage.

<table>
<thead>
<tr>
<th>Variable</th>
<th>0 kg</th>
<th>20 kg</th>
<th>SMD 0 kg =&gt;20kg</th>
<th>35 kg</th>
<th>SMD 0 kg =&gt;35kg</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peak PFJS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M: 2.2</td>
<td>mPa</td>
<td>0.6†</td>
<td>d=0.39</td>
<td>M: 2.9 mPa</td>
<td>0.9†</td>
</tr>
<tr>
<td>F: 2.0</td>
<td>mPa</td>
<td>0.6†</td>
<td></td>
<td>F: 3.4 mPa</td>
<td>1.0†</td>
</tr>
<tr>
<td><strong>PFJS Loading Rate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M: 22.8</td>
<td>mPa/s</td>
<td>±9.7</td>
<td>d=0.42</td>
<td>M: 29.2 mPa/s</td>
<td>±12.1†</td>
</tr>
<tr>
<td>F: 18.7</td>
<td>mPa/s</td>
<td>±10.0</td>
<td></td>
<td>F: 34.5 mPa/s</td>
<td>±12.8†</td>
</tr>
</tbody>
</table>

**CONCLUSIONS:** Females experienced greater relative increases in PFJS metrics with added load carriage compared with males, but only the approach load (35 kg) resulted in large SMDs. Thus, training volume, e.g., march distances, with approach loads should be increased more cautiously in females compared with males whereas fighting loads (20kg) appear less risky and may require minimal adjustments in training volume between sexes. These findings provide insight into why females have a disproportionately higher rate of PPP in the military than the general population.
Previous work has identified that standard concussion balance measures (e.g., BESS) do not differentiate Special Operations Forces (SOF) combat soldiers with and without concussion history. Recent evidence also associates incident concussion with a subsequent increased musculoskeletal injury risk. There is a need to study functional balance performance tasks designed to challenge this military population. PURPOSE: To study the interaction between concussion history and increasing visual occlusion on functional balance performance in SOF combat soldiers. METHODS: 74 SOF combat soldiers (age=34.0±4.7 yrs) participated in our study and self-reported concussion history (33 no, 41 yes). All participants completed the Y-Balance Test (YBT) under 3 different counterbalanced visual conditions: 1) eyes-open, 2) low occlusion, and 3) high occlusion. Low (level 2) and high (level 6) occlusion conditions were produced using stroboscopic eyewear. Dependent variables included the right and left composite reach distance (percentage) for each vision level. Mixed model ANOVAs evaluated differences in composite reach distance between visual conditions and concussion history. RESULTS: Increasing vision occlusion affected right (F[2,144]=5.28; p=0.025) and left (F[2,144]=8.49; p=0.005) YBT performance compared to those self-reporting concussion history regardless of vision occlusion. There was no interaction effect between visual occlusion and concussion history on right (F[3,144]=0.71; p=0.63) or left (F[3,144]=0.01; p=0.99) YBT performance in our sample. CONCLUSION: Increasing visual occlusion or self-reporting concussion history negatively affect SOF combat soldiers’ YBT performance. These data suggest introducing stroboscopic eyewear and presenting SOF combat soldiers with a challenging balance task (e.g., YBT) may be an effective post-concussion assessment consideration. Funded by US Army Special Operations Command

Military personnel are at risk of stress fracture injuries, especially those in load carriage-based military occupational specialty, such as infantry. Recently, wearable inertial measurement unit (IMU)-based accelerometry has become a useful tool for identifying markers of lower extremity musculoskeletal injury risk in soldiers in field settings. Purpose: To compare differences in accelerometry between non-dominant and dominant foot using foot-worn IMU sensors during a 2km best effort run with heavy (20kg) load carriage. Methods: Acceleration data from six healthy participants (3 male: 30.33±6.7 y, 1,822±0.01 m, 77.80±11.0 kg and 3 female: 21.0±2.6 y, 1,666±0.1 m, 64.62±13.5 kg) were recorded using 3-axial IMU attached to posterior dorsum of each foot. Participant performed a 2km best effort march (run and walk) across grass carrying 20 kg on their back. Data were divided into 200m ±/− blocks from the beginning, middle and end of the exercise for analysis. The acceleration amplitudes from each trial were expressed as the root mean square (GRMS), calculated as the average of the square of the acceleration over time, and were used to quantify the accelerations attenuation. The magnitude of the resultant acceleration signal Accr, referred to as the “composite acceleration signal”, was computed as: sqrt (accx^2+accy^2+accz^2), where accx, accy, and accz are obtained from each individual axis of the tri-axial accelerometer. Results: The mean GRMS values at the three phases obtained for the dominant and non-dominant feet of the men were 4.72, 5.15, and 5.23, and 4.93, 4.75, and 4.41 m/s^2, respectively whereas those obtained for the dominant and non-dominant feet of the women were 3.91, 4.32, and 4.78, and 3.87, 4.42, and 4.71 m/s^2, respectively. These findings revealed that the GRMS values of the feet obtained for both sexes gradually increased during the load carriage task, except for the non-dominant foot of the men, which decreased. Conclusion: Increases in GRMS during loaded marching suggest non-linear effect of increasing cumulative mechanical stress exposure as distance increases. Foot worn IMU-based measurement systems may provide means to accurately assess injury risk in real time. Supported by UK Ministry of Defence (WGGC 5.5.6-Task 0107) and US Dept of Defense (W81XWH-17-2-0070).

B-45 Thematic Poster - Care of the Female Athlete

Wednesday, May 27, 2020, 3:15 PM - 5:15 PM
Room: CC-2007

Chair: Emily Kraus, Stanford Hospital and Clinics, Woodside, CA.

(No relevant relationships reported)

Board #1 May 27 3:15 PM - 5:15 PM
Practical And Applied Knowledge Of Athletic Trainers On The Female Athlete Triad
Jennifer L. Scheid, Erin M. DeHeer, Daemen College, Amherst, NY.
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(No relevant relationships reported)

BACKGROUND: The female athlete triad is the interrelation of low energy availability, menstrual dysfunction, and low bone mineral density. Athletic trainers are in a position to be able to identify the female athlete triad in athletes. However, limited research exists regarding practical and applied knowledge of the female athlete triad. PURPOSE: The purpose of this study was to determine the level of practical knowledge of athletic trainers on the female athlete triad and also determine if athletic trainers are applying this knowledge by properly screening athletes for the female athlete triad. METHODS: Certified athletic trainers (n=116) completed an online survey via Qualtrics that assessed both knowledge of the female athlete triad and current practical application of the female athlete. Linear-by-linear tests were used to find associations between practical knowledge and applied knowledge for related components of the triad. RESULTS: The athletic trainers mostly work with high school athletes (39%) and college athletes (32%). Fifty percent of the athletic trainers had at least 7 years of experience. Sixty-nine percent of the the athletic trainers were female. While most of the general knowledge of the athletic trainers was high (for example 70% believe that increasing energy availability is key when returning an athlete back to sport and 73% believe that repeated stress fractures is a red flag for the female athlete triad) most of the applied knowledge was low (for example only 14% screen their athletes for eating disorders and only 36% ask about history of stress fractures). Linear-by-linear association (p=0.035) demonstrated an association between agreeing about importance of energy availability and always screening for eating disorders. However, we did not demonstrate linear-by-linear association (p=0.354) between agreeing that stress fractures are a red flag for the female athlete triad and asking about history of stress fractures. CONCLUSION: While general knowledge of the female athlete triad is high, a low percentage of athletic trainers appear to be applying their knowledge in prevention and detection of the female athlete triad. More education is need to help athletic trainers to implement screening, prevention, and return to play techniques to keep our athletes safe.

Board #2 May 27 3:15 PM - 5:15 PM
Prevalence And Impact Of Dysmenorrhea In Japanese Female Athletes
Reiko Momma1, Akemi Sawai1, Maha Takeda2, Hiroaki Natsu1, Naoki Muka1, Koichi Watanabe2, 1University of Tsukuba, Tsukuba, Japan; 2International Pacific University, Okayama, Japan.
3Japan Women’s College of Physical Education, Setagaya, Japan.
(No relevant relationships reported)

Dysmenorrhea (menstrual cramps) is a one of the big problems that many women suffers. It has been previously reported that dysmenorrhea is associated with lifestyle habit including sleep, exercise, smoking, and alcohol. Many female athletes have been reported to suffer with dysmenorrhea, however, the prevalence and impact of
dysmenorrhea and in relation to lifestyle in Japanese female athletes are not clarified yet. 

**Purpose**: To investigate the prevalence and impact of dysmenorrhea in Japanese female athletes.

**Methods**: 98 collegiate female athletes participated in this study (mean age 21±1.6). Sports type in participants were soccer (n=23), track and field (n=31), kendo (n=13), wheel gymnastics (n=10), lacrosse (n=21). Demographic information questions addressed age, height, weight, length of sporting career, and training volume (training hour, training frequency per week, training hour per time). Lifestyle habits questions included time to sleep, sleeping hours, dietary habit, coffee-drinking, alcohol-drinking and smoking habits. Age of menarche, day counts of menstrual cycle, day counts of menstruation, dysmenorrhea symptoms (e.g.; breast tenderness, abdominal pain, low back pain, headache), dysmenorrhea severity (from 0 to 10; none to very severe), and medication during menstruation were asked in the menstrual questionnaire. 

**Results**: The dysmenorrhea symptom that many subjects complained were low abdominal pain and fatigue. Length of sporting career, menarche age, training habits and lifestyle habits did not show significant correlation with severity of dysmenorrhea. However, the prevalence of severe dysmenorrhea positively correlated significantly with age (p = 0.004, r = 0.29). 

**Conclusions**: In this study, the prevalence of dysmenorrhea was associated with older age in Japanese female athletes. Therefore, in female athletes it is necessary to deal with dysmenorrhea considering age.
Male athletes are at risk of developing a similar condition to the female athlete triad that is characterized by low bone mineral density (BMD), low energy availability (EA), and reduced reproductive hormones. However, the triad has not been well studied in males.

PURPOSE: The purpose of this study was to assess BMD and EA in male NCAA division I athletes participating in leanness emphasized sports (cross country and wrestling) and non-leanness sports (soccer and basketball). We hypothesized that EA and BMD would be lower in XC and wrestling compared to soccer and basketball and EA would be positively correlated with BMD.

METHODS: Participants included 27 NCAA division I male athletes (n = 5). Following a 12 hr fast and abstinence from physical activity, a 1x3 ANOVA and Chi-Square test was used to investigate whether sporting discipline and training volume (≥ 10 h/week) impacted the prevalence of ID, IDE, and IDA in female athletes.

RESULTS: A total of 85 athletes involved at higher levels of competition were assigned into groups according to sporting discipline (volleyball, n=36; handball, n=24; soccer, n=19; judo, n=6) and training volume (≥ 10 h/week, n= 47; <10 h/week, n=38). The following iron depletion categorization was used: first-stage-ID defined as serum ferritin <35 μg/L, transferrin saturation >16%, and hemoglobin >115 g/L; second stage–IDE defined as serum ferritin <20 μg/L, transferrin saturation <16%, and hemoglobin <115 g/L; and third stage–IDA defined as serum ferritin <12 μg/L, transferrin saturation <16%, and hemoglobin <115 g/L.

CONCLUSIONS: Female athletes undergo rigorous training, travel, and competition schedules, and therefore may be susceptible to iron deficiency (ID), with further progression to stages 2-iron deficient erythrocytopenia (IDE) and 3 [ID anemia (IDA)].

B-46 Thematic Poster - Hormones and Cytokines

Wednesday, May 27, 2020, 3:15 PM - 5:15 PM
Room: CC-211

Chair: Linda E. May, FACSM. East Carolina University, Greenville, NC.

(No relevant relationships reported)

B-46 Board #1 May 27 3:15 PM - 5:15 PM

Menstrual Cycle And Menopause Influence On Creatine Kinase Response After Exercise-Induced Muscle Damage


(No relevant relationships reported)

Studies with animals have demonstrated that estrogens contribute to limit exercise-induced muscle damage. However, this effect is not entirely clear in humans, despite some benefits have been observed. For instance, estrogen replacement therapy
to evaluate the influence of sex hormones on common measures of body composition across time. The study utilized four visits for a total of 28 visits (4 sessions per week for a month). Each session involved the collection of baseline (pre-exercise) and post-exercise (10 minutes post-exercise) measures of body composition including dual-energy X-ray absorptiometry (DXA), air displacement plethysmography (ADP), and bioelectrical impedance analysis (BIA). The study was conducted in the university's physiology laboratory and involved 19 participants (12 women and 7 men) who had no history of regular exercise. The participants were divided into three groups: a control group (no exercise), an aerobic group (150 min of moderate aerobic exercise weekly), and a resistance group (24+ week resistance training). The results indicated significant differences in body composition measures between the groups, with the resistance group showing the greatest improvements in lean body mass and body fat percentage. The findings suggest that both aerobic and resistance exercise can be effective in improving body composition, but the resistance group showed greater improvements in lean body mass and body fat percentage.

CONCLUSIONS: These data suggest that weight machines may not significantly alter arterial stiffness or measures of pulse wave reflection between the sexes. However, an acute bout of resistance exercises consisting of weight machines may reduce function of the left ventricle for at least 10 minutes.

Many women complain about weight fluctuation across the span of a month as a result of hormonal changes that accompany their menstrual cycle (MC). Specific research regarding the menstrual cycle phases of females and their effects on body composition measures have been limited to examining these changes as a subset of other variables. As water makes up approximately 73% of lean body tissue, fluctuations in body water due to changes in a woman’s MC may impact measurements of body composition.

PURPOSE: To investigate whether phases of the MC have an impact upon common measures of body composition METHODS: 51 apparently healthy females between the ages of 18-45 participated in 4 week collection sessions for a month. Each week, participants self-reported the presence or absence of menses during that week, including starting or ending days. Participants completed three body composition assessments: bioelectrical impedance analysis (BIA), dual-energy X-ray absorptiometry (DXA), and air displacement plethysmography (ADP) according to manufacturer's instructions, and also reported their exercise habits for the previous week. RESULTS: RMANOVA revealed no differences in physical activity levels between sessions for participants and that total body water amounts in participants did not change across time when measured via BIA. A 3 (device) x 4 (MC phase) interaction was found for BIA measurements and a 4 (device) x 5 (MC phase) interaction was found for DXA measurements. CONCLUSION: Although there were no changes in body composition across the MC phases, there were differences in body composition values among the three types of devices used to quantify body composition. These findings suggest that differences in the technology used to quantify body composition may explain varying results across studies.

573 Board #4 May 27 3:15 PM - 5:15 PM
Effects Of Menstrual Cycle Phases On Measures Of Body Composition
Abigail R. Champion, Lauren E. Coleman, Heather E. Webb. Texas A&M Corpus Christi, Corpus Christi, TX. (Sponsor: Edmund O. Acedo, FACSM)

Many women complain about weight fluctuation across the span of a month as a result of hormonal changes that accompany their menstrual cycle (MC). Specific research regarding the menstrual cycle phases of females and their effects on body composition measures have been limited to examining these changes as a subset of other variables. As water makes up approximately 73% of lean body tissue, fluctuations in body water due to changes in a woman’s MC may impact measurements of body composition.

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.004) compared to pre-test. No other significant pre- to post-test differences were noted on the YBT. The vertical jump height was also significantly lower (-1.0 ± 3.0 inches, \( p = .004 \)) at post-test. CONCLUSION: Transitioning from daytime to nighttime operations during military training negatively impacts dynamic balance and vertical jump performance in elite male Army Soldiers. Considering the post-test was conducted after the first night into the nighttime operation training, where Soldiers missed their normal sleep opportunity, sleep loss and fatigue were likely contributing factors to the decreased performance. Investigation of measures that may limit these physical impairments during the transition from daytime to nighttime operations is warranted. Future research should also to investigate whether the noted impairments have any impact on this population’s injury risk considering impaired dynamic balance has been associated with injury risk in other athletic populations.

791 Board #6 May 27 3:15 PM - 5:15 PM
Effect Of Sex And Neuromuscular Training On Lower Limb Stiffness Characteristics And Jump Performance
Mengru Huang1, Jiaxin Cai1, Zhihai Wang1, Eamonn Delahunt1, Dan Wang1, 1Shanghai University of Sports, Shanghai, China. 2University College Dublin, Dublin, Ireland.
Email: huangmengru33@163.com

(No relevant relationships reported)

Stiffness is potentially related to sports injury and athletic performance. Higher stiffness within a certain range may represent lower sports injury risk and better athletic performance. It is not clear whether a sex difference existed in lower limb stiffness changes induced by neuromuscular training.

PURPOSE: To investigate the effect of neuromuscular training on lower limb stiffness in both male and female young recreational athletes.

METHODS: Eleven recreational athletes (5 females: 24.4 ± 3.4 yr; 6 males: 24.0 ± 3.9 yr) underwent neuromuscular training 3 times a week for continuous 6 weeks, including plyometric training (e.g. squat jump, wall jump et al.) and strength training (e.g. barbell squat, bench press et al.) with progression every two weeks. Pre- and post-intervention measurements included: gastrocnemius lateralis (GL), gastrocnemius medialis (GM), soleus muscle and the Achilles tendon (AT) stiffness on both lower limbs by Myometer; vertical stiffness (Kvert), jump height and reactive strength index (RSI) by force plate during drop vertical jump from a 40 cm step.

RESULTS: Two-way repeated measures ANOVA was conducted and found no significant interaction between time and sex in all the variables mentioned above, but significant results on time in left GL stiffness (\( p = 0.021 \)), left GM stiffness (\( p = 0.008 \)), right AT stiffness (\( p = 0.040 \)), Kvert (\( p = 0.019 \)), jump height (\( p = 0.012 \)), and RSI (\( p = 0.008 \)). Paired-T test was further conducted and identified jump height in females, with a tendency to decrease lower limb stiffness in males and females. Significant interaction between time and sex in all the variables mentioned above, but significant results on time in left GL stiffness (\( p = 0.021 \)), left GM stiffness (\( p = 0.008 \)), right AT stiffness (\( p = 0.040 \)), Kvert (\( p = 0.019 \)), jump height (\( p = 0.012 \)), and RSI (\( p = 0.008 \)).

CONCLUSIONS: Males and females may achieve similar benefits from neuromuscular training. Neuromuscular training can improve jump performance in females, with a tendency to decrease lower limb stiffness in males and females. Supported by Shanghai University of Sports A1-3G02-19-000209

792 Board #7 May 27 3:15 PM - 5:15 PM
Cardiorespiratory Variables During A Maximal Running Test In Well-trained Females With Different Hormonal Profiles
Par. HR was continuously monitored with a 12-lead ECG. Participants began with a warm-up of 3 minutes at 6 km/h. Then, the speed was set at 8 km/h, increasing 0.2 km/h every 12 seconds until exhaustion. RESULTS: One way ANOVA reported lower values in post-menopausal females compared to the other two groups (eumenorrheic and OC users) for all variables measured: VO2 max (2924.2±389.7 ml/min for the eumenorrheic; 2808.8±366.7 ml/min for the OC; and 2455.1±284.0 ml/min for the postmenopausal; \( p = 0.001 \)), maximal HR (184.2±10.3; 189.9±8.4; and 172.1±12.9 bpm respectively; \( p = 0.001 \)) and maximal VE (111.8±17.5; 114.7±15.1; and 96.4±10.4 l/min, respectively; \( p = 0.003 \)). Nonetheless, no significant differences in VO2max, HR and VE were found between eumenorrheic females and OC users. CONCLUSION: The drastic decrease of sex hormones in postmenopausal females, along with other hormonal and physiological changes caused by the age, may explain the drop in VO2 max, HR and VE in this population. In terms of young women, despite literature reported lower values in OC users, the lack of difference observed in this study may be due to the lower concentrations of sex hormones that OC pills have nowadays, or because of the fact that all were well-trained participants.

Funding: DEP2016-75387-P (Spanish National Plan 2013-2016)

793 Board #8 May 27 3:15 PM - 5:15 PM
Work-matched High-intensity Interval And Moderate-intensity Continuous Training Adaptations On 17 Lactate Threshold Methods In Females
Felipe Mattioni Maturana1, Manuel Widmann1, Barbara Munz1, Ansgar Thiel1, Andreas M. Niehl1. 1University Hospital of Tiibingen, Tiibingen, Germany. 2Eberhard Karls University Tiibingen, Tiibingen, Germany.

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(No relevant relationships reported)

PURPOSE: To compare exercise training effects on 17 lactate threshold methods to 6 weeks (3x/week) of high-intensity interval training (HIIT) or moderate-intensity continuous training (MICT) in females. METHODS: 24 healthy sedentary females (mean ± SD: peak oxygen uptake 30.0 ± 3.2 ml·kg⁻¹·min⁻¹, peak power output 151 ± 21 W, body mass index 23.4 ± 2.6 kg·m⁻²) were randomly assigned to either HIIT or MICT. Participants performed a step-intercremental test on a cycle ergometer (3-min stages of 25-W increments, starting at 25 W) pre- and post-training. The HIIT group (N = 12) performed a 10-min warm-up (power output (PO) at 70% of the maximal heart rate (HRmax)), and 4 four-min intervals (PO at 90% HRmax) interspersed with 4-min recovery at 30 W. The MICT group (N = 12) performed 60-min continuous cycling (PO at 90% of the lactate turning-point (LT1)). Lactate thresholds were analyzed as: Log-log, onset of blood lactate accumulation (OBLA, N = 5), fixed value above baseline (Bsl+n, N = 3), Dmax, and its modified versions (N = 5), lactate-turning-points (LT1 and LT2), and the minimal lactate-intensity ratio (LTmir). A two-way analysis of variance was used to test differences within (post versus pre) and between groups. Additionally, the width of confidence intervals (CIm) from the delta change was calculated for each method and group. RESULTS: In the HIIT group, the intensity derived from all the methods significantly increased after training (\( p < 0.01 \)), except for LTmir (\( p = 0.6 \)). In the MICT group, the intensity from OBLA, Bsl+n, and the modified Dmax methods significantly increased after training (\( p < 0.05 \)), whereas Log-log, Dmax, LT1, LT2, and LTmir did not improve significantly (\( p > 0.05 \)). The HIIT group showed a higher increase in intensity from the Dmax methods, and in LT1 and LT2 compared with the MICT group (\( p < 0.05 \)). No differences were observed between the groups in the improvements of Log-log, OBLA, Bsl+n, and LTmir. CIm was observed at 3.5 and 4.0 mmol·l⁻¹, and Dmax presented the narrowest CImin (range 7 - 12 W), while Bsl+n 0.5 mS, Bsl+n 1.0 mS, and Log-log had the widest CImin (range 24 - 32 W). CONCLUSIONS: In healthy sedentary females, improvements of the Dmax methods, LT1 and LT2 were superior in the HIIT group. The lowest intra-individual variability in response to training was observed in the Dmax and OBLA at 3.5 and 4.0 mmol·l⁻¹ methods.

Differences in estrogen and progesterone levels along a natural menstrual cycle and an oral contraceptive (OC) cycle may influence them in a different way than in young women. Previous literature reported lower strength, maximal oxygen consumption (VO2 max) and ventilatory changes during the transition from daytime to nighttime operations is warranted. Future research should also to investigate whether the noted impairments have any impact on this population’s injury risk considering impaired dynamic balance has been associated with injury risk in other athletic populations.
Simulated altitude and high ambient temperature independently compromise endurance performance, although there is limited evidence on the combined exposure to both stressors. In addition, the effect of corresponding underlying key mechanisms has yet to be quantified. PURPOSE: To investigate the separate and combined effects of acute simulated altitude and high ambient temperature on time trial (TT) performance, VO2max, the ventilatory threshold (VT) and gross efficiency (GE). METHODS: Ten trained male cyclists performed 4 maximal incremental exercise tests (GXT) and GE-tests, both at sea-level (0 m; 20.93% O2) and simulated altitude (2000 m; 16.3% O2) in high environmental temperature (36.00 ± 1.4°C, 42.58 ± 0.8% RH) and temperature conditions (16.00 ± 0.3°C, 40.20 ± 1.2% RH). The GXT included 3 min at 100 W, followed by 25 W min⁻¹ until volitional fatigue. GE was determined at 50% of the power attained at VO2peak in relative conditions, prior to and following 4000m TT performances. RESULTS: Although average VO2 was significantly reduced during TT performance at simulated altitude (31 ± 18 W, p < 0.001, n² = 795) and high ambient temperature (9 ± 16 W, p < 0.001, n² = 570), no significant interaction was found (p = 0.137). At simulated altitude, VO2max (3.77 ± 2.1 ml·kg⁻¹·min⁻¹, p < 0.001, n² = 925), VT (3.39 ± 2.9 ml·kg⁻¹·min⁻¹, p < 0.001, n² = 795) and GE (0.72 ± 0.97%, p < 0.001, n² = 555) were significantly reduced compared to sea level. However, VO2max (3.33 ± 3.1 ml·kg⁻¹·min⁻¹, p < 0.005, n² = 680) and VT (2.05 ± 3.1 ml·kg⁻¹·min⁻¹, p < 0.001, n² = 462) were significantly increased at high ambient temperature, although no effect on GE (p = 0.240) was found. CONCLUSION: The reduction in TT performance at acute simulated altitude is associated with a decline in VO2max, VT and GE, likely because a lower SpO2, VT and GE are significantly higher at acute high ambient temperature, likely because the metabolic cost of physiological heat stress increases relative exercise intensity at similar absolute PO. GE was unaffected by acute high ambient temperature, likely because heat exposure during the GE-test was too short to increase Tcore. VO2max of VT and GE were not compromised during combined exposure, which corresponds with the absence of a significant interaction effect in endurance performance. PURPOSE: To examine the effect of a 5-day training protocol in the heat on physiological acclimation, perceptual responses, and 16 km time-trial performance in moderate hypoxia. METHODS: Twelve well-trained, healthy male participants (age = 27 ± 8 years; VO2max = 66.51 ± 4.94 ml·kg⁻¹·min⁻¹) were randomly assigned to a hot (HOT; 40°C, 35% RH) or control (CON; 18°C, 35% RH) group, and completed five consecutive days of cycling for 60 min at 50% VO2max. Participants completed a 16 km time-trial in hypoxia (F0₂ = 0.165; S0₂ = 86.00 ± 2.64%), pre- (TT1) and post-training (TT2), to determine if heat training enhanced hypoxic cycling performance. Rectal core temperature (Trect), heart rate, and rating of perceived exertion were assessed during the training protocol. RESULTS: Time to completion from TT1 (HOT = 1637 ± 110 s, CON = 1684 ± 117 s) to TT2 (HOT = 1617 ± 118 s, CON = 1671 ± 109 s) was reduced (p < 0.029); however, there was no interaction between groups (p = 0.599). There was no difference in mean (p = 0.443) or peak heart rate (p = 0.651) between TT1 and TT2 across both groups. Training resulted in a reduction in resting heart rate (Day 1: HOT = 61 ± 14 beats·min⁻¹, CON = 72 ± 4 beats·min⁻¹ vs. Day 5: HOT = 58 ± 11 beats·min⁻¹, CON = 66 ± 6 beats·min⁻¹) and a trend toward a reduction in rating of perceived exertion (Day 1: HOT = 4 ± 1, CON = 3 ± 2 vs Day 5: HOT = 3 ± 1, CON = 2 ± 1; p = 0.083), particularly in exercise (Tp = 0.027), or peak exercising Tp (p = 0.152) responses between Day 1 and Day 5 of the training protocol. CONCLUSION: This study found that the 5-day training protocol improved time-trial performance in hypoxia; however, there was no perceptual, physiological or performance benefits associated with training in the heat compared to normoxic conditions. Heat acclimation (HA) has been reported to improve endurance exercise performance in normobaric hypoxia. However, the impact of prior HA on exercise performance in hypobaric hypoxia (HH) is unclear. PURPOSE: To determine whether HA alters steady-state (SS) exercise responses and time-trial (TT) cycle performance during a 30 hour exposure to HH. METHODS: Thirty-one sea level (SL) resident men (mean ± SD; age: 21 ± 3 years; height: 173 ± 8 cm; weight: 75 ± 12 kg; SL cycle ergometer VO2peak: 43 ± 5 ml·kg⁻¹·min⁻¹) participated in two 30 hour HH exposures in a hypobaric chamber (496mmHg ≈ 3500m, 20°C, 20% RH). The HH exposures were separated by a 14 day washout period during which volunteers completed an 8-day exercise-HA protocol (2 hours of treadmill walking: 5km·h⁻¹, 2% grade; 40°C, 40% RH). During each HH exposure, volunteers completed 30 min of SS exercise followed by a 15 min cycle TT at ~2 and 24 hours of exposure. SS exercise consisted of cycling at ~50% SL VO2peak while gas exchange (oxygen consumption (VO2), minute ventilation (VE), end tidal partial pressure of oxygen (PETO2), and oxygen saturation (SpO2)) were recorded. For the TT, volunteers completed as much work (kJ) as possible in 15 min, with heart rate (HR), SpO2, and Rating of Perceived Exertion (RPE, Borg Scale) recorded at the end of exercise. A two way repeated measures ANOVA was used to compare the effects of condition (Pre HA and Post HA) and time (~2 and 24 hours). RESULTS: There were no condition x time interaction effects among the SS or TT variables. For main effect of condition, from Pre HA vs. Post HA, SS VO2 tended to be lower (1.63 ± 0.00 L·min⁻¹ vs. 1.60 ± 0.01 L·min⁻¹; p = 0.05), PETO2 was higher (75.7 ± 1.0 mmHg vs. 76.8 ± 0.7 mmHg; p < 0.01), and VO2 and SpO2 did not differ (p > 0.05 for both). For the TT, there was no main effect of HA on total work completed (106.8 ± 23.0 kJ vs. 103.8 ± 21.3 kJ), HR (159 ± 13 bpm vs. 158 ± 13 bpm), SpO2 (83 ± 3% vs. 83 ± 3%), or RPE (17 ± 2 vs. 17 ± 2) (p > 0.05, for all). CONCLUSIONS: Our results suggest that although HA may augment some aspects of ventilation during low-intensity SS exercise, exercise performance measured by a 15 min cycle TT in HH is not affected by HA. Supported by USAMRDC; author views not official US Army or DoD policy. Cutaneous vasodilation is attenuated when exercise is performed in a hypoxic environment, which may impair convective heat loss. Heat acclimation (HA) improves cutaneous blood flow in response to an increase in core temperature; however, the effect of HA on cutaneous blood flow during exercise in hypobaric hypoxia has not been examined. PURPOSE: The aim of this study was to test the hypothesis that cutaneous blood flow would be augmented during steady-state exercise at 3500 m altitude (hypobaric chamber) following 8 days of exercise-HA. METHODS: Thirty healthy men (21 ± 3 yr; ht: 173 ± 8 cm; wt: 75 ± 12.2 kg; sea level VO2max: 42.9 ± 4.6 ml·kg⁻¹·min⁻¹) participated in two 30 h altitude exposures (495 mmHg ≈ 3500 m, 20°C, 20% RH) separated by a 14 day washout period in which they completed 8 days of exercise-HA (2 h of treadmill walking in 40°C, 40% RH). At hour ~24 of each altitude exposure, subjects performed a 400-m shuttle run of steady-state exercise (~50% sea-level VO2max). Red blood cell flux (laser-Doppler flowmetry) was continuously measured during a 5 min seated baseline period and minutes 20-25 of exercise. Cutaneous vascular conductance (CVC = red blood cell flux/mean arterial
pressure) was calculated and normalized to a percentage of maximum (local skin heating to 42°C). RESULTS: Compared to Day 1 of HA, core temperature (Day 1: 38.1 ± 0.3 vs Day 8: 38.6 ± 0.0 °C) and heart rate (Day 1: 134 ± 17 vs Day 8: 121 ± 13 bpm; p<0.01) were significantly lower at min 120 of exercise on Day 8, indicating HA was achieved. Baseline cutaneous blood flow at altitude was reduced after HA (pre: 7.3 ± 1.2 vs post: 5.1 ± 0.7 %CCV; p<0.03). During steady-state exercise at altitude, cutaneous blood flow was not different pre- and post-HA (pre: 23.5 ± 4.4 vs post: 20.9 ± 3.4 %CCV; p=0.55). CONCLUSION: These data suggest that HA does not alter cutaneous blood flow during steady-state exercise at 3500 m altitude. However, while the magnitude of the blood flow response is unchanged, cutaneous blood flow may be elevated relative to core temperature following HA. Future studies examining potential benefits of HA on the relation between cutaneous blood flow and core temperature during exercise at altitude are warranted. Supported by USAMRDC; author views not official US Army or DoD policy.

801 Board #7 May 27 3:15 PM - 5:15 PM High Intensity Intervals Expands Plasma And Improves Cycling Performance In Acute Hypoxia Felipe Gorini Pereira, Trevor Gillum. California Baptist University, Riverside, CA. Email: felipegorinilienert.pereira@calsbaptist.edu (No relevant relationships reported)

INTRODUCTION: Hypoxia cause decreases in submaximal and maximal exercise performance. Hypervolemia may improve O2 delivery to the metabolically active tissue, thus lowering physiological and cardiovascular strain during moderate exercise at altitude. Since two weeks are needed to acclimate to hypoxia, we sought to expand plasma volume (PVE) following HI (8x4 minutes at 85% VO2max with 4 minutes rest between rounds) or a control bout (CON) performed at 50% VO2max, in which duration was extended in order to assure workloads were matched between conditions (identical kilojoules between conditions). Pre-exercise blood samples were collected to quantify changes in blood volume, while hemodynamic data were collected utilizing PhysioFlow. Results: Increased PVE was observed 24 hours (6.96% ± 4.84%) and 48 hours (9.77% ± 4.26%) (p<0.05) following the HI bout while the CON condition decreased plasma volume 48 hours post (-3.75% ± 2.62%). Under the HI condition, participants showed an improvement in TT performance (Time: 1880 ± 215s to 1840 ± 203s, Power: 164.8 ± 41.2W to 171 ± 39.5W) (p<0.05) and lowered HR (164.5 ± 9.5 bpm to 161 ± 8.8bpm) (p<0.05). SV and Q manifested an upwards trend during TT performance within the HI condition (p = 0.09 and p = 0.08, respectively). There was no difference in performance, Q, or SV in the CON condition. Hydration, RPE, SaO2, and blood lactate were similar in both TTs in hypoxia.

CONCLUSION: A single bout of HI intervals resulted in increased cycling performance in acute hypoxia, accompanied by enhanced PVE both 24 and 48 hours following exercise. This observed enhancement in cardiac efficiency following intense exercise may be desirable in military populations or individual desiring to complete physical tasks at moderate altitude without the means or time to fully acclimatize.
protocol (treadmill walking: 120 minutes at 5 km hr⁻¹, 2% grade; 40°C and 40% RH), and Phase 3) post HA 30 hour HH exposure (HH2). During the HA protocol, heart rate (HR) and core temperature (Tc) were recorded throughout exercise. AMS was assessed using the Environmental Symptoms Questionnaire after 12, 21, and 23 hours of exposure during each HH phase. HR and pulse oxygen saturation (SpO2) were measured at rest immediately after assessment of AMS. A t-test was used to assess difference in HR and Tc from Day 1 and Day 8 of HA. For the HH exposures, HR and SpO2 data were analyzed by fitting a mixed effects model as implemented by GraphPad Prism 8.1.2. RESULTS: Heat acclimation was achieved as indicated by a lower Tc (Day 1: 38.1 ± 0.3 vs Day 8: 37.8 ± 0.3 °C; p<0.01) and HR (Day 1: 134 ± 17 vs Day 8: 121 ± 13 bpm; p<0.01) at the end of exercise on Day 8 compared to Day 1. Three of 13 volunteers developed AMS during HH1 but not during HH2. A fourth volunteer only developed AMS during HH2. From HH1 to HH2, resting HR (84 ± 17 vs Day 8: 121 ± 13 bpm; p<0.01) and HR during HH2 (38.1 ± 0.3 vs Day 8: 37.8 ± 0.3 °C; p<0.01) and HR 

CONCLUSION: Our results suggest that in unacclimatized individuals, HA may be an effective, though not perfect training strategy for reducing the incidence of AMS during rapid exposure to 3,500 m. Changes in AMS incidence could not be explained by alterations in HR or SpO2. Supported by USAMRDC; author views not official US Army or DoD policy.

**B-48 Thematic Poster - Spine**

**Wednesday, May 27, 2020, 3:15 PM - 5:15 PM**  
**Room: CC-2000**

**803 Chair:** Ajit Mohan Worthen Chaudhari, FACSM. *The Ohio State University, Columbus, OH.*

*No relevant relationships reported*

**804 Board #1**  
**May 27 3:15 PM - 5:15 PM**  
**Spinal Range Of Motion And Back Pain In Female Artistic Adolescent Gymnasts**

Emily A. Sweeney¹, Morgan N. Potter², Richard E. Pimental², James J. Carollo², David R. Howell¹. ¹Children’s Hospital Colorado, Aurora, CO. ²University of Delaware, Newark, DE. ³University of North Carolina at Chapel Hill, Chapel Hill, NC. ⁴University of Colorado School of Medicine, Aurora, CO. (Sponsor: James MacDonald, FACSM)

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*No relevant relationships reported*

**PURPOSE:** Back pain is a common complaint among female gymnasts, but it is unknown if gymnasts with back pain demonstrate different movement patterns during gymnastics skills compared to those gymnasts without back pain. Our purpose was to evaluate gymnasts’ movement patterns in their native environment using wearable sensors. Specifically, we examined three-dimensional spine range of motion (ROM) during back walksovers (BWOs) and back handsprings (BHSs) on the floor and balance beam. METHODS: Female artistic gymnasts ages 8 to 18 years were divided based on presence or absence of self-reported back pain within the last 12 months. Gymnasts performed BWOs and BHSs on floor and balance beam while wearing ADPM Opal V2 sensors. Valid spine sagittal plane maximums, minimums, and ROM during trials for each skill were compared between groups via Kruskal Wallis analysis of variance. RESULTS: Seventeen participants (n=6 with back pain, mean age=13.9±2.6; n=11 without back pain, mean age=13.3±1.7 years) completed BWOs and BHSs. There were no demographic differences between groups for age, height, weight, competition level, or years of experience. Gymnasts with back pain had a greater maximum back extension (45.0±15.4°) back pain vs. 34.6±17.1° no pain; p=0.011, Cohen’s d=1.46) and range of motion (94.6±18.9°) back pain vs. 80.9±19.6° no pain; p=0.032, Cohen’s d=0.70) during BWOs compared to gymnasts without back pain. There were no differences between groups in peak extension, peak flexion, or ROM during BHS skills. CONCLUSION: Gymnasts with a history of back pain had increased spinal motion when performing BWO skills. To perform a BWO, gymnasts must have higher levels of shoulder, spine, and hip flexibility, which may relate to back pain. This study suggests the need for future studies to evaluate if increased spinal motion during gymnastics is a contributing factor to the development of back pain.

**How does the dancer’s spine move? Application of a multisegmented model.**

Marjanne Liederbach¹, Christopher T.V. Swain², Ian J. Kremenic³, Karl F. Orishimo³, Marshall Hagnis³. ¹NYU Langone Orthopedic Hospital, New York, NY. ²Australian Catholic University, Melbourne, Australia. ³Lenox Hill Hospital, New York, NY. (Sponsor: Malachy McGlough, PhD, FACSM)

*No relevant relationships reported*

**How does The Dancer’s Spine Move? Application Of A Multisegmented Model.**

Maryanne Liederbach, Christopher T.V. Swain, Ian J. Kremenic, Karl F. Orishimo, Marshall Hagnis. NYU Langone Orthopedic Hospital, New York, NY. Australian Catholic University, Melbourne, Australia. Lenox Hill Hospital, New York, NY. (Sponsor: Malachy McGlough, FACSM)

*No relevant relationships reported*

**805 Board #2**  
**May 27 3:15 PM - 5:15 PM**

**How Does The Dancer’s Spine Move? Application Of A Multisegmented Model.**

Maryanne Liederbach¹, Christopher T.V. Swain², Ian J. Kremenic³, Karl F. Orishimo³, Marshall Hagnis³. ¹NYU Langone Orthopedic Hospital, New York, NY. ²Australian Catholic University, Melbourne, Australia. ³Lenox Hill Hospital, New York, NY. (Sponsor: Malachy McGlough, PhD, FACSM)

*No relevant relationships reported*

**806 Board #3**  
**May 27 3:15 PM - 5:15 PM**

**Appropriate Neck Flexion Without Head-hitting Decreases The Thrower Player’s Risk Of Brain Injury In Judo**

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*No relevant relationships reported*

**PURPOSE:** Judo is one of the worldwide sports and its competitive athletic events have been held in Olympic Games. Serious brain injuries, however, have been occasionally noted in judo practices and/or competitions. Since the patterns and severities of brain injuries largely depend on the kinematics of the thrown players, it is essential to investigate the mechanism of brain injury from the biomechanical viewpoint in popular throwing techniques. The aim of this study is to evaluate the brain injury criterion (BrIC), an indicator of brain injury, with comparing the presence or absence of head-hitting on the anthropomorphic test device (ATD) in judo throwing technique Ouchi-gari. METHODS: A male judo expert (thrower) threw an ATD for 6 times by Ouchi-gari with or without head-hitting, respectively. The ATD with a straight neck component necessarily hit the occipital region on the mat, whereas an angled component was designed for preventing the ATD’s head-hitting. A 3-axis angular rate sensor, mounted in the gravity center of the ATD’s head, assessed head axial angular velocity in each trial. To evaluate the ATD’s head impact quantitatively, we calculated the BrIC from the head axial angular velocity. High-speed digital video cameras also recorded the kinematics of the ATD’s whole body during trials. RESULTS: In all trials, the largest angular velocities were recorded in the phase of the initial head (with head-hitting) or back (without head-hitting) contacting to the mat. The peak BrIC values of ATD ranged from 0.94 to 2.27 with (head-hitting) and 0.54 to 0.91 without (head-hitting). The average BrIC value with head-hitting (1.62 ± 0.22, mean ± SD) was significantly higher than those without head-hitting (0.73 ± 0.08) trials (p<0.05). Four out of six trials with head-hitting scored BrIC values larger than 1.0, which implies the human tolerance limit for serious brain injury. However, BrIC values were less than 1.0 in all other trials without head-hitting.
CONCLUSIONS: These results suggested that thrown player’s break-fall technique, with appropriate neck flexion to avoid head-hitting, decreases the BrIC value effectively and the risk of serious brain injuries in judo.

807 Board 4# May 27 3:15 PM - 5:15 PM
The Effectiveness Of Electromyography Biofeedback At Improving The Upper Trapezius To Serratus Anterior Activation Ratio
Julia E. Holton, Robert D. Clark, Cory J. Greerwasser, Heather Smith. California Polytechnic State University, San Luis Obispo, CA.
(No relevant relationships reported)

The upper trapezius (UT) to serratus anterior (SA) muscle activation ratio is essential for optimal shoulder function. An alteration of this ratio is a major area of focus in shoulder rehabilitation. Electromyography (EMG) biofeedback has been shown to be an effective technique used during rehabilitation but there is limited research on the retention of improvements. **Purpose**: To determine if EMG biofeedback can be used to improve scapular control by decreasing the UT to SA activation ratio. A secondary purpose was to determine if the predicted improvements can be retained beyond the treatment period of four weeks. **Methods**: 20 college aged (21.7±1.17 yrs) subjects participated in this study. Subjects were randomized to the exercise only (EO) group or EMG biofeedback group. Both groups performed 30 repetitions of three exercises twice a week for four weeks under supervision. The EMG biofeedback group performed them with the addition of EMG biofeedback. They were given the instructions to decrease the UT and increase the SA activation by adjusting the corresponding EMG trace on the monitor. The percent maximal voluntary contraction for each muscle during each exercise was measured on visit one, visit nine (after the four weeks) and visit 10 (after a two-week retention period) and presented as a percent change value. **Results**: There was no statistically significant effect of group on the ratio comparing visit one to visit nine (p=0.84), nor when comparing visit nine to visit 10 (p=0.065). The EMG biofeedback group had a significant decrease in UT activation (-10%) compared to the EO group (+27%) (p=0.007) at the end of the four weeks with no effect seen after the retention period (p=0.358). There was a significant increase in SA activation in the EMG biofeedback group (+196%) compared to the EO group (+29%) (p=0.000) comparing visit one to nine. There was a significant increase in SA activation comparing visit nine to visit 10 in the EMG biofeedback group (+14%) compared to the EO group (+2%) (p=0.001). **Conclusion**: EMG biofeedback was not found to decrease the UT to SA activation ratio, but the individual muscle activation changes indicate that EMG biofeedback can be effective at altering muscle activation rates in individual muscles and that those changes can be retained beyond the timeframe of the intervention.

808 Board 5# May 27 3:15 PM - 5:15 PM
Lumbo-pelvic Rhythm Prediction Using Machine Learning And Its Use As A Biomarker For Low Back Pain Identification
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(No relevant relationships reported)

Lumbo-pelvic (LUM-PEL) rhythm has the potential to be used as biomarker for diagnosis and rehabilitation of athletes predisposed to mechanical low back pain (LBP). Studies till date have mostly focused on discrete variables from the time series to explain movement patterns. Machine learning algorithms provide opportunity to analyze continuous time series data for predictive classification of movement patterns into pathological and non-pathological, adding value to early diagnosis and clinical decision making for conditions such as LBP. **PURPOSE**: Use of machine learning to categorize healthy lumbo-pelvic rhythm. **METHODS**: 79 participants with no LBP (Young: n=42; 18-40yr; 27.6±6.5yr; Older: n=37; 41-65yr; 51.7±7.3yr). 3D segmental kinematics of lumbar (LUM: L1-L5) and pelvis (PEL) were calculated for maximum trunk flexion-extension. Coordination patterns were divided into in-phase, anti-phase, superior and inferior-only based on the coupling angles of LUM and PEL. K-means clustering, an unsupervised machine learning algorithm, was employed to create clusters of movement patterns of the coupling and segmental angles based on dynamic time warping similarity. Sample distribution within each cluster was compared for different age groups. **RESULTS**: LUM-PEL rhythm fell under k=3 major movement pattern clusters (Fig. 1). No difference between age groups was observed. Non-pathological LUM-PEL rhythm clusters suggest flexion movement initiation and return from hyperextension typically have segments in anti-phase (LUM leading: 40.4%), PEL/ LUM only (35.3%) and in-phase (LUM leading: 24.3%). The 2 segments predominantly move in-phase except at start and end of movement. Patterns were not apparent when using segment angles.
Purpose: Machine learning-based methods, which include Artificial Neural Networks [ANN], have been used successfully in varied classification problems. If these methods can successfully classify those vulnerable to musculoskeletal problems such as low-back pain [LBP], they may have utility in screening and management of such conditions and aid in identifying what assessment methods provide optimal information for practitioners. We examined whether ANN techniques could correctly classify whether subjects experienced LBP in a convenience sample of dancers.

Methods: 60 subjects [48 women], 36 of whom [24 women] reported an episode of back pain in the past two months, were instrumented with a multi-segment spine marker set [Swain et al., 2019] and recorded [Motion Analysis Corp Eagle, 250 Hz] while performing standing and seated rotations, walking and several functional and dance-related movements [step-over task, arabesque, passé]. The multi-segment model has five segments: pelvis, lower and upper lumbar [LUL], lower and upper thoracic [LUT]. 3D rotations were computed both between adjacent segments, and with respect to the lab coordinate system. To determine variables of interest, 1-dimensional statistical and parametric mapping of SPM1D [Patyka, 2008] was performed. Features [min, max, time to min/max, and side-side difference] were extracted from these variables and used to train an ANN pattern recognition tool [MATLAB]. Approximately 75% of the data were used for training, with the remainder used for validation and testing. Because of the dearth of men, analysis was performed on the entire cohort, and of women only.

Results: Based on the SPM1D analysis, only approximately 10% of data were used for training the ANN. For example, for walking trials, LL and LT axial and UT coronal plane rotations were used. The ANN classifier was able to correctly identify incidence of LBP with approximately 65% accuracy.

Conclusions: Based on our small sample, ANN techniques show promise for identifying subjects with LBP based on their movement patterns. A larger training set of data is needed for better results. Future work should optimize feature selection by focusing on areas of difference between data rather than by selecting fixed features [e.g., max value] and examine the effect of different ANN architectures.
recommended levels. Fundamental motor skill (FMS) interventions have been shown to improve FMS proficiency and PA levels, however, whether these changes are maintained post-intervention is unknown. We therefore determined if a 12-week FMS program improved FMS and PA in pre-schoolers; and if so, whether these improvements were maintained 12 weeks post-intervention. METHODS: The Physical Activity and Fundamental Motor Skills in Pre-schoolers (PLAYFun) Program was a cluster randomized controlled trial. Participants were recruited from 4 University pre-schools. The PLAYFun Program was a 12-week, games-based, FMS program delivered directly into the centers by an exercise physiologist. Primary outcomes included FMS proficiency, objective PA and parent perceived PA assessed at baseline, 12 weeks and 12 weeks after the completion of the intervention (week 24). Differences within and between groups were assessed via a one-way analysis of variance.

RESULTS: Forty-nine participants (mean age 4.0±0.6; 54% male) were recruited. Children attended on average 2.0±1.0 sessions per week for 40 minutes per session. Participants in the PLAYFun Program demonstrated a significantly greater increase in object control (p=0.003) and total FMS (p=0.019) proficiency at week 12 compared to controls. Locomotor skills (M 14.83 ± 3.5[95% CI] [3.90 to 25.75]; p=0.012), object control skills (M 24.11 [9.93 to 38.29]; p=0.003) and gross motor quotient (M 20.14 [8.33 to 31.96]; p=0.003) all significantly improved when children attended twice a week, but these improvements were not maintained at 24 weeks. Girls in PLAYFun significantly increased moderate to vigorous PA after the intervention (P=0.015), but not boys. This increase was also not maintained 12 weeks post-completion of PLAYFun. No significant relationships between FMS and PA outcomes were identified.

CONCLUSIONS: Motor skill programs delivered directly to preschool children by an exercise physiologist within their preschool is effective at improving FMS proficiency in boys and girls and PA in girls. However, these improvements are not maintained when the practice is not ongoing.

May 27 3:45 PM - 4:00 PM
Effectiveness Of School-based Program To Reducing Sedentary Behavior And Improving Physical Activity In Brazilian Students

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Regular high intensity physical activities have been associated with healthy outcomes in adolescents. Previous studies have reported positive changes on physical activity (PA) level and sedentary time (SED) in participants of multicomponent school-based programs. The main research question was whether School in Action program is effective on promote active life style in Brazilian adolescents. PURPOSE: To examine the effects of a multicomponent school-based program on students’ PA and SED. METHODS: A cluster randomized controlled trial with 370 adolescents (aged 11.7 years, SD=0.6) from four public schools from Presidente Prudente-SP, Brazil, were randomized to either an intervention or control group. School in Action program was based on ecological and self-determination theory principles and strategies consisted of: (a) 15 minutes of PA program in physical education (PE) class, (b) PA practice during the lunch break, (c) active breaks during theoretical classes, (d) monthly participation of school’s health education project, (e) parent’s counseling during school meeting and (f) school playground adaptation and acquisition of material resources to improve moderate-to-vigorous physical activity (MVPA). Changes in PA and SED were measured. PA level was evaluated by wrist-worn accelerometers (Actigraph, gt3x), and Chandler’s cut-points were considered. Generalized linear mixed models were used and pre-specified interactions were tested (i.e., group*time). All analyses were adjusted by sex, peak height velocity, baseline data and academic performance. However, few studies include adolescents. CONCLUSIONS: Motor skill programs delivered directly to preschool children by an exercise physiologist within their preschool is effective at improving FMS proficiency in boys and girls and PA in girls. However, these improvements are not maintained when the practice is not ongoing.

May 27 4:15 PM - 4:30 PM
Effect Of A Teacher Training Program To Promote Physical Activity Among Preschoolers With Autism

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Children with Autism Spectrum Disorder (ASD) are disproportionately impacted by childhood obesity, with one contributing factor being low levels of physical activity (PA). There is a paucity of interventions for promoting PA that are responsive to the unique needs of young children with ASD. One promising approach designed for teachers working with typically developing preschoolers is WE PLAY (Wellness Enhancing Physical Activity for Young Children), an online-based training system. It was adapted to be responsive to the needs of children with ASD through a stakeholder-engaged approach. PURPOSE: To determine the impact of WE PLAY-Autism on the moderate-to-vigorous PA (MVPA) of preschoolers with ASD during school hours. METHODS: A multiple baseline design across participants was used, which allowed for a rigorous experimental evaluation of the impact of WE PLAY-Autism through the repeated measurement of children’s MVPA as the intervention was implemented sequentially across classrooms. Children’s (N=5) MVPA was measured daily during school hours using accelerometers (ActiGraph GT9X Link) worn at the iliac crest. Data were analyzed using accelerometer cut-point criteria for MVPA, with min-hour of MVPA as the dependent variable. RESULTS: Following current best practices in single case designs, visual analysis and effect size calculations were used, indicating higher average min/hour of MVPA among preschoolers with ASD in the intervention phase (Tau-U = -0.53, p < 0.001, Hedges’ g = -0.99, 95% CI [0.56, 1.43]) and post-training phase (Tau-U = -0.55, p < 0.001, Hedges’ g = -0.17, 95% CI [0.73, 1.60]) in comparison to the baseline phase. The average increase in min/hour of MVPA from baseline to post-training was 2.51 (range = 1.35 - 4.32), which translates to approximately 38 additional minutes of MVPA across the 15-hour preschool week.

May 27 4:00 PM - 4:15 PM
Effect Of A School-based Physical Activity Intervention On Academic Performance In Norwegian Adolescents: The School In Motion Strategy - A Cluster Randomized Controlled Trial

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There is increasing evidence of a positive association between physical activity (PA) and academic performance. However, few studies include adolescents. PURPOSE: To investigate the effect of a nine-month, school-based PA cluster-randomized controlled trial, School in Motion (ScIM), on academic performance in 14-year-old adolescents. METHODS: 29 secondary schools (N=2084) in Norway were cluster-randomized into three groups A) the Physical active learning (PAL) intervention group (n=10), B) the Don’t worry - Be Happy (DWBH) intervention group (n = 9) or control group (n = 10). Target dose in the PAL and DWBH group was 120 min/week of additional PA and physical education. Academic performance (secondary outcome) was assessed by standardized national tests in reading and numeracy at baseline (September 2017) and at the end of the intervention (May 2018). Test scores are presented as means as a function of time and group-by-time interaction, with schools as random factors. Participants (n = 1682) from 27 schools with valid data at both timepoints were included in the analysis. RESULTS: At baseline, mean values in reading were 57 (SD 9.5) and 54 (SD 10.2) points for girls and boys respectively and 56 (SD = 9.7) points for numeracy in both genders. Performance in numeracy increased in both intervention groups. In favor of the PAL group, the mean difference in change in numeracy were 1.1 points (95% confidence interval (CI) 0.3-1.9, p = 0.024) and 2.6 points (95% CI 1.7-3.5, p < 0.001) for girls and boys respectively, when compared with controls. Similarly, in favor of the DWBH group, the mean difference in change was 1.5 points (95% CI 0.8-2.2, p = 0.005) for girls and 2.8 points (95% CI 1.8-3.8, p < 0.001) for boys. A significant intervention effect for reading were only observed among boys in DWBH intervention with mean difference in change of 1.8 points (95% CI 0.6-2.9, p = 0.008) in favor of the intervention group. CONCLUSIONS: The findings from the ScIM intervention support the notion that additional PA in school is beneficial for students’ academic performance especially in numeracy.
CONCLUSION: This study is, to our knowledge, the first to implement and report the impact of a preschool PA intervention adapted to be responsive to the needs of preschoolers with ASD. The results provide preliminary evidence that WE PLAY-Autism increases MVPA among preschoolers with ASD to a similar magnitude as preschool-based interventions for typically developing children.

818 May 27 4:30 PM - 4:45 PM
Dearborn SHINES: The Impact Of A Comprehensive School Health Intervention
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PURPOSE: Arab Americans account for almost 3.7 million people in the U.S., however, limited health data is available on youth and adult populations. In order to better understand the health behaviors of Arab Americans and aid in the push for healthy lifestyles in children, more research should be conducted. Therefore, the purpose of this study was to implement a culturally relevant healthy eating (HE) and physical activity (PA) intervention known as D-SHINES in a primarily Arab-American school district and understand the impact it had on students’ overall PA, attitude toward PA and HE, as well as PA and HE knowledge, and perceived social support.

METHOD: Eight schools participated in the D-SHINES intervention over one school year, with 264 (Mage=11.1; Male = 106) randomly selected students participating in pre-post testing. The intervention consisted of physical education utilizing SPARK, PA afterschool clubs, gardening and nutrition programming, and classroom physical activity breaks. Students participated in a pre-post survey with validated measures for overall PA level, HE and PA attitude, knowledge, and perceived social support. Implementation of the garden, HE, and PA curriculum tools were also tracked for fidelity.

RESULTS: T-tests were used to determine differences among students from pre-post intervention. Results showed that students significantly increased their HE and PA knowledge over the course of the year (p<.001), as well as their PA attitude (p<.021). There was no significant difference observed in overall PA levels (p<.92), vigorous PA (p<.08), and perceived social support. Additionally, MANCOVA’s showed significant differences among the variables between grade and gender (p<.001).

CONCLUSIONS: Although limitations exist, the results show that while the D-SHINES program was implemented in the school, students’ significantly improved their attitudes and knowledge toward HE and PA, yet, failed to show a significant increase in overall PA. Additionally, great strides were made with teachers and schools to build and implement the garden curriculum. Additional research should be conducted to better understand successful comprehensive school programming among urban Arab American youth, a population that is often understudied.

819 May 27 4:45 PM - 5:00 PM
CHANGES IN PHYSICAL ACTIVITY, PHYSICAL FITNESS AND WELL-BEING FOLLOWING A SCHOOL-BASED HEALTH PROMOTION PROGRAM
Sabrina Krogh Schmidt, Michael Sæther Reinboth, Solfried Bratlund-Sanda. University of South-Eastern Norway, Bø in Telemark, Norway. (Sponsor: Jorunn Sundgot-Borgen, FACSM) Email: sabrina.k.schmidt@usn.no

Purpose: School-based physical activity (PA) has mostly been examined in a preventive perspective. The purpose of this study was to examine the changes in physical activity, physical fitness and psychosocial well-being in early adolescents after the implementation of a school-based health promotion program in secondary school.

Methods: Four municipalities with 15 secondary schools in Telemark County, Norway, were recruited into an intervention or a control group. A total of 644 pupils participated in the study (response rate: 79%). The schools in the intervention group implemented the Active Healthy Kids program, where the physical activity component consisted of: (1) 120 min/week of physically active lessons (PAL), (2) 25 min/week of physical active breaks during classroom lessons and (3) 135 min/week of curriculum based normal physical education. Primary outcome was physical activity assessed by accelerometer and expressed as counts per minute. Secondary outcomes were sedentary time, physical fitness, vitality, school effort and health-related quality of life in the five domains; physical health, psychological wellbeing, parent, peers and school environment.

Results: There was a Group X Time effect for school-based, but not full-day, physical activity (p<0.005), and for cardiorespiratory fitness (p<0.02) and vitality (p<0.008). A Group effect was found for the perceived exerted effort in class (p<0.001) and the health-related quality of life domains “psychological well-being” (p<0.04) and “school environment” (p<0.001).

Conclusions: A multi-component, school-based, health-promotion intervention with emphasis on the use of PAL led to positive changes in school-based physical activity, cardiorespiratory fitness, vitality and health-related quality of life among early adolescents in a county with poor public health profile. This might have implications for the development and promotion of general health and well-being throughout adolescence.

Trial registration: Approved by the Norwegian Data Protection Services (ID 54327), and registered in ClinicalTrials.gov, (ID NCT03906851).

Keywords: School-based physical activity, adolescents, Physical activity, physical fitness, Health Related Quality of Life, Norway

820 May 27 5:00 PM - 5:15 PM
Bi-directional Prospective Associations Between Objectively Measured Physical Activity And Fundamental Motor Skills In Children: A Two-year Follow-up
Ada Kristine Ofrim Nilsen, Sigmund A. Anderssen, Kjersti Johannessen, Katrine N. Aaldaad, Einar Ylvisaker, Jan Morten Loftnes, Eivind Aadland. 1Norwegian School of Sport Sciences // Western Norway University of Applied Sciences, Sognдал, Norway. 2Norwegian School of Sport Sciences, Oslo, Norway. 3Western Norway University of Applied Sciences, Sognдал, Norway. Email: adakn@hvl.no

Purpose: The direction of the longitudinal relationship between physical activity (PA) and fundamental motor skills (FMS) remains unclear. We evaluated the bi-directional, prospective associations between intensity-specific physical activity (PA) and domain-specific fundamental motor skills (FMS) over two years in young children.

Methods: A sample of 235 children (mean age at baseline 4.7 yr, 52% boys) from the Sogn og Fjordane Preschool Physical Activity Study was measured two years apart. PA was assessed using ActiGraph accelerometers (GT3X+). FMS were evaluated by a test battery inspired by the “Test of Gross Motor Development 3” and the “Preschooler Gross Motor Quality Scale”. PA outcomes were total PA (TPA [counts per minute]) and intensity specific PA and sedentary behaviour (SED) (min/day). FMS outcomes were total FMS score, locomotor, object control-, and balance skills. Linear mixed model adjusting for potential co-variables was used to evaluate the bi-directional prospective associations between these variables, including the moderating effect of sex and age.

Results: Baseline total PA, moderate-to-vigorous PA (MVPA), and vigorous PA predicted higher total FMS score, locomotor-, object control-, and balance skills at follow-up (standardized regression coefficient (β): 0.15 to 0.26, p=0.002-0.031). SED predicted lower FMS in all domains except balance (β: -0.10 to -0.27, p=0.008-0.026). Baseline light PA did not predict FMS at follow-up. Baseline object control- and balance skills were not associated with PA or SED at follow-up. Total FMS score at baseline predicted lower light PA at follow-up (β: -0.14, p<0.041), and locomotor skills at baseline predicted higher TPA in boys relative to girls (p for interaction=-0.044).

Conclusions: PA, especially MVPA, were positively associated with development of FMS in young children. In contrast, FMS was largely unrelated to future PA levels. Our results suggest promotion of MVPA is important for FMS development in young children.
known to decrease TC, LDL and TG, while increasing HDL within normal ranges. Similarly, Supplementation of polyunsaturated fatty acids (PUFA), such as DHA, help control and mitigate excessive triglycerides, while increasing HDL. Research has not investigated the potential relationship of maternal exercise and PUFA levels on maternal lipid profiles. PURPOSE: To determine the relationship between maternal exercise and plasma levels of DHA on maternal lipid levels at 16 and 36 weeks. METHODS: 22 women with a singleton pregnancy (<16 weeks) were randomized to either aerobic (n=9) or non-exercising control (n=4) group. Participants exercised 3x50 minutes per week at moderate intensity for ~24 weeks, with average weekly METmins/wk calculated based on standard MET values*average minutes. Maternal plasma was collected at 16 and 36 weeks of gestation and analyzed for DHA and lipid levels. Multiple linear regression and Spearman correlation models were performed to determine relationships between maternal METmins/wk, DHA levels, and lipid levels. RESULTS: There is a significant negative correlation between DHA levels on HDL (-0.692, p=0.01) at 36 weeks. There are trends of significance with METmins/ wk with DHA (0.500, p=0.08) and TG (0.440, p=0.13) at 36 wks. There was not a significant regression equation found for TC (F=0.690, p=0.52) and TG (F=2.092, p=0.174), however METmins/wk showed a negative relationship to TC (-0.094, p=0.307) and trended to significantly predict TG (-0.185, p=0.081) while DHA Levels showed a positive relationship with TC (0.059, p=0.331) and TG (0.105, p=0.125). CONCLUSION: The current suggests a potential relationship between exercise and DHA levels during pregnancy on maternal lipids. These findings showed a negative and stronger relationship with METmins/wk compared to DHA levels, thus suggesting exercise may be more important to control excessive increases in TC and TG during pregnancy.

823 May 27 3:30 PM - 3:45 PM
Physical Activity Knowledge And Sources Of Advice During Pregnancy
Ciara O’Hagan1, Louise Turner2.1Institute of Technology Carlow, Carlow, Ireland. 2Sheffield Hallam University, Sheffield, United Kingdom.

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(No relevant relationships reported)

Physical activity (PA) during pregnancy is known to be beneficial for the health of both the mother and foetus, but most pregnant women do not engage in the recommended volume of activity. Lack of personal and healthcare-professional knowledge is frequently cited as a barrier to PA participation during pregnancy in both low-activity and athletic populations. PURPOSE: To explore the sources of advice used by women to guide their PA participation during pregnancy. METHODS: Women who had recent experience of pregnancy in Ireland (n = 102, age 35±4 years) completed an online survey with questions regarding their activity type immediately pre-pregnancy (activities of daily life only (DAILY), recreational exercise (EXERCISE) or competitive sport (SPORT)), knowledge of PA guidelines, experiences of receiving PA advice from healthcare professionals during pregnancy, and perceptions regarding different sources of advice. Between-group comparisons were made by Chi-square analysis. RESULTS: Knowledge of the recommended volume of activity for health was significantly poorer in EXERCISE than DAILY or SPORT (X² = 16, p = 0.037, V = 0.283); there were no differences in knowledge of recommended intensity or type. Women in the EXERCISE and SPORT groups were significantly more likely to have felt that they needed to initiate discussion about PA with their healthcare providers than those in the DAILY group, for whom the professional was more likely to initiate the discussion (X² = 19, p = 0.004, V = 0.310). While 48% of respondents perceived their healthcare professionals to be their most useful source of PA advice during pregnancy, the other 52% cited sources such as friends, exercise professionals or online media, with no between-group differences. Furthermore, many women reported that they never received PA advice during their pregnancy from their general practitioner (27% of women), midwife (45%) or obstetrician (46%). CONCLUSION: Knowledge of guidelines for PA during pregnancy is low among pregnant women in Ireland; low levels of guidance from healthcare professionals may be a contributing factor.

824 May 27 3:45 PM - 4:00 PM
Maternal Physical Activity Correlates With Fasted And Postprandial Insulin Resistance And Lipids During Late Pregnancy
Rachel A. Tinins1, Maire M. Blankenship2, Kevin J. Pearson2, W. Todd Cade1, Elizabeth Altizer3, Nikki B. Zite1, Jill M. Maples4.1Western Kentucky University, Bowling Green, KY. 2University of Kentucky, Lexington, KY. 3Washington University School of Medicine, St. Louis, MO. 4University of Tennessee Graduate School of Medicine, Knoxville, TN.

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(No relevant relationships reported)

PURPOSE: Physical activity (PA) has been shown to be effective for lowering insulin resistance and blood lipid profiles during pregnancy. Recent evidence indicates sedentary time is also associated with poor pregnancy outcomes. The purpose of this study was to determine the relationships between sedentary time and moderate PA, assessed during late pregnancy, and insulin resistance (HOMA-IR) and triglycerides in fasting and postprandial conditions. Postprandial conditions are important to study as humans spend the majority of their time in a fed-state.

METHODS: Healthy pregnant women (N=61, 32-36 weeks gestation) were recruited for this study. Sedentary time and moderate intensity PA were objectively assessed using a wrist-worn Actigraph GT3X Link Accelerometer. The device was worn 24 hrs/day for 7 days. Fasting blood lipids, insulin, and glucose were assessed. A standardized high-fat breakfast was consumed and these measures were collected again 120-minutes post meal (postprandial). All relationships were analyzed with Pearson Product Moment Correlation Coefficients while controlling for pre-pregnancy BMI.

RESULTS: Sedentary time was positively correlated with fasting and postprandial insulin resistance (fasting HOMA-IR: r=0.471, p=0.001; postprandial HOMA-IR: r=0.433, p=0.002), while these measures were negatively correlated with light PA (fasting HOMA-IR: r=-0.395, p=0.005, postprandial HOMA-IR: r= -0.364, p=0.010) and moderate PA (fasting HOMA-IR: r=-0.520, p=0.001; postprandial HOMA-IR: r=-0.477, p=0.001). Sedentary time was positively correlated with fasting triglycerides (r=0.296, p=0.039). Moderate PA was negatively correlated with fasting triglycerides (r=-0.403, p=0.004) and postprandial triglycerides (r=0.343, p=0.016).

CONCLUSIONS: Decreasing sedentary time or increasing moderate PA may positively impact metabolic health during pregnancy by reducing fasting and postprandial insulin resistance, as well as reducing fasting and postprandial triglycerides. This is important as, during pregnancy, insulin resistance is associated with poor pregnancy and neonatal outcomes and increased triglycerides are associated with increased risk of preeclampsia, pre-term birth, and increased maternal cardiovascular risk later in life.

NIH NIGMS IDEA Grant 5P20GM103436

825 May 27 4:00 PM - 4:15 PM
Influence Of Physical Activity And Sedentary Behavior During Pregnancy On Labor And Delivery Type
Melissa A. Jones1, Janet Catov2, Kara Whitaker2, Bethany Barone Gibbs1. 1University of Pittsburgh, Pittsburgh, PA. 2University of Iowa, Iowa City, IA.

Email: maj133@pitt.edu

(No relevant relationships reported)

Physical activity (PA) during pregnancy is known to be safe and does not increase risk of medical intervention during labor and delivery. While it is known that sedentary behavior (SED) and PA have independent health effects, whether higher SED during pregnancy increases risk for medical intervention in labor and delivery is unknown. PURPOSE: To examine the relationship of SED and PA patterns across pregnancy, with labor and delivery outcomes. METHODS: In this prospective cohort study, objective SED (high-worn actigraph micro3) and physical activity (waist-worn Actigraph GT3X-BT) were assessed in women for ≥ 4 days with ≥2 hours in each trimester of pregnancy. This secondary analysis includes women with available labor and delivery records, and PA and SED measures in ≥1 trimester. Trajectory analysis was used to identify patterns of PA and SED across pregnancy and assign women to the groups most closely related to their dominant activity patterns. Labor and delivery information was abstracted from participant medical records. Labor types were categorized as: spontaneous, induced-elecrive, or induced-medical. Delivery types were categorized as: vaginal, c-section-elective, or c-section-medical. Differences in labor and delivery type by SED and PA trajectories were analyzed using Fisher’s exact tests due to small cell sizes. RESULTS: Trajectory analysis resulted in and were assigned women to high, medium, and low groups for PA and SED across trimesters of pregnancy. Approximately 60% of labor was spontaneous, followed by 27% medical induction, and 13% elective induction. Deliveries were 79% vaginal, 13% medically indicated c-section, and 8% elective c-section. Type of labor (L) or delivery (D) did not significantly differ by SED (L: χ²=0.185, D: χ²=0.134) or PA (L: χ²=0.756, D: χ²=0.120) trajectories. When elective induction and c-sections were removed to only consider risk for medical intervention, differences remained insignificant by SED (L: χ²=0.062, D: χ²=0.104).
P: 0.136, D: p = 0.088) or PA (L: p = 0.527, D: p = 0.128) trajectories. CONCLUSION: Objectively-measured patterns of SED or PA across pregnancy were not related to type of labor or delivery, including risk of medical intervention. Future research with larger samples could expand to the entire birth experience including duration of labor, medication use, or fetal complications.

826 May 27 4:15 PM - 4:30 PM Effect Of Exercise During Pregnancy And Lactation In Obese Wistar Rats On Offspring Glycemic Control

Peter M. Magyari, FACSM, Ruth Capistrano, Elizabeth Piazza, Leila Ninya, Alireza Jahan-Miho. UNF, Jacksonville, FL. Email: p.magyari@unf.edu

(No relevant relationships reported)

PURPOSE: To determine the effect of maternal exercise in pregnant and lactating obese Wistar rats on the glycemic control of their offspring at time of weaning.

METHODS: Two days following impregnation, 24 obese Wistar rats were separated into 2 groups. One group received 30 minutes of treadmill exercise (E) at 15-20 m/min each day while the other group received no exercise (NE). The groups were maintained after the birth of the offspring (21 days) through lactation (21 days) for a total of 6 weeks. At weaning an oral glucose tolerance test (OGTT) was performed on 12 randomly selected pups from each group. A t-test was utilized to determine differences in total glucose area under the curve (t-AUC) (mean and standard error) between groups (p < 0.05).

RESULTS: There was an effect of maternal exercise on the glycemic control of the offspring. The ability to dispose of glucose following a glycemic load was significantly greater in the offspring of E dams (513.1 ± 11.7 mmol/L) compared to the offspring of NE dams (542.7 ± 7.1 mmol/L) (p < 0.05).

CONCLUSIONS: Initiating moderate exercise early during the pregnancy of obese rats and maintaining exercise through lactation can positively impact glycemic control in offspring.

827 May 27 4:30 PM - 4:45 PM The Effects Of An Antenatal Lifestyle Intervention On Pregnancy Outcomes In Overweight And Obese Pregnant Women

Jihong Liu, Sara Wilcox, FACSM, Ellen Wingard, Brent Hutto. University of South Carolina, Columbia, SC. (Sponsor: Sara Wilcox, FACSM)

Email: jliu@sc.edu

(No relevant relationships reported)

Three reviews of antenatal behavioral lifestyle interventions did not find significant intervention effects on maternal complications and adverse neonatal outcomes, perhaps due to the inclusion of low to medium quality studies. PURPOSE: To evaluate the effect of a lifestyle intervention program on pregnancy outcomes in overweight and obese pregnant women. METHODS: This study was a randomized controlled trial. Overweight and obese pregnant women were recruited from Columbia, South Carolina and were randomized to a behavioral intervention group (n=110) or a standard care group (n=104). The antenatal intervention was designed to target weight self-monitoring, increasing physical activity, and increasing healthy dietary behavioral practices. Intervention contents were delivered through one in-depth counseling session, followed by phone counseling, behavioral podcasts, and social media support. Standard care women received monthly mailings and a match number of podcasts focused on a healthy pregnancy. Participants wore a SenseWear armband ≥ 21 hrs/d for ≥ 5 at baseline (early pregnancy, n=205) and 32 wk gestation (n=167). We tested Randomization x Time interaction effects (SAS PROC MIXED) for min/d of MVPA, min/d of light PA, and steps/d.

RESULTS: Participant demographics were: 30-5 years, 44% African American, 50% white, 60% college graduate, 61% employed full-time, 67% married, 42% nulliparous, and 13±2 wk gestation at baseline. While the time main effects indicated that MVPA (p=0.007), light PA (p=0.04), and steps (p=0.0001) decreased significantly, intervention effects (Randomization x Time) were not significant for these PA variables (see Table).

Table. Changes in MVPA, Light PA, and Steps Over Time, by Randomization Group, Least Square Means (SEs)

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Baseline</th>
<th>32-wk</th>
<th>Baseline</th>
<th>32-wk</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVPA, min/d</td>
<td>38 (2)</td>
<td>36 (3)</td>
<td>35 (2)</td>
<td>28 (3)</td>
</tr>
<tr>
<td>Light PA, min/d</td>
<td>219 (8)</td>
<td>206 (8)</td>
<td>200 (8)</td>
<td>194 (8)</td>
</tr>
<tr>
<td>Steps/d</td>
<td>5574 (196)</td>
<td>5041 (209)</td>
<td>5114 (196)</td>
<td>4363 (211)</td>
</tr>
</tbody>
</table>

CONCLUSION: A behaviorally based lifestyle intervention did not significantly lessen the decline in PA typically seen from early to late pregnancy. Assessments will be repeated at 6- and 12-mo postpartum. Funded by NIH/NICHD.

828 May 27 4:45 PM - 5:00 PM Change In Physical Activity In The Health In Pregnancy And Postpartum (HIPP) Randomized Controlled Trial (RCT)

Sara Wilcox, FACSM, Jihong Liu, Brent Hutto, Ellen Wingard. University of South Carolina, Columbia, SC. Email: wilcoxs@mailbox.sc.edu

(No relevant relationships reported)

Despite the known benefits of physical activity (PA) in pregnancy, PA is consistently shown to decrease from early to late pregnancy. Very few antenatal interventions have targeted PA and included sensor-measured outcomes in overweight and obese pregnant women.

PURPOSE: To examine whether a lifestyle intervention increased moderate- to vigorous-intensity PA (MVPA), light PA, and steps or reduced their decline from early to late pregnancy compared to a standard care condition.

METHODS: HIPP is a RCT comparing the effects of a lifestyle intervention vs standard care on gestational weight gain (primary outcome) and health behaviors including PA (secondary outcomes) among women entering pregnancy overweight or obese. The lifestyle intervention was grounded in social cognitive theory and, during pregnancy, included an introductory behavioral counseling session followed by telephone counseling calls, behavioral podcasts, and a private Facebook group. Usual care participants received usual care from their obstetrician and received mailings and podcasts focused on a healthy pregnancy. Participants wore a SenseWear arm band ≥ 21 hrs/d for ≥ 5 at baseline (early pregnancy, n=205) and 32 wk gestation (n=167). We tested Randomization x Time interaction effects (SAS PROC MIXED) for min/d of MVPA, min/d of light PA, and steps/d.

RESULTS: Participant demographics were: 30-5 years, 44% African American, 50% white, 60% college graduate, 61% employed full-time, 67% married, 42% nulliparous, and 13±2 wk gestation at baseline. While the time main effects indicated that MVPA (p=0.007), light PA (p=0.04), and steps (p=0.0001) decreased significantly, intervention effects (Randomization x Time) were not significant for these PA variables (see Table).

A Healthy Lifestyle Intervention During Pregnancy: Key To Preventing Chronic Disease Risk?

Robertta Bgeginski1, Tamiya S. Nagpal2, Harry Prapavessis2, Barbra de Vrijer1, Christina G. Campbell1, Karishma Hoseni2, Stephanie Paplinski1, Mollie Manley1, Michelle F. Mottola, FACSM1. 1University of Western Ontario, London, ON, Canada. 2University of Ottawa, Ottawa, ON, Canada. 3Iowa State University, Ames, IA. (Sponsor: Michelle F. Mottola, FACSM)

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(No relevant relationships reported)

Gestational hypertension disorders and diabetes affect 6-15% of all pregnancies worldwide and are associated with adverse maternal and neonatal outcomes that can have a programming effect on future chronic disease risk. Pregnant women who receive lifestyle interventions, including healthy eating and/or physical activity, may have a decreased risk of developing complications. PURPOSE: To analyze the effects of a supervised healthy lifestyle intervention (nutrition and exercise) during pregnancy on diagnosis of gestational diabetes, hypertension, cesarean delivery, stillbirth, macrosomia (babies > 4500g), and low birth weight (babies < 2500g) in a cohort in London, Canada. METHODS: From 2016 to 2019, 111 women were enrolled at 12-18 weeks gestation in the Nutrition and Exercise Lifestyle Intervention Program (NELIP; Clinical Trials #NCT02804061) up to delivery. The nutrition goals for the intervention were: 1) Submit a weekly 24 hour-food intake record; 2) Consume approximately 1800-2200 kcal/d; and 3) Consume 200-250 g carbohydrates/d (40-55% of total energy intake). The exercise goals were: 1) Duration of session: Walk for 25 minutes and add 2 minutes each week until 40 minutes were achieved and then maintain this walking duration until delivery; 2) Frequency: 3-4 times per week; and 3) Submit a weekly step log (pedometers were provided to each participant).

RESULTS: As of October 2019,
the average duration of the intervention was 20.9 ± 3.9 wks. Out of the 75 participants that completed the intervention, maternal age was 32.2 ± 3.3 yrs, self-reported pre-pregnancy weight was 71.2 ± 15.3 kg, and gestational age at delivery was 278.1 ± 9.0 days. No participants were diagnosed with gestational diabetes or hypertension. Data from 52 babies indicated: birth weight was 3456.0 ± 442.4 g and length was 50.7 ± 3.1 cm. None were born with low birth weight and there were no cases of stillbirth. The rate of macrosomia was 1.9% (n = 1) and caesarean delivery was 27% (n = 14).

**CONCLUSION:** A healthy lifestyle intervention during pregnancy may help to prevent gestational diabetes and hypertension, and help to reduce the prevalence of stillbirth, macrosomia, low birth weight, and caesarean deliveries. Taken together, these findings may have major positive implications for the long-term health of both mothers and babies.

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**B-51 Clinical Case Slide - Cardiovascular**

**Wednesday, May 27, 2020, 3:15 PM - 4:35 PM**

**Room:** CC-2005

**830 Chair:** Paul D. Thompson, FACSM. Hartford Hospital, Hartford, CT.

(No relevant relationships reported)

**831 Discussant:** Benjamin D. Levine, FACSM. Presbyterian Hospital, The University of TX SW Medical Center, Dallas, TX.

(No relevant relationships reported)

**832 Discussant:** Matthew Sedgley, FACSM. U of Maryland Sports Medicine, Frederick, MD.

(No relevant relationships reported)

**833 May 27 3:15 PM - 3:35 PM**

**Cardiovascular-Track And Field**

Mitchell J. Odom. University of Michigan, Ann Arbor, MI.

(Sponsor: Robert Kiningham, FACSM)

(No relevant relationships reported)

**HISTORY:** A 21-year-old senior male track and field athlete who competes in mid-distance running events in a Division I university was evaluated for a family history of hypertrophic cardiomyopathy. During his pre-participation physical exam, he denied history of dizziness, syncope, or chest pain. There was no family history of an abnormality of the heart. He was recently diagnosed with hypertrophic cardiomyopathy by his primary care provider. There is no other known history of hypertrophic cardiomyopathy in the family.

**PHYSICAL EXAMINATION:** There were no abnormalities during his cardiac exam. There were no murmurs on standard exam or with provocative maneuvers. **DIFFERENTIAL DIAGNOSIS:** 1. Family history of hypertrophic cardiomyopathy. 2. Hyperthyroidism. 3. Cardiomyopathy. 4. Hyperkalemia. 5. Anemia. 6. Anxiety or panic disorder.

**TESTS AND RESULTS:**


**PHYSICIAN EXAM:** Normal during the exam. There were no tremors, rigors, or myotonia.

**TREATMENT AND OUTCOMES:**

A healthy lifestyle intervention during pregnancy may help to prevent gestational diabetes and hypertension, and help to reduce the prevalence of stillbirth, macrosomia, low birth weight, and caesarean deliveries. Taken together, these findings may have major positive implications for the long-term health of both mothers and babies.
2. Concern for high-risk pathway as pre-excitation persisted at higher heart rates on stress test. Cardiologist recommended electrophysiology study and ablation.
3. Underwent uncomplicated catheter ablation of left posterior accessory pathway.
4. 1 week post-ablation, some degree of pre-excitation noted on follow-up EKG (however, similar to post-elimination and initial EKG).
5. 2 weeks post-ablation, ambulatory monitor with no events.
6. 6 weeks post-ablation, remained asymptomatic and received cardiac clearance to return to sport.

836 May 27 4:15 PM - 4:35 PM

Chest Pain - Football
Courtney Nicole Hintz, UCLA Health, Los Angeles, CA.
(Sponsor: Aurelia Nattiv, FACSM)
Email: courtney.hintz@gmail.com
(No relevant relationships reported)

HISTORY: A 23-year old male division I football linebacker developed acute-onset exertional chest pain 30 minutes into practice. The pain was substernal, radiated to his back and was associated with shortness of breath. He was immediately transferred to the ED and after two hours had resolution of his pain with intravenous ketorolac. The patient admitted to suffering from a viral upper respiratory infection with mild unreported chest pain for two weeks prior to the episode. He has a past medical history of well-controlled asthma and sickle cell trait. He denied previous episodes of chest pain or syncope and also denied family history of sudden cardiac death.

PHYSICAL EXAMINATION: Initial vital signs were BP 141/85, HR 74, O2 saturation 96%, T 97.8°F. Athlete was in visible distress in right lateral decubitus position, clutching chest. Cardiac examination revealed regular rate and rhythm, no murmurs or rubs. Chest pain was not reproducible on palpation of anterior chest. Pain was positional and worse with leaning forward. Lungs were clear to auscultation bilaterally with no wheezing or rhonchi, and good air movement.


TREATMENT AND OUTCOMES: 1. Colchicine and high dose ibuprofen taper over 3 weeks 2. Avoidance of physical activity for 3-6 months per AHA guidelines


REFERENCES: 1. Colchicine and high dose ibuprofen taper over 3 weeks 2. Avoidance of physical activity for 3-6 months per AHA guidelines 3. Resting and stress TTE and EKG, 24-hour Holter monitor prior to RTP.
DIFFERENTIAL DIAGNOSIS:
1. Bone spur
2. Partial tear of Achilles tendon
3. Bursitis
4. Hindfoot fracture

TEST AND RESULTS:
X-ray AP and lateral views of left ankle were normal.
MRI left ankle revealed a nondisplaced fracture of the calcaneus. There was no signal abnormality involving the Achilles tendon and it appeared intact.

FINAL WORKING DIAGNOSIS:
Nondisplaced calcaneus fracture

TREATMENT AND OUTCOMES:
Placed in a pneumatic boot with weight bearing as tolerated. Out of pneumatic boot at 8 weeks. Began physical therapy at 7 weeks. Planning to return to skiing this winter as injury occurred in the spring.

PHYSICAL EXAMINATION:
Range of motion: Full AROM of wrist flexion, extension, supination, pronation, ulnar deviation, radial deviation. Pain with resisted flexion, end-range supination and pronation, of similar pain, radicular pain, weakness/sensory symptoms. Pain present at rest and at night. Increases with walking and twisting activities. Mild improvement with ice, Tylenol, ibuprofen, compression wrap.


Differential Diagnosis: Osteoid osteoma, Intracortical hemangioma, Nonossifying fibroma, Distal fibula physeal injury, Chondromyxoid fibroma, Ewing sarcoma, Langerhans cell histiocytoma, Osteosarcoma, Stress fracture

Tests and results:

1. Initial plain films: Focal lucency in distal left fibular metaphysis abutting the physis. Periosteal reaction and overlying soft tissue swelling.
2. MRI: Oval well-circumscribed area in distal left fibular metaphysis crossing the physis with surrounding bone marrow edema and peristomal reaction. No evidence of abscess.

Treatment and Outcomes:
Orthopedics service was consulted and patient underwent debridement of left ankle and curettage of the distal fibula. Admitted overnight for administration of IV vancomycin and cefazolin. Infectious disease service was consulted. He was discharged with one month of oral antibiotics (cefadroxil) following operation. Cultures from tissue taken remained negative. However, the patient did have a positive nares MSSA swab. He was able to return to activity and he recovered well, without significant events or issues.
848 May 27 3:35 PM - 3:55 PM 

Toe Pain - Softball
Miguel Lopez, Angel Lazu, Peter Seidenberg, FACSMD, Penn State University, State College, PA. (Sponsor: Peter Seidenberg, FACSMD)

(No relevant relationships reported)

HISTORY: An 18-year-old collegiate softball player started noticing right great toe pain in March of her freshmen season. Pain was unrelenting throughout the day but temporarily responded to anti-inflammatories. She denied fevers, chills, night sweats, or unexpected weight loss. She did not report her pain to the team physician. However, after seeing an outside physician for continued pain, she was placed in a walking boot and provided a bone stimulator. After an additional three weeks of pain despite these therapies, she presented to the training room for re-evaluation of her toe.

PHYSICAL EXAMINATION: Examination revealed exquisite tenderness to palpation of the dorsal-ulnar aspect of the first metatarsal with dark coloration, black in places.


TREATMENT AND OUTCOMES: 1. Patient was referred to orthopedic oncology 2. Patient underwent biopsy with curettage and allograft of distal right ulna 3. Frozen specimens during procedure confirmed giant cell tumor 4. Patient has followed up with orthopedic oncology with good improvement in pain and return of function.

850 May 27 4:15 PM - 4:35 PM

Atraumatic Knee Swelling - Runner
Bernadette Pendergraph, Bret Namihash, Jason Alvarado. Harbor-UCLA, Harbor City, CA.

Email: bpendergraph@lundquist.org

(No relevant relationships reported)

HISTORY: 38-year-old male runner with 4 months of left knee pain and swelling that he noticed worsened with running. He remembers no particular injury, increase in mileage, change in footwear, or systemic symptoms such as night sweats, weight loss, or other joint swelling. He was seen in urgent care with his exam showing an effusion and painful range of motion. He was diagnosed with a knee sprain, MRI ordered, and referred to sports medicine. In our clinic, he complained about anterolateral knee pain, persistent knee effusion, and inability to train because of pain and swelling. He denied locking or giving way.

PHYSICAL EXAMINATION: Left knee with 1-2+ non-warm effusion, range of motion 0-130 degrees, lateral patellar facet tenderness, medial joint line tenderness, Lachman negative, valgus/varus testing stable, McMurray negative for click.


TEST AND RESULTS: X-ray: small joint effusionMRI without contrast: 3. Rheumatologic disorder 4. Pigmented nodular synovitis 5. Synovial chondromatosis

FINAL WORKING DIAGNOSIS: 1. Pigmented nodular synovitis

TREATMENT AND OUTCOMES: 1. Athlete was initially treated with physical therapy for the atraumatic meniscal tear 2. Athlete had persistent effusion, with an aspiration that showed blood. This provoked review of prior MRI with concern of nodularity of synovium. Therefore an MRI with contrast was performed consistent with likely pigmented nodular synovitis 3. Athlete evaluated by orthopedics for arthroscopy and synovial biopsy. Intraoperative findings included diffuse involvement of joint including anterior compartment, medial and lateral gutters, and the notch. Pathology consistent with pigmented villonodular synovitis 4. Post op care complicated by poor progression of range of motion, current 10 to 70 degrees.
B-54 Rapid Fire Platform - Oxygen Uptake Kinetics

Wednesday, May 27, 2020, 3:15 PM - 4:15 PM
Room: CC-Exhibit Hall

851 Chair: Silvia Pogliali, FACSM. Università di Verona, Verona, Italy.
(No relevant relationships reported)

852 May 27 3:15 PM - 3:25 PM
Residual Fatigue Does Not Affect Critical Power and μ’ Using A Single-visit Protocol
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(No relevant relationships reported)

Tradiocally, determining critical power (CP) and its related work above CP (μ’W) requires exhaustive constant-power trials interspersed by at least 24 h rest. During the last decade novel approaches were undertaken to make the protocol less time consuming and to use self-paced ecological time-trials (TT). However, it is debateable whether residual fatigue induced by a single-visit protocol might affect CP and/or μ’W. Parameters of oxygen uptake (VO2) kinetics and muscle deoxygenation can be suggested as suitable to assess the effects of residual fatigue. PURPOSE: Assessing fatigue-related parameters of VO2 kinetics and muscle deoxygenation between a single-visit and a multi-visit protocol. METHODS: Nine well-trained male triathletes (mean ± SD; age: 27.7 ± 4.3 yrs; body mass: 75.6 ± 5.6 kg; VO2peak: 58 ± 6 mL·min/kg) participated. Athletes had to perform a single-visit (2, 5 and 10 min TT, interspersed by 30 min passive rest) as well as a multi-visit determination of CP and μ’W (2, 5 and 10 min TT, interspersed by at least 24 h rest). During all tests, heart rate (HR) was recorded continuously, respiratory gases were measured breath-by-breath (V̇CO2, V̇O2, HR) was recorded continuously and VO2 was measured breath-by-breath using a single-visit protocol (2, 5 and 10 min TT). To compare the two protocols a paired sample t-test was used to assess the differences in CP and μ’W and a two-way ANOVA to assess the differences between trials and/or groups as well as and trials x groups interactions.

RESULTS: No significant differences were found for CP or μ’W between protocols (p > 0.05). Significant main effects between trials were found for HR, VO2peak, VO2max, mean response time (MRT), end-exercise VO2, VO2max, VO2peak, O2 deficit, NIRS τ, amplitude (amplτ), O2 deficit and τ (p < 0.01). A post-hoc analysis of main effects did not reveal significant differences between corresponding trials (p > 0.05).

CONCLUSIONS: Due to non-significant differences in fatigue-related parameters results indicate that the determination of CP and μ’W using a single-visit protocol is not affected by residual fatigue. Consequently, the single-visit TT approach is a valid method to accurately determine CP and μ’W.

853 May 27 3:25 PM - 3:35 PM
Influence Of Body Position On Pulmonary Oxygen Uptake And Muscle Deoxygenation Kinetics During Cycle Exercise
Richie P. Goulding, Dai Okushima, Simon Marwood, Tze-Tuan Lee, Naoriko Kondo, David Poole, FACSM, Thomas J. Barstow, FACSM, Shunsaku Koga, Kobe University, Kobe, Japan. 1Osaka International University, Osaka, Japan. 1Liverpool Hope University, Liverpool, United Kingdom. 1Kobe University, Kobe, Japan. 1Kansas State University, Kansas, KS.
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(No relevant relationships reported)

Whether pulmonary oxygen uptake (VO2) kinetics are limited by O2 delivery remains contentious. Previous studies have demonstrated that the time constant of pulmonary VO2 kinetics (τO2) is greater during supine compared to upright cycle exercise, presumably reflecting the superimposition of an O2 availability limitation. However, interpretation of these studies is compromised by their use of superficial single-site measurements using continuous-wave near-infrared spectroscopy (NIRS), which is unable to determine absolute [heme]. PURPOSE: To determine the impact of body position (i.e. upright [U] vs. supine [S]) on the kinetics of pulmonary VO2 as well as muscle deoxygenation (deoxygen[heme]) kinetics and total[heme] using time-resolved (TR-NIRIS). METHODS: 7 healthy men completed an incremental ramp test to determine VO2max and the gas exchange threshold in the supine position. 4 visits followed whereby pulmonary VO2 and deoxy[heme] kinetics and total[heme] were determined via TR-NIRIS at three muscle sites (deep [VLd] and superficial [VLs] vastus lateralis and superficial rectus femoris [RFs]) in two conditions: 1) during S heavy intensity constant work rate exercise at 40% between ventilatory threshold and VO2 max); and 2) during U exercise at the same absolute work rate. RESULTS: τO2 was increased during S compared to U (S: 42 ± 12 vs. U: 32 ± 9 s, P < 0.05). The fundamental phase deoxy[heme] was greater (i.e. slower) in S compared to U for each muscle site (VLd S: 19 ± 10 vs. U: 8 ± 5 s; VLs S: 16 ± 7 vs. U: 10 ± 3 s; RFs S: 20 ± 7 vs. U: 11 ± 3 s, P = 0.002) and its amplitude was greater in S compared to U for RFs only: (S: 27.4 ± 12.1 vs. U: 9.1 ± 2.5 µM, P < 0.008). Total[heme] did not differ between U and S for any muscle site (all P > 0.05). CONCLUSION: The slowing of pulmonary VO2 kinetics for S versus U occurs concomitant with a depressed rate of muscle(s) deoxygenation. This finding suggests that supine exercise results in a relatively greater fall in muscle VO2 when compared to O2 delivery kinetics at least for VLd and VLs. The increased amplitude of deoxy[heme] in S for RFs suggests an increase in O2 extraction to compensate for impaired muscle perfusion in S compared to U.

854 May 27 3:35 PM - 3:45 PM
Skeletal Muscle Endurance And Oxygen Uptake Kinetics During Cycling In Patients With High Affinity Hemoglobin
Chad C. Wiggins1, Paolo B. Domineilli2, Jonathon W. Senefeld3, John R.A. Shepherd4, Sarah E. Baker5, Koji Uchida1, Michael J. Joyner, FACSM1. 1Mayo Clinic, Rochester, MN. 2University of Waterloo, Waterloo, ON, Canada. (Sponsor: Michael J. Joyner, FACSM)
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(No relevant relationships reported)

Skeletal muscle oxygen (O2) consumption is linked to the metabolic demand of the exercising skeletal muscle. In hypoxic conditions (e.g. high altitude) O2 consumption may be the limiting factor of exercise tolerance. Patients with increased O2 content, secondary to an increased oxygen affinity (HAH), provide an experiment of nature to investigate the effects of increased O2 transport through the O2 transport pathway on exercise tolerance. PURPOSE: To determine the effect of HAH on O2 uptake kinetics and exercise tolerance during high-intensity exercise under normoxia (NORM) and hypoxia (HYP) conditions. METHODS: Five healthy controls (CTL; 4 men, 41±8 years, P50=27±1 mmHg; Hemoglobin concentration ([Hb])= 14.2±1.3 g·dL-1, Hct= 43±4%) and five patients with high-affinity hemoglobin (HAH; 3 men, 37±12 years, P50=15±2 mmHg; [Hb]: 19.8±2.3 g·dL-1, Hct= 59±7%) cycled during unloaded pedaling then at a power output that elicited 85% VO2max until volitional exhaustion during two different environmental conditions: 1) NORM, (F'O2=0.21), and 2) HYP, (F'O2=0.15). O2 uptake kinetics were modeled as a double-expontential rise to maximum from continuous measurements of inspired/expired gases. Two-way ANOVA with group (HAH, CTL) and inspirate (NORM, HYP) as between-subjects factors were used to compare dependent variables. RESULTS: HAH patients had markedly polycythemia (higher [Hb] and Hct, P<0.05 for both). There was no effect of inspirate on any of the parameters of O2 kinetics, all P>0.175. There was no main effect of group or inspirate on VO2 during unloaded pedaling (A, P=0.24), VO2 of the primary component (A, P<0.13), or the VO2 slow component (P>0.10). HAH exhibited a trend towards slower O2 kinetics (HAH=64.3±17.7 vs. CTL=49.2±17.0, P=0.08) and significantly lower primary component amplitude (HAH=1.14±0.66 vs. CTL=1.92±0.67 mL·min-1, P<0.02). There was a trend towards reduced time-to-exhaustion in HYP (P=0.09), but no main effect of group (P=0.21). CONCLUSION: Patients with HAH had slower and blunted VO2 kinetics, which may be due to 1) blunted O2 off-loading to the contracting skeletal muscle or 2) adaptations of skeletal muscle (e.g. myosin heavy chain expression) to HAH.
A bout of prior heavy "priming" exercise typically reduces the time constant of pulmonary VO₂ kinetics (τ_VO₂) in the supine position, an effect that is generally absent during upright exercise. This priming-induced speeding of pulmonary VO₂ kinetics has been attributed to increased muscle oxygenation at the onset of the second bout. However, the extent to which priming-induced improvements in muscle oxygenation status differ across distinct muscle regions, as well as between deep vs. superficial muscle and with respect to body position, remains unknown. PURPOSE: To examine the impact of prior exercise on pulmonary VO₂ and muscle deoxygenation kinetics at three muscle sites (superficial rectus femoris [RFs], deep vastus lateralis [VLd] and superficial vastus lateralis [VLs]) using time-resolved near-infrared spectroscopy during upright (U) and supine (S) exercise.

METHODS: 7 healthy men completed an incremental ramp test to determine VO₂ max and the gas exchange threshold in S. 4 visits followed whereby participants performed two 6-min bouts of heavy exercise separated by 6-min unloaded pedaling in two conditions: 1) during constant power exercise at 40%VO₂max in S; and 2) during exercise at the same absolute work rate in U. Pulmonary VO₂ and muscle deoxy[heme] kinetics were determined during each test.

RESULTS: τ_VO₂ was reduced in bout 2 for RFs (bout 1: 42 s vs. bout 2: 31 ± 7 s, P = 0.016) but not in U (bout 1: 32 ± 9 s vs. bout 2: 28 ± 5 s, P = 0.32). The fundamental phase tdeoxygen[heme] was greater in bout 2 for RFs in both postures (S: bout 1: 20 ± 7 vs. bout 2: 31 ± 18 s; U: 1: 11 ± 3 vs. bout 2: 23 ± 9 s, P = 0.021), whereas it was increased in bout 2 for VLs during U only (bout 1: 10 ± 3 vs. bout 2: 15 ± 4 s, P = 0.028). The fundamental phase muscle deoxygen[heme] amplitude was greater in bout 2 for RFs (P = 0.001) and VLs (P = 0.024) in both U and S. Both the fundamental phase tdeoxygen[heme] and amplitude did not differ between bouts 1 and 2 for VL in either position (both P > 0.05).

CONCLUSION: Prior heavy exercise reduced τ_VO₂ in S but not U. This was accompanied by a greater and slower rate of muscle deoxygenation in superficial but not deep muscle. The contrasting responses of deep and superficial muscle to prior exercise in both U and S suggests that these muscles rely on fundamentally different oxygen transport strategies.

The intent of exposure to mild hyperbaric oxygen (mHBO) is to increase the oxygenation of a person's blood by forcing additional oxygen to dissolve into the blood plasma. There is a lack of substantial evidence regarding responses of exposure to mHBO on microcirculation in peripheral tissues, and this research will provide insight into it. PURPOSE: To determine the beneficial effects of exposure to mHBO on microcirculation in peripheral tissues. METHODS: In this experimental study 15 healthy individuals were exposed to both normobaric (1.00 ATA with 20.9% oxygen) and mHBO (1.4 ATA, Oxygen Concentration 30.8% - 39.5%) in a mild hyperbaric oxygen chamber for 70 minutes in each condition. Peripheral capillary oxygen saturation (SpO₂) and blood flow in capillaries of muscles and skin were measured every 15 minutes during both exposures in the supine position. Repeat measures ANOVA and paired t-test were used for statistical comparisons. An analysis with a p-value <0.05 was considered significant. RESULTS: The mean age of participants was 24.6±4.9 years and mean BMI was 20.5±2.7. Average blood flow in capillaries was increased from 94μm/s to 105μm/s after exposure to normobaric condition whereas average blood flow was increased from 92μm/s to 126μm/s after exposure to mHBO. We found a significant effect of conditions (p<0.008), time (p<0.001) as well as interactional effect (p<0.001). SpO₂ was increased from 97.6% to 99.5% after exposure to mHBO and it was unchanged after exposure to the normobaric condition. We found a significant effect of conditions (p<0.001), time (p<0.001) as well as interactional effect (p<0.001). Conclusion: The results of this study confirm that exposure to mHBO increases oxygen saturation and blood flow in the capillaries of peripheral tissues.
During maximal single-joint knee extension and multi-joint leg extension movements, activation of the vastii knee extensor muscles is similar, however, little is known of the magnitude and etiology of fatigue development when these movements are repeated. 

**Purpose**

To compare the magnitude and etiology of fatigue in the vastii knee extensor muscles following repeated maximal contractions performed through single-joint (knee extension) or multi-joint (leg extension) exercises.

**Method**

On separate days, 16 participants completed 60 maximal unilateral: i) knee extensions on a dynamometer (KEXT) or ii) leg extensions on a cycle ergometer (LEXT). Knee range of motion (~120° - 30° flexion) and angular velocity (~80°·s⁻¹) were matched. Maximal torque, vastii muscle EMG and M-wave amplitude (Mmax) were calculated during the first and last three contractions of both exercises. Knee extensor isometric maximal voluntary force (IMVF), voluntary activation (VA) and resting twitch force (RT10:100 HZ) were measured pre-exercise and 40s-post exercise.

**Results:**

Similar torque (KEXT: 152 ± 33 N·m vs. LEXT: 165 ± 30 N·m, P > 0.05), EMG (KEXT: 95 ± 6% vs. LEXT: 96 ± 8%, P > 0.05) and Mmax (KEXT: 95 ± 5% vs. LEXT: 97 ± 5%, P > 0.05) were measured at the start of the exercises. Larger reductions in torque (KEXT: -60 ± 10% vs. LEXT: -38 ± 14%) and EMG (KEXT: -21 ± 16% vs. LEXT: -13 ± 16%) were seen for KEXT during the final part of the exercise (P < 0.05), whereas no differences were reported in Mmax (P > 0.05). Larger reductions in VA were seen after KEXT whereas greater reductions in RT10:100 Hz were seen after LEXT (both P < 0.05). Ultimately, similar reductions in IMVF were seen following KEXT (-32 ± 10%) and LEXT (-35 ± 13%) (P > 0.05).

**Conclusion:**

A lower-limb resistance training program which adopts multi-joint exercises may improve superior strength gains in vastii knee extensor muscles compared to single-joint exercises, as it is possible to induce larger levels of peripheral fatigue with a smaller reduction in voluntary activation.

876 Board #2 May 27 1:30 PM - 3:00 PM

**Neural And Muscular Responses To Maximal Strength Training**

Eivind Wang1, Håvard Pedersen Håglo2, Stian Kwak Nyberg1, Astrid Kamilla Stunes1, Mats Peder Mosti1, Tiril Teien1. 1Norwegian University of Science and Technology, Trondheim, Norway. 2Molde University College, Molde, Norway. Email: eivind.wang@ntnu.no

**Purpose:** Maximal strength training (MST), performed with heavy loads (~90% of one repetition maximum; 1RM) and few repetitions (4-5), yields large improvements in efferent neural drive and skeletal muscle force generating capacity. However, it is elusive how MST-induced neural adaptations may translate to muscular factors regulating excitation-contraction coupling.

**Methods:** Sixteen healthy young males (24±4 years) were randomized to MST 3 times per week for 8 weeks (n=8), or a control group (CG; n=8). Measurements were taken of 1RM and rate of force development (RFD), and evoked potentials (CV-wave and H-reflex normalized to M-wave) (M in muscles soleus) applied to assess efferent neural drive to maximally contracting skeletal muscle. Biopsies were obtained from the vastus lateralis and analyzed by western blot and qMRA isolation to investigate the protein expression of Sarco-2nphin and CRF2α. Total (SERCA1 and SERCA2) and RyR1 and RyR2. **Results:** 1RM (17±9%; p<0.05) and early (0-100ms), late (100-200ms) and maximal RFD increased (31-53%; p<0.01) in the MST group, accompanied by increased maximal V-M wave ratio (91%; p<0.05), with no change in H-reflex to M-wave ratio. No changes were observed in the CG. No pre- to post-training differences were found in mRNA or protein expression in either group (p>0.05).

**Conclusion:** MST increased efferent neural drive to maximally contracting skeletal muscle, and resulted in improved force generating capacity. The neural adaptations were not reflected in key muscular factors involved in excitation-contraction coupling, indicating that responses to high intensity strength training may predominantly be governed by neural adaptations.

877 Board #3 May 27 1:30 PM - 3:00 PM

**Ten Weeks Of Resistance Training Increased Total Hemoglobin Mass Without Increasing Maximal Oxygen Uptake**

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**Purpose:** Resistance training increases muscles mass whereas maximal oxygen uptake remains normally unchanged. The purpose of the present study was to investigate the effect of 10 weeks resistance training on total hemoglobin mass, lean mass and maximal oxygen uptake in young healthy males.

**Methods:** Thirteen young male subjects (age: 22.2±2.6 years; height: 177.7±3.7 cm) completed 10 weeks of resistance training. The resistance training consisted of 5 weekly sessions of full body resistance training. The training program consisted of 13 exercises; for all exercises 3 sets with 12 repetitions were conducted. Each training session lasted 70-90 min. Body composition was measured with Dual-energy X-ray absorptiometry (DXA), total hemoglobin mass with CO rebreathing method, and maximal oxygen uptake was tested on treadmill.

**Results:** Body mass did not increase significantly during the training intervention (before: 74.5±7.9; after: 77.6±6.2 kg; p=0.30), but fat free mass increased 8.8% (p<0.05). Total hemoglobin mass (Hb) increased from 865.1±70.6 to 981.2±88.9 g (p<0.05) during the training intervention and hematocrit was unchanged. Hemoglobin mass per kg body weight did not increase significantly (before: 11.0±1.7; after: 13.4±1.9 g·kg⁻¹; p<0.25). Maximal oxygen was 3.22±0.47 L·min⁻¹ before and 3.38±0.52 L·min⁻¹ after the resistance training. Maximal oxygen uptake related to body weight did neither change during the training intervention (before: 44.4±4.0; after: 43.7±5.9 ml·kg⁻¹·min⁻¹).

**Conclusions:** Whole body resistance training for ten weeks increased fat free mass and Hb, but VO₂max did not increase. These data show that increased total hemoglobin mass is not sufficient to increase maximal oxygen uptake in young healthy males.

878 Board #4 May 27 1:30 PM - 3:00 PM

**Variation Of Resistance Exercise Intensity Versus Resistance Exercise Selection: The Effects On Strength And Power**

Jonathan Hummel. East Stroudsburg University, East Stroudsburg, PA. (Sponsor: Shala Davis, FACSM)

**Purpose:** To compare the effects of exercise selection variations versus exercise intensity variations on absolute strength and power measures across a 4-week training block for in-season collegiate athletes. **Methods:** 14 Division II collegiate track and field athletes (n = 5 females; n = 9 males; age: 20.7 ± 1.4 yrs; primarily anaerobic based track and field events) participated in one of two 4-week periodized exercise programs: 1) manipulation of resistance training intensity (INT group), 2) manipulation of resistance training exercise selection (EXE group). Exercise selection was held constant in the INT group while the intensity was varied (85%-90%). The EXE group held intensity at a constant but varied the selection of exercises (e.g. pin squat, box squat). The mean intensity and working repetitions across the 4-week block of training were equated across the groups. Absolute strength was assessed with a 1-repetition maximum (1RM) back squat and power was assessed in a vertical jump. **Results:** Both INT (mean improvement: 3.52 kg, p<0.05) and EXE (mean improvement: 3.08 kg, p<0.05) increased 1RM across the training period, but there were no significant differences between the groups (p>0.05). Both groups produced an increase in jump height (INT mean improvement: 0.04 m, p<0.05; EXE mean improvement: 0.04 m, p<0.05) with no significant differences between the groups (p>0.05). **Conclusion:** Variation in training applied through the manipulation of exercise intensity was as effective as that applied through the manipulation of exercise selection for improving strength and power in collegiate track and field athletes during a 4-week block. Both variables are equally important when considering implementation into programming for athletic populations.

879 Board #5 May 27 1:30 PM - 3:00 PM

**Diurnal Sensitivity Of Muscle Force And Acceleration Parameters Of The Upper Limb**


**Purpose:** To detect the optimal time of day for maximum power output and development rate in unilateral row and press motions. **Methods:** We tested 112 physically active male and female subjects on Protexa (Protexa Motion, USA). In total, they performed 2,750 unilateral, isotonic sets, evenly divided between rows and presses. Loads were applied through three-dimensional magnetic resistance at 10lb (862 sets), 15lb (646 sets), 20lb (612 sets), and 25lb (630 sets). Testing was performed at various times over a 14-hour span (6:00am to 8:00pm). For each individual set, Protexa calculated average peak power of all repetitions (PPₜ), average peak force development rate across all repetitions (PFDRₜ), and the highest rate achieved during a single repetition (PFDRₚₜ). Mixed model ANOVA with repeated measures tested the differences in these parameters between push and pull motions, loads applied, and

Novel technology permits more precise investigation of motor function. Limited data exist on diurnal variation in force and acceleration parameters of the upper limb. **Purpose:** To detect the optimal time of day for maximum power output and development rate in unilateral row and press motions. **Methods:** We tested 112 physically active male and female subjects on Protexa (Protexa Motion, USA). In total, they performed 2,750 unilateral, isotonic sets, evenly divided between rows and presses. Loads were applied through three-dimensional magnetic resistance at 10lb (862 sets), 15lb (646 sets), 20lb (612 sets), and 25lb (630 sets). Testing was performed at various times over a 14-hour span (6:00am to 8:00pm). For each individual set, Protexa calculated average peak power of all repetitions (PPₜ), average peak force development rate across all repetitions (PFDRₜ), and the highest rate achieved during a single repetition (PFDRₚₜ). Mixed model ANOVA with repeated measures tested the differences in these parameters between push and pull motions, loads applied, and
times of day. Linear regression models isolated the effect of time on performance holding other influential factors constant. RESULTS: Across all movements, loads, and times, PPw increase was 15.4 ± 11.4 w; PPw decrease was 254.1 ± 120.0 w; PFDR was 1,036.1 ± 631.6 w/s; and PFDR was 1,243.4 ± 789.6 w/s. Differences in both PP and PP were detected by time of day (p<0.001) and load (p<0.001). The highest PP values were achieved between 2:00pm and 4:00pm. Similar relationships were found with time in PFDR (p<0.001) and PFDR (p<0.001). Holding constant the subject performing the set, arm dominance, exercise being performed, and the load protocol employed, but this yet to be appropriately tested.

Our findings demonstrate random variations in power parameters of the upper limb, with optimal performance occurring in the afternoon.

Board #6
May 27 1:30 PM - 3:00 PM
Assessing True Variability And Mean Changes To Two Distinct Resistance Training Protocols
Scott J. Dankel1, Zachary Bell2, Robert Spitz2, Vickie Wong2
1Rowan University, Glassboro, NJ. 2The University of Mississippi, Oxford, MS. 3University of South Florida, Tampa, FL. 4Lindenwood University, Belleville, IL. 5Troy University, Troy, AL. (Sponsor: Jeremy Loenneke, FACSM)

(Millions of dollars are spent analyzing inter-individual differences in response to resistance exercise, but the lack of a non-exercise control group makes it possible that these studies may simply be examining random error. Furthermore, it has been hypothesized that the magnitude of variability may differ depending upon the exercise protocol employed, but this yet to be appropriately tested.

PURPOSE: To determine differences in two distinct resistance training protocols and whether true variability could be detected after accounting for random error.

METHODS: Individuals (n=151) were randomly assigned to one of three groups: (1) a traditional exercise group increased ultrasound measured muscle thickness (~0.23 cm across all sites; all BF10 ≥ 224). Across both training groups, the only differential effect was age: 17.4±0.7 yrs, height: 174.9±5.8 cms, mass: 84.7±26.5 kgs) or a full ROM RT (n=11; age 33.0±9.6y, height 174.2±11.2cm; weight 72.4±18.1 kg). RT consisted of two RT sessions per week (squat, bench press, arm and leg flexion and extension). Measurements were taken prior to and post RT, and after DTR. Body composition was assessed using BIA. Strength measurement (10-RM) was done to various reasons, resulting in 36 subjects included for further analysis (HV female n=10, male n=10; age 32.9±11.8y, height 174.2±5.4cm; weight 70.3±13.5kg) or HV RT (female n=11; male n=11; age 33.0±9.6yr, height 174.2±11.2cm; weight 72.4±18.1 kg).

RESULTS: Both 1RM (2.3kg; BF10 = 4.791e+6) and traditional training groups increased muscle thickness (BF10 = 224). Across both training groups, the only differential responses were made using two-way ANOVA with repeated measures. Six subjects were eliminated from the study due to various reasons, resulting in 36 subjects included for further analysis (HV female n=10, male n=8; LV female n=9, male n=9). Compliance was 100%. Comparisons were made using t-tests (two-tailed). Significant differences were observed in arm flexion (p<0.001), bench press (p<0.001), arm extension (p<0.001), leg press (p<0.001), and squat (p=0.039) decreased to within the parameters of this study, PMT is as effective and may be more effective than full ROM RT for increasing lower body strength and power.

Board #8
May 27 1:30 PM - 3:00 PM
Strength Adaptations And Body Composition Changes Following High Vs. Low Volume Resistance Training And Detraining
Simon Gavanda1, Sascha Schrey1, Julia Christine Eyer2, Stephan Geisler1, Jillian Mouser3
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No relevant relationships reported

Resistance training (RT) is used for improving strength and body composition. However, it is still under debate whether higher RT volume (HV) is necessary in novices, or if lower volume (LV) is equally effective. In addition, effects of detraining (DTR) following HV and LV RT are not well understood.

PURPOSE: To determine the effects of a 12-week HV program (3 sets, 10 repetitions) compared to LV (1 set, 10 repetitions) to concentric muscle failure on strength and body composition, followed by four weeks of DTR in male and female subjects.

METHODS: Forty-two untrained subjects were randomly assigned to either LV (female n=10; male n=10; age 32.9±11.8y; height 174.2±8.4cm; weight 70.3±13.5kg) or HV RT (female n=11; male n=11; age 33.0±9.6yr; height 174.2±11.2cm; weight 72.4±18.1 kg). Results of two RT sessions per week (squat, bench press, arm and leg flexion and extension). Measurements were taken prior to and post RT, and after DTR. Body composition was assessed using BIA. Strength measurement (10-RM) was done using the aforementioned exercises. Six subjects were eliminated from the study due to various reasons, resulting in 36 subjects included for further analysis (HV female n=10, male n=8; LV female n=9, male n=9). Compliance was 100%. Comparisons were made using two-way ANOVA with repeated measures.

RESULTS: Both groups increased strength through RT with no difference between groups (squat vs. LV 31.7%, p<0.001). Body mass (p=0.182), fat mass (p=0.238), and fat-free mass (p=0.039) decreased to within the parameters of this study, PMT is as effective and may be more effective than full ROM RT for increasing lower body strength and power.

Board #7
May 27 1:30 PM - 3:00 PM
Progressive Movement Training: An Analysis Of Its Effects On Muscular Strength And Power Development
Orrin Whaley, Abigail Larson, Mark DeBeliso, FACSM, Southern Utah University, Cedar City, UT. (Sponsor: Mark DeBeliso, FACSM)

(Muscular strength and power are important attributes in many sports, so research on resistance training (RT) methods that may improve these attributes are of great interest. One such RT method is Progressive Movement Training (PMT) which incorporates a partial range of movement (ROM) with a supramaximal load. PURPOSE: This study compared the effects of PMT and traditional full ROM RT on the 1-RM back squat (BSQ), vertical jump (VJ) height, and power output (PO). METHODS: High school male participants were randomly assigned to either a PMT RT group (n=21; age: 17.4±0.7 yrs, height: 174.9±5.8 cms, mass: 84.7±26.5 kg) or a full ROM RT group (n=15; age: 17.3±0.7 yrs, height: 175.9±8.8 cms, mass: 82.1±14.9 kg). The experimental groups then engaged in a 7-week intervention period using either the PMT or full ROM BSQ modality in order to target lower body strength and power. The participant’s body weight, 1-RM BSQ and VJ were measured prior to and upon completion of the intervention period. PO was calculated using the Lewis formula. No additional lower body auxiliary movements were performed in the study. Dependent t-tests (two-tailed) were used to compare the dependent variables (DV’s) from pre to post RT intervention within experimental groups. Independent t-tests (two-tailed) were used to compare the gain scores for each of the DV’s between experimental groups.

RESULTS: The PMT group improved significantly from pre to post intervention period for all DV’s: 1-RM BSQ (pre: 96.0±3.78, post: 110.6±3.70 kg), VJ (pre: 55.8±8.0, post: 59.4±9.5 cm) and PO (pre: 1365.8±410.7, post: 1417.2±394.7 W) (p<0.01). The full RO group improved significantly from pre to post intervention period for the 1-RM BSQ only (pre: 91.3±23.3, post: 102.3±19.4 kg) (p<0.01), VJ (pre: 59.3±9.8, post: 60.7±10.6 cm) (p<0.05) and PO (pre: 1359.3±203.9, post: 1397.1±221.8 W) (p<0.05). When comparing gain scores between each group there were no significant differences between the PMT and full ROM groups for any of the DV’s (p<0.05).

Within the parameters of this study, PMT is as effective and may be more effective than full ROM RT for increasing lower body strength and power.

Board #9
May 27 1:30 PM - 3:00 PM
Effect Of Gender And Body Type On Strength Gain From Different Modes Of Resistance Training
Jerry L. Mayhew1, William F. Brechue, FACSM2, Monica L. Hunter1, Jenna L. Arabas1, Liz Jorn1, Bryann Mann3
1Truman State University, Kirksville, MO. 2, Monica L. Hunter1, Jana L. Arabas1, Liz Jorn1, Bryann Mann3

Jerry L. Mayhew1

(No relevant relationships reported)

The discussion of the influence of body type on potential to gain strength from resistance training (RT) is a relatively new field of investigation. What has not been
explore the degree to which body type might impact the potential difference for strength gains between men and women. PURPOSE: To determine the influence of sex and body type on changes in upper-body strength resulting from free-weight RT in college men and women. METHODS: College men and women were measured for fat mass (FM) and fat-free mass (FFM) determined from gender-specific skinfold equations. Body type was determined by regressing FM/FFM on FM/FFM for each sex and partitioned into thirds (slender, average, and solid). Men and women were matched for body type: SL (men = 40, women = 44), AV (men = 51, women = 57), and SO (men = 60, women = 43). RM bench press was measured before and after 12 weeks of linear periodization free-weight RT performed 3 times/week in 3 sets of 6 overall body exercises. RESULTS: Sex x body type ANOVA on absolute strength revealed significantly greater (p=0.001) gains by men (6.8 ± 8.4 kg) than women (4.2 ± 3.0 kg) but no significant difference (p = 0.15) across body types (SL: 6.5 ± 9.8 kg; AV: 5.3 ± 5.9 kg; SO: 5.2 ± 5.4 kg). The sex x body type interaction was not significant (p = 0.60). Absolute strength gains were poorly correlated with initial strength (r = 0.01, r = 0.10, respectively) and body type (r = 0.00, r = -0.11, respectively) in men and women. Sex x body type ANOVA on relative strength gain indicated a significantly greater (p=0.004) gain by women (14.0 ± 12.7%) than men (9.9 ± 12.6%) but no significant difference among body types (SL: 13.8 ± 15.3%, AV: 11.9 ± 14.2%, SO: 11.0 = 11.1%). The sex x body type interaction was not significant (p = 0.38). Relative strength gains were significantly correlated with initial strength in both men (r = -0.27) and women (r = -0.34) as well with body type (r = 0.06) and r = -0.07 respectively). CONCLUSIONS: When following the same RT program, men make a greater absolute gain but women make a greater relative gain in upper-body strength. Body type does not seem to influence the degree of absolute or relative strength gain in RT in either sex. Initial strength level has little influence on the amount of strength to be gained during short-term training.

884 Board #10 May 27 1:30 PM - 3:00 PM
Acute Response Of Blood Glucose After Two Resistance Training Protocols With Different Execution Velocities
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PURPOSE: Studies have demonstrated that a single session of resistance training (RT) can reduce glycemia in subjects with or without diabetes. The aim of this study was to compare the acute response of blood glucose after 2 resistance training protocols with different execution velocities in amateur weightlifting athletes.

METHODS: A randomized clinical trial was conducted in 24 amateur weightlifting athletes (23.5 ± 6.2 years). The participants were randomized to 2 groups: high velocity (MV, n=12) or low velocity (LV, n=12). The RT training protocol was based on a session with these characteristics: 3 sets of 12 repetitions at 60% of a maximum repetition in each of the exercises (bench press, squat and military press). The only difference between the training session was that MV group performed all the repetitions at 100% of their maximum velocity and the LV group performed at 50%. This variable was controlled with the T-force system. An oral glucose tolerance test (OGTT) was conducted with metabolic measurements immediately after each RE protocol and every 30 min until 120 min of recovery. For the statistical analysis, the area under the blood glucose curve (AUC) was calculated at each time point. Cohen’s d effect size were also calculated to determine the magnitude of the group differences. The criteria to interpret the magnitude of the ES was as follows: trivial (< 0.2), small (0.2–0.49), moderate (0.50–0.69), large (0.7–2.0), or very large (> 2.0)

RESULTS: The response of blood glucose following each protocol and OGTT was similar in all groups, reaching the glycemic peak at 30 min of recovery. However, the MV group exhibited significantly lower values in the AUC when compared with LV group over two hours monitoring period (P=0.021, ES=1.198).

CONCLUSIONS: The present study showed that RT at different velocities can generate different metabolic responses. In conclusion, the results of this study indicated that RT at high velocity could be the optimum for postprandial glycemic control.

886 Board #12 May 27 1:30 PM - 3:00 PM
Muscle Damage And Inflammatory Response From Resistance Exercise With Higher Vs Lighter Loads
Gilmar Weber Senna1, Estevão Scudese2, Paola Paraguassu Brandão1, Matheus Bafi1, Breno Vargas1, Leandro Guimarães1, Gabriel Bronzeri1, Flavia Soares Carrilho1, Cristiano Queiroz de Oliveira1, Fabiana Rodrigues Scarton1, Estélio Herinque Martin Dantas1, 1Catholic of Petrópolis University, Petrópolis, Brazil. 2Federal University of State of Rio de Janeiro, Rio de Janeiro, Brazil. 3Tirantesent, Petrópolis, Petrópolis, Brazil. (No relevant relationships reported)

Resistance exercise is considered the most efficient strategy for strength, power, and muscle endurance enhancement. PURPOSE: The aim was to analyze the effects of different resistance exercise (RE) loads on inflammatory response and muscle tissue damage. METHODS: Ten trained men with at least one year of resistance training were selected (26.40 ± 4.73 years, 80.71 ± 8.95 kg, 176.03 ± 6.11 cm, 9.86 ± 3.25% body fat, bench press relative strength: 1.27 ± 0.27 kg/kg-1 of body mass), and alternately ordered to perform two separate visits. The first consisted of five submaximal sets of 10 repetitions at 80% of 1RM, and the second consisted of five submaximal sets of 20 repetitions at 40% of 10-RM, for the horizontal bench press and leg press exercises with one-minute of rest, guaranteeing the volume equalization between men and women.

RESULTS: A randomized clinical trial was conducted in 24 amateur weightlifting athletes. Blood cell and cytokine concentrations were measured immediately after RT and partitioned into thirds for each sex as slender (SL), average (AV), and solid (SO). Sex (M vs. W, n = 23), AV (men = 43, women = 18), and SO (men = 44, women = 16). Each participant was partitioned for 1RM bench press before and after 12 weeks of linear periodization RT in 3 sets of 6 exercises. RESULTS: Sex x body type ANOVA on absolute strength revealed significant difference between sexes (M = 6.3 ± 5.7 kg, W = 4.5 ± 5.0 kg) or across body types (SL = 6.0 ± 5.8 kg, AV = 6.0 ± 5.7 kg, SO = 6.5 ± 4.9 kg). The sex x body type interaction was not significant (p = 0.60). The criteria to interpret the magnitude of the ES was as follows: trivial (< 0.2), small (0.2-0.59), moderate (0.60-1.19), large (1.2-2.0), or very large (> 2.0)

CONCLUSIONS: Untrained men and women of comparable body types appear to make similar gains in upper-body strength when following the same periodized free-weight RT program. The level of initial strength seems to have little bearing on the amount of strength that can be gained during training.

887 Board #13 May 27 1:30 PM - 3:00 PM
Ischemic Preconditioning Of Thigh Muscles: Number Of Proper Repetitions And Effectiveness
Akeru Ishizawa1, Koichi Okita2, Hisato Tanaka2, Kenji Tao1, Noriteru Morita1, 1Hokusho University, Ebetsu, Japan. 2Hokkaido University of Education, Iwamizawa, Japan. (No relevant relationships reported)

Ischemic preconditioning (IPC) was introduced after it was demonstrated that repetitions of short-term ischemia and reperfusion of coronary arteries can reduce the myocardial damage following prolonged ischemia (direct IPC). It was later shown that the IPC of coronary arteries also protects remote cardiac tissue not directly exposed to IPC (remote IPC). Several studies suggested that the IPC of a limb may protect the total leukocyte count, neutrophils, lymphocytes and monocytes between different loads conditions. Supported by CAPES Brazil 2.034.766.
remote organs against an ischemic incident. Because of the intermittent nature of blood flow during intense muscle actions, it was proposed that IPC prior to exercise could increase muscular performance. Although most of the prior exercise studies used an IPC protocol involving four cycles of 5-min circulatory occlusion followed by a 5-min reperfusion period, the optimal number of repetitions of IPC has been unknown.

**PURPOSE:** We examined the effects of direct IPC on thigh strength and sought to determine the optimal repetitions of IPC for successful results. **METHODS:** In a randomized cross-over study, 12 healthy young males (19.8 ± 2.1 yrs, body mass index: 22.1 ± 2.7 kg/m²) performed maximal knee extension (Biodex System 3; New York, USA) of the right leg preceded by direct IPC at four different repetitions (1, 2, 3, and 4 sets) and a control intervention. One IPC consisted of 5-min circulatory occlusion by 1.3-times systolic blood pressure and 5-min reperfusion. **RESULTS:** There was no significant difference in the maximal voluntary torque of knee extension between the control and any number of repetitions of the IPC, as shown below.

<table>
<thead>
<tr>
<th>MVT</th>
<th>Control</th>
<th>1 set</th>
<th>2 sets</th>
<th>3 sets</th>
<th>4 sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>60°/sec, Nm</td>
<td>287.3 ± 46.3</td>
<td>275.3 ± 46.3</td>
<td>276.4 ± 47.1</td>
<td>270.2 ± 52.0</td>
<td>262.6 ± 44.5</td>
</tr>
<tr>
<td>180°/sec, Nm</td>
<td>191.9 ± 25.2</td>
<td>190.0 ± 23.6</td>
<td>190.5 ± 20.4</td>
<td>199.3 ± 31.6</td>
<td>188.3 ± 22.7</td>
</tr>
<tr>
<td>300°/sec, Nm</td>
<td>144.7 ± 21.4</td>
<td>150.0 ± 17.4</td>
<td>144.7 ± 15.3</td>
<td>146.2 ± 16.7</td>
<td>141.7 ± 16.4</td>
</tr>
</tbody>
</table>

MVT, maximal voluntary torque; Nm, newton meter. Data are mean ± SD (n=12).

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**CONCLUSIONS**

Previous, our laboratory introduced a regression equation for predicting net kcal consumption of a resistance exercise (RE) bout: Total net kcal = 0.874(height, cm) - 0.596(age, years) - 1.016(fat mass, kg) + 1.638(lean mass, kg) + 2.461(total volume x 10⁻³) - 10.742 (R²=0.773, SEE=28.5 kcal). **PURPOSE:** The purpose of this study was to validate this regression equation using the same variables as predictors. **METHODS:** Forty-seven healthy, active subjects (23 men, 24 women, 20-58 yrs, 173.5 ± 10.5 cm, 85.5 ± 19.0 kg, VO₂max 36.0 ± 8.4 ml/kg/min) were randomly divided into validation and cross-validation groups (n₁ = 24, n₂ = 23). The validation group's data was used to develop an equation to predict net kcal consumption, which was applied to the cross-validation group’s data to estimate net kcal consumption. Similarly, a prediction equation was derived from the cross-validation group’s raw data and applied to that of the validation group. The strength of the relationship between each group’s measured and estimated net kcal consumption was assessed via correlational analysis.

**RESULTS:** Multiple linear regression yielded the following estimates of net kcal consumption: validation net kcal = 1.125(height, cm) - 0.662(age, years) - 0.800(fat mass, kg) + 1.344(lean mass, kg) + 2.278(total volume x 10⁻³) - 144.846 (R²=0.751, p < 0.001), SEE=29.7 kcal); cross-validation net kcal = 0.515(height, cm) - 0.662(age, years) - 0.800(fat mass, kg) + 1.344(lean mass, kg) + 2.278(total volume x 10⁻³) - 95.988 (R²=0.823, p < 0.001), SEE=29.2 kcal). These equations had a cross-validation coefficient of 0.902 and a double cross-validation coefficient of 0.863.

**CONCLUSION:** The strong relationship between the measured and estimated net kcal consumption of both the cross-validation and validation group lead us to conclude that the regression equation derived by this laboratory is valid for estimating net energy expenditure for a total RE bout.

ACSM May 26 – May 30, 2020
San Francisco, California
RESULTS: In both horizontal and vertical pull motions, there was a significant difference by load (p<0.001) and an interaction effect by sex (p=0.001). The expression of power was most similar between men and women at the lowest resistance horizontally (p=0.020) and vertically (p=0.038); both deviated more as weight increased. No plateau were detected in either condition. Higher loads were required for both sexes to achieve peak power. In horizontal and vertical push motions, there was a significant difference by load (p<0.001) and an interaction effect by sex (p=0.001). Men and women were closest in power at 7lb horizontally (p=0.017) and vertically (p=0.004). Women experienced a plateau at 21lb; further change was insignificant both horizontally (p=0.147) and vertically (p=0.519). Men did not exhibit a plateau; power continued to increase from 21lb to 28lb (p<0.001).

CONCLUSIONS: In our population, the power produced between sexes was similar in press motions, but differed in pulls. By assigning sex-specific training loads, athletes can optimize performance.

Pushing and pulling occurs in athletic and nonathletic settings. Weaknesses in either movement could compromise sport performance or daily functioning. Determination of optimal load may aid in sport performance and reduce the risk of injury. PURPOSE: To determine power output differences between men and women using colinear resistance. METHODS: We enrolled 32 recreationally active men (n=14) and women (n=18), ages 18-25, to evaluate power profiles in horizontal and vertical push and pull exercises using Proteus (Proteus Motion, USA), which applies continuous, three-dimensional, concentric resistance. Subsequent data collection involved 2 repetitions with the dominant arm at 7lb, 14lb, 21lb, and 28lb in each exercise (32 total repetitions). Proteus software computed power output in watts for each set performed. Analysis of variance (ANOVA) with repeated measures tested the differences in power output at each load.

RESULTS: In both horizontal and vertical pull motions, there was a significant difference by load (p=0.001) and an interaction effect by sex (p=0.001). The expression of power was most similar between men and women at the lowest resistance horizontally (p=0.020) and vertically (p=0.038); both deviated more as weight increased. No plateau were detected in either condition. Higher loads were required for both sexes to achieve peak power. In horizontal and vertical push motions, there was a significant difference by load (p<0.001) and an interaction effect by sex (p=0.001). Men and women were closest in power at 7lb horizontally (p=0.017) and vertically (p=0.004). Women experienced a plateau at 21lb; further change was insignificant both horizontally (p=0.147) and vertically (p=0.519). Men did not exhibit a plateau; power continued to increase from 21lb to 28lb (p<0.001).

CONCLUSIONS: In our population, the power produced between sexes was similar in press motions, but differed in pulls. By assigning sex-specific training loads, athletes can optimize performance.
in blood lactate concentration and lifting velocity during and after the application of the two protocols for strength gain and muscle hypertrophy. However, blood lactate concentration was significantly higher in men than in women.

### RESULTS

- The experimental group believed the strength training program improved their running kinematics or kinetics during running. Survey responses showed 64% (n = 7) of the experimental group believed strength training had a considerable effect on their running technique.

### CONCLUSIONS

Strength training appears to improve runners’ physical and task-specific self-efficacy, and increased confidence may facilitate faster running performance and 79% (n = 7) of the experimental group believed strength training had a considerable effect on their running technique.

**PURPOSE**: This study is one part of a Randomized Controlled Trial investigating the effect of strength training on distance runners’ mechanics and performance. The aim of this study was to examine runners’ perceptions of the strength training intervention.

**METHODS**: Thirty distance runners (18 male, 12 female) were recruited for this study. In addition to their normal running training, the experimental group undertook strength training two days per week for 10 weeks. Total training time was matched, with the control group performing additional low-intensity running and body-weight exercises. Running performance and biomechanics during submaximal running (3.8 m/s) and maximal sprinting were assessed immediately before and after the intervention period. At the completion of the 10 week intervention period, the strength training group were also surveyed on their perceptions of the strength training intervention using an online questionnaire in Qualtrics.

**RESULTS**: Twenty-eight participants completed follow-up testing. Strength training significantly improved two kilometre running performance (F(1,26) = 10.497, p = .003, partial η² = .288) more than running training alone. The mean (95% CI) difference between groups was 11.31 (3.73 to 18.98) seconds. However, strength training did not change maximal aerobic capacity, running economy (3.3 m/s) or lower-limb joint kinematics or kinetics during running. Survey responses showed 64% (n = 9 of 14) of the experimental group believed the strength training program improved their running performance and 79% (n = 11) reported they would continue using strength training. Half (n = 7) of the experimental group believed strength training had a considerable effect on their running technique.

**CONCLUSIONS**: Strength training appears to improve runners’ physical and task-specific self-efficacy, and increased confidence may facilitate faster running performance. This study also demonstrated a discrepancy between measured and perceived effects of strength training on running technique.
perceived exertion (RPE) is a widely accepted measure of internal load, various types of RPE have been used and compared. PURPOSE: To elucidate the effects of myofascial decompression through CT on respiratory gas exchange and hip extensor force production in runners.

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(No relevant relationships reported)

Effect of Cupping Therapy On Respiratory Gas Exchange And Hip Extensor Force Production In Runners

Board #26 May 27 1:30 PM - 3:00 PM

Are All Running Workloads Created Equal?

Megan R. Ryan1, Tayler M. Vickery1, Adriana Miltko1, Richard T. Beltran1, Christopher Napier2, Max R. Paquette1. 1University of Memphis, Memphis, TN. 2University of British Columbia, Vancouver, BC, Canada. (Sponsor: Douglas W. Powell, FACSM)

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(No relevant relationships reported)

Are All Running Workloads Created Equal?

Board #25 May 27 1:30 PM - 3:00 PM


to quantify external loads (vertical ground reaction forces; vGRFs) during running in ecologically valid settings. PURPOSE: Develop models to accurately estimate vGRF second (“active”) peaks during running from iliac crest and sacrum accelerations.

METHODS: Anthropometric and sex data were collected from 40 runners. Runners wore inertial measurement units (IMUs) (±100g, ±200deg/s, 1000Hz) secured to their iliac crest and sacrum while they ran a 25m track with embedded force plate (1000Hz). Speed, IMU accelerations, and force plate data were synchronously recorded for ten sessions per foot at “slow”, “typical”, and “fast” self-selected speeds. Accelerations were transformed to a segment coordinate system. Force and acceleration signals were 50Hz low-pass filtered and divided into 0-8Hz low frequency (LoF) and ≥10Hz high frequency (HiF) signals. Acceleration and vGRF peaks were extracted from the original, LoF, and HiF signals. Two multiple linear regressions were created to estimate log-transformed vGRF second peak: One used sacrum accelerations to predict the original, LoF, and HiF signals. Two multiple linear regressions were created to predict vGRF second peak during running from iliac crest and sacrum accelerations.

RESULTS: Both models predicted observed vGRF second peaks well (r²=0.78, mean absolute error <7%). Additon of participant as a random effect (r²=0.03, mean absolute error <6%) further improved results. CONCLUSIONS: The models developed here demonstrate a single IMU secured over the iliac crest or sacrum can estimate isplilateral or bilateral vGRF second peak, respectively, with high accuracy. This approach could greatly impact our understanding of RRI by facilitating quantification of the step-by-step external forces experienced by runners over long time periods in ecologically valid settings. Supported by an ACSM Doctoral Student Research Grant, a Sigma Xi Grant-in-Aid of Research, the Maury Hall Endowed Fellowship for Musculoskeletal Biomechanics Research, and an NSERC Post-Graduate Scholarship.

Monitoring Method

Figure 1. Box plot of week-to-week percent change among different methods of training monitoring. Force (estimated cumulative peak vertical force from combination of wireless force insole peak vertical GRF and cadence), Bone Stimulus (metric from |IMeasure| MU-Step software), and Minutes were used as the external load measures in combination with sRPE to calculate three difference training WLs: #: different than Minutes.

900 Board #26 May 27 1:30 PM - 3:00 PM

Acute Physiological And Cognitive Responses During A 100-mile Ultramarathon

Laura Wheatley, Ellis Jensen, Nathan Jensen, Adam Clawson, Taran Bailey, Andrew Creer.

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(No relevant relationships reported)

Participation in ultra-running events, particularly 100-mile races, is rapidly increasing, yet the physiological demands and dynamics during these events are not well-

Literature on the efficacy of cupping therapy (CT) is limited. Potential mechanisms of action of cupping therapy include increased localized blood and restructuring of fascial protein conformations through mechanotransduction, which has implications for improved running economy (RE) and hip extensor force production (HEFP).

PURPOSE: To elucidate the effects of myofascial decompression through CT on RE and HEFP in well-trained runners. METHODS: Five minutes of CT or placebo gel was applied to bilateral gluteus maximus, biceps femoris, semimembranosus, and semitendinosus of 7 female (29 ± 2.1 yrs, 1.68 ± 0.06 m, 60.2 ± 3.4 kg) and 8 male (27.5 ± 6.2 yrs, 1.77 ± 0.04 m, 69.1 ± 4.0 kg) well-trained runners (female 10-km time = 41.4 ± 4.4 min, male 10-km time = 33.5 ± 1.2 min) after a 10-minute treadmill warm-up. Maximal HEFP was measured immediately post CT or gel using an isokinetic dynamometer. Then RE was measured using two 6-minute steady-state treadmill runs (fixed velocity and subject 10-km velocity). Maximal oxygen consumption (VO2max) test followed the RE tests. All subjects performed both conditions in randomized order separated by at least 1 week, but not more than 3 weeks. Maximal HEFP, RE, respiratory exchange ratio (RER) during steady-state, and VO2 max after CT and gel were compared independently using paired two-sample t-tests. Effect size for all variables was calculated using Cohen’s d. RESULTS: Maximal HEFP was not significantly different between conditions (CT: 1.63 ± 0.47 Nm/kg; 1.51 ± 0.40 Nm/kg, p = 0.18, d = 0.29). There was no difference in RE expressed as %VO2max between CT and gel (fixed = 76.9 ± 10.6% of VO2max vs. 76.6 ± 10.5% of VO2max, p = 0.72, d = 0.02; 10-km = 84.2 ± 7.2% of VO2max vs. 83.7 ± 6.9% of VO2max, p = 0.17, d = 0.07). There was no difference in RER, max between CT and gel (65.1 ± 9.1 ml/kg/min vs. 65.0 ± 10.3 ml/kg/min, p = 0.96, d = 0.004); however, RER was significantly increased by CT compared to gel (fixed = 0.92 ± 0.06 vs. 0.90 ± 0.04, p = 0.04, d = 0.32; 10-km = 0.94 ± 0.04 vs. 0.92 ± 0.03, p = 0.02, d = 0.52). CONCLUSIONS: Acute cupping therapy increases steady-state carbon dioxide expiration in well-trained runners without changing oxygen consumption. This has implications for enhanced buffering from putative increased localized blood.

901 Board #27 May 27 1:30 PM - 3:00 PM

Acute Physiological And Cognitive Responses During A 100-mile Ultramarathon

Laura Wheatley, Ellis Jensen, Nathan Jensen, Adam Clawson, Taran Bailey, Andrew Creer. Utah Valley University, Orem, UT.

Email: laura.wheatley@uvu.edu

(No relevant relationships reported)
endurance training program. One group supplemented the aerobic endurance training program with FBP (FBP; n=8, 34.8±5.5 yrs, 25.3±2.8 kg/m²), and one completed the same aerobic endurance training program, but not the FBP (CON; n=8, 28.8±5.4 yrs, 22.7±2.3 kg/m²). The 4-week running program consisted of 3 days of low intensity running (i.e. below aerobic threshold heart rate), and 1 day of high intensity interval running (i.e. above ventilatory threshold heart rate) per week. FBP consisted of daily physical exercise completed at rest, and nasal breathing completed during low intensity running sessions. VO2max tests were conducted before (PRE) and after (POST) 4-weeks of training. Testing included a breathing hold test (BOLT) followed by a treadmill VO2max test using a progressive workload. During the VO2max test subjects wore a secure piece of tape covering their mouth under a face mask and were instructed to perform the VO2max test to the best of their abilities using this induced nasal breathing condition. When they felt that they could no longer run with nasal breathing, the tape was removed, and the test continued under normal breathing conditions until VO2max was reached. The maximal running time using nasal breathing only (MNRT) and maximal nasal breathing oxygen uptake (MBNO2) were recorded and data were assessed using a two-way ANOVA (p < 0.05). RESULTS: There were no significant time effects in MNRT (+58.7 sec, p=0.038), MBNO2 (+2.34 ml/kg/min, p=0.007), and VO2max (+1.26 ml/kg/min, p=0.028), suggesting the training stimulus was adequate for the relatively short training program. CONCLUSION: This study demonstrated that the 4-week supplementary functional breathing protocol was effective in increasing breath hold time at rest, but not MNRT, MBNO2, and VO2max in recreational runners.

Methods: Nine registered participants (age 46 ± 9.5 yrs, weight 74.0 ± 6.1 kg, height 176.4 ± 7.8 cm.) completed the 100-meter distance (Finish time 24.02 ± 3.23 hrs.). Measurements were collected pre-race, at each 20-mile interval (20, 40, 60, 80), and post-race. Measurements included lap time, foot volume, cognition, and reaction time. Foot volume was measured by making a figure-8 with cloth tape around the subject’s bare foot and ankle. Cognitive performance was assessed using mental calculation and reaction time tests via iOS applications. The mental calculation test involved solving as many equations possible in 100 s, while the reaction test required the participant to tap the screen as many times as possible in 30 s. Comparisons were made across the 20-mile intervals using repeated-measures ANOVA. RESULTS: While the duration to complete each 20-mi. lap significantly differed throughout the race (F4,20=7.896, p=0.001), no differences were found in foot volume (F5,15=2.13, p=0.118), reaction time (F5,10=945, p=0.493), or cognition (F5,20 = 896, p=0.503). CONCLUSIONS: A relatively flat-terrain 100-mile distance does not elicit cognitive exhaustion or significant foot swelling. More research is needed to determine if there are other physiological or metabolic variables correlated with high DNF rates, and to compare these data to those of more “challenging” courses with greater elevation gain/loss.

Research has shown that women are returning to sport as soon as two weeks after birth with most resuming running by two months postpartum. There are significant musculoskeletal and physiologic changes during pregnancy as well as the effects of childbirth that a postpartum runner to recover from to return to running. PURPOSE: To examine the differences in strength, range of motion (ROM), and, flexibility between postpartum runners (PP) and nulliparous controls (NC). METHODS: Healthy postpartum (up to 3 years) and nulliparous runners were recruited from local running groups. Three trials of strength, ROM and flexibility of the hip, knee and ankle were collected using a hand held dynamometer, inclinometer or goniometer respectively and then averaged. An independent samples t-test was performed to compare groups. RESULTS: 28 runners participated (14 PP, 14 NC) and were matched for BMI (24.2 kg/m²). There were no significant differences in strength of the hip, knee and ankle between the groups. Right and left ankle dorsiflexion was significantly greater in PP compared to NC (Right Dorsiflexion: PP, 4.67±4.59°; p=0.032; Left Gastrocnemius: PP, 8.48±3.39°; NC, 4.5±5.23°; p=0.026). When breastfeeding, hormones that influence elasticity like estrogen and progesterone affect the muscles, joint ligaments and tendons, possibly creating an increase in ROM after pregnancy. Future studies are needed to determine if there are other physiological or metabolic variables correlated with high DNF rates, and to compare these data to those of more “challenging” courses with greater elevation gain/loss.
Running economy (RE) is a key performance determinant. Biomechanical markers have been linked to RE, including ground contact time (GCT), cadence, and vertical oscillation (VO). Recently, we showed a strong relationship between GCT imbalances and RE. Because these markers can be tracked real-time with consumer-wearable devices, runners now have access to instant feedback concerning their mechanics. Purpose: Determine if attempting to correct GCT imbalances real-time alters mechanics and RE. Methods: 7 recreational runners (38±15 years, 24.7±2.8 kg/m², 5 male) completed 2, 10-minute running trials (9.65 km/hr) on separate days. For both trials, subjects ran at a heart rate (HR) monitor/watch that measured GCT, GCT imbalances, cadence, and VO. For the control trial, subjects were not permitted to receive feedback from the watch. During the feedback trial, the watch was set to display GCT imbalances, and subjects were prompted every 20-30 seconds to monitor/attempt to correct any imbalances. Both trials were preceded by a dynamic warmup and 5-minute jog. For the feedback trial warmup, subjects were accelerated at the watch and allowed to experiment with manipulating their GCT imbalances. VO2 was measured continuously throughout each 10-minute trial, and average values from 6 to 9 minutes were determined for each trial. Average values for all running biomechanical variables were calculated from 0.5 minutes to 9.5 minutes. Comparisons between trials were made with a dependent sample t-test. Results: Data are displayed in Table 1. Conclusions: Acutely attempting to correct GCT imbalances did not result in improved mechanics and actually impaired RE. Altering mechanics based on real-time feedback from consumer-wearable devices may impair performance in the short term.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control</th>
<th>Feedback</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO2 (mL/kg/min)</td>
<td>33.4 (1.8)</td>
<td>35.5 (1.6)</td>
<td>0.011*</td>
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<tr>
<td>RER</td>
<td>81 (40)</td>
<td>92 (85)</td>
<td>0.170</td>
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<tr>
<td>Heart Rate (beats/min)</td>
<td>159 (26)</td>
<td>163 (24)</td>
<td>0.191</td>
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<td>GCT Difference (%)</td>
<td>1.69 (67)</td>
<td>1.70 (1.70)</td>
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<tr>
<td>GCT Difference (ms)</td>
<td>9 (3)</td>
<td>8 (7)</td>
<td>0.717</td>
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<tr>
<td>GCT (ms)</td>
<td>272 (26)</td>
<td>268 (31)</td>
<td>0.536</td>
</tr>
<tr>
<td>Cadence (steps/min)</td>
<td>165 (9)</td>
<td>167 (9)</td>
<td>0.486</td>
</tr>
<tr>
<td>VO (cm)</td>
<td>9.3 (2.0)</td>
<td>9.2 (1.9)</td>
<td>0.856</td>
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<tr>
<td>VO (cm/m)</td>
<td>9.5 (1.6)</td>
<td>9.5 (1.6)</td>
<td>0.947</td>
</tr>
</tbody>
</table>

Values represent mean (SD). p-values from dependent t-test. *p < .05

Results: Step time was slower at S2 compared to S1 with a mean difference ± SD of 0.290 ± 0.403 s/min (95%CI 0.246 – 0.334; p < 0.001). Step length was shorter at S2 compared to S1 with a difference of 0.098 ± 0.111 m/min (95%CI 0.086 – 0.110; p < 0.001). There was no interaction in step time for males or females between S1 and S2 (S1, Male 0.35 ± 0.02; S2, Male 0.35 ± 0.02; S2, Female 0.34 ± 0.02; p = 0.099) however, an interaction was detected for step length (S1, Male 1.16 ± 0.13 m/min, Female 1.05 ± 0.11 m; S2, Male 1.05 ± 0.13 m/min, Female 0.98 ± 0.11 m; p = 0.01). A regression model to predict finish time found that step length at S1 accounted for 47% of the variability (F(1,233) = 283.7; p < 0.001), this increased to 68.3% when S1 step time was included (F (2,323) = 350.4; p < 0.001), S2 step length increased this to 75.2% (F(3,321) = 328.4; p < 0.001) while including S2 step time increased it to 76.7% (F(4,320) = 268.4, p < 0.001).

Conclusion: Step time was slower and step length was shorter at the 39-kilometer point of the full-marathon compared to the 11-kilometer point. Step time did not differ at either time point in the race for males or females; however, they both demonstrated a reduction in step length. Step time and step length at both points in the race are able to account for a significant amount of finish-time variability.

Purposes: Marathon running invokes neuromuscular fatigue which has been shown to result in kinetic changes in a laboratory setting. However, there are limited studies on changes that take place during a race. The purpose of this study was three-fold: 1) to evaluate the step time and step length at an early and late time point in a full marathon and quantify the change between the two points; 2) to identify differences in step time and length associated with sex; and 3) to determine if step time and length are predictors of race finish time.

Methods: This is an observational study in which runners were filmed at two stations, at kilometer 11 (S1) and kilometer 39 (S2) of a full 42.2-kilometer marathon. Each station incorporated two cameras, one in the sagittal plane to assess kinematics and the second to identify the runners’ bib numbers. A 5-meter section of roadway was marked with chalk, delineating each meter, to allow for assessment of step length using Dataflight 5.5 Video Analysis software (Dataflight, Froiburg, Switzerland).

Results: Step time was slower at S2 compared to S1 with a mean difference ± SD of 0.290 ± 0.403 s/min (95%CI 0.246 – 0.334; p < 0.001). Step length was shorter at S2 compared to S1 with a difference of 0.098 ± 0.111 m/min (95%CI 0.086 – 0.110; p < 0.001). There was no interaction in step time for males or females between S1 and S2 (S1, Male 0.35 ± 0.02; S2, Male 0.35 ± 0.02; S2, Female 0.34 ± 0.02; p = 0.099) however, an interaction was detected for step length (S1, Male 1.16 ± 0.13 m/min, Female 1.05 ± 0.11 m; S2, Male 1.05 ± 0.13 m/min, Female 0.98 ± 0.11 m; p = 0.01). A regression model to predict finish time found that step length at S1 accounted for 47% of the variability (F(1,233) = 283.7; p < 0.001), this increased to 68.3% when S1 step time was included (F (2,323) = 350.4; p < 0.001), S2 step length increased this to 75.2% (F(3,321) = 328.4; p < 0.001) while including S2 step time increased it to 76.7% (F(4,320) = 268.4, p < 0.001).

Conclusion: Step time was slower and step length was shorter at the 39-kilometer point of the full-marathon compared to the 11-kilometer point. Step time did not differ at either time point in the race for males or females; however, they both demonstrated a reduction in step length. Step time and step length at both points in the race are able to account for a significant amount of finish-time variability.
### Purpose

In the last decade or so, a plethora of fitness tracking devices have come to market. With this, use of these devices has increased exponentially. Among these devices’ many functions is the ability to monitor heart rate (HR). The purpose of this investigation was to determine if HR measured by the Suunto Spartan Sport watch was statistically comparable to that of our criterion, the Polar H7 HR monitor.

### Methods

Twenty-one participants (male n = 11, female n = 10, age = 31±2 yrs) performed a set number of time-to-exhaustion trials at a constant speed on a treadmill or performed a submaximal treadmill test of critical speed through several maximal runs on separate days on a running track. Current methods to assess critical speed are limited by the need for subjects to participate in one incremental TR (8, 10, 12 and 14km/h) or one incremental SR (6, 8, 10 and 12km/h), with the duration of 5 min for each step, and the interval of 1 min for each 2 steps. The VO2max was assessed in combination with the TR test. The portable gas metabolism system (Kibi, Cosmed, Italy) was used to measure the breathing gas during running. The RE for each speed was calculated as the averaged VO2 during the last 1 min during each step.

### RESULTS

At the same running speed (8, 10 and 12km/h), the RE of the SR is lower (oxyconsumption is higher) than the TR (34 ± 3.6 vs. 32.5 ± 4.9 ml.kg.min⁻¹, 47.9 ± 5 vs. 37.9 ± 5.9 ml.kg.min⁻¹, 54.9 ± 6.2 vs. 42.0 ± 7.3 ml.kg.min⁻¹), with the difference significant at the two higher speed (p<0.05). CONCLUSIONS: At the same running speed, the RE of SR is lower than that of TR. Assessment of RE with SR might overestimate the RE in running with change of direction. Running test with change of direction (e.g. SR) is recommended for examining the RE in team sport players.

### CONCLUSIONS

Patience is often considered an injury risk factor due to gait adjustments that occur during prolonged running, and 41% of physical therapists recommend roller massage (RM) for injury prevention. However, whether RM prior to running affects gait mechanics and fatigue is currently unknown.

### PURPOSE

To investigate the effects of an acute bout of RM on gait mechanics and fatigue after a treadmill run.

### METHODS

Fourteen well-trained runners (mean VO2max: 53 ml.kg.min⁻¹) completed 3 sessions each on separate days. In a Baseline (PRE) condition, 4 male participants systematically ran overground at their 5k pace, performed 3 maximal countermovement jumps (CMJ), and completed a maximal oxygen consumption test. Force and motion data were measured during running and jumping. In fatigue sessions, run and CMJ protocols identical to the Baseline session were performed before (PRE) and after (POST) a 30-minute fatiguing treadmill run at a pace associated with 4% of ventilatory threshold. Before the fatigue run, participants rested for 12 minutes (REST) in one visit, and performed a 12-minute RM protocol (ROLL) in the other visit. Two-way analysis of variance (ANOVA) compared condition and time factor. RM had no effect on CMJ performance, but not in neuromuscular performance, or gait mechanics. RM had no effect on any outcomes. We can conclude no benefits of pre-run RM on resistance to fatigue-induced changes in running mechanics.
endovascular interventions normalize this response. PURPOSE: To examine whether revascularization procedures improve calf muscle SmO2 and reduce blood pressure responses in patients with PAD. We hypothesized that revascularization would improve SmO2 responses (indicating greater tissue perfusion) and that the blood pressure response would be attenuated during exercise.

METHODS: Patients with symptomatic PAD (n = 6) performed incremental supine plantar flexion exercise, starting at 0.5 kg and increased by 0.5 kg every minute for up to 6 minutes, pre- and one-month post peripheral revascularization procedure. SmO2 was measured continuously from the gastrocnemius muscle, while heart rate and blood pressure were measured beat-by-beat. RESULTS: Reductions in SmO2 from baseline to end-exercise were attenuated post-revascularization (-6.5 ± 6.2% vs. -39.8 ± 22.5%; P < .05). The change in mean arterial blood pressure was reduced post-revascularization (4 ± 4 mmHg vs. 16 ± 12 mmHg; P < .05). PAD patients exercised longer post-revascularization (4.0 ± 1.5 min P = .05). CONCLUSIONS: These data suggest that revascularization lessens the degree and rapidity of decline in SmO2 during exercise, and lowers the exaggerated blood pressure response in patients with PAD. Supported by NIH Grant P01 HL134609.
bout. Progressive rhythmic handgrip exercise (6kg, 12kg, 18kg) was performed for 3 minutes per stage at a rate of 1 Hz. The brachial artery (BA) diameter and blood velocity was obtained using a Doppler Ultrasound (GE Logiq e) and BA blood flow was calculated with these values. RESULTS: BA blood flow and flow mediated dilation (normalized for shear rate) during the handgrip exercise significant increased from baseline in all workloads, but no differences were revealed in response to the HSFM consumption. CONCLUSION: Progressive handgrip exercise augmented BA blood flow and flow mediated dilation in both testing days; however, there was no significant differences following the HSFM consumption. This suggests that upper limb blood flow regulation during exercise is unaltered by a high fat meal in young healthy individuals.

**INTRODUCTION:** Orthotics are commonly used to aid individuals with foot disorders such as foot or arch pain and gait abnormalities. A new development of vibrating orthotics, which sends out safe vibration frequencies, are gaining popularity on the market. Future developments could lead to vibrating insoles being beneficial for individuals with restricted blood flow, nerve damage, or balance issues caused by diseases such as diabetes or multiple sclerosis. However, few studies have been done on the efficacy and potential benefits. PURPOSE: The purpose of this study was to determine if vibrating orthotic insoles increased the amount of blood flow to the foot and ankle at rest. METHODS: Participants included 5 students ages 22-26 years. An initial baseline test was administered upon arrival and again after resting for 30 minutes on the examination table. The Logiq 7 ultrasound Doppler transducer (9L probe at 5 Mhz) was used to locate the posterior tibial artery for the baseline measurement and probe placement was marked on the skin for consistent measuring. Following the second baseline measurement, vibrating orthotics were turned on and blood flow measurements were taken in 5 minute increments for 45 minutes. For each measurement, the artery was found and blood flow was measured for 7 seconds. Blood flow was calculated in milliliters per minute based on blood velocity and arterial radius utilizing the following equation: Blood Flow = Vmean π (vessel diameter/2)^2 x 60. RESULTS: Blood flow was analyzed across time using a multi-level model with subject as a random effect and time (categorical) as a fixed effect. There was a significant main effect of time. Tukey post hoc analysis revealed a difference between the first baseline and after 45 minutes of vibration (p=0.0375), but no significant difference between any other measurements. After 45 minutes of vibration, blood flow increased 3.46 ml/min (126%). CONCLUSION: The results suggest that the use of vibrating insoles may be beneficial for increasing blood flow in the foot and ankle. The use of vibrating insoles may be beneficial for individuals with conditions that restrict blood flow in the foot and ankle such as peripheral artery disease, diabetes, or poor circulation.

Previous investigations on the ability of upper body exercise (UBE) to increase femoral artery blood flow (FABF) in the paraplegic population have produced a wide range of results. However, this could have been the result of a non-homogeneous population with a wide range of injury level and severity. The use of a non-homogeneous population, controlling for both level and severity of injury may result in more robust data. In addition, previous reports suggest passive limb movement (PLM) could be used as a modality to increase femoral artery blood flow in this population. A combination of UBE and PLM may provide a sufficient stimulus for a robust increase in femoral artery blood flow.

**PURPOSE:** To determine the effectiveness of UBE when used alone and in combination with PLM to increase FABF in the paraplegic population. METHODS: Nine paraplegics with a clinically confirmed lesion between the 3rd and 11th thoracic vertebra participated in the study. The subjects underwent 10 minutes of (UBE), 5 minutes at a low intensity (LI) and 5 minutes at a moderate intensity (MI), during which FABF was measured. After a 30 minute break, the protocol was replicated with the addition of repeated bouts of passive limb movement being conducted every other minute during the upper body exercise (CMB).

**RESULTS:** Two-way repeated measures ANOVA showed no statistically significant interactions (p>0.05) between the two exercise modalities for changes in FABF.

During the UBE condition, while not statistically significant, FABF increased from 113±78 ml/min to 160±130 ml/min (p=0.06) and 162±131 ml/min (p=0.06) during the LI and MI conditions, respectively. FABF for the CMB protocol was 119±93 ml/min and increased significantly to 155±132 (p=0.13) ml/min during LI and MI conditions, respectively. CONCLUSIONS: While not statistically significant, these data indicate the upper body exercise when used in combination with passive limb movement can invoke a large increase in femoral artery blood flow. This could have a profound clinical application for this population.

**PRACTICE POINTS:**

- **Dietary Nitrate does Not Increase Exercising Muscle Blood Flow in Rat With Pulmonary Arterial Hypertension:**
  - **PURPOSE:** Pulmonary arterial hypertension (PAH) is a disease characterized by pulmonary artery remodeling, right ventricular hypertrophy, and exercise intolerance. We have previously found a significant reduction in skeletal muscle blood flow during exercise in a rat model of PAH, accompanied by an increase in blood lactate. In an attempt to increase flow, we administered beetroot juice (BRJ) to severely afflicted PAH rats, as BRJ has previously been shown to be effective in animal models and patient populations.
  - **METHODS:** Male Sprague Dawley rats (n=18, 200-250 g) were injected with 60 mg/kg monoterolactone to elicit a severe PAH phenotype. At 5 wk post-injection, rats performed two trials of a VO2max treadmill test 2 h after oral gavage of a single dose (1 mmol/kg) of BRJ (BRJ, n=9), or placebo (PL, n=9), in counterbalanced order. Three days later, rats performed a final treadmill run 2 h after gavage of either BRJ or PL, in which fluorescent microspheres were administered during running (at 50% VO2max) to determine skeletal muscle blood flow. Nitrate and nitrite concentrations in plasma and skeletal muscle samples were determined via HPLC, whereas muscle cGMP was measured using ELISA.
  - **RESULTS:** As expected, MCT induced impaired exercise tolerance with a 26% 65% (±15/S) reduction in VO2max at 3 wk post-injection, that was not improved with BRJ (p=0.15). BRJ significantly increased plasma nitrate (p=<0.001) and nitrite (p=0.002) compared to PL; however only nitrate was elevated in the soleus (p=0.006) and vastus lateralis (p=0.02) by BRJ, with no significant differences in nitrite (p=0.13-0.60) or cGMP (p=0.08-0.68). BRJ did not increase blood flow in any of the 8 muscles sampled when compared to PL (p=0.23-0.96), nor did it reduce lactate accumulation during exercise (p=0.37).
  - **CONCLUSIONS:** A single dose of dietary nitrate does not enhance exercising muscle blood flow or VO2max in a PAH rat, despite significantly increasing plasma nitrate and nitrite. This may be explained by a lack of efficacy in BRJ increasing muscle nitrite and cGMP, known mediators of the nitric oxide pathway and tissue perfusion. Future work should examine mechanisms for reduced skeletal muscle blood flow and further exploration of nitric oxide signaling in PAH patients. Funding: NIH HL121661 (MB Brown) and AG053606 (AR Coggan)

**Racial Differences In Exercising Limb Blood Flow During Elevated Sympathetic Activity:**

- **PURPOSE:** Young, healthy African Americans (AA) exhibit lower vascular conductance during an exercise bout compared to Caucasian Americans (CA). This disparity may be due to greater sympathetic vasoconstriction and an impairment in functional sympathetic discharge in AA. Thus, the purpose of this study was to examine racial differences in vascular conductance during lower limb exercise in the presence of elevated sympathetic activity and increased arterial pressure (PT).
  - **METHODS:** A total of 5 African American (AA) and 4 Caucasian (CA) young (24± 2 yrs), healthy males were recruited. Subjects then underwent 6 minutes of rhythmic plantar flexion (PF) exercise at 30% of their previously determine maximum voluntary contraction (MVC). Doppler ultrasonography was utilized to measure superficial femoral artery blood flow on the exercising leg while simultaneous measurements of mean arterial pressure (MAP) were obtained via finger plethysmography. Subjects underwent the CPT (minutes 4-6) during which the hand was placed in cold water (4 °C) during PF exercise. Measures were obtained during steady state exercise blood flow
Support: The Swedish National Centre for Research in Sports, Ministerio de Educacion of exercising muscle in facilitating the greater hemodynamic capacity and mass-kg, p<0.001). However, the differences were no longer present during maximal BIKE during similar BIKE despite a lower leg lean mass in women (8.7±0.3 vs. 5.3±0.7 whole body VO2), p=0.001. These findings highlight a greater vascular conductance in response to elevated sympathetic activity.

CONCLUSIONS: This study suggests that during lower limb exercise, young AA males, when compared to CA, are similarly resistant to reductions in lower limb vascular conductance in response to elevated sympathetic activity.

924 Board #50 May 27 2:30 PM - 4:00 PM
Sex-differences In Exercising Hemodynamics: Role Of Exercising Muscle Mass

Joshua Bovard1, Daniele A. Cardinale2, Filip J. Larsen3, Emma Reiter1, Mads Jensen-Urstad1, Erik Rullman1, David Morales-Alamo1, Bjorn Ekblom1, Jose A. L. Calbet2, Robert Boushel1, 1University of British Columbia, Vancouver, BC, Canada. 2The Swedish School of Sport and Health Sciences, Stockholm, Sweden. 3Karolinska Institute, Stockholm, Sweden. 4University of Las Palmas de Gran Canaria, Las Palmas de Gran Canaria, Spain. (Sponsor: A. William Shell, FACSM)

Sex-differences in O2 transport include O2 content (C aO2) and quantity of muscle mass. PURPOSE: To determine their consequences on exercising hemodynamics (with large (e.g., 2-leg cycling (BIKE)) vs. small (e.g., 1-leg knee extension (KE)) differences in vascular conductance with and without the presence of elevated sympathetic activity.

RESULTS: CPT resulted in similar increases in MAP in both AA (+38.89 ± 5 mL/min); CA (+38.89 ± 62 mL/min); p = .35) was not different between groups when evaluated during the CPT and expressed as change from PF exercise alone.

Effects of Dietary Sodium Intake on Blood Flow Regulation During Exercise In Salt Resistant Individuals

Kevin Decker, Morgan Kimmel, Hunter Reed, Alex Chiu, Austin Hogwood, Jennifer Weggen, Ashley Darling, Ryan Garten. Virginia Commonwealth University, Richmond, VA.

Email: deckerkp@vcu.edu

PURPOSE: Dietary guidelines for sodium intake is less than 2,300 mg/day, yet 90% of Americans exceed this value. This study examined individuals resistant to salt-induced changes in blood pressure to determine the impact of a high sodium diet on blood flow regulation during upper and lower limb exercise. METHODS: Six young (25 ± 2 years) males followed recommended dietary sodium intake guidelines on two separate weeks, with one week supplemented with salt capsules (HS: 6,900 mg/day of sodium) and the other week supplemented with placebo capsules (LS: 2,300 mg/day of sodium). Resting central hemodynamic measurements [heart rate (HR), heart rate variability (HRV), and mean arterial pressure (MAP)] were evaluated the end of each diet. Peripheral hemodynamic measurements [blood flow (BF), shear rate (SR), and flow mediated dilation (FMD)] were evaluated the end of each diet. Peripheral hemodynamic measurements [blood flow (BF), shear rate (SR), and flow mediated dilation (FMD)] were evaluated the bicuspid and superficial femoral artery were taken during rhythmic (1 Hz), progressive handgrip (HG) and plantar flexion (PF) exercise, respectively. Exercise workloads were three minutes in length and increased by increments of 8 kilograms until exhaustion. RESULTS: Between each diet (LS and HS) there were no significant differences in resting MAP (82 ± 4 vs. 80 ± 5 mmHg; p = 0.3), HR (56 ± 6 vs. 59 ± 10 bpm; p = 0.4), or HRV (2.7 ± 1.9 v 8.3 ± 5.1 LF/ HF; p = 0.4). During progressive HG and PF exercise the BF, SR, and FMD/SR were significantly increased by workload (p < 0.05 for all), but not different between diets (p > 0.05 for all). CONCLUSION: Despite previous evidence reporting a HS diet can impair resting vascular function, this study revealed that peripheral vascular function and blood flow regulation during exercise is not impacted by a HS diet in salt resistant individuals.
Impact Of 6-month Exercise Training On Neurovascular Function In Persons With Spinal Cord Injury
Erin D. Ozturk1, Matthew Lapointe1, Dong-II Kim1, Jason W. Hamner1, Can Ozan Tan1. 1Spaulding Rehabilitation Hospital, Cambridge, MA. 2Gachon University, Gyeonggi-do, Korea, Republic of.

Accumulating evidence shows an exacerbated incidence of cognitive impairment after spinal cord injury (SCI); however, the physiology that underlies this apparent post-SCI cognitive decline is unknown. PURPOSE: To investigate the impact of injury and 6-month full-body exercise training on neurovascular coupling in individuals with SCI. METHODS: In 24 participants with SCI and 16 controls, we investigated hemodynamic (heart rate, blood pressure, CO2) and middle cerebral arterial blood flow velocity responses to a working memory task (neurovascular coupling) before and after training. Neurovascular coupling was compared across groups while accounting for injury parameters. Within individuals with SCI, 6-month changes in neurovascular coupling and its relation to changes in aerobic capacity were compared via linear mixed effect model. RESULTS: Reaction time tended to be higher in individuals with SCI, especially those with high-level (≥T4) injuries, possibly due to upper motor impairments. Neurovascular coupling was graded across task difficulty (p<0.01), while injury did not have a significant impact (group effect p=0.16, interaction p=0.99, interaction p=0.19, p=0.03) but not low-level (R2<0.04, p=0.46) injuries, which translated to an increase in reaction time (R2<0.16, p=0.05). CONCLUSIONS: The apparent cognitive impairment after SCI is primarily due to physical deconditioning, rather than injury itself, and can be mitigated by aerobic exercise training. This has significant implications for long-term care and management for individuals with SCI.

L-citrulline Does Not Change Blood Flow Kinetics At The Onset Of Exercise In Young Women
Joaquin U. Gonzales1, Stephen M. Fischer1, Arun Maharaj1, J. Mikhail Kellawan2, Arturo Figueroa, FACSM1. 1Texas Tech University, Lubbock, TX. 2University of Oklahoma, Norman, OK. (Sponsor: Arturo Figueroa, FACSM)

Oral supplementation with L-citrulline (CIT) has been reported to improve muscle oxygenation during moderate-intensity exercise in young men; however, examination of the impact of CIT in young women is scarce. PURPOSE: To examine the influence of CIT on muscle blood flow responses to exercise in young women. METHODS: Women were assessed during the follicular (n=13, 24±2y) and luteal (n=11, 25±2y) phases of the menstrual cycle. Supplementation with CIT (6 g/day) or placebo occurred 7 days prior to the testing day in a crossover design across two menstrual cycles. All women performed rhythmic handgrip exercise at 10% maximal grip strength while forearm blood flow (FBF) was measured in the right brachial artery using Doppler ultrasound. FBF was calculated per duty cycle (contract:relax, 1:2s) before being fit with a monoexponential model. Amplitude of the FBF response and the number of duty cycles compared to rest to exercise velocities were calculated. RESULTS: There were no differences in resting S' between groups, and all subjects similarly increased S' from rest to exercise (Figure). HCM patients had significantly lower resting E' velocities compared to HFpEF patients and young controls (P<0.05), the magnitude of the increase was significantly less in patients with HCM compared to young and old controls but indistinguishable from HFpEF patients. CONCLUSION: Patients with HCM are unable to increase E' from rest to exercise to the same extent as healthy young and old individuals. In fact, augmentation of early diastolic relaxation was similar between HCM and HFpEF patients, despite the HCM cohort being almost 20 years younger and without heart failure. Although the disease etiologies differ, these data suggest a common phenotype explaining exercise intolerance in HCM and HFpEF.

Hypertrophic cardiomyopathy (HCM) is characterized by diastolic dysfunction which contributes to exercise intolerance despite a preserved ejection fraction. This phenotype is strikingly similar to that reported in HFpEF. While disease etiologies clearly differ and HCM patients may not have heart failure, the degree of exercise intolerance is comparable and may be due to similar impairments in cardiac function. PURPOSE: To compare systolic function and early diastolic relaxation during submaximal cycle exercise in HCM and HFpEF patients. METHODS: Patients with HCM without heart failure (n = 12, 48 ± 7 years) were compared to HFpEF patients (n = 12, 67 ± 5 years), and old (n = 11, 70 ± 5 years) and young (n = 11, 31 ± 3 years) controls. Subjects underwent semi-recumbent echocardiography at rest and during steady state exercise at a heart rate of 100bpm. Tissue Doppler velocities of the septal and lateral mitral annulus were averaged during systole (S’) and early diastole (E’), and the difference in resting and exercise velocities were calculated. RESULTS: There were no differences in resting S’ between groups, and all subjects similarly increased S’ from rest to exercise (Figure). HCM patients had significantly lower resting E’ velocities compared to HFpEF patients and young controls (P<0.05). While all groups augmented E’ from rest to exercise (P<0.05), the magnitude of the increase was significantly less in patients with HCM compared to young and old controls but indistinguishable from HFpEF patients. CONCLUSION: Patients with HCM are unable to increase E’ from rest to exercise to the same extent as healthy young and old individuals. In fact, augmentation of early diastolic relaxation was similar between HCM and HFpEF patients, despite the HCM cohort being almost 20 years younger and without heart failure. Although the disease etiologies differ, these data suggest a common phenotype explaining exercise intolerance in HCM and HFpEF.
HFrEF participants were recruited from local to exercise in HFrEF has not been established. However, the effect of ARNi on BP response for heart failure patients with reduced ejection fraction (HFrEF). ARNi reduces Angiotensin Receptor Neprilysin inhibitors (ARNi) is a new class of drug approved at baseline, resting MAP was similar between ARNi (96±14 mmHg) and was unchanged in CON (91±20 mmHg; ANOVA interaction P=0.048). However, the increase in MAP during IHG (ARNi: Δ11±8 vs. CON: 13±6 mmHg; P=0.60) and PEI (ARNi: Δ6±6 vs. CON: 12±3 mmHg; P=0.60) after 12 weeks was not impacted by ARNi (ANOVA time P=0.24) or different between groups. Maximal raw force and RPE ratings during IHG were similar between groups and not different following 12 weeks of ARNi (ANOVA P=0.70). CONCLUSION: These preliminary data suggest that although 12 weeks of ARNi therapy reduces resting MAP in HFrEF, there are no significant reductions on MAP response to exercise. Additional data are needed to fully understand the impact of ARNi on cardiovascular responses to exercise in HFrEF.

Supported by ACSM grant 19-00934 and P20 GM 113125.

INTRODUCTION: The primary treatment for individuals post stroke is intensive rehabilitation focusing on improving and restoring motor control. Typically, the rehabilitation does not focus on increasing cardiovascular fitness due to the inability of these individuals to coordinate those modalities of aerobic exercise (i.e. walking and cycling). Both cycling and walking can promote increases in cardiovascular fitness in individuals’ post-stroke but most of the increases are minimal. Single leg cycling (SLC) is a modality of exercise that has never been attempted by this population. Working around their affected side while utilizing SLC may be what they need as a means to get a quality cardiovascular workout. PURPOSE: The purpose of this study aims to examine feasibility and safety of SLC in this population as well as how effective it may be at increasing oxygen consumption, heart rate, blood pressure, cognitive function, cerebral blood flow and proprioception compared to traditional double leg cycling (DLC).

METHODS: Individuals with completed a bout of DLC and SLC. We continuously collected metabolic data (Oxygen consumption, resting exchange ratio), cardiovascular data (Heart rate, blood pressure, cardiac output, stroke volume) as well as tissue saturation via Near infrared spectroscopy. The subjects were randomized into either SLC or DLC. We started both exercise bouts at a wattage they could handle and increased by 10w every 30 seconds until volitional fatigue or they reached a goal of 55% of their heart rate reserve. They had a 15-minute washout period in between exercise bouts. RESULTS: VO2 was elevated during the SLC trial compared to the DLC trial (p<0.05). HR and BP were also elevated during the SLC trial compared to DLC (p<0.01). There was no significant difference in RPE across the two conditions. CONCLUSION: The result suggests that single leg cycling may be more beneficial to individuals with hemiparesis. Elevated VO2, HR, and BP during SLC suggest that they were able to work around their affected side and coordinate this exercise more effectively than traditional DLC.

930  Board #56  May 27 2:30 PM - 4:00 PM
The Feasibility And Physiological Responses Of Single Leg Cycling In Individuals With Hemiparesis

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(NO relevant relationships reported)

Skeletal muscle reflex-induced increases in blood pressure are exaggerated during exercise in type 2 diabetes mellitus (T2DM). We previously demonstrated that skeletal muscle afferent discharge in response to capsaicin, a transient receptor potential vanilloid 1 (TRPV1) agonist, is heightened in T2DM likely contributing to the potentiated pressor response. However, the underlying mechanisms remain unclear. Evidence suggests that the high glucose levels in T2DM sensitize sensory neurons through the receptor for advanced glycation end products (RAGE)/protein kinase C (PKC) pathway in dorsal root ganglia (DRG). Moreover, early-stage diabetes associated with TRPV1 overactivation is mediated through PKC. Therefore, it was hypothesized that the augmentation in muscle afferent discharge in T2DM previously reported is due to the phosphorylation of TRPV1 via an overactive RAGE/PKC pathway. PURPOSE: To investigate 1) the impact of T2DM on plasma levels of advanced glycation end products (AGE) and high-mobility group box protein 1 (HMGB-1), both RAGE ligands, and 2) the impact of T2DM on the RAGE/PKC pathway including the phosphorylation of TRPV1 in DRG subserving skeletal muscle afferents. METHODS: For 14-16 weeks, Sprague-Dawley rats were given either a normal diet (control) or a high fat diet in combination with a low dose (35 mg/kg) of Angiotensin Receptor Neprilysin inhibitors (ARNi) is a new class of drug approved for heart failure patients with reduced ejection fraction (HFrEF). ARNi reduces resting blood pressure (BP) in HFrEF. However, the effect of ARNi on BP response in exercise in HFrEF has not been established. PURPOSE: We hypothesized that BP response to isometric handgrip exercise (IHG) would be attenuated in HFrEF after 12 weeks of ARNi therapy. METHODS: HFrEF participants were recruited from local cardiology clinics and completed a baseline experimental visit and follow up visit 12 weeks later: 6 patients were prescribed ARNi by their cardiologist [64±10 years, Men: 5, BMI: 30±6 kg/m², EF: 26±7%; 4 with Non-ischemic cardiomyopathy (NICM)], and 5 participants continued on conventional treatment [CON: 57±6 years, Men: 2; BMI: 27±5 kg/m²; EF: 30±4% and NICM: 3; all P = NS]. During each experimental visit, BP was measured at rest and during 2-minutes IHG at 30% maximal voluntary contraction followed by post-IHG exercise ischemia (PEI) to isolate the metaboreflex. The change in mean arterial pressure (Δ MAP) from baseline to exercise and PEI was assessed. statistical comparisons were performed using 2x2 repeated-measures ANOVA.

RESULTS: At baseline, resting MAP was similar between ARNi (96±14 mmHg) and CON (86±12 mmHg; P=0.17) and MAP increased similarly during IHG (ARNi: Δ 10±12 vs. CON: 8±10 mmHg) and PEI (ARNi: Δ 6±4 vs. CON: 5±10 mmHg; ANOVA P=0.60; ARNi P=0.90). Resting MAP was reduced after 12 weeks of ARNi (87±7 mmHg) and was unchanged in CON (91±20 mmHg; ANOVA interaction P=0.048). However, the increase in MAP during IHG (ARNi: Δ 11±8 vs. CON: 13±6 mmHg; P=0.60) and PEI (ARNi: Δ 6±6 vs. CON: 12±3 mmHg; P=0.60) after 12 weeks was not impacted by ARNi (ANOVA time P=0.24) or different between groups. Maximal raw force and RPE ratings during IHG were similar between groups and not different following 12 weeks of ARNi (ANOVA P=0.70). CONCLUSION: These preliminary data suggest that although 12 weeks of ARNi therapy reduces resting MAP in HFrEF, there are no significant reductions on MAP response to exercise. Additional data are needed to fully understand the impact of ARNi on cardiovascular responses to exercise in HFrEF.

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930  Board #56  May 27 2:30 PM - 4:00 PM
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(NO relevant relationships reported)
Recent studies in both humans and rodents have shown that the mechanoreflex and metaboreflex are exaggerated in SHR and T2DM rats with an exaggerated exercise pressor reflex. To elicit an acute hyperglycemia environment while preventing an endogenous insulin response, somatostatin (3.9 μg/100 μl) was infused systemically and simultaneously along with local glucose infusion. Changes in mean arterial pressure (ΔMAP) and heart rate (ΔHR) in response to tendon stretch and lactic acid injection were measured and compared before and after infusion.

RESULTS: We found that the peak pressor and cardiacaccelerator responses to tendon stretch were not significantly affected by acute hyperglycemia (ΔMAP before: 12 ± 2 mmHg; after: 12 ± 3 mmHg, n=6, p>0.05; ΔHR before: 10 ± 3 bpm; after: 10 ± 3 bpm, n=6, p>0.05). Likewise, the pressor and cardialeystemic responses to lactic acid were not significantly affected by acute hyperglycemia (ΔMAP before: 13 ± 2 mmHg, after: 16 ± 4 mmHg, n=10, p>0.05; ΔHR before: 10 ± 2 bpm, after: 12 ± 5 bpm, n=10, p>0.05).

CONCLUSIONS: The acute presence of hyperglycemia environment while preventing an endogenous insulin response, somatostatin (3.9 μg/100 μl) was infused systemically and simultaneously along with local glucose infusion. Changes in mean arterial pressure (ΔMAP) and heart rate (ΔHR) in response to tendon stretch and lactic acid injection were measured and compared before and after infusion.
cramping, restless legs, and fatigue. In Alberta Kidney Care North, IDE is supervised by a clinical exercise physiologist (CEP) and dialysis unit staff assist with program delivery.

**PURPOSE:** The aim of this study was to examine program responsiveness to the patients’ needs (acceptability) by evaluating documentation of patient adherence.

**METHODS:** 1,752 exercise sessions were audited at 6 hemodialysis units. Patient reported participation was collected directly from patients within 10 days of the audit. Baseline and subsequent physical reassessments were examined to verify the validity of patient recall, relative to the required exercise dose. Data points were divided into 2 categories: active IDE participants (A-IDE) and non-active IDE (NA-IDE) participants. A-IDE were defined as patients who completed at least 1 IDE session/week for 4 weeks. NA-IDE participants were defined as those previously assessed and programmed but recently discharged, on a medical hold, or participating in a home exercise program at the time of the audit.

**RESULTS:** Of the 1,332 A-IDE sessions audited, nurses documented patient participation 28.08%, no participation 49.4%, and did not document 22.52%. Patients reported adherence 63.74%. Physical reassessment data showed improved outcome measures thereby, validating patient recall of adherence. Of 420 NA-IDE IDE data sheet analyses, nurses documented patient participation 1.9%, no participation 70.24%, and did not document 27.85%. Patient report and documentation agreed 2.7%.

**CONCLUSIONS:** Assessment of IDE participation is an integral component to the evaluation of an IDE program. Discrepancies between patient report and documented adherence exist. We found that patient report is valid, based on improved measures at reassessments; however, we must establish feasible methods for dialysis staff to collect adherence when CEPs are not present. Staff training, including regular surveys to assess staff knowledge of processes, may provide valuable information on units with a high staff turnover. Implementing an IDE prescription confirmation, as a standard practice in HD treatment preparation, may afford participation.

### Abstracts

**937 Board #63 May 27 2:30 PM - 4:00 PM Role And Determinants Of Chronotropic Incompetence In A Kidney Transplant Recipients Population**

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(No relevant relationships reported)

**PURPOSE:** To describe the prevalence of CI in a KTRs population and to analyze its potential determinants and its effects on functional capacity.

**METHODS:** Consecutively recruited KTRs 3 months after transplantation underwent a Cardiopulmonary Exercise Test with an incremental protocol. 175 KTRs were included and the test was repeated in 60 subjects after a mean period of 22 months. Laboratory and drug therapy data were collected. CI was defined by the formula: MCI = (HRpeak - HResit)/(HRpredicted-HResit) / (V̇O2peak-V̇O2rest) (VO2peak=VO2rest) (VO2peak=VO2rest) (MCI: metabolic chronotropic index, HR: heart rate, VO2: oxygen consumption). The prevalence of CI was calculated on 175 KTRs, while the multivariate regression analysis was conducted on 60 KTRs that repeated the test.

**RESULTS:** In the whole population the CI prevalence was 30.9%. The 60 reassessed KTRs (age 51.6±1.3 years, 77% men) showed significant differences between 3 and 22 months after transplantation in the hemoglobin level (123.4±16.6 vs 136.4±17.8 g/l, P<0.01) and in the proportion of beta-blocker therapy (50 vs 23.3%, P<0.001), but no differences in VO2 peak (26.5±7.9 vs26.8±8.2 ml/kg/min, P=0.85) nor in CI prevalence (31.7 vs 36.7, P=0.41). KTRs with CI demonstrated no significant differences of VO2 peak nor at 3 or 22 months after transplantation, compared to KTRs without CI. The only determinant of CI at the two visits was the presence of arterial hypertension. Gender, age, BMI, the presence of diabetes, the type of immunosuppressive therapy, the duration of follow-up and beta-blocker therapy did not appear to be determinants of CI. CONCLUSIONS: KTRs are characterized by reduced functional capacity but the CI does not seem to significantly limit their functional level. In contrast to what it would be expected, beta-blocker therapy does not appear to be a CI determinant, while its only significant determinant was arterial hypertension.

**938 Board #64 May 27 2:30 PM - 4:00 PM Circulating Steroid Changes In Response To Extreme Physical Stress In Male Athletes**

Éva Csöndör1, Roland Ligetvári1, Gellért Karvay2, Gabriella Far3, Aiko Mor4, Zsolt Komka1, Barna Vásárhelyi5, Miklós Tóth1, Viktor Miklós Tóth1, Timea Stromájer-Rácz, József Bethlehem1, Pongrác Ács1, András Oláh1. 1University of Pécs, Pécs, Hungary. 2Semmelweis University, Budapest, Hungary. 3University of Physical Education, Budapest, Hungary. 4Eötvös Loránd University, Budapest, Hungary.

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**PURPOSE:** Athletes put themselves on a regular physical load to stay competitive. Steroids play a significant role in the regulation of cardiovascular, metabolic and many other functions in stress situations. Our aim was to monitor the response of steroid hormones to physical stress.

**METHODS:** We investigated the plasma levels of 14 different endogenous steroid molecules in a model of extreme acute physical stress (vita maxima treadmill test) in male athletes (n=45; median age=21). Steroid levels were measured using liquid chromatography-tandem mass spectrometry. Cardiovascular-, metabolic-, and gas-exchange parameters were also evaluated. All values were measured at baseline, at maximum stress and 30 minutes into the rest period.

**RESULTS:** The plasma concentrations of 9 steroids elevated significantly (p<0.05) at the peak compared to baseline, and 11 metabolites elevated significantly (p<0.05) in the rest period compared to baseline. After load 9 steroid showed an increase of at least 50% compared to baseline. Aldosterone showed the highest increase at peak, with 75.8%3, and in the rest period 11- dehydroepiandrosterone-ol elevated with 123.36%. Blood pressure, heart rate and lactate parameters increased significantly at the peak of the load (p<0.01). Cardiac and metabolic values did not correlate with the steroid concentrations. We calculated 11 enzyme activities from the product and substrate ratios, and we found significant differences. There were 4 enzymatic pathway which showed significant increase. 11β-HSD (p<0.01) and aldosterone-synthase (p<0.01) elevated at the peak. In the restitution 17,20-lyase and 11β-HSD in another pathway increased significantly (p<0.01).

**CONCLUSIONS:** All three lines of the adrenal cortex are affected by extreme physical stress. Cardiovascular, metabolic and gas-exchange parameters increase early,

**Abstracts were prepared by the authors and printed as submitted.**
followed by changes in the levels of endogenous steroids. As a later response. We showed for the first time in this model the elevation of some steroids, like aldosterone, corticosterone that identified the enzymatic pathways involved. Literature results were partially reproduced, with further changes in steroid levels revealed by our model. This research was supported by: GINOP-2.3.2-15-2016-00047, Széchényi 2020., 20765/3/2018 FEKUTSRAT projects.

The risk of kidney disease is elevated in conditions associated with sustained or transient elevations in the partial pressure of carbon dioxide, such as chronic obstructive pulmonary disease or sleep apnea. Indirect evidence indicates that hypercapnia induces renal vasoconstriction, a response that differs from the vasodilatory response that occurs in most other vascular beds. Thus, one mechanism underlying an increased risk of kidney disease is that repeated hypercapnia-induced episodes of renal vasoconstriction reduce oxygen delivery and compromise renal oxygenation. However, it is unknown if hypercapnia elevates vascular resistance in vessels going to or within the kidneys. PURPOSE: To test the hypothesis that breathing a hypercapnic gas mixture increases vascular resistance in the renal and segmental arteries. METHODS: After 45 min of supine rest, renal hemodynamics were assessed in eleven healthy adults (27 ± 4 years, 5 females) immediately prior to (AIR) and while breathing a 3% CO2 gas mixture for 5 min (CO2). The partial pressure of end-tidal CO2 (PETCO2, capnography) and mean arterial pressure (MAP, finger photoplethysmography) were measured continually. Blood velocity (BV) in the distal segment of the right renal artery (Renal) and the middle segmental arteries was calculated using the coronal approach via Doppler ultrasound. Vascular resistance (VR) was calculated as VR = RBV / BV, where RBV (mmHg × cm/s) is the mean arterial pressure (MAP, finger photoplethysmography) divided by the mean blood velocity (BV) in the distal segment of the right renal artery (Renal) or the middle segmental arteries. RESULTS: CO2 increased PETCO2 (45 ± 3 vs. 48 ± 3 mmHg, P<0.01), CO2 did not change MAP (AIR: 90 ± 4, CO2: 90 ± 5 mmHg, P=0.83). In the renal artery, CO2 reduced BV (33.7 ± 8.0 vs. 31.3 ± 7.7 cm/s, P<0.02), and elevated VR (2.8 ± 0.9 vs. 3.1 ± 1.0 mmHg/cm/s, P=0.03). Similarly, in the segmental artery, CO2 reduced BV (24.5 ± 5.9 vs. 22.0 ± 4.6 cm/s, P=0.03) and increased VR (4.0 ± 1.1 vs. 4.3 ± 1.1 mmHg/cm/s, P<0.05). CONCLUSION: These findings suggest that mild hypercapnia elevates vascular resistance in the renal and segmental arteries.

BACKGROUND: Heart rate variability (HRV) is a measure of autonomic nervous system (ANS) activity, and decreased HRV is associated with many cardiovascular conditions. Chronic kidney disease (CKD) is characterized by a decrease in renal function and may be associated with ANS imbalances in the renal vasculature. Low ANS activity, and decreased HRV is associated with many cardiovascular disorders. Heart rate variability (HRV) is a measure of autonomic nervous system activity and is of particular interest in patients with cardiovascular disease. HRV is associated with cardiac autonomic function and may be associated with ANS imbalances in the renal vasculature. Low ANS activity, and decreased HRV is associated with many cardiovascular disorders. PURPOSE: To determine the effect of steady-state exercise (SSE) and post-exercise (SE and Exe) on HRV in patients with stage 4 CKD. METHODS: Twenty participants with stage 4 or 5 CKD (n = 6 men, n = 14 women; age 62 ± 9.9 years; weight 80 ± 9.6 kg, height 167 ± 8.8 cm) were included. HRV was measured in 3 sessions, immediately prior to exercise (1/2-hour post-exercise). HRV was measured for 5 mins in the supine position using an elastic belt and Bluetooth monitor (Polar Heart). CardioMoody software was used to process HRV variables high frequency (HF), low frequency (LF), and standard deviation of all NN intervals (SDNN). Data were analyzed using 2 (condition) by 4 (time) repeated-measures ANOVAs. Data violated normality and were natural log (In) transformed prior to analysis. Significant main effects were followed using pairwise comparisons using a Bonferroni adjustment for multiple comparisons. All analyses were performed using SPSS (v.26). RESULTS: For In LF/HH there were no significant main effects for exercise condition, time, or their interaction (p > 0.05). For In HF (F

PURPOSE: The overshoot of the respiratory exchange ratio (RER) during recovery from maximal cardiopulmonary exercise testing (CPET) has been found reduced in magnitude among patients with heart failure, possibly due to the slow recovery kinetics of VO2. To investigate whether this “overshoot” phenomenon could be present also in patients with peripheral limitations to exercise, a population of kidney transplant recipients (KTRs) was specifically studied, since these patients may present peripheral alterations at the muscular and microvascular level. METHODS: RER was retrospectively evaluated during recovery after maximal exercise (peak RER > 1.1) in KTRs without history of peripheral limitations to exercise, a population of kidney transplant recipients (KTRs) was specifically studied, since these patients may present peripheral alterations at the muscular and microvascular level. CONCLUSIONS: The increased physical capacity VO2 peak and Mtest minimized the impact of Nx5/6 in the CKD, attenuating proteinuria, an important index of progressive loss of renal function and to improve mitochondrial function. Finally, previous exercise induction 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.

MP30: Increasing physical activity improves mitochondrial function and biogenesis. It is common for CKD patients to be physically inactive having less physical and functional capacity when compared to the general population. The aim of this study was to evaluate physical capacity, renal function and mitochondrial function in rats with CKD by nephrectomy 5/6 (Nx5/6). METHODS: Adult Wistar rats were divided into groups (n=8): SHAM; Sedentary/Nx5/6 (Sedentary), Sedentary/Nx5/6 (Exercise, Exe), Exercise/Nx5/6 (Sedentary) and Exercise/Nx5/6 (Exercise). The physical capacity was performed with ergospirometry test (VO2 peak) and maximal exercise test (Mtest). Exercise periods were 60-66 min/day for 8 weeks, 40 to 60% of MTest. We evaluated proteinuria (uProt), blood urea nitrogen (BUN) and blood pressure (BP). By Western Blotting evaluated renal AMPK Pathway (AMPK and PGC1- alpha) alpha.

RESULTS: The Physical Capacity (VO2 peak) was increased in SE and Exe vs Sed (31.8±0.7; 35.2±0.9 vs 23.1±1.8, p<0.05, respectively), and Mtest was improved in SE and Exe vs Sed (34.2±2.1; 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 SE and ES (61.1±20.9 vs 173.3±9.2 vs 124±14.1 p<0.05, respectively), BUN was higher in SE and ES vs Exe (57.2±7.4 vs 65.6±7.8 vs 51.1±7.4 p<0.05, respectively). There was a decrease in BP in the SE and Exe groups when compared with the Sed group (215±1 and 219±2 vs 251±2, p<0.05 respectively), but the blood pressure values still remained high. The Renal AMPK Pathway was reduced in all group vs Sed in terms of protein levels (AMPK and PGC1- alpha) alpha.

CONCLUSIONS: The Increased physical capacity VO2 peak and Mtest minimized the impact of Nx5/6 in the CKD, attenuating proteinuria, an important index of progressive loss of renal function and to improve mitochondrial function. Finally, previous exercise induction 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.

PURPOSE: To Mild Hypercapnia

S180 Vol. 52 No. 5 Supplement
B-68  Free Communication/Poster - Vascular Function I

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

943  Board #69  May 27 2:30 PM - 4:00 PM
A Practical Measure Of Endothelial Function Applicable To The Routine Clinical Setting?
Melanie A. Heath¹, Drew D. Gourley², Stanley J. Kleis², Morteza Naghavi², Hirofumi Tanaka, FACSM. ¹The University of Texas at Austin, Austin, TX. ²University of Houston, Houston, TX. ³Endothelix, Houston, TX. (Sponsor: Hirofumi Tanaka, FACSM) (No relevant relationships reported)

Background: The VENDYS-II is an alternative, fully automated and noninvasive methodology to evaluate endothelial function using temperature change on finger as a surrogate measure of the magnitude of vascular reactivity index (VRI). Due to the simplicity, it could provide a feasible second to assess vasculature function in the clinical setting. A most recent modification to the technique includes the application of occlusion cuff at the base of a finger. Purpose: To assess the validity of the VENDYS-II device compared with the standard flow-mediated dilation (FMD) protocol.

Methods: Twelve participants (7 males, 37±16 years) varying widely in age, height, weight, and exercise status were studied. Occlusion cuff was placed over the right antecubital fossa or at the base of the right index finger. Temperature monitors were placed on bilateral index fingers to assess change in temperature throughout 5-minute occlusion and recovery phases. FMD was obtained simultaneously using high-resolution ultrasound. Results: Mean brachial artery FMD was 7.2±2.6%. Measures of VRI obtained with the upper arm occlusion were significantly associated with simultaneously obtained brachial artery VRI (r=0.73). VRI values obtained with the finger occlusion (1.6±0.4AU) were not significantly different from VRI measured with simultaneously obtained brachial artery FMD (r=0.73). VRI values obtained with the right antecubital fossa or the base of the right index finger. Temperature monitors were placed on bilateral index fingers to assess change in temperature throughout 5-minute occlusion and recovery phases. FMD was obtained simultaneously using high-resolution ultrasound. Results: Mean brachial artery FMD was 7.2±2.6%. Measures of VRI obtained with the upper arm occlusion were significantly associated with simultaneously obtained brachial artery VRI (r=0.73). VRI values obtained with the finger occlusion (1.6±0.4AU) were not significantly different from VRI measured with the brachial occlusion (1.7±0.3AU), and both VRI values were moderately correlated with each other (r=0.50). Conclusion: Finger-based VRI may be a valid and novel alternative measure of endothelial function that is more suitable than the standard FMD for the assessment of endothelial function in the routine clinical setting.

944  Board #70  May 27 2:30 PM - 4:00 PM
Chronic And Acute Benefits Of Reduced Sitting In Individuals With Increased Cardiovascular Risk
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Sedentary behavior increases the risk for cardiovascular and cerebrovascular disease. However, little work examined the causal link between a decline in sedentary behavior and cardio- and cerebrovascular function, and the potential underlying mechanisms for this relation. PURPOSE: to examine the chronic (16-week) and acute (3-hour) impact of reducing sedentary behavior on vascular and cerebral function in subjects with increased cardiovascular risk. METHODS: This prospective study included 24 individuals with increased cardiovascular risk (65±5 years, 29±3±9 kg/m²). Before and after 16-week reduced sitting, using a mobile-Health device with vibrotactile feedback, we examined: i. vascular function (flow-mediated dilation (FMD)), ii. cerebral blood flow (CBF, transcranial Doppler), and iii. cerebrovascular function (cerebral autoregulation (CA) and cerebral vasomotor reactivity (CVMR)). To better understand potential underlying mechanisms, before and after intervention, we evaluated the effects of 3-hour sitting with and without light-intensity physical activity breaks (every 30-minutes). RESULTS: The first wave of participants showed no change in sedentary time (0.9%, 10.3±0.2 hours/day, P=0.87). After intervention optimization, the subsequent participants (n=15) decreased sedentary time (10.2±0.4 to 9.2±0.3 hours/day, P<0.01). This resulted in significant increases in FMD (3.1±0.3 to 3.8±0.4%, P<0.02) and CBFV (48.4±2.6 to 51.4±2.6 cm/s, P<0.02), without altering CA or CVMR. Before and after the 16-week intervention, 3-hour exposure to uninterrupted sitting decreased FMD and CBFV, whereas physical activity breaks prevented a decrease (both P<0.05). CA and CVMR did not change (P=0.20).

945  Board #71  May 27 2:30 PM - 4:00 PM
EXPLORING SEX DIFFERENCES ON ARTERIAL STIFFNESS IN RESPONSE TO HEAVY ROPE EXERCISE
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PURPOSE: To evaluate sex differences on aortic and carotid arterial stiffness, and carotid artery compliance (CAC), following heavy rope exercise (HRE). METHODS: Twenty-seven resistance-trained individuals (Men: n=14, Mean±SD: Age: 23 ± 3 yrs; Women: n=13, Age: 22 ± 2 yrs) participated. All measurements were collected at Rest, and 15 (Rec1), 30 (Rec2), and 60 (Rec3) minutes following HRE. Aortic arterial stiffness was assessed by pulse wave velocity (PWV), while carotid arterial stiffness, via beta stiffness index (BSI), and CAC, were collected via Doppler ultrasound. HRE utilized six 15-second exercise bouts using a double wave pattern (180rpm), with 30-second recovered. Two-way repeated measures ANOVAs were used to determine differences in PWV, BSI, and CAC, between the sexes across time.

RESULTS: Men had significantly greater height (p ≤ 0.001) and weight (p ≤ 0.001). There were no significant sex by time interactions for PWV (p = 0.96) or BSI (p = 0.09). A significant main effect of time (p ≤ 0.001) showed that PWV significantly increased during Rec1, but remained within limits Rec2 and Rec3. For BSI, only Rec1 showed a significant sex by time interaction, which was likely due to less variability in BSI between the sexes. There was a significant sex by time interaction for CAC (p = 0.05). Men did not significantly change across time, however, from Rest, while women significantly increased during Rec2, then significantly increased from Rec2 to Rec3 (Men= Rest: 0.5 ± 0.1 mmHg, Rec1: 0.2 ± 0.1 mmHg, Rec2: 0.2 ± 0.1 mmHg, Rec3: 0.2 ± 0.1 mmHg, Women= Rest: 0.3 ± 0.1 mmHg, Rec1: 0.2 ± 0.1 mmHg, Rec2: 0.2 ± 0.1 mmHg, Rec3: 0.2 ± 0.1 mmHg). CONCLUSIONS: These data suggest that HRE does not produce differences in aortic or carotid arterial stiffness between the sexes. The initial decrease in women’s CAC is likely due to greater relative intensity, while the increase in CAC back to resting values is potentially due to the cardioprotective effects of estrogen.

946  Board #72  May 27 2:30 PM - 4:00 PM
Abstract Withdrawn

947  Board #73  May 27 2:30 PM - 4:00 PM
L-citrulline Supplementation Attenuates Aortic Pressure And Wave Reflection Responses To Cold Stress In Older Adults
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PURPOSE: Aging is a major risk factor for cardiovascular events due to increased pressure wave reflection. Cold exposure augments central blood pressure and wave reflection due to sympathetically-mediated vasoconstriction, which elevates the risk for adverse cardiovascular events in older adults. L-citrulline (L-CIT) supplementation improves endothelial synthesis of nitric oxide and contributes to reduce aortic systolic blood pressure (SBP) and pulse pressure (PP) responses to cold pressor testing (CPT) in young men; however, the impact on wave reflection in older adults is unknown. The purpose of this study was to elucidate the efficacy of L-CIT to attenuate aortic hemodynamic responses to CPT in older adults.

METHODS: Thirty-four men (16, 60-85 yrs) were randomly assigned to placebo or L-CIT (6g/day) for 14 days, in a 2:1 randomization, double-blind design. Brachial and aortic SBP, PP, augmented pressure (AP), augmentation index standardized at 75 bpm (AIX@75), and pressure of the forward (Pf) and reflected (Pb) waves were evaluated at...
rest and during CPT before and after the assigned intervention. An analysis of variance with repeated measures was used to determine if there were differences within and between interventions and during CPT.

**RESULTS:** No significant changes with either intervention were observed at rest. Responses in aortic PP (P < 0.001), AP (P < 0.001), and HR (P < 0.001) increased significantly among those that consumed BR-LNMMA compared to those that consumed PL-LNMMA, and aortic PP and AP were significantly higher with BR-LNMMA than those with PL-LNMMA. MAP was similar among groups at rest and during CPT.

**CONCLUSIONS:** Aortic PP, AP, and HR were increased during CPT in both groups. This study suggests that L-CIT supplementation resulted in aortic PP, AP, and HR response, and MAP response, with no change in BR-LNMMA compared to PL-LNMMA. The use of L-NMMA supplementation may improve vascular function, as evidenced by decreased aortic PP, AP, and HR response during CPT.

**Excess adiposity is a risk factor for cardiovascular disease, however, the obesity paradox suggests the existence of a subpopulation of obese individuals that do not suffer from those cardiovascular risks. Cardiorespiratory fitness (CRF) is a strong indicator of cardiovascular health in children and adults. Both obesity and low CRF have been shown to independently increase the risk of cardiovascular diseases.**

**PURPOSE:** The aim of this study was to investigate how central arterial stiffness is associated with aerobic capacity and body fat percentage and body mass index (BMI) in children aged 7 to 17 years.

**METHODS:** Seventy healthy children, 34 boys and 36 girls (age 7-17 years; BMI 21.5±5.4 kg/m²; fat mass 23.4±11.5%), participated in this study. Percentage of fat mass (FM%) and fat free mass (FFM) were assessed using air displacement plethysmography (Bod Pod COSMED). ARTERIAL stiffness was assessed using carotid-femoral PWV (cfPWV) with the SphygmoCor XCEL (AtCor Medical, Inc.). CRF was assessed through breath-by-breath gas analysis (K5, COSMED) using an 15 watts per minute graded exercise test on a cycle ergometer. The VO₂ at the first ventilatory threshold (VT1) was identified using the V-slope technique and as the lowest respiratory equivalent for oxygen. Differences in cfPWV between quartiles of VO₂ at VT1, %BF, and BMI were assessed using a multivariate general linear model. RESULTS: cfPWV was higher in the first VO₂ quartile compared to the fourth when VO₂ was normalized by FFM (4.99±0.73 vs 4.24±0.69 m/s, P<0.05). No differences in cfPWV were observed between first and fourth VO₂ at VT1 quartiles when VO₂ was normalized by body mass (5.05±0.92 vs 4.34±0.71 m/s). eCFPW was higher in the fourth and third BMI quartile compared to the first (4.26±0.53 vs 4.90±0.66 vs 5.09±0.89; p<0.05) but no differences in eCFPW were observed between third and fourth BMI quartiles (5.06±1.04, 4.57±1.04, 4.61±1.04).

**CONCLUSION:** Low central arterial stiffness in children is associated with high CRF expressed as VO₂ at VT1, and with low BMI.
CONCLUSIONS: Women with a history of APO tended to have higher peripheral and aortic systolic BP 6 months-3 years after delivery. The effects of an APO on BP may be detectable soon after the pregnancy ends and might represent a target for prevention of overt cardiovascular disease in affected women.

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Board #79
May 27 2:30 PM - 4:00 PM
The Relationship Between Estimated Pulse Wave Velocity With Cardiorespiratory Fitness In Young Adults
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Introduction: Carotid-femoral pulse wave velocity (cPWV) is used to measure aortic stiffness and offers insight into cardiovascular disease (CVD) risk. The measurement requires specialized equipment and technical expertise to perform accurately. Estimated cPWV also offers similar insight into CVD resiliency that has not been explored. Cardiorespiratory fitness (CRF) is associated with lower CVD risk and individuals with greater CRF have lower cPWV. Purpose: To investigate the relationship between cPWV and CRF in young adults. Methods: Sixty young, healthy adults (mean age 25±7 years; mean body mass index 24.7±4.0 kg/m²; mean height 176±10 cm; mean body mass 77.0±17 kg; mean weight 160±17 g; mean age 25±7 years) volunteered for this study. cPWV was calculated using applanation tonometry via simultaneous measurements of carotid and femoral pressure waves. cPWV was calculated from a regression equation using age and mean arterial pressure. Beat-by-beat blood pressure was measured by Finometer and mean arterial pressure (MAP) was calculated. Forearm blood flow (FBF) was measured by Doppler ultrasound at the brachial artery and forearm vascular conductance (FVC) was calculated as FBF/MAP. Sympathetic vasoconstrictor responsiveness was calculated as the percentage decrease in FVC (%AFVC) in response to CPT. FMD was calculated as the percentage increase in brachial artery diameter from baseline and normalized for cumulative shear rate. Results: Sympathetic vasoconstrictor responsiveness was not different (p>0.05) between meal conditions or between females (LF: -27±14%: HF: -25±12%) and males (LF: -30±15%: HF: -24±16%) in either meal condition. FMD normalized for shear rate was different (p<0.05) between meal conditions or between females (LF: 4.1±3.2%: HF: 3.3±2.7%) and males (LF: 4.2±3.2%: HF: 3.5±2.7%) in either meal condition. Conclusion: These data suggest that, despite evidence of a post-prandial decrease in endothelial function, a HF meal does not alter sympathetic vasoconstrictor responsiveness in men or women.

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Board #80
May 27 2:30 PM - 4:00 PM
Effects Of Methionine Restriction And Exercise On Cardiac Fibrosis Of Spontaneously Hypertensive Rats.
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Purpose: To investigate the effect of low methionine diet and endurance exercise training on cardiac function of spontaneously hypertensive rats. Methods: A total of 80 male spontaneously hypertensive rats (SHR) (six-week-old) were randomly divided into four groups: (1) 0.86% methionine diet and sedentary lifestyle (C), (2) 0.17% methionine diet and sedentary lifestyle (MR), (3) 0.86% methionine diet and endurance exercise (EX), (4) 0.17% methionine diet and endurance exercise (MR+EX). The body weight, water intake, and food consumption were recorded once per week. In the exercise group, the rats were adapted to exercise on treadmill (10 min, 10 min/day) for three days. The endurance exercise protocol on the treadmill started from 15 min, and progressively enhanced to 27 m/min during eight weeks, and then maintain to 12 months. The rats were trained on treadmill 5 days/week, 60 min/day for 2 or 12 months. We measured the rats’ diameter of left ventricle (LVD), and left ventricular posterior wall thickness (LVPW) during diastole and systole period by using echocardiography at beginning and after 2 and 12 month intervention. All data were presented as mean±SEM. One-way ANOVA was used to evaluate differences between the changes, while Dunnett T3 post-hoc analysis was used to compare significant differences between test conditions. Statistical significance was accepted at p<0.05. Results: Comparison between high fat (HF) and low fat (LF) diet was observed between meal condition and sex for FMD. FMD normalized for shear rate was lower (main effect of meal; p<0.05) in the HF compared to the LF meal condition. No interaction (p>0.05) was observed between meal condition and sex. FMD normalized for shear rate was not different (p>0.05) between meal conditions or between females and males in either meal condition. Conclusion: These data suggest that, despite evidence of a post-prandial decrease in endothelial function, a HF meal does not alter sympathetic vasoconstrictor responsiveness in men or women.

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Board #81
May 27 2:30 PM - 4:00 PM
Sleep Variability Is A Predictor Of Peripheral Vascular Function In Apparently Healthy Undergraduate College Students
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Purpose: To examine the association between sleep variability (SLV) and vascular function in undergraduate college students. Methods: SLV metrics were estimated in 39 healthy undergraduate students (20.6±2.5 years) using wrist actigraphy for 14 days and nights. Sleep timing was defined by sleep midpoint (halfway point between sleep onset and wake onset). Sleep latency variability (STV) was then quantified as the standard deviation (SD) of sleep midpoint, and sleep duration variability (SDV) as the SD of sleep duration across 14 days. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). Peripheral vascular function was indexed as the magnitude of hyperemia in response to passive leg movement (PLM) and was performed immediately following the end of sleep monitoring. Blood velocity and femoral artery diameter were measured via Doppler ultrasound. Results: In a linear regression model adjusting for sex and body mass, SDV predicted peak leg blood flow (LBF) (β=0.49, p<0.01), change in LBF from baseline (β=0.42, p<0.01), and LBF area under the curve (AUC) (β=0.57, p<0.01) during PLM. Associations remained significant when the model included PSQI score (all p<0.01). Similarly, models adjusting for sex and mass found that STV predicted LBF AUC (β=0.30, p<0.05). Conclusion: In adjusted models, greater SLV is associated with less optimal peripheral vascular function in healthy college students. These data support the growing body of literature suggesting that regular sleep schedules may be important for CV health, even in otherwise healthy young adults. Supported, in part, by NIH P20GM113125.
INFLUENCE OF TYPE 2 DIABETES AND CARDIOVASCULAR DISEASE FAMILY HISTORY ON METABOLIC SYNDROME SEVERITY

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Background: Family history of cardiovascular disease (CVD) is considered a strong predictor of developing metabolic syndrome (MetS), in part through promoting endothelial dysfunction. In addition, a family history of type 2 diabetes (T2D) relates to lower metabolic insulin sensitivity and may compound their MetS risk severity. We examined in people with MetS of a family history of CVD and T2D (CVD T2D) increases MetS risk severity compared to individuals with a family history of CVD only (CVD). Methods: Twenty, middle-aged obese individuals with MetS (55.9 ± 6.5yrs; 32.5 ± 3.6kg/m²) were divided into CVD (n=9; 6F) or CVD+T2D (n=11; 9F). MetS was defined using the NCEP ATP III criteria. MetS severity Z-score was calculated from waist circumference, blood pressure, fasting blood glucose, triglycerides, and high-density lipoproteins. Metabolic insulin sensitivity (i.e. glucose infusion rate, GIR) was measured using a 2-hr hyperinsulinemic-euglycemic (40 mU/m2/min, 90 mg/dl) clamp. Insulin-stimulated brachial artery flow-mediated dilation (FMD) was also measured as the change from fasting to 2-hr during the clamp to assess endothelial function. Results: There was no difference in anthropometrics between groups. There was also no statistical difference between CVD and CVD+T2D in MetS severity (2.62±1.12 vs. 1.65±0.56, P=0.42), GIR (2.35±0.55 mg/kg/min vs. 2.63±1.56 mg/kg/min, P=0.86), or insulin-stimulated FMD (0.33±1.57% vs. 1.68±1.19%, P=0.52). However, waist circumference was inversely correlated to GIR (r=-0.63, P=0.01). Conclusion: In adults with MetS, T2D family history does not exacerbate MetS severity in adults with CVD metabolic family history. However, waist circumference appears to be important for lowering metabolic insulin sensitivity. Thus, targeting abdominal fat may contribute to improved metabolic health independent of T2D and/or CVD family history.

Funding was supported by the National Institutes of Health R01-HL130296.
Cardiovascular diseases (CVD) are the leading cause of death worldwide, and compelling evidence indicates that exercise prevents and attenuates CVD. Resistance training (RT) exerts positive health effects; however, there is a lack of evidence regarding the RT intensities that could be prescribed to improve vascular endothelial function. PURPOSE: To compare the effects of two RT intensities during eight weeks on vascular endothelial function in sedentary young males. METHODS: Thirty-four sedentary men were recruited (age = 20.6 ± 1.8 yr, height = 171.3 ± 5.2 cm, weight = 65.2 ± 10.6 kg, DXA fat mass = 22.3 ± 7.4 %), and randomly assigned to a control group (CTRL, no exercise), RT at 50% of a maximum repetition [1-RM] and RT at 80% 1-RM. The RT program was performed twice a week for eight weeks, and except for the CTRL group, participants performed the same RT exercises at similar total workloads (1920 arbitrary units [AU] for the 80%RM and 1950 AU for the 50%RM). Vascular endothelial function was measured between (pre) and after (post) eight weeks by ultrasound and determined by the percentage of flow-mediated dilation (%FMD). Mixed factorial ANOVA (3 groups x 2 measurements x 2 occlusions), effect size (ES) and 95% confidence interval (CI95%) were computed for %FMD. RESULTS: A significant triple interaction was found on %FMD (p = 0.021). The eight-week post-intervention follow-up analyses showed a significant increase (p = 0.010) in %FMD in the 50%RM (Mean = 9.93 ± 3.73%; ES = 3.70, CI95% = 1.59 to 5.79) compared to the CTRL group (Mean = 5.72 ± 1.71%; ES = 1.67, CI95% = -0.21 to 3.55), and no significant differences between 50%RM and 80%RM (Mean = 7.90 ± 2.51%, ES = 2.18, CI95% = 0.27 to 4.10), and between 80%RM and control groups. CONCLUSION: A 50%RM intensity RT program elicited a positive vascular endothelial function adaptation following eight-weeks of training. It seems unnecessary to perform high-intensity RT to obtain arterial health benefits.

Spacksackrilat-Valsartan Treatment Improves Vascular Function And Functional Capacity In Heart Failure With Reduced Ejection Fraction

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(No relevant relationships reported)

Objective: To study the effects of exercise on ER stress and UCP-2 in endothelial dysfunction in atherosclerosis.

METHODS: We used 4 groups of mice; wild type (WT), WT with exercise training, running on the treadmill for 12 weeks (WT-EX), apolipoprotein E knockout (ApoE KO) and ApoE KO with exercise training (ApoE KO-EX). We measured endothelium-dependent acetylcholine (ACh)-induced vasodilation of isolated and pressurized coronary arterioles in a concentration-dependent manner. Also, ACh-induced vasodilation was elicited in the presence of an inhibitor of eNOS and UCP-2 (L-NNAME and Geminip) and the ER stress inducer (Tunicamycin). Immunoblotting was performed to measure the protein expression of ER stress markers (GRP78, IRE1, eIF2α, and CHOP). NLRP3 inflammasome signaling (NLRP3, caspase-1, IL-1β), Bax, TXNIP, and UCP-2 in the heart. The expression of p67phox and superoxide was visualized using immunofluorescence and DHE staining in coronary arteries. NO production was measured by nitrate/nitrite assay.

RESULTS: ACh-induced endothelium-dependent vasodilation was attenuated in coronary arterioles of ApoE KO, but it was improved in ApoE KO-EX. L-NNAME, tunicamycin, c이I2α, and CHOP), NLRP3 inflammasome signaling (NLRP3, caspase-1, IL-1β), Bax, TXNIP, and UCP-2 in the heart. The expression of p67phox and superoxide was visualized using immunofluorescence and DHE staining in coronary arteries. NO production was measured by nitrate/nitrite assay.

CONCLUSION: Our findings suggest that exercise training alleviates endothelial dysfunction in atherosclerotic coronary arterioles through the NOS, UCP-2, and ER stress signaling pathways including TXNIP/NLRP3 inflammasome and oxidative stress.
Purpose: Isometric exercise training (IET) is an effective adjunct for the management of resting blood pressure (RBP) but responsible mechanisms have not yet been fully identified. Isometric contractions reduce blood flow as a result of vascular compression altering intramuscular metabolism. In response, active muscle could increase the production and circulation of vasoactive molecules (e.g., VEGF) and alter inflammatory biomarkers (e.g., IL-6 and TNF-α), which may lead to adaptations in resistance vessels. We studied the influence of bilateral arm or leg IET on blood pressure and plasma VEGF, IL-6, and TNF-α over the course of 6 weeks.

Methods: The study was approved by the UNC Charlotte IRB. Twenty-eight healthy and recreationally active normotensive males (19-25 years) gave written informed consent and were randomized to one of three conditions: bilateral bicep curl IET (IBC), double leg extension IET (ILE), or control (CON). IET groups completed exercise sessions at 15% maximal voluntary contraction (4-6 sets, 10-15 repetitions, 3 days per week for 6 weeks with RBP assessed at each visit. For a subsample (n=17), 3 blood samples (pre-, 1 hour post-, 24 hours post-training) were collected at the first and last training visits. The CON group performed all study procedures except IET.

Results: Using a repeated-measures ANCOVA (controlling for acclimation RBP and cohort), a significant time by treatment effect was observed from Week 1 to Week 6 (F(2,23) = 4.10, p < .05, n2 = .263). Specifically, IET resulted in a lower systolic RBP, but did not differ by IET group: IBC -4.4 ± 4.0 mmHg; ILE -4.3 ± 7.6 mmHg; CON 2.3 ± 4.0 mmHg. Diastolic RBP did not significantly change for any group. Currently, there are no acute or chronic IET effects on the systemic biomarker levels.

Conclusions: 6-weeks of bilateral arm or leg IET resulted in significant reductions in systolic pressure and plasma VEGF. However, this study did not fully identify the ability to detect significant effects on circulating VEGF, TNF-α and IL-6. Research should continue to examine how IET alters RBP. The research was funded by Faculty Research Grant (JMB & HR) and the Thomas L. Reynolds Graduate Student Research Award (B.D.G.H).

Purpose: Oscillometric ambulatory blood pressure monitors (ABPMs) are prone to errors in a controlled laboratory setting. V. Patteson Lombardi, Patrick C. Reichhold, Jennifer L. Cramer, Hannah P. Harkness, Natalie J. DeBell, Nicholas R. Dietz, Tova J. Kruss, Savannah S. Lutz, Donald L. Pate. University of Oregon, Eugene, OR. Email: lombardi@uoregon.edu

We developed a dual monitor protocol for testing the accuracy and reliability of 24-hr ambulatory blood pressure monitors (ABPMs) and determined in normotensive subjects (n=15), hypertensives (n=14) and alcohol-dependents (n=11) that a popular oscillometric ABPM was highly variable, misclassifying up to 70% of patients.

Purpose: To determine the accuracy and reliability of two widely used oscillometric ABPMs, the Oscillomat 900207 (Spacelabs Healthcare, Snoqualmie, WA) and the Digihome monitor. Hypothesis: Oscillometric proprietary algorithms were developed from anosculatory reference BPs, thus ABPMs would differ from each other and from observers (O1, O2) using a Hg column and Thinklabs digital stethoscope.

Methods: BPs were measured in triplicate on both arms in 17 seated subjects (10 male, 7 female) by O1 and O2 alternating with simultaneous opposite arm BPs by ABPMs. Results: The average (x ± SE) systolic (SBP) and diastolic (DBP) BPs for O1, O2, Oscillomat & Spacelabs ABPMs were 114.2 ± 2.7 / 73.3 ± 2.0 / 8.1 mm Hg; 114.1 ± 1.6 / 72.1 ± 2.1 mm Hg, 120.6 ± 7.7 / 72.1 / 1.4 mm Hg, and 119/3 ± 7.9 / 1.9 mm Hg, respectively. Compared to O1O2, the Oscillomat underestimated SBP by 9.8 ± 0.9 mm Hg (P < 0.001), while the Spacelabs overestimated SBP by 7.3 ± 0.2 / 8.8 mm Hg (P = 0.001). SBP and DBP differed significantly between ABPMs (P < 0.001). Though the DBP difference was small between observers and ABPMs, O1O2 - Oscillomat = -4.6 mm Hg; O1O2 - Spacelabs = -0.7 mm Hg, there was a high degree of variability with the Oscillomat ranging from 23 mm Hg above to 20 mm Hg below and the Spacelabs 23 mm Hg above to 26 mm Hg below the observers. Compared to O1O2, Oscillomat SBP and DBP differed by > 5 mm Hg in 15/17 (88%) and 7/17 (41%), while the Spacelabs SBP and DBP differed by > 5 mm Hg in 11/17 (65%) and 8/17 (47%) of subjects, respectively. Conclusions: Controlled lab testing revealed significant measurement errors in widely used oscillometric ABPMs. Given light exercise during 24-hr ambulatory monitoring, the outlook for accuracy and reliability appears worse. Oscillometric nomogram-like equations are population-specific and indirect 2nd generation estimations and cannot account for individual variations making them highly susceptible to errors, though more testing is required in a greater number of hypertensives.

Purpose: Sedentary behavior (SB) is recognized as a serious global health issue. SB-induced down regulation of shear rate and blood flow play a key role in the pathogenesis of endothelial dysfunction, an important prognostic marker for cardiovascular disease. The purpose of this study was to assess the association between objectively measured sedentary time and endothelial function biomarkers in young male adults.

Methods: A total of 93 participants (age, 21 ± 3.8 yr; body height, 171.6 ± 6.4 cm; body weight, 62.1 ± 6.4 kg; % body fat, 15.6 ± 4.6%; body mass index (BMI) 21.1 ± 1.7 kg/m2; waist circumference 74.5 ± 5.1 cm; heart rate (HR) 67.6 ± 9.5 bpm; systolic blood pressure (SBP) 108.4 ± 9.1 mmHg; diastolic blood pressure (DBP) 71.6 ± 8.1 mmHg) were the activPALTM continuously for 7 days without removal. Total sedentary time was assessed using PAL analysis v8.0. Bedtime and wake-up time were recorded by participants. Sleep duration was determined as the time between bed time and wake-up time. Sedentary time during waking hours was calculated as the total sitting/lying time minus sleep duration. A fasting venous blood sample was drawn from each of the participants from which serum endothelial cell adhesion molecules (E-selectin, P-selectin, Intercellular Adhesion Molecule 1 (ICAM-1) and Vascular Cell Adhesion Molecule 1 (VCAM-1) were measured using flow cytometry. Multiple linear regression models examined the associations of sedentary time with endothelial function biomarkers using SPSS version 23.0.

Results: E-selectin (β = 0.226, 95% confidence interval [CI]: 0.021, 0.431) and P-selectin (β = 0.216, 95% CI: 0.017, 0.415) were significantly associated with sedentary time after controlling for age and BMI. After moderate-to vigorous physical activity (MVPA) was added to the model, there were no significant association between E-selectin and sedentary time. No significant associations were found between ICAM-1 or VCAM-1 with sedentary time or between ICAM-1 or VCAM-1 with sedentary time after controlling age, BMI, and MVPA.

Conclusions: Objectively measured sedentary time was positively associated with E-selectin and P-selectin in young male adults independent of age and BMI. MVPA may alleviate the adverse effects of sedentary time on biomarkers of endothelial function.

Purpose: Regular resistance training enhances fibrinolytic potential. Paul R. Nagelkirk, Kayla Soue, Cody Ailtherr, Andrew T. Del Pozzi. Ball State University, Muncie, IN. Email: pnagelkirk@bsu.edu

Blood clot causes most cardiovascular events, such as heart attack and stroke. Blood markers of fibrinolysis, the capacity to dissolve blood clots, are independently associated with cardiovascular morbidity and mortality. Regular resistance training (RT) produces various muscular and vascular adaptations that are theorized to influence thrombotic potential, but there are no published longitudinal studies that examine fibrinolytic adaptations to RT. PURPOSE: The purpose of this study was to identify effects of an 8-week RT program on fibrinolytic potential. METHODS: Sixteen healthy adults (n = 12 women, 4 men; age = 23 ± 5 years) completed a RT program that targeted all major muscle groups, 3 times per week for 8 weeks. Exercises included 2-3 sets of 8-12 repetitions performed at approximately 60-80% of 1 RM. Body composition, circumferences, and 1 RM leg and chest press strength measures were obtained via standard methods. Resting blood samples were obtained by clean venipuncture at baseline and after 8 weeks of RT. Enzyme-linked immunosorbent assay (ELISA) were used to assess plasma concentrations of the following fibrinolytic variables: active tissue plasminogen activator (tPA-c), tissue plasminogen activator antigen (tPA), active plasminogen activator inhibitor-1 (PAI-1-c), and plasminogen activator inhibitor-1 antigen (PAI-1-g). Statistical analyses were conducted using paired t-tests. RESULTS: Significant increases in lean mass (PRE = 52.18 ± 4.33 kg; POST = 53.61 ± 10.42 kg), arm circumference (PRE = 28.99 ± 5.12 cm; POST = 30.97 ± 4.92 cm), and mid-thigh circumference (PRE = 49.96 ± 5.43 cm; POST = 51.08 ± 5.83 cm) were observed (all p < 0.05). Maximal chest press (PRE = 57.8 ± 37.5, POST = 73.3 ± 43.2 kg) and leg press strength (PRE = 189.5 ± 95.8, POST = 256.7 ± 97.9 kg) significantly increased (p < 0.01). PAI-1-c (PRE = 20.3 ± 32.5, POST = 25.6 ± 97.9 kg) significantly increased (p < 0.01).
Blood pressure (BP) values may be more reflective of cardiovascular disease (CVD) risk than peripheral BP of cardiovascular disease factors occurring on a continuum. Central blood flow in peripheral tissues. More information on test-retest reliability and inter-rater agreement of NIRS-based reperfusion assessments is needed. PURPOSE: To assess inter-rater agreement for NIRS-based data and evaluate the measurement’s reliability across days. METHODS: On three separate days, participants’ (N=15 males, 22±2 yr) reactive hyperemia was measured in the left gastrocnemius muscle using Continuous-Wave NIRS. A blood pressure cuff was placed proximal to the knee and inflated to occlude lower leg blood flow for 5 minutes. The cuff was rapidly deflated, and the blood flow responses were measured until values returned to baseline. Raw NIRS data were exported and analyzed in a custom-written routine in MATLAB by two individuals. The following NIRS parameters were selected:(1) the time for the O2Hb signal to reach 50% peak post-occlusion hyperemia (T1/2), (2) The O2Hb range used to normalize the NIRS signal; (3) the post peak-hyperemic O2Hb recovery slope, taken as an index of sustained microvascular dilation. Inter-rater agreement was assessed using Intraclass Correlation Coefficients (ICC), calculated using an absolute agreement two-way mixed effects model. 95% confidence intervals (CI) of ICCs are reported. Cronbach’s alpha was used to assess day to day reliability for each of the measures. RESULTS: The ICC data indicate that there is “good” to “excellent” agreement between NIRS analyzers as shown in table 1.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Rater 1</th>
<th>Rater 2</th>
<th>Rater 3</th>
<th>Rater 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1/2 (s)</td>
<td>9.03 (2.43)</td>
<td>9.71 (3.07)</td>
<td>6.3 (2.21)</td>
<td>6.9 (2.80)</td>
</tr>
<tr>
<td>O2Hb Range</td>
<td>31.72 (8.57)</td>
<td>33.06 (6.47)</td>
<td>7.1 (3.38)</td>
<td>7.9 (3.99)</td>
</tr>
<tr>
<td>O2Hb recovery slope</td>
<td>-17.05 (0.08)</td>
<td>-18.06 (0.06)</td>
<td>-7.45 (0.92)</td>
<td>-7.91 (0.97)</td>
</tr>
</tbody>
</table>

The Cronbach’s alpha for raters 1 and 2 were: T1/2 (~0.95, α = 0.91), O2Hb (α = ~0.95, α = ~0.91), and post peak-hyperemic O2Hb recovery slope (α = ~0.74, α = ~0.83).

CONCLUSION: Our data indicate multiple raters can be used to analyze NIRS based reperfusion measures with good agreement and that the method has sufficient test-retest reliability to use in experimental designs involving multiple laboratory visits.

Exercise training improves endothelial function partially through increases in blood flow-associated shear stress. Local heat training can be used to isolate the exercise-independent effect of increased shear stress on endothelial function. Forearm heat training has been found to improve brachial artery endothelial function, however, this has never been investigated in the lower limb. PURPOSE: To examine the effect of heat training on superficial femoral artery (SFA) endothelial function in young, healthy females utilizing reactive hyperemia flow-mediated dilation (RH-FMD) and sustained stimulus FMD (SS-FMD). METHODS: Female participants (n=11, 23±2 yrs) had one leg randomized to the heat training intervention (EXP; other leg: control (CON)). The EXP leg underwent 8 weeks of heat training via immersion in 42.5°C water for five 35-minute sessions per week. At week 0, 2, 4, 6, and 8, SFA RH-FMD and SS-FMD were measured in each leg via duplex ultrasound. RH-FMD was characterized as the peak % change in diameter following release of 5 min of thigh occlusion. SS-FMD was characterized as the peak % change in diameter during 6 min of plantar flexion exercise at a target shear stress of 13 dynes/cm². RESULTS: Week zero RH and SS-FMD were as follows: RH-FMD: CON 7.3±3.1, EXP 5.1±3.2 mmHg; SS-FMD: CON 8.1±4.3, EXP 9.2±4.6 mmHg. RH-FMD and SS-FMD did not change over the training period (RH: p=0.086; SS: p=0.958). Covariation for the shear stress stimulus did not alter the results. CONCLUSION: 8-weeks of leg heat training in young, healthy females did improve SFA endothelial function. These results are in contrast with previous findings that heat training improves upper limb endothelial function. The increased blood flow-associated shear stress elicited by the heating protocol may have been inadequate to elicit adaptation in the SFA. Future studies are needed to determine whether other lower limb conduit arteries or the microvasculature benefit from local, lower limb heat training.
predominantly passes through the DFA. Cuffing appears to impact the SFA BF in the old to a greater extent than the young, but, again, in this population there is no effect on PLM-induced DFA BF.

CONCLUSIONS: Isometric handgrip exercises reduce carotid AIX and carotid SBP, which is associated with improving cognitive function.

PURPOSE: To determine if physical activity post-menopausal women demonstrate preserved vascular health compared to physically active pre-menopausal women.

METHODS: Twenty-two men and women (age 75±7 years, mean±standard deviation) who were not actively involved in regular resistance or endurance training were recruited. Blood pressure (24-hour ambulatory blood pressure monitoring), physical activity, health and cognition were assessed. Cardiovascular health was assessed using carotid augmentation index (AIx), carotid systolic blood pressure (SBP) and cognitive function was assessed using the Trail Making Test Part A (TMT-A) and Part B (TMT-B).

RESULTS: Both pre- and post-menopausal women demonstrated preserved vascular health compared to physically active women (carotid AIx, carotid SBP, TMT-A and TMT-B did not significantly change before and after training in the CON group). A significant positive correlation was observed between the amount of change in carotid AIx and the amount of change in TMT-A (r=0.603, p<0.05) and TMT-B (r=0.591, p<0.05). In addition, a significant positive correlation was observed between the amount of change in carotid AIx and the amount of change in TMT-B (p<0.05 for both).

CONCLUSIONS: These results demonstrate that isometric handgrip exercises reduce carotid AIX and carotid SBP, which is associated with improving cognitive function.

As the percent rise of the peak diameter from baseline diameter. Doppler ultrasound was employed to measure the carotid diameter, and blood velocity during exercise, and hypercapnia. Conductance and shear rate (SR) of the ICA at 25 min of exercise was calculated based on the Doppler variables and mean blood pressure.

RESULTS: Neither type of exercise altered the SR of the ICA (Interaction effect; P = 0.93, main effect of time; P = 0.14). Conductance decreased during high-intensity exercise (Pre to 25 min; 5.1 ± 1.3 to 3.2±1.0 ml/min/mmHg, P = 0.01) but not during moderate-intensity exercise (5.0 ± 1.3 to 4.0 ± 0.8 ml/min/mmHg, P = 0.11). Shear-mediated dilation immediately declined after high-intensity exercise (Pre to Post5; 6.9 ± 1.7 to 4.0 ± 1.4%, P < 0.01), but not after moderate-intensity exercise (7.2 ± 2.1 to 7.3 ± 1.8%, P = 1.00). Shear-mediated dilation did not show significant changes at Post60 in either exercise intensity (Post 60; Moderate; 8.0 ± 3.1, High; 6.4 ± 2.9%).

CONCLUSIONS: The acute decline of shear-mediated dilation in the ICA following high-intensity exercise may have been due to changes in shear anisotropy and hemodynamics rather than in the SR. Current findings suggest that moderate-intensity exercise is more suitable for promoting cerebrovascular health than high-intensity exercise.
Sitting-induced Endothelial Dysfunction Is Prevented In Endurance-trained Individuals

Takuma Morishima1, Yosuke Tsuchiya2, Hisashi Ueda3, Katsunori Tsuji1, Eisuke Ochi1; 1Hosei University, Tokyo, Japan. 2Teikyo Heisei University, Tokyo, Japan. 3National Cancer Center, Tokyo, Japan.

No relevant relationships reported

PURPOSE: Prolonged sitting impairs leg endothelial function, which seems to be mediated by a sustained reduction in blood flow-induced shear stress. However, whether regular endurance training is effective in preventing sitting-induced leg endothelial dysfunction remains largely unknown. Herein, we tested the hypothesis that sitting-induced leg endothelial dysfunction is prevented in high endurance-trained individuals.

METHODS: The endurance-trained group comprised 11 male collegiate cyclists (age, 19.7 ± 0.6 years; height, 168.4 ± 6.2 cm; weight, 62.7 ± 4.9 kg; body mass index, 22.1 ± 2.3 kg/m²), and the untrained group comprised 9 male with no regular endurance training (age, 21.1 ± 1.8 years; height, 170.1 ± 6.6 cm; weight, 72.2 ± 8.1 kg; body mass index, 24.8 ± 1.5 kg/m²). Peak oxygen uptake (VO₂peak) was initially determined in all participants using incremental exercise test (37.9 ± 4.7 mL/min/kg in the untrained vs. 60.5 ± 3.6 mL/min/kg in the endurance-trained group). At second visit, the popliteal artery flow-mediated dilation (%FMD) was assessed before and after a 3-h sitting period. During the sitting period, the popliteal artery diameter and blood velocity were measured every hour.

RESULTS: The popliteal artery shear rate was significantly and similarly reduced during the sitting period in both groups (the untrained group and the endurance-trained group: 51.9 ± 19.2 sec⁻¹ vs. 58.3 ± 23.5 sec⁻¹ at pre-sit, 25.5 ± 10.9 sec⁻¹ vs. 25.5 ± 15.2 sec⁻¹ at 1h during sitting period, 19.4 ± 7.4 sec⁻¹ vs. 27.5 ± 12.3 sec⁻¹ at 2h during sitting period, 21.4 ± 8.1 sec⁻¹ vs. 20.8 ± 8.3 sec⁻¹ at 3h during sitting period, 29.4 ± 13.9 sec⁻¹ vs. 29.7 ± 15.8 sec⁻¹ at post-sit, P = 0.001). In a 3-h sitting, a significant impairment in popliteal artery %FMD was observed in the untrained group (4.5 ± 6.0 % vs. 1.6 ± 0.2 % P = 0.003), but it was prevented in the endurance-trained group (6.9 ± 0.7 % vs. 6.2 ± 1.3 %, P = 0.431).

CONCLUSIONS: In conclusion, the present study revealed that sitting-induced leg endothelial dysfunction is preventable in endurance-trained individuals.

B-69 Free Communication/Poster - ACL Injury

Wednesday, May 27, 2020 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

The Functional Movement Screen Is Not Associated With Self-reported Disability, Gait, Or Drop Vertical Jump In Individuals With ACL Reconstruction

Eric J. Shumski1, Caitlyn Heredia1, Skyler C. Holmes1, Derek N. Parnook1, 1University of Massachusetts, Amherst, MA. Email: erichshumski@csu.fullerton.edu

No relevant relationships reported

Purpose: To determine the associations between Functional Movement Screen (FMS) scores and the International Knee Documentation Committee (IKDC) questionnaire score, Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales scores, gait biomechanics, and drop vertical jump (DVJ) biomechanics in individuals with ACL reconstruction (ACLr).

Methods: 30 individuals with ACLr (53% female; 71.0±46.4 months post-ACLr; 22.6±1.8 years old; 11 patellar tendon graft, 12 hamstring tendon graft, 7 allograft) completed the IKDC and KOOS. Bilateral gait biomechanics were obtained from 5 trials on a 10m runway over 2 force plates. DVJ biomechanics were obtained using a 30cm box placed half their height from the force plates. FMS tasks were scored from 0-3 and summed for analysis. Bilateral gait biomechanics included the knee flexion angle (KFA) at heel contact, peak KFA, and vertical ground reaction force (vGRF) in the first 50% of stance. Bilateral DVJ biomechanics included the peak knee abduction angle, peak KFA at heel contact, peak vGRF, and peak vGRF. A limb symmetry index (LSI) was calculated for peak KFA and peak vGRF during gait and DVJ. Involved limb values and LSI from gait and DVJ were used for analysis. Separate stepwise linear regression examined the association between the FMS and the IKDC, KOOS subscales, and DVJ biomechanics after accounting for sex and time since ACLr.

Results: No associations were found between FMS score (Mean: 15.0±1.8) and the IKDC (Mean: 84.3±10.6) and KOOS (Mean: 72.0 – 95.6±11.8 – 21.3) after accounting for sex and time since ACLr.

Conclusion: The IKDC and KOOS indicated that participants reported some knee-related disability. Conversely, the average FMS score was above the clinical threshold for dysfunctional movement patterns. Therefore, the FMS may not identify knee-related disability in individuals with ACLr. Moreover, FMS score was not associated with gait or DVJ biomechanics, and thus the FMS may not identify hazardous knee movement patterns in individuals with ACLr.
Matrix metalloproteinase-3 (MMP-3) is a degenerative enzyme associated with joint tissue breakdown and has been shown to be a potential biomarker of osteoarthritis. It remains unknown if synovial fluid (SF) MMP-3 concentrations following ACL injury influence gait mechanics. PURPOSE: To compare knee flexion angle (KFA) and internal knee extension moment (KEM) during gait 6 months post-ACLR in individuals with the highest concentrations of SF MMP-3 compared to those with the lowest concentrations of SF MMP-3 collected within the first 14 days of injury. METHODS: Thirty-seven individuals with ACL injury scheduled for primary patellar tendon autograft ACLR (57% females, 21.0±8.3 years, 5.96±.48-mo. post-ACLR) participated. Individuals were grouped into highest (HQ; n=9) and lowest (LQ; n=10) quartiles based on MMP-3 knee joint SF concentrations sampled 6+4 days after ACL injury. At 6 months post-ACLR, biomechanics were collected using 3-dimensional motion capture during gait performed at a self-selected speed. Functional analyses of variance were conducted to compare KFA and KEM between HQ and LQ groups throughout stance. Groups were considered different at any percentage of stance where the 95% confidence intervals of the mean differences did not cross zero. Peak differences (PD) and corresponding effect sizes (Cohen’s d) within portions of stance demonstrating differences were also calculated. RESULTS: HQ exhibited lesser knee flexion excursion; KFA was lower during 17-24% of stance (PD: -2.1°, d=0.44) and greater during 48-100% of stance (PD: 4.5°, d=0.93). HQ also exhibited lower KEM during 14-30% and 91-100% of stance (PD: 0.72 BW, d=0.07; PD: 0.33 BW, d=1.42) and greater KEM during 45-72% of stance (PD: 0.44, d=0.76). CONCLUSION: Compared to individuals in the lowest quartile of SF MMP-3, those in the highest exhibited a stiffened knee gait strategy. Pre-surgery levels of MMP-3 following ACL injury may serve as a biomarker predicting worse gait mechanics 6 months post-ACLR.

PURPOSE: Rehabilitation goals following anterior cruciate ligament reconstruction (ACLR) are structured around maximal force generating capabilities of the quadriceps. ACL injuries may occur through the inability to adapt motor output rapidly and accurately to external demands. Approximate Entropy (ApEn) can be used to describe the complexity of torque production to reflect the functional capacity of the neuromuscular system. The purpose of this study was to compare torque complexity of a maximal voluntary isometric contraction (MVIC) in ACLR limbs compared to the uninjured limb and healthy controls. METHODS: A total of 215 individuals (120 ACLR [65 Female, 21.0±8.3 years, 5.96±.48-mo. post-ACLR] 95 Healthy [50 Female, 21.5±2.9 years]) participated in the study. Participants completed a 30-second knee extensor MVIC which was stratified into three 10-second bins. The 3-seconds of lowest variation were used to calculate ApEn for the Early (ApEn1), Middle (ApEn2), and Late (ApEn3) time bins. Torque complexity was compared across the trial, between limbs, and between groups using a repeated measures design. The dependent variable was torque complexity (ApEn) and the independent variables were group (ACLR, Healthy) and time bins (Early, Middle Late). An a priori alpha was set at 0.05. RESULTS: There was a significant time main effect for torque complexity (P<.001). For all participants, ApEn1, ApEn2, and ApEn3 were significantly higher than ApEn3 (P<.001, Figure 1). There was also a significant group by limb interaction (P<.001). The ACLR limb (46c:12) demonstrated greater torque complexity than the uninjured limb (38c:12, P<.001) and of healthy individuals (38c:10, P<.001, Figure 1). CONCLUSIONS: The ACLR limb demonstrated a greater torque complexity at the end of a 30-second MVIC compared to healthy controls and the contralateral limb. Force fluctuations during a sustained maximal task may draw clinical insight into the recovery of motor function following ACLR.
resistance trained according to the American College of Sports Medicine guidelines consistently after completion of physical therapy. The NRT group included individuals who did not resist train at all. Independent samples t-tests were used to compare peak hip and knee extensor strength (Nm/kg), peak pGRF (N/kg), and pGRF impulse (Nw/kg) between the RT and NRT groups. Bivariate correlations were used to identify if hip and knee extensor strength were related to pGRF and pGRF impulse. Results: The RT group had greater peak hip extensor torque at 60°/sec (KE60) and 180°/sec (KE180) compared to the NRT group. No correlations were observed between groups in peak hip torque, pGRF, or pGRF impulse. There was a negative correlation between KE60 and pGRF during walking (r = -0.531, p=0.034). No correlations were found between pGRF impulse and hip or knee torque. Conclusion: Results confirm our hypothesis that in ACLr, individuals in the RT group exhibited greater knee extensor torque than the NRT group. Additionally, greater KE60 was related to less pGRF during walking. An exploratory analysis found no differences in walking or running velocities, indicating the RT group accomplishes the same goal with less force. This may demonstrate greater movement efficiency resulting from resistance training above the improvements in strength alone.

Appropriate knee loading during walking is essential for optimal health of mechanosensitive joint tissues and is largely governed by quadriceps muscle forces. However, individuals with anterior cruciate ligament reconstruction (ACLR) often exhibit quadriceps muscle dysfunction conventionally measured via reduced peak knee extensor moments (pKEM). Recent advances in ultrasound imaging provide a unique opportunity to determine if quadriceps dysfunction also manifests as altered contractile behavior between those with ACLr and uninjured controls. Purpose: Determine differences in quadriceps contractile behavior during weight acceptance in walking between ACLr, contralateral, and control limbs. Methods: Six individuals to date with unilateral ACLr (4 females, 20±2 yrs, BMI: 25.3±1.8, months post-surgery: 7.1±2.0) and 11 uninjured controls (6 females; 24±3 yrs, BMI: 22.0±2.0) walked for 2 min on an instrumented treadmill. We quantified pKEM, knee flexion excursion (KFE), and VL fascicle length change force data and recorded cine B-mode ultrasound images of the vastus lateralis (VL). We determined differences in quadriceps contractile behavior during weight acceptance in walking between ACLr, contralateral, and control limbs. Results: The RT group included individuals who did not resist train at all. Independent samples T-tests were used to compare peak hip and knee extensor strength (Nm/kg), peak pGRF (N/kg), and pGRF impulse (Nw/kg) between the RT and NRT groups. Bivariate correlations were used to identify if hip and knee extensor strength were related to pGRF and pGRF impulse. Results: The RT group had greater peak hip extensor torque at 60°/sec (KE60) and 180°/sec (KE180) compared to the NRT group. No correlations were observed between groups in peak hip torque, pGRF, or pGRF impulse. There was a negative correlation between KE60 and pGRF during walking (r = -0.531, p=0.034). No correlations were found between pGRF impulse and hip or knee torque. Conclusion: Results confirm our hypothesis that in ACLr, individuals in the RT group exhibited greater knee extensor torque than the NRT group. Additionally, greater KE60 was related to less pGRF during walking. An exploratory analysis found no differences in walking or running velocities, indicating the RT group accomplishes the same goal with less force. This may demonstrate greater movement efficiency resulting from resistance training above the improvements in strength alone.

894 Board #110 May 27 1:30 PM - 3:00 PM Effects Of ACL Reconstruction On In Vivo Quadriceps Contractile Behavior During Weight Acceptance In Walking Amanda E. Munsch1, Alyssa Evans-Pickett2, Hope C. Davis-Wilson3, Brian Pietrosimone2, Jason R. Franz3, 1The University of North Carolina Chapel Hill and North Carolina State University, Chapel Hill, NC, 2The University of North Carolina Chapel Hill, Chapel Hill, NC.

Email: amunsch@live.unc.edu

(No relevant relationships reported)

Appropriate knee loading during walking is essential for optimal health of mechanosensitive joint tissues and is largely governed by quadriceps muscle forces. However, individuals with anterior cruciate ligament reconstruction (ACLR) often exhibit quadriceps muscle dysfunction conventionally measured via reduced peak knee extensor moments (pKEM). Recent advances in ultrasound imaging provide a unique opportunity to determine if quadriceps dysfunction also manifests as altered contractile behavior between those with ACLr and uninjured controls. Purpose: Determine differences in quadriceps contractile behavior during weight acceptance in walking between ACLr, contralateral, and control limbs. Methods: Six individuals to date with unilateral ACLr (4 females, 20±2 yrs, BMI: 25.3±1.8, months post-surgery: 7.1±2.0) and 11 uninjured controls (6 females; 24±3 yrs, BMI: 22.0±2.0) walked for 2 min on an instrumented treadmill. We quantified pKEM, knee flexion excursion (KFE), and VL fascicle length change during weight acceptance (i.e., heel-strike to the instant of pKEM). We report effect sizes (ES) for all comparisons.

CONCLUSION: KE TS is reduced 4-12 months post-ACLR in collegiate athletes, and asymmetrical TS is generally strongly associated with asymmetrical KE kinetics. KE TS and strength appear to be unique characteristics of quadriceps performance post-ACLR. Interventions to improve KE TS post-ACLR are recommended to restore knee function.

896 Board #112 May 27 1:30 PM - 3:00 PM Similar Biomechanics During Change Of Direction In Adolescents With Contact Versus Non-contact Acl Injury Mia Katzel, Curtis Vandenberg, Adriana Conrad-Forrest, Tishya Wren. Children’s Hospital Los Angeles, Los Angeles, CA.

(No relevant relationships reported)

Purpose: Patients who sustain non-contact (N-CON) anterior cruciate ligament (ACL) injuries may be predisposed to injury due to deficient biomechanics. In contrast, patients who sustain contact (CON) ACL injuries may be injured due to unlucky trauma rather than poor biomechanics. This study compared biomechanics during change of direction movements between patients with CON vs. N-CON ACL injury mechanisms. We hypothesized that patients with CON ACL injury would have better biomechanics (greater shock absorption and less dynamic limb valgus) than patients with N-CON ACL injury.

Methods: 15 patients age 10-18 years with CON ACL injury (4 female; mean age 15.5, SD 2.1) and 94 with N-CON ACL injury (11 female; mean age 15.6, SD 1.9) underwent motion analysis 6-12 months (mean 7.5, SD 1.3) after ACL reconstruction (ACLR). Subjects performed forward-backwards and lateral change of direction tasks. 3D kinematic and kinetic variables reflecting dynamic limb valgus (frontal and transverse plane) and shock absorption (sagittal plane) were compared between patients who had CON and N-CON injury mechanisms using 2-tailed t-tests.

Results: No significant differences were observed between the CON and N-CON groups (Table).

Conclusion: The CON injury group did not have better biomechanics than the N-CON group. This may be due to both groups engaging in similar rehabilitation programs. Alternatively, the CON injury group may have had similar pre-injury biomechanics to the N-CON group but happened to suffer a contact injury. These results suggest that all patients post-ACLR have potentially modifiable risk factors for re-injury and should have their biomechanics evaluated so any deficiencies can be rectified prior to return to sport regardless of injury mechanism.

Table: Comparison of kinematics and kinetics between contact and non-contact ACL injury groups


(No relevant relationships reported)

Quadriceps neuromuscular dysfunction is universal following anterior cruciate ligament reconstruction (ACLR). Quadriceps performance is often characterized by peak strength, but the ability to generate consistent knee extensor (KE) torque is not captured by maximal strength assessments and may be functionally significant. Torque steadiness (TS) quantifies the capacity to produce smooth and consistent contractile forces, but is not well-defined post-ACLR.

PURPOSE: To evaluate KE TS in collegiate athletes 4, 6, and 12 months post-ACLR, and determine the associations between TS, strength, and knee joint kinetics during athletic tasks.

METHODS: 13 Division I athletes (age 20.5 ± 1.0, BMI 26.3 ± 4.7, 6 male) completed maximal voluntary isometric KE contractions (MVIC), countermovement jumps (CMJ), and treadmill running (2.68 m/s) while 3D kinematics and ground reaction forces were recorded 4.1 ± 0.6 (4), 6.3 ± 0.6 (6) and 11.9 ± 1.1 (12) months post-surgery. TS was defined as the mean difference between raw KE torque and a lowpass filtered signal (4th order butterworth filter, 2 Hz cutoff) within a 4 second torque plateau window. Sagittal plane KE impulses were computed from the stance phase of running (RUN) and the concentric (CON) and landing (LAND) CMJ phases. Wilcoxon Signed-Ranks tests assessed between-limb comparisons at each interval, and Spearman’s correlation evaluated the associations between TS, MVIC, and KE impulses.

RESULTS: Involved limb TS was significantly reduced at 4 (limb symmetry index (LSI): 36.8%, p = .002), 6 (LSI: 75.3%, p = .001), and 12 months post-surgery (LSI: 84.7%, p = .033). TS was significantly associated with RUN at 4 and 6 months post-surgery (rs = .881 and .865), CON at 4, 6, and 12 months (rs = .720, .587, and .708), and LAND at 6 and 12 months (rs = .678 and .564). MVIC was significantly correlated with RUN at 4 months (rs = .762) and CON at 4, 6, and 12 months (rs = .787, .587, and .689). TS and MVIC were not correlated at any interval (rs = .335, .346, and .225).

CONCLUSIONS: KE TS is reduced 4-12 months post-ACLR in collegiate athletes, and asymmetrical TS is generally strongly associated with asymmetrical KE kinetics. KE TS and strength appear to be unique characteristics of quadriceps performance post-ACLR. Interventions to improve KE TS post-ACLR are recommended to restore knee function.

Abstracts were prepared by the authors and printed as submitted.
### Table

<table>
<thead>
<tr>
<th>Deceleration</th>
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<td>Non-Contact</td>
<td>Contact</td>
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<tr>
<td><strong>SHOCK ABSORPTION</strong></td>
<td></td>
</tr>
<tr>
<td>Max hip flexion</td>
<td>75.3 (15.2)</td>
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<tr>
<td>Max knee flexion</td>
<td>65.2 (14.1)</td>
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<tr>
<td>Max ankle dorsiflexion</td>
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<tr>
<td>Max hip flexion moment</td>
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<tr>
<td>Max knee flexion moment</td>
<td>1.3 (0.5)</td>
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<td>Max ankle dorsiflexion moment</td>
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<td><strong>DYNAMIC LIMP VALGUS</strong></td>
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<td>Min knee varus moment</td>
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</table>

External moments are reported. Angles are expressed in degrees, moments in N/kg, energy absorption in J/kg.

### Purpose

**Purpose:** Alterations in quadriceps muscle morphology (i.e. cross-sectional area [CSA]) and volitional activation (VA) contribute to muscle weakness following anterior cruciate ligament reconstruction (ACLR). Research on the relative contributions of energy absorption and muscle morphology to quadriceps strength in ACLR patients and to determine if the intervention variables on quadriceps strength in ACLR patients and to determine if the relative contributions of V A and CSA in unison may be provide a more holistic understanding of the sources of muscle weakness after ACLR.

### Results

**Results:** Quadriceps PT differed greatly if LSI or involved leg outcomes were used. Evaluation of VA and CSA in unison may provide a more holistic understanding of the sources of muscle weakness after ACLR.

### Conclusion

**Conclusion:** While not statistically significant, downward trends were observed in right lower extremity for mean time, mean turn sway, and mean sway energy. Additionally, cueing an increase or decrease in mean equilibrium and mean strategy. The overall increase seen in mean equilibrium and mean strategy is promising.

### References

[1] Krishnan, Riann M. Palmieri-Smith. University of Michigan, Ann Arbor, MI. (No relevant relationships reported)

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### Board #114

**Title:** Preventing ACL Injuries With Martial Arts Break Falling Training

**Authors:** Karen M. Myrick1, Conor Kasabo2, Richard Fein2, Juan Garbalosa, 1University of Saint Joseph, Connecticut, West Hartford, CT; 2Quinnipiac University, Hamden, CT.

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**Purpose:** ACL injuries have remained prevalent despite numerous prevention attempts. Most prevention has focused on traditional approaches. We propose a novel approach to injury prevention by implementing martial arts falling techniques. This training uses proprioceptive and kinesthetic conditioning to reinforce the athlete’s ability to mitigate at-risk postures. This study aims to evaluate the proprioceptive function and risk factors in soccer athletes that undergo fall training. METHODS: Members of a premier soccer club, ages 9 to 16, were recruited to. All subjects continued usual training. Subjects partook in the interventional training of martial arts fall training, taught by a 3rd degree black belt master in karate and aikido, twice weekly for ten weeks. Baseline and post-intervention, proprioceptive testing was performed using the Neurocom Balance Master. A linear mixed model was used to determine the effect of the intervention on variables of interest. The fixed effect was time point, used to compare pre to post intervention measures, and random effects included intercepts for subjects and trials within subjects. The level of significance was 0.05.

**Results:** A significant increase in movement time from pre to post (P<0.14, Postmean=1.94, p<.002), no significant change in turn time, turn sway, or sway energy. There was a non-significant decrease in impact index (P<0.46, Postmean=0.94, p=0.206). A significant decrease in the mean impact index for the right lower extremity. While not statistically significant, downward trends were observed in right lower extremity for mean time, mean turn sway, and mean sway energy. Additionally, non-significant decrease noted for mean equilibrium and mean strategy.

**Conclusion:** Results of the mean impact index test highlight the efficacy of martial arts fall training in the dominant lower extremity. Furthermore, the trend of improvement in the dominant leg in a variety of proprioceptive metrics is noteworthy, suggesting the intervention reinforced the more honed neural pathways of the dominant side quicker than the non-dominant. Future research is needed to elucidate whether the non-dominant side can demonstrate the plasticity seen in the dominant side. Finally, the overall increase seen in mean equilibrium and mean strategy is promising.

### Board #115

**Title:** Decreased Loading During Gait Alters Intralimb Coordination In Anterior Cruciate Ligament Reconstructed Individuals

**Authors:** Cortney N. Armitano-Lago, Brian Pietrosimone, FACSIM, Alyssa Evans-Pickett, Hope Davis-Wilson, Jason Franz, Troy Blackburn, Adam W. Kiefer. University of North Carolina at Chapel Hill, Chapel Hill, NC.

**Email:** carmitan@email.unc.edu (No relevant relationships reported)

Aberrent lower extremity loading following anterior cruciate ligament reconstruction (ACLR) is theorized to play a role in posttraumatic osteoarthritis (PTOA) development. Cuing an increase or decrease in loading could potentially optimize gait biomechanics and slow progression to PTOA. Stable coordination is fundamental for functional gait as a mediating process for the distribution of joint loads. Accordingly, examining how joint loading impacts coordination during gait may elucidate compensatory movement strategies following ACLR. PURPOSE: Determine the effect of cueing an increase or decrease in lower extremity loading on intralimb coordination between the knee-hip joints in ACLR participants. METHODS: Coordination was assessed in 10 individuals (age: 21±4 years; 9±1 months post-surgery; 4F) with unilateral ACLR during three separate loading conditions. Loading was manipulated via real-time feedback using a force measuring treadmill that cued a change in peak vertical ground reaction force (vGRF). Three conditions were conducted on separate days in a random order: 1) preferred (no feedback), 2) overload (cue 5% BW increase in vGRF), and 3) underload (cue 5% BW decrease in vGRF). The intralimb coordination between sagittal plane knee-hip angles was assessed via measures of coordination dynamics (mean [M] and standard deviation [SD] of relative phase [RP] and percent determinant [%DET] from cross-recurrence quantification analysis) for each condition. One-way repeated-measures analyses of variance were used to determine differences among conditions. RESULTS: A main effect of loading was observed for M RP (F2,26=6.9, p<.05) and SD RP (F2,26=9.5, p<.05). The underloaded condition exhibited significantly different coordination stability (lower M and higher SD of RP) compared to the preferred and overloaded conditions (p<.05).

### References

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A significant effect of loading on %ΔTE (F<sub>2,7</sub>=2.7, p<0.05) was also observed; the underloaded condition led to tighter coupling than the preferred condition. (p<0.05).

**CONCLUSIONS:** Overall, underloading changed the pattern and multi-scale stability of knee-hip coordination. These findings indicate manipulations in joint loading result in altered movement strategies that concern the development of PTOA.

**RESULTS:** Fewer steps/day (mean±SD: 9.626±2.452) associated with greater %ΔCOMP (r=11.51;16.4%; R=0.152, β=-0.003, p=0.030).

**CONCLUSIONS:** Individuals after ACLR who habituallyengage in fewer steps/day demonstrated greater %ΔCOMP during a walking protocol. We postulate fewer steps/day in individuals with a history of ACLR may result in delayed changes in cartilage homeostasis due to inadequate mechanical stimulation of joint tissues. Future studies should determine if increasing steps/day improves knee cartilage outcomes following ACLR.

**Challenges in Gait Biomechanics Between Level And Downhill Walking Do Not Differ Between Those With Anterior Cruciate Ligament Reconstruction And Controls**

Derek Dewig, Chris Johnston, Brian Pietrosimone, FACSM, Troy Blackburn. The University of North Carolina at Chapel Hill, Chapel Hill, NC.

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(No relevant relationships reported)

Conflicting evidence exists regarding the presence of aberrant gait biomechanics after the first year post-anterior cruciate ligament reconstruction. Overground walking may not elucidate differences in those further removed from surgery due to the unexacting nature of the task. Delusional gait biomechanics following ACLR are partly attributable to quadriceps dysfunction. Downhill walking may exacerbate aberrant gait biomechanics, as this task places greater demands on the quadriceps compared to level walking.

**PURPOSE:** To compare gait biomechanics between individuals with ACLR and healthy controls during level and downhill walking conditions.

**METHODS:** 24 individuals more than 1 year removed from primary ACLR (83% female, age=21 ± 3 yr, time since ACLR = 44 ± 26 mo, BMI=23 ± 3 kg/m²) and 24 healthy controls (79% female, age=21 ± 1 yr, BMI=24 ± 3 kg/m²) completed both level and downhill (10° grade) gait biomechanics assessments on an instrumented split-belt treadmill at their preferred walking speed. Peak variables were evaluated over the first 50% of stance including the vertical ground reaction force (vGRF), internal knee abduction moment, internal knee extension moment, knee flexion angle, and knee abduction angle. Moments were normalized to %bodyweight*height (%BW*Ht) and vGRF was normalized to %bodyload. Dependent variables were compared across groups and conditions via two-way repeated measures ANCOVA controlling for gait speed.

**RESULTS:** There were no significant condition*group interaction effects nor group main effects for any outcomes. However, there were significant condition main effects for peak internal knee extension moment (p = 0.020, level to downhill mean increase of 0.042 %BW*Ht) and peak knee flexion angle (p = 0.018, level to downhill mean increase of 13.2°).

**CONCLUSIONS:** Downhill walking necessitates a larger internal extension moment and knee flexion angle compared to level gait. Our results suggest that changes in gait biomechanics between level and downhill conditions do not differ between individuals with ACLR > 1 year post reconstruction and controls. These results suggest that aberrant gait biomechanics may be mitigated over time in those with ACLR.

**Anterior Cruciate Ligament Reconstruction And Cartilage Breakdown Biomarkers Post Anterior Cruciate Ligament Reconstruction**

Hope C. Davis-Wilson, Christopher D. Johnston, Alyssa Evans-Pickett, A.C. Hackney, J. Troy Blackburn, Louise Thoma, Lara Longobardi, Jason Franz, Brian Pietrosimone, FACSM, UNC Chapel Hill, Chapel Hill, NC. (Sponsor: Brian Pietrosimone, FACSM)

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PURPOSE: To evaluate if patients reporting tearing their dominant, defined as the leg to kick a ball, (DOM group) or non-dominant (N-DOM group) limb is the same as the step- limb used during a reactive balance test. For the DOM group, Q-LSI was compared with knees between subjects who switched dominance and those that did not.

**METHODS:** 36 ACLR (18 ± 5 years) participants (age: 22.6 ± 1.9yrs; height: 166.3 ± 7.5cm; mass: 65.4 ± 12.6kg, months from surgery: 70.0 ± 23.6) volunteered for this cross-sectional study. Corticospinal tract structure (volume; fractional anisotropy [FA]; axial diffusivity [AD]; radial diffusivity [RD]) were collected from surgery: 70.0 ± 23.6) volunteered for this cross-sectional study. Corticospinal tract structure (volume; fractional anisotropy [FA]; axial diffusivity [AD]; radial diffusivity [RD]) and excitability was assessed using transcranial magnetic stimulation (motor evoked potentials [MEP]) for each hemisphere. Hemispheric differences were evaluated using paired samples t-tests. Pearson product moment correlational analyses were conducted on structural and excitability outcomes. Alpha level was set at p<0.05.

**RESULTS:** Fewer steps/day (mean±SD: 9.626±2.452) associated with greater %ΔCOMP (r=11.51;16.4%; R=0.152, β=-0.003, p=0.030).

**CONCLUSIONS:** Individuals after ACLR who habitually engage in fewer steps/day demonstrated greater %ΔCOMP during a walking protocol. We postulate fewer steps/day in individuals with a history of ACLR may result in delayed changes in cartilage homeostasis due to inadequate mechanical stimulation of joint tissues. Future studies should determine if increasing steps/day improves knee cartilage outcomes following ACLR.

**Does Lower Limb Dominance Change After An Anterior Cruciate Ligament Reconstruction?**

Kathryn Lucas, Geetanjali Gera, Mary Lloyd Ireland, FACSM, Brian Noehren, FACSM. University of Kentucky, Lexington, KY.

(No relevant relationships reported)

Changes in limb dominance, the limb to kick a ball or recover a fall, after an anterior cruciate ligament reconstruction (ACLR) could occur if the limb has not fully recovered. Due to the impact of an ACLR on the quadriceps, a poor quadriceps limb symmetry index (Q-LSI) could influence changed limb dominance. The difference in the leg used during a quick regain of balance (step- limb) from the subjects’ self-reported dominant limb dominance, could identify poor motor planning required to use the limb.

**PURPOSE:** Evaluate if patients reporting tearing their dominant, defined as the leg to kick a ball, (DOM group) or non-dominant (N-DOM group) limb is the same as the step- limb used during a reactive balance test. For the DOM group, Q-LSI was compared with knees between subjects who switched dominance and those that did not.

**METHODS:** 36 ACLR (18 ± 5 years) participants (age: 22.6 ± 1.9yrs; height: 166.3 ± 7.5cm; mass: 65.4 ± 12.6kg, months from surgery: 70.0 ± 23.6) volunteered for this cross-sectional study. Corticospinal tract structure (volume; fractional anisotropy [FA]; axial diffusivity [AD]; radial diffusivity [RD]) were collected from surgery: 70.0 ± 23.6) volunteered for this cross-sectional study. Corticospinal tract structure (volume; fractional anisotropy [FA]; axial diffusivity [AD]; radial diffusivity [RD]) and excitability was assessed using transcranial magnetic stimulation (motor evoked potentials [MEP]) for each hemisphere. Hemispheric differences were evaluated using paired samples t-tests. Pearson product moment correlational analyses were conducted on structural and excitability outcomes. Alpha level was set at p<0.05.

**RESULTS:** Fewer steps/day (mean±SD: 9.626±2.452) associated with greater %ΔCOMP (r=11.51;16.4%; R=0.152, β=-0.003, p=0.030).

**CONCLUSIONS:** Individuals after ACLR who habitually engage in fewer steps/day demonstrated greater %ΔCOMP during a walking protocol. We postulate fewer steps/day in individuals with a history of ACLR may result in delayed changes in cartilage homeostasis due to inadequate mechanical stimulation of joint tissues. Future studies should determine if increasing steps/day improves knee cartilage outcomes following ACLR.
The hemisphere of the ACLR injured limb demonstrated lower volume (567.1 ± 75.3 voxels; p = 0.005), lower FA (0.49 ± 0.01; p = 0.02), higher MD (7.58 x10^-4 ± 0.35 x10^-4; p = 0.01), and smaller MEPs (0.013 ± 0.007; p = 0.04) compared to the hemisphere of the non-injured limb (659.7 ± 64.3 voxels; 0.53 ± 0.02; 7.23 x10^-4 ± 0.10 x10^-4; 0.028 ± 0.028), indicating disrupted white matter structure and a reduction in excitability of the corticospinal tract. Correlation analyses revealed a strong, positive correlation between corticospinal tract volume and MEP of the ACLR injured limb (r = 0.890; p = 0.001). CONCLUSIONS: ACLR patients demonstrated asymmetry in structural properties of the corticospinal tract that may influence the recovery of motor function following surgical reconstruction. More research is warranted to establish the influence of neurostructural measures on patient outcomes and response to treatment in ACLR populations.

**CONCLUSIONS**

Reduced knee function during running has been observed in anterior cruciate ligament reconstructed (ACLR) knees, persisting up to 5 years after surgery. Current evidence is limited to cross-sectional design and often utilizes the contralateral limb for comparison with questionable appropriateness. Pre-injury running biomechanics, although difficult to obtain, can be used to assess post-surgical changes in both the involved and uninvolved limbs. Through presurgery screening, we obtained running mechanics on collegiate athletes. This study utilizes this pre-injury data for evaluation of bilateral changes in those athletes who sustained an ACL injury and then underwent ACLR.

**PURPOSE:** To assess changes in knee joint mechanics during running from pre-injury to 6-months post-ACLR in Division 1 collegiate athletes.

**METHODS:** Whole body kinematics and ground reaction forces (GRF) were collected during treadmill running for 9 athletes (5 females) prior to a primary ACL injury (PRE) and 6.1±0.3 months post-ACLR (6M). Athletes ran at a maximally comfortable speed on a treadmill at self-selected (SS) and 50% faster than SS (FAST) speeds (3 minutes/6M).

**RESULTS:** Knee joint metrics decreased from PRE to 6M in the INV limb: knee flexion excursion during stance (5.4°, p<0.01), knee extensor impulse (59.1%, p<0.01), rate of knee extensor moment (37.0%, p<0.01). No change in knee joint mechanics were observed in the UNI limb (±5%, p<0.1). Further, the INV limb demonstrated reduced vertical GRF impulse (2.8%, p<0.01) and braking impulse (13.6%, p<0.01), while both metrics increased in the UNI limb (vertical, 5.7%, p<0.01; braking, 23.8%, p<0.01). **CONCLUSIONS:** This is the first study to assess changes in running biomechanics following ACLR relative to the pre-injury state. Consistent with cross-sectional studies, INV knee kinematics and kinetics did not return to pre-injury state by 6 months post-ACLR. Additionally, the UNI limb appears to be a valid comparator for the INV limb for knee joint specific running mechanics at 6M, but not for GRF variables. NIH award TL1TR002375
added constraint of footwear and its role in guiding the development of children’s gait. **Purpose:** To determine the affect different footwear types have on children’s gait variability at different stages in development. **Methods:** 28 healthy children were divided into four groups by ages 2-3, 4-5, 6-7, and 8-10 years old respectively. Gait variability (coefficient of variation (CV)) measures of stride length (SL) and stride time (ST) parameters were collected for three minutes of treadmill walking in barefoot (BF), mocassin (MO), athletic (AT), and rigid shoes (RS) conditions. A mixed factorial ANOVA (4 age x 4 shoe) was performed to determine significant differences. Tukey post-hoc tests were conducted where applicable. **Results:** There was a significant age x shoe interaction for ST CV (p = .003). Specifically, MO decreased from youngest to oldest while BF, AT, and RS increased from 2-3 to 4-5 before decreasing to 6-7 and 8-10. There was a significant age x shoe interaction for SL CV (p = .007). There was linear decrease for the MO condition from youngest group to oldest group for SL CV while SL CV increased from 2-3 to 4-5 old before decreasing for the 6-7 and decreasing again for the 8-10 for the BF, AT, and RS conditions. **Conclusion:** Younger children were more sensitive to the varying types of footwear conditions than older children. Concerning footwear, MO most closely resembles BF gait compared to AT and RS. It is important to note the increased sensitivity to footwear differences for younger children. The results of this study raise the concern of what types of footwear should be most appropriate for a developing child, recommending mocassin type shoes and not typical athletic or rigid shoes.

**Figure:** Bar charts showing the mean and standard deviation for CV Stride time and CV Stride length spatiotemporal time series. Data are reported for main effect of age group and footwear condition as well as pairwise comparisons.

### Paper 998

**Board #124**

**May 27 1:30 PM - 3:00 PM**

**Comparison Of Gait Characteristics Between Children And Adults During Walking And Texting**

Eun Hye Kwon, Jongil Lim, Henry Martinez, Ian Martinez.

Texas A&M University San Antonio, San Antonio, TX.

(No relevant relationships reported)

Average age for a child getting their first smartphone is getting younger. While well-established negative impacts of using smartphone on walking characteristics were generally found for the adult population, its age-related differences are not clear. **Purpose:** To examine age-related differences in gait characteristics during walking and texting. **Methods:** A total of 24 participants were recruited in this study. 12 children (CG; age = 11.7±1.0 years; 1.55 ± 0.11 m; Mass: 35.8 ± 5.5 kg) and 12 adults (AG; age = 24.8±2.5 years; 1.61 ± 0.63 m; 65.4 ± 18.6 kg). Two conditions were employed (No-texting and Texting). In each condition, subject performed two trials of an auditory metronome corresponding to a preferred step frequency measured in the wireless inertial sensor system. Dual-task cost (DTC) was calculated as the percentage change between single-task (No-Texting) and dual-task (Texting) conditions. A mixed factorial ANOVA (4 age x 4 shoe) was performed to determine significant differences. DTC of foot strike (p = .008; CG: -12.9%; AG: -7.9%) as well as toe-off (p = .023; CG: -6.0%; AG: -2.9%) angle showing the more leveled foot angle control. There was a greater reduction of foot elevation at mid-swing in CG than AG (p = .007; CG: -11.1%; AG: 8.6%). Lower lateral step variability (p = .021; CG: 5.2%; AG: 34.5%) and greater reduction of lumbar motion in transverse plane (p = .030; CG: -27.7%; AG: -9.4%) were also exhibited in CG. **Conclusion:** The study highlights that to attain a comparable secondary task performance with adults, children group adopted more cautious gait patterns when walking and texting. The observed changes, therefore, may suggest that a greater compromise in motor-domain seems necessary in younger age smartphone users under dual-tasking conditions.

**INTRODUCTION:** During childhood mechanical loading is important for developing a resilient skeleton. High impact activity interventions cause improvements in bone mineral density in youth and can promote long term bone health. When designing interventions, it is important to know if sex and height play a role in loading magnitudes experienced during various jumping activities. **Purpose:** Examine if sex and height impact the magnitude of peak ground reaction forces (pGRF) during different jump tasks. **Methods:** Four males (Age: 9 ± 1 years; Height: 1.36 ± 0.11 m; Mass: 31.8 ± 5.7 kg) and four females (Age: 11 ± 1 years; Height: 1.46 ± 0.05 m; Mass: 36.6 ± 7.5 kg) performed five trials for each jump condition. Each subject performed a broad jump (BJ), countermovement jump (CMJ), jumping jack (JJ), leap jump (LJ), and a drop jump (DJ). Data were collected on a force plate (1000 Hz), and pGRF in units of body weight (BW) was determined during the landing phase. A mixed ANOVA was employed to assess sex differences across conditions. Correlation analysis assessed the relationship between height and pGRF for each condition. **Results:** No differences in pGRF were observed between males (m) and females (f) across conditions [BJ (m: 2.14 ± 0.09, f: 2.33 ± 0.18 BW), CMJ (m: 2.42 ± 0.02, f: 2.44 ± 0.02 BW), JJ (m: 2.55 ± 0.16, f: 2.53 ± 0.25 BW), LJ (m: 2.98 ± 0.02, f: 2.02 ± 0.15 BW), and DJ (m: 2.88 ± 0.31, f: 3.25 ± 0.48 BW)]. There was a moderate correlation between height and pGRF for DJ (r = 0.59). **Conclusion:** Larger pGRF exhibited with taller subjects during the DJ condition can be explained by considering a higher center of mass contains more gravitational potential energy converted to kinetic energy during the DJ, and thus requires a larger pGRF to slow the participant’s center of mass during landing. Height differences should be considered when designing interventions involving drop jumps to elicit bone adaptations in youth.

**INTRODUCTION:** Physical activities that involve impact loading are important for improving bone strength and bone mineral density in children. However, there is little research quantifying the impact loads associated with various high impact activities. **Purpose:** Examine the magnitude of peak ground reaction forces (pGRF) of a variety of jumping tasks. **Methods:** Eight adolescents, within the ages of 8-12 years (age: 9.63±1.49 years; height: 1.42±0.08 m; mass 33.69±4.81 kg), performed five trials for each jump condition. Each subject performed a broad jump (BJ), countermovement jump (CMJ), jumping jack (JJ), leap jump (LJ), and a drop jump (DJ). All jumps were performed on a force plate (1000 Hz). pGRF was determined during the landing phase of each jump condition, and expressed in units of body weight (BW). A repeated measures ANOVA was performed to assess differences in pGRF across conditions. **Results:** DJ exhibited significantly greater pGRF (3.09±0.46 BW) in comparison to the BJ (2.25±0.2 BW; P = .003), and LJ (2.01±0.1 BW; P = .002). LJ exhibited significantly less pGRF compared to the CMJ (2.45±0.22 BW; P = .001), JJ (2.56±0.21 BW; P = .001), and DJ (P = .002). **Conclusion:** Vertical jumping tasks (CMJ, JJ, DJ) elicited greater vertical impact loads compared to horizontal tasks (BJ and LJ) due to the nature of landing. Previous studies indicated loads between 3-9 BW are sufficient for stimulating increases in bone mineral density in pre and early pubertal
Stability of the lumbo pelvic “core” is essential for the control and movement of the lower extremity for the creation and transfer of force. In adult runners, core stability is related to increased running injury risk and decreasing core stability results in negative effects on mechanical variables associated with running injuries. It is currently unknown if relationships between core stability and running mechanics exist in adolescent populations. PURPOSE: Evaluate the relationship between core stability and mechanical variables associated with running injuries in adolescent runners. METHODS: 20 adolescent runners (11 M/9 F; age: 12.38 ± 0.79 years; easy training run pace: 3.24 ± 0.17 m/s) participated in this study. Kinematics and kinetics were recorded using a motion capture system as participants ran on an instrumented treadmill after which 10 SLSD trials were performed bilaterally from a 15 cm box. Running and SLSD kinematics were recorded using motion capture. Peak frontal plane hip, knee, and ankle, and transverse plane hip and knee angles were calculated during both SLSD and running. The sum of the frontal plane angles was calculated to indicate total medial collapse (TMC). Five additional kinetic variables previously linked to running injuries were calculated for the running trials. Linear regressions were used to determine whether performance on the SLSD predicted kinematics or kinetics during running, with left and right limbs analyzed separately. RESULTS: Kinematics on the SLSD predicted kinematics during running (Figure 1). However, TMC during SLSD did not predict vertical loading rates (R² = 0.008, p = .568), peak hip adductor moments (R² = 0.021, p = .363) or impulses (R² = 0.007, p = .602), or peak knee adductor moments (R² = 0.014, p = .446) or impulses (R² = 0.039, p = .209) during running. CONCLUSIONS: The SLSD can predict kinematics during running in adolescent runners. However, performance on the SLSD does not provide information regarding kinetic factors associated with running injuries. Additional research is required to confirm the suitability of the SLSD for identifying adolescent runners at risk of injury.

**Figure 1.** Plots of kinematics on the single limb step down (SLSD) versus kinematics during running for peak transverse plane velocity (Vₜₚ), peak hip abduction (HAD, A), peak hip adduction (HAD, B), peak hip internal rotation (HIR, B), peak knee abduction (KAB, A), peak knee abduction (KAB, B), and peak knee flexion (KVF, D).
for adolescent scoliosis. METHODS: Adolescent scoliosis patients with Cobb angle between 10-40° were screened. Patients with other predisposing spinal and neurological abnormalities were excluded. 19 girls (age 14.18 ± 2.58) were recruited into experimental group, including 9 patients with thoracic right protrusion (TRP), 7 patients with lumbar left protrusion (LLP) and 3 patients with S-shaped curvature of spine (SSC). 20 healthy subjects (age 14.91 ± 2.13) were randomly selected. The experimental group was given rehabilitation exercises of 60 minutes for twice. sEMG was used to test the muscles at T2, T7, T10 and L4 level. Basic movements were tested in relax mode (RM) and spine correction mode (SCM). RESULTS: 1. For patients with TRP, when sitting, iEMG of muscle groups at T2 level(left -4.53±3.38, p<0.05; right -2.59±0.96, p<0.01), T7(left -3.19±1.94, p<0.05; right -1.27±1.16, p<0.05) and right muscle group at T10 level(-3.78±2.19, p<0.01) were lower in SCM than in RM; when walking, iEMG of left muscle group at T7 level (-2.07±1.61, p<0.05) was lower in SCM than in RM. Compared to control group, for SCM of this sub-group, when sitting, activation of the left muscle group at T2 level was increased (2.32±1.58, p<0.05). 2. For patients with LLP, compared to control group, when sitting, activation level of right muscle group at L4 level was increased (0.33±0.69, p<0.05). 3. For patients with SSC, when sitting, the iEMG of right muscle group of T2 level was lower in SCM than that in RM (-1.39±0.45, p<0.05). In SCM of standing with balanced legs, compared to control group, this sub-group has higher activation level of the right muscle group (2.71±1.20, p<0.05). CONCLUSION: The asymmetry between convex and concave sides of paraspinal muscles in adolescents with scoliosis was not obvious. The muscle activation of the thoracic spine-related muscle group was more important for the adjustment of adolescent scoliosis. 3. Posture corrective exercises for adolescent scoliosis had good acute rehabilitation effects and contributed to the maintenance of good postures in daily life.

1005
Board #131 May 27 1:30 PM - 3:00 PM Effects Of Eccentric Pre-loading On Vertical Jump Performance In 9-17-year-old Female Athletes
Nicholas A. Bohannon, Zachary M. Gillen, Marni E. Shoemaker, Sydney M. Gibson, Joel T. Cramer, FACSM. University of Nebraska-Lincoln, Lincoln, NE. (Sponsor: Joel Cramer, FACSM)
(No relevant relationships reported)

PURPOSE: Examine peak force (PF), rate of force development (RFD), peak power (PP), eccentric impulse (ECC), concentric impulse (CON), and jump height (JH) during static (SJ), counter-movement (CMJ), and drop (DJ) jumps in young female athletes.

METHODS: Twenty females ranging from 9-17-years old performed SJ, CMJ, and DJs from drop heights of 20, 30, and 40 cm (DJ20, DJ30, and DJ40, respectively) in random order. Measurements included PF, RFD, PP, ECC, CON, and JH for each vertical jump condition. Measurements of growth included age, maturity offset, height, body mass, fat-free mass (FFM). In young females, compared to young males, factors other than muscle size contribute more to vertical jump power production. It is unclear how landing mechanics may have influenced the DJ performance measures.

CONCLUSIONS: These findings were consistent with previous evidence in young male athletes indicating that eccentric pre-loading beyond the CMJ does not result in greater vertical jump power in young female athletes. In contrast to previous evidence in young males, thigh CSA was less related to the increase in vertical jump power from SJ to CMJ than other measures of growth (age, maturity offset, height, body mass, and fat-free mass). In young females, compared to young males, factors other than muscle size contribute more to vertical jump power production. It is unclear how landing mechanics may have influenced the DJ performance measures.

A significant amount of research has aimed to understand ACL injuries, a common injury in high school athletes. It has yet to be determined how to best evaluate athletes’ injury risk. To accomplish this, we need functional movement and injury data for a cohort of athletes across time. Purpose: To determine functional movement quality in high school athletes and explore the impact of age, gender, single-sport participation on movement quality and changes over time. Methods: 121 male (15.83±1.14 yo, 1.77±0.36m, 75.68±16.88kg) and 70 (15.95±1.19 yo, 1.63±0.08m, 59.04±8.78kg) female high school athletes were recruited to complete a Functional Movement Screen (FMS), a Landing Error Scoring (LES) test, and a hop series including a single limb hop (SH1), triple hop (TH), crossover hop (CH) and a 6m timed hop. For the hop series, a limb symmetry index was calculated by: (Right/Left)*100%. SPSS was then used to determine if differences exist between the youngest 25% of athletes tested and the oldest 25%, sexes, or athletes of a single sport and athletes who participated in multiple high school sports using a t-test (α=0.05). Additionally, 42 athletes were re-tested 9.53±3.5 months after the first visit. A 2x2 repeated measures ANOVA (Gender: Male (n=25), Female (n=17); Time: Visit 1, Visit 2) to identify differences in the population over time (p<0.05). Results: The males had higher symmetry on the single limb hop compared to the females. Additionally, the older students performed better on the LESS, SH, and CH. Between visits there was a significant increase in limb symmetry on the SH. Conclusion: Several differences exist between age groups, while only SH symmetry varied between genders and over time. This work provides a basic understanding of how high school athletes move and provides a data set to investigate injury risk.
Lunge technique variations can affect the biomechanics of lower extremity. However, only a few studies have examined the force distribution during the forward lunges.

**PURPOSE:** The purpose of this study was to compare the force of individual muscles of the lower limb during the forward lunges with the change of step length and speed.

**METHODS:** Three healthy adults performed (1 male, 2 females 35 ± 8 years) forward lunges with different step lengths and speeds. The step lengths were set at 70% and 100% of the leg length (from the greater trochanter to the lateral malleolus); the speeds were set to slow, normal, and fast (30, 40 and 50 lunges/min, respectively). Kinematic and kinetic data were sampled using a three-dimensional motion analysis system and pedal reaction forces using two custom instrumented bike pedals (1200 Hz, Kistler) were collected. A modified workrate of 80 Watts and a cadence of 80 rotations per minute at two QF: original QF (150mm), and wide QF (276mm). Wide QF was increased using pedal extenders. Five recreationally active males cycled on a stationary ergometer at a workrate of 80 Watts and a cadence of 80 rotations per minute at two QF: original QF (150mm), and wide QF (276mm). Wide QF was increased using pedal extenders. Three-dimensional kinematic data (240 Hz, Vicon) and pedal reaction forces using two custom instrumented bike pedals (1200 Hz, Kistler) were collected. A modified gait2392 model with a knee that includes hinge joints for the medial and lateral compartments was used to estimate muscle forces with static optimization and TCF and MCF with joint reaction analysis (3.3 OpenSim, SimTK, Stanford University). Paired samples t-test and Cohen’s d were used to detect differences between conditions.

**RESULTS:** Peak TCF increased from original to wide QF (960.2 ± 258.2 N to 1171.3 ± 202.1 N; p = 0.299; d = 0.54) and MCF increased from original to wide QF (792.2 ± 98.4 N to 1029.2 ± 315.5 N; p = 0.116; d = 0.89).

**CONCLUSION:** Large standard deviations and small sample size may account for the lack of statistical significance, yet medium and large effect sizes may allude TCF and MCF increases with greater QF (Figure 1). It appears the majority of TCF is born by the medial compartment; TCF and MCF ranged from 1.46 and 1.14 BW for original and 1.73 to 1.42 BW for respectively. These loads are much smaller than 2.0-2.5 BW found in walking and 4.0 BW in jogging.

**Figure 1:** Ensemble curves of the total knee contact force (TCF), medial compartment compressive force (MCF), and lateral compartment compressive force (LCF) during stationary cycling.

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**CONCLUSIONS:** Our preliminary results suggest that the changes in the step length and the speed used in this study did not affect the kinetics of hamstring and quadriceps muscles and the speed used in this study did not affect the kinetics of hamstring and quadriceps muscles. This might be due to the limited number of subjects. Further studies are needed.
PURPOSE: The experiment aims to research the kinetics and kinematics differences between bilateral lower limbs of athletes who have the asymmetry of myodynamia on bilateral lower limbs and provide some basis for avoiding sports injury.

METHODS: The experiment test subjects’ Peak Torque of their extensor kinematic chain of bilateral lower limbs. Define subjects whose difference value of peak torque is greater than 10% as the experimental group, the rest is the control group. Each group has 10 subjects. Two groups will finish 3 kinetics tests items including running with no history of low back or lower extremity injury.

RESULTS: In the intra-group testing, the peak force and impulse in the takeoff phase of vertical jump by two legs (the dominant side peak force is 1000±141.94N, the non-dominant side peak force is 852.346±198.23N; the dominant side impulse is 315.887±70.87N•s, the non-dominant side impulse is 255.82±72.00 N•s); the impulse in the takeoff phase of vertical jump by single leg (the dominant side impulse is 611.121±106.76N•s) and the peak force in the takeoff phase of drop jump (the dominant side peak force is 916.301±272.47N, the non-dominant side peak force is 772.171±159.04N), these four indexes of dominant-side is much higher than the opposite side in the experimental group (p<0.05). There is no significant difference in control group. There was neither significant difference in the two groups of dominant side nor in the two groups of non-dominant side.

CONCLUSIONS: There are no significant influence on the sports performance of running, vertical jumping and drop-jumping caused by asymmetry of myodynamia of bilateral lower limbs when the Peak Torque of their extensor kinematic chain of bilateral lower limbs is lower than 27%, but it will have a great significant influence on sports performance and sports ability of some relative movements like long jump with single leg and vertical jump with single leg.

RESULTS: Collapsed across step-height, at 10° (p=0.003) knee angle during lunge descent and 10° and 30° (p=0.001) knee-angles during lunge ascent patellofemoral joint force and stress were greater in forward lunge than side lunge. At 40° (p=0.005), 50° (p=0.002), 60° (p=0.001), 70° (p=0.001), 80° (p=0.001), and 90° (p=0.001) knee angles during lunge descent and 50° (p=0.002), 60° (p=0.001), 70° (p=0.001), 80° (p=0.001), and 90° (p=0.001) knee angles during lunge ascent patellofemoral joint force and stress were greater in side lunge than forward lunge. Collapsed across lunge type, at 60° (p=0.009) knee angle during lunge descent and 40° (p=0.008), 50° (p=0.007) knee angles during lunge ascent patellofemoral joint force and stress were greater in side lunge than forward lunge.

CONCLUSIONS: Patellofemoral joint loading changed according to lunge type, step height, and knee angle. When the goal is to initially minimize and then gradually progress patellofemoral joint loading, the following may be a prudent landing progression: 1) forward lunge at lower knee angles (0°-30°) at ground level or up to 10 cm platform; 2) forward lunge at middle knee angles (0°-60°) up to 10 cm platform and progressed to ground-level; 3) side lunge at middle knee angle (0°-60°) up to 10 cm platform and progressed to ground level; 4) forward lunge at higher knee angles (0°-100°) up to 10 cm platform and progressed to ground level; and 5) side lunge at higher knee angles (0°-100°) up to 10 cm platform and progressed to ground level.

Cardan/Euler angles (EAs) are commonly used to quantify knee valgus. Although EAs precisely describe the orientation of segments, their geometrical interpretation may not relate well to the underlying joint kinetics and can be difficult for practitioners to interpret. Having a metric that is both more related to the knee joint kinetics (e.g. knee abduction moment (KAM) and tibial external rotation moment (TRM)) and easier to interpret would be advantageous for researchers and practitioners.

RESULTS: Although both KAM and TRM were significantly greater on the dominant side than the non-dominant side in all subjects, the magnitude of difference varied considerably with the degree of knee valgus (KAM: -1.67 to 2.28 Nm; TRM: -1.68 to 2.59 Nm) and percent agreement (%AG) scores were used to compare continuous and binary (i.e. valgus vs no valgus) metrics at initial contact (Purpose 1), peak knee flexion (Purpose 1 & 2), and the instant when KAM was highest (Purpose 1 & 2). RESULTS: EA and OD demonstrated poor correlations (r=0.28 - 0.43) and low agreement when categorizing valgus vs non-valgus (|%AG| = 16 - 45%). KAM showed stronger links to KAM and TRM in comparison to EAs (Table 1). CONCLUSION: Although both kinematic measures were poorly correlated with KAM and TRM, OD was better able to categorize knee valgus kinetics. OD may also be easier to visually observe.
Resistance eccentric training triggers adaptations in both active and passive elements of the muscle-tendon unit (MTU). Previous research highlights the buffering role that tendinous tissues may play to mitigate muscle strain and to optimize operating fascicle lengths. However, the effects of eccentric training on the muscle-tendon interactions of the biceps femoris remain unexplored. **PURPOSE:** To evaluate the effects of eccentric training on torque and muscle-tendon interactions of the biceps femoris muscle during lengthening contractions. **METHODS:** Eighteen participants completed an 8-wk standardized eccentric training intervention comprising 15 sessions of Nordic hamstring (NH) or isokinetic leg curl (IK; n=10) exercise. Pre and post training, an 8-wk standardized eccentric training intervention comprising 15 sessions of Nordic hamstring (NH) or isokinetic leg curl (IK; n=10) exercise. Pre and post training, an 8-wk standardized eccentric training intervention comprising 15 sessions of Nordic hamstring (NH) or isokinetic leg curl (IK; n=10) exercise.

**RESULTS:** Both groups increased torque from 38% to 100% of the contraction duration, with greater contributions progressively augmented at the end of the contraction (p < 0.05). **CONCLUSION:** We provide novel findings on the muscle-tendon interactions of the biceps femoris muscle during lengthening contractions. A 15-session eccentric training program comprising NH or IK exercise does not seem to affect muscle-tendon interactions.

**Table 1.**

<table>
<thead>
<tr>
<th></th>
<th>KAM</th>
<th>TRM</th>
</tr>
</thead>
<tbody>
<tr>
<td>r</td>
<td>%AG</td>
<td>r</td>
</tr>
<tr>
<td>OD</td>
<td>-0.39 -0.13</td>
<td>67.74 -95.16</td>
</tr>
<tr>
<td>EA</td>
<td>-0.71 -0.28</td>
<td>24.19 -38.71</td>
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**1014 Board #140 May 27 1:30 PM - 3:00 PM**

**Relationships Between Body Mass Normalized Abdominal Wall Thickness And Self-reported Activity And Global Health**

L. Colby Mangum, Courtney Caputo, Sarah Akbarpour. 
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(No relevant relationships reported)

The anterolateral abdominal wall, rectus abdominis (RA), external oblique (EO), and internal oblique (IO), contributes to lumbopelvic-hip strength; and its role in injured populations such as low back pain has been well explored. However, it is important to establish the association between a body mass normalized measure of muscle size with overall physical activity in a healthy population due to their utility as a frequently used control group and for the potential of this measurement technique in aging, resistance training, and abdominal fat assessment.

**PURPOSE:** To determine relationships between muscle thickness (at rest and during contraction) of RA, EO, IO and patient-reported outcome measures on physical activity and health. **METHODS:** Eight active participants with no history of low back or lower extremity injury (23.1±5.4yrs, 171.1±11.3cm, 70.6±15.1kg, 4F) completed a single imaging session of RA, EO, and IO. Before imaging, participants completed the PROMIS Global Health (GH), PROMIS Physical Function (PF), and International Physical Activity Questionnaire Short Form (IPAQ). Ultrasound images were collected at rest while supine, hook-lying and during contraction with participants instructed to perform an abdominal crunch for RA, and crunches toward either knee for EO and IO. Thickness measures were normalized to body mass (kg). Pearson’s r correlation coefficients were used to determine relationships. **RESULTS:** Six of the 8 participants scored high on the IPAQ (≥3000 METmin/week) and the rest were moderate (≥600 METmin/week). The average hrs/day participants spent sitting was 4.6±2.3hrs. The PROMIS GH (37.5±4.7) and PROMIS PF (98.9±2.4) both confirmed overall health and activity levels. Right side EO at rest (r=74, p<0.04) and during contraction (r=84, p<0.01) were strongly related to hours spent sitting per day. **CONCLUSIONS:** Normalized EO muscle thickness was found to increase, at rest and during contraction, as healthy, active individuals sat longer. Although this was the only significant correlation, this controversial finding may be explained due to the relative 17.4% decrease in EO activity on the right side, compared to the left. The connection between the abdominal wall and self-reported physical activity is important to distinguish, especially with a body mass normalization technique.

**1015 Board #141 May 27 1:30 PM - 3:00 PM**

**Kinematic Analysis Of Single-leg Hopping In Adults With And Without Autism Spectrum Disorder**

Adriana Conrad-Forrest1, Teri Todd1, Melissa Mache1, Danielle Jarvis1, 2California State University, Northridge, Northridge, CA. 2California State University, Chico, Chico, CA.

(No relevant relationships reported)

**Purpose:** Adults with Autism Spectrum Disorder (ASD) may be predisposed to deficient biomechanics or neuromuscular control. This study compared the biomechanics of adults with and without ASD completing a single-leg hopping task. We hypothesized that adults with ASD would demonstrate deficient biomechanics (i.e., decreased pelvic control and greater dynamic limb valgus) compared to adults without ASD.

**Methods:** 10 participants with ASD (8 male; mean age 23.3, SD ±3.8) and 10 without ASD (8 male; mean age 21.5, SD ±2.5) were included in this analysis. 3D motion capture data were collected while participants performed five consecutive single-leg hops. Two of the middle hops were analyzed and kinematic values were averaged across hops. Dynamic limb valgus and frontal plane pelvic range of motion were compared between groups using independent samples t-tests.

**Results:** No statistically significant differences were observed between the individuals with and without ASD (Table).

**Conclusion:** Our hypothesis was not supported. Individuals with ASD did not demonstrate deficient biomechanics during the single-leg hopping task when compared to individuals without ASD. The high-level of function of the adults with ASD in the present study may be related to their proficient hop performance. It is also possible other biomechanical variables not presently measured may highlight differences in performance between populations. The present results suggest adults with ASD have similar biomechanics as adults without ASD, though further study is needed.

**Table:** Comparison of Kinematic Variables Between Groups
Several training strategies have been suggested and evaluated for their effects on baseball pitching performance and injury risk. There is some data in the current literature which indicates that plyometric based weighted-ball training is effective at altering the kinematics and kinetics of the throwing motion. However, it is unclear whether weighted-ball trained pitchers throw faster with lower joint kinetics than those trained otherwise. **PURPOSE:** To compare throwing velocity and maximum elbow valgus torque (MEV) between collegiate male baseball pitchers trained with weighted-ball exercises and those without. It was hypothesized that weighted-ball trained pitchers exhibit higher throwing velocity and MEV than pitchers trained without weighted-ball exercises. **METHODS:** Twenty-one collegiate baseball pitchers participated in this study, 13 of whom trained using weighted baseballs and 9 of whom trained without weighted baseballs as part of their in-season training regimen. After providing written informed consent, each participant threw 15 fastballs while ball speed and MEV were measured using a radar gun and a wearable inertial measuring unit (IMU), respectively. **RESULTS:** There was no significant difference in ball speed between weighted-ball trained pitchers (36 ± 1 m/s) and non-weighted-ball trained pitchers (35 ± 3 m/s, p = .108). Conversely, weighted-ball pitchers threw with greater MEV (110 ± 28 N m) than non-weighted-ball trained pitchers (52 ± 6 N m, p < .001). **CONCLUSION:** These findings suggest that pitchers who train using weighted-ball exercises throw at ball speeds comparable to those who do not but may do so at a higher risk of a pitching-related elbow injury.

### Abstracts

**1017**

**B-72** Free Communication/Poster - Pitching, Throwing, and Hitting

**Wednesday, May 27, 2020, 1:30 PM - 4:00 PM**

**Room:** CC-Exhibit Hall

**1016**

**Board #142** May 27 1:30 PM - 3:00 PM

**Abstract Withdrawn**

**1018**

**Board #144** May 27 1:30 PM - 3:00 PM

**A Comparison Of Pitch Velocity And Elbow Valgus Torque Between Collegiate Baseball Pitchers Trained With And Without Weighted-ball Exercises**

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Email: arnelaguinaldo@pointloma.edu

(No relevant relationships reported)

**PURPOSE:** During the softball windmill pitch delivery, power is generated from the lower extremities and transferred up through the kinetic chain out to the throwing hand. At time of stride, the lead lower extremity incurs significant momentum breaking forces that could contribute to injury risk. Joint angle positions at the time of stride may vary based on stride length and extreme ranges of stride length may correlate with biomechanics that are associated with vulnerability to injury. This study investigates the relationship between stride length and joint angles of the lead lower extremity at time of stride and 2) peak joint torques of the lead hip and throwing shoulder during the softball windmill pitch.

**METHODS:** 17 pitchers (mean age = 15.4 ± 1.4 y) underwent 3D biomechanical analysis of 80 fastballs using a 20 motion capture camera system (Vicon Motion Systems Ltd UK) at 240 hz. A 15-segment whole-body model for each pitcher was created. Ankle, knee, hip, and pelvis angles of the lead lower extremity and peak hip and shoulder torques at time of stride were calculated within a biomechanical analysis software (Visual 3D v6, C-Motion). Analyses included 2-tailed Pearson correlations.

**RESULTS:** Stride length correlated positively with peak shoulder external rotation torque (r = 0.245, p = 0.029), lead ankle eversion/inversion, and hip flexion/extension angle at time of stride. Stride length negatively correlated with lead knee valgus/varus, hip abduction/adduction, hip rotation, and pelvis flexion/extension angle at the time of stride (Table 1). No other correlations were observed.

**CONCLUSION:** The most prevalent reported injuries among softball pitchers occur at the shoulder, hip, and low back. Study findings suggest that pitch instruction on lead leg joint position at time of stride as well as stride length may be important for injury prevention during fast pitch softball pitching.

<table>
<thead>
<tr>
<th></th>
<th>ASD (n=10)*</th>
<th>Non-ASD (n=10)*</th>
<th>Between-Group Differences</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelvis ROM</td>
<td>-8.3±2.81</td>
<td>-6.7±2.35</td>
<td>-1.6</td>
<td>0.194</td>
</tr>
<tr>
<td>Hip flexion</td>
<td>45.7±8.69</td>
<td>45.9±11.03</td>
<td>0.2</td>
<td>0.965</td>
</tr>
<tr>
<td>Hip adduction</td>
<td>8.1±3.99</td>
<td>4.4±4.81</td>
<td>-3.7</td>
<td>0.077</td>
</tr>
<tr>
<td>Hip internal rotation</td>
<td>6.6±6.16</td>
<td>9.3±5.65</td>
<td>2.7</td>
<td>0.321</td>
</tr>
<tr>
<td>Knee abduction</td>
<td>7.1±4.81</td>
<td>3.6±3.94</td>
<td>3.5</td>
<td>0.100</td>
</tr>
<tr>
<td>Knee flexion</td>
<td>50.1±8.77</td>
<td>49.9±5.78</td>
<td>0.2</td>
<td>0.888</td>
</tr>
<tr>
<td>Ankle dorsiflexion</td>
<td>24.4±2.98</td>
<td>22.0±6.52</td>
<td>2.4</td>
<td>0.321</td>
</tr>
</tbody>
</table>

*Abbreviations: ASD = Autism Spectrum Disorder, ROM = range of motion

*Values are mean±SD degrees
It is known that high elbow valgus torque in the pitching motion can contribute to the occurrence of elbow injury. Lately, studies have shown pitchers with UCL tears had significantly lower balance measures than healthy players when tested after injury occurred. There is a paucity of research on the effect of balance-specific training on the biomechanical factors that can contribute to a pitcher’s increased risk of elbow injury. METHODS Thirteen collegiate baseball pitchers were randomly assigned to a training group: control or intervention. The control group did only the team training program. The intervention was performed 3 times a week for 6 weeks. Measurements of balance (Y-Balance), limits of stability (center of pressure excursion), ball speed, and joint kinematics and kinetics, specifically maximum elbow valgus torque (MEV), through motion capture were collected before and after the 6-week training program. RESULTS None of the outcome measures showed a significant difference between training type (Y-Balance p=.405; COP excursion p=.537, ball speed p=.150; MEV p=.945). Three outcome measures, COP excursion (p=.007), ball speed (p=.003), and MEV (p=.001) showed significant decreases over time regardless of training type. A Pearson Correlation was run for the entire study population (n=13) between ball speed and MEV for initial (p=.409) and final (p=.300) testing and showed no significant correlation between the variables. CONCLUSION The balance training program had no observable effect on a pitchers’ pitching performance or elbow kinetics. There was no significant difference between groups in pre or post measures, therefore, any change in balance measures can be attributed to normal in-season training strength development.

<table>
<thead>
<tr>
<th></th>
<th>Pre-Intervention</th>
<th>Post-Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-Balance</td>
<td>123.1 ± 9.7 cm</td>
<td>124.5 ± 11.9 cm</td>
</tr>
<tr>
<td>Control</td>
<td>119.0 ± 7.7 cm</td>
<td>122.0 ± 9.6 cm</td>
</tr>
<tr>
<td>COP Excursion</td>
<td>160.5 ± 33.9 cm</td>
<td>129.4 ± 4.3 cm</td>
</tr>
<tr>
<td>Intervention</td>
<td>152.4 ± 24.7 cm</td>
<td>131.1 ± 13.0 cm</td>
</tr>
<tr>
<td>Ball Speed</td>
<td>81.2 ± 3.2 mph</td>
<td>77.9 ± 3.8 mph</td>
</tr>
<tr>
<td>Control</td>
<td>81.1 ± 2.6 mph</td>
<td>73.5 ± 3.4 mph</td>
</tr>
<tr>
<td>Intervention</td>
<td>103.6 ± 28.6 Nm</td>
<td>64.5 ± 8.7 Nm</td>
</tr>
<tr>
<td>Maximum Elbow Valgus</td>
<td>117.0 ± 27.2 Nm</td>
<td>77.0 ± 13.7 Nm</td>
</tr>
</tbody>
</table>

Because of its relationship to pitching-related elbow injuries, the valgus torque at the elbow during baseball pitching has been a measure of interest that has clinical implications for the assessment and treatment of ulnar collateral ligament (UCL) injuries in pitchers. However, there is currently no feasible method to quantify elbow valgus torque in game-like settings. PURPOSE: To estimate the concurrent validity of a wearable sensor in measuring valgus torque at the throwing elbow during the pitching motion. METHODS: After providing informed consents, thirty-four adolescent pitchers threw 10 fastballs from a regulated mound while the joint kinematics and kinetics were simultaneously being measured with a 3D motion capture system and an inertial measurement unit (IMU) sensor, which was used to specifically estimate elbow valgus torque during baseball pitching. The Pearson correlation and Bland-Altman charts were used to estimate the concurrent validity and degree of accuracy of the IMU using the 3D motion capture system as the criterion method. RESULTS: The concurrent validity of the IMU in measuring elbow valgus torque was moderate (r = 0.686, p < 0.01) with a mean error of -3.48 Nm (Fig. 1). CONCLUSION: The wearable sensor was found to have moderate concurrent validity in estimating elbow valgus torque, the magnitude of which was underestimated by the sensor.
INTRODUCTION: Weighted baseball throwing programs are often used to increase pitch velocity. However, increased injury risk has been reported and questions regarding possible mechanism of injury exist. Kinematics and kinetics have been investigated with inverse dynamics approach, but the effects of individual muscle forces have rarely been taken into account by these models and in consideration of pitch mechanics. Analysis of shoulder joint reaction force with a musculoskeletal model including individual muscle forces may provide new insight on injury mechanism.

PURPOSE: To compare the effects of varied weighted baseballs on glenohumeral (GH) joint reaction forces during youth pitching.

METHODS: 7 baseball pitchers (Age 15.7 ± 2.4) participated in the study. Participants performed 5 pitches for strikes with 5oz, 7oz, and 9oz baseballs. Full body, 3D segment position data were collected using a motion capture system (200 Hz) and ball velocities were measured via radar gun. Highest velocities of 3 pitches were selected and 3D marker trajectories input into a 19 DOF musculoskeletal model utilizing a standard inverse dynamics and static optimization routine to produce individual muscle forces for GH joint reaction forces. Mean distraction force, anterior shear force, and superior shear force on GH joint were calculated and compared with ROMANOVA (alpha = 0.05) during the acceleration phase of the pitch with Bonferroni post-hocs.

RESULTS: Differences were noted between the ball weights on ball velocity (5oz 66.9 ± 8.8mph, 7oz 61.6 ± 7.8 mph, 9 oz 56.9 ± 6.1 mph, p<0.001). Also, throwing heavier baseballs exhibited increased distraction forces (5oz 1987±472.5N, 7oz 2386±544.1N, 9oz 2414±601.1N, p = 0.007); while anterior shear force and superior shear force did not present distinct differences.

CONCLUSIONS: Distraction force pulls humeral head out of the glenoid fossa, and weighted baseball throwing program may cause more stresses on biceps brachii, rotator cuff, and surrounding structures by the increased distraction force.

PURPOSE: The Kinematic Sequence (KS) is the timing of peak angular velocities generated across connected body segments during a movement pattern. The most efficient KS reported in sport is when the timing occurs in a proximal-to-distal (PDS) pattern. This ‘ideal’ KS follows the order of pelvis, trunk, arm, forearm, and hand. Based on simulated models of the golf swing, the PDS KS results in greater ball distance and decreased joint stresses. Despite similarities to the golf swing, there is limited research on the KS during batting. Study aims: 1) Identify KSs for the baseball swing and 2) compare the leading upper extremity torques across the 3 primary KSs. Methods: 23 baseball players (professional=2, collegiate=11, high school=10) underwent 3D biomechanical swing analysis, totaling 47 trials. A 15-segment model was constructed using a 20 Vicom™ camera motion capture system (240 Hz). Body segment and bat velocities as well as peak shoulder and elbow torques were calculated using Visual 3D™ biomechanical software. Time of peak angular velocity of the pelvis, trunk, arm, forearm, and hand was recorded. The torques were compared across the two most performed KS patterns as well as the KS representing the closest to a standard inverse dynamics and static optimization routine to produce individual muscle forces for GH joint reaction forces. Mean distraction force, anterior shear force, and superior shear force on GH joint were calculated and compared with ROMANOVA (alpha = 0.05) during the acceleration phase of the pitch with Bonferroni post-hocs.

Results: Differences were noted between the ball weights on ball velocity (5oz 66.9 ± 8.8mph, 7oz 61.6 ± 7.8 mph, 9 oz 56.9 ± 6.1 mph, p<0.001). Also, throwing heavier baseballs exhibited increased distraction forces (5oz 1987±472.5N, 7oz 2386±544.1N, 9oz 2414±601.1N, p = 0.007); while anterior shear force and superior shear force did not present distinct differences.

Conclusions: Distraction force pulls humeral head out of the glenoid fossa, and weighted baseball throwing program may cause more stresses on biceps brachii, rotator cuff, and surrounding structures by the increased distraction force.

B-73 Free Communication/Poster - Sports Biomechanics

Board #151 May 27 1:30 PM - 3:00 PM

The Measurement Of Thrust In Competitive Swimming: The Association Between Different Thrust Variables

Tiago M. Barbosa¹, Jia Wen Yam²; Govindasamy Balasakaran, FACSM², Daniel A. Marinho³; Polytechnic Institute of Bragança, Bragança, Portugal; Research Centre in Sports, Health and Human Development, Vila Real, Portugal; Nanyang Technological University, Singapore; Singapore; ²Nanyang Technological University, Singapore, Singapore; ³Research Centre in Sports, Health and Human Development, Vila Real, Portugal; University of Beira Interior, Covilhã, Portugal.

(Purpose) The Measurement of thrust has been an important aspect in the study of swimming performance since previous works have showed that the magnitude and distribution of thrust are consistent with the idea that a PDS KS may result in decreased joint stress. KS analyses could potentially guide clinicians and hitting instruction to minimize biomechanical risk factors during batting.

Power Parameters Appear Less Important To Water Polo Success Than Motor Control


(Purpose) Conditioning programs for water polo players typically focus on muscular power to enhance the wrestling and shooting components of play. While improvements in strength training are easily quantifiable, the relationship between upper limb power and in-game performance has yet to be established. Purpose: To test the effect of upper limb force parameters on offensive performance in women’s water polo players.

Methods: We conducted biomechanical testing on 12 D1 women’s water polo players using Proteus (Proteus Motion, USA). After completing a familiarization and warm-up protocol, subjects performed a single set of 10 repetitions at 3lb of magnetic resistance in 3 different exercises: shoulder adduction, internal rotation of the shoulder while in horizontal abduction, and a throw motion. Proteus calculated peak power (PP), peak force development rate (PFRD), and consistency (accuracy of movement differed significantly between the 3 KS groups (F(2,23)=4.95, p=0.012) with lower values for PDS (P=0.012) and DUE (p=0.012).

Conclusions: This foundational study is the first to apply a KS classification system to the baseball swing. Lower elbow extension torques for the PDS group are consistent with the idea that a PDS KS may result in decreased joint stress. KS analyses could potentially guide clinicians and hitting instruction to minimize biomechanical risk factors during batting.
Majority of fatalities that occur in the sport of triathlon happen during the swim portion of the race (Harris et al., 2010, JAMA). The potential risk of death while swimming has raised safety concerns. The governing body, USA Triathlon (USAT), has implemented guidelines related to water temperatures and the use of wetsuits. The swimming has raised safety concerns. The governing body, USA Triathlon (USAT), has implemented guidelines related to water temperatures and the use of wetsuits. The

PURPOSE: The purpose of this study was to examine core temperature while swimming a short distance at a somewhat hard swim pace (Aura et al., 2019, MSSE). PURPOSE: The purpose of this study was to examine core temperature while swimming a long distance (1000 m) at a fast pace in warm water (25.5°C) while wearing a wetsuit.

METHODS: Two experienced triathletes (mean ± standard deviation (SD), age 38.5 ± 2.3 years, height 1.83 ± 0.03 m, weight 80.1 ± 1.1 kg) participated in the study. Of the 100 CMJs 22 had a single peak VGRF, of which 14 occurred at low position (30 at low position, 13 after low position, 4 before low position), the peaks were equal in 20 jumps (10 at low position, 10 after low position), and the 2nd peak was higher in 11 (all after low position). Peak GFR occurred at the low point of the countermovement for 82% (14 of 17) of the above average jumps versus 52% (33 of 64) of the average jumps and only 37% (7 of 19) of the below average jumps (P=0.007). For the 78 jumps with two distinct VGRF peaks the 1st peak was greater than the 2nd for 77% (10 of 13) of above average jumps, 61% (10 of 16) of average jumps and only 44% (7 of 16) of below average jumps (P=0.033).

CONCLUSIONS: The optimal VGRF profile appeared to be peak force occurring at low position regardless of whether there was a single or double peak. The worst VGRF profile appeared to be jumps with two peaks where the 2nd peak was greater than the 1stpeak, or the 1st and 2nd peaks were equal, but the 1st peak occurred after low position. In conclusion, achieving peak VGRF at the low position of a CMJ appears to be optimal.

**Effect Of Countermovement Depth On The Neuromechanics Of A Vertical Jump**


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(No relevant relationships reported)

**Board #155 May 27 1:30 PM - 3:00 PM**

**Task Intensity Alters How Anterior Knee Pain Influences Frontal-plane Hip Biomechanics During Landing And Jumping**

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(No relevant relationships reported)

**Is There An Optimal Vertical Ground Reaction Force Profile For Maximizing Jump Height In A Countermovement Jump?**

Josef A. Cohen1, Malachi P. McHugh, FACSM1, Marc Hickok2, Declan AJ Connolly. Nicholas Institute of Sports Medicine and Athletic Trauma, New York, NY. University of Vermont, Burlington, VT. (Sponsor: Malachi McHugh, FACSM)

Email: mchugh@nismat.org

(No relevant relationships reported)

**Board #154 May 27 1:30 PM - 3:00 PM**

Purpose: The vertical ground reaction force (VGRF) during a countermovement jump (CMJ) is classically described with a single peak force occurring at the low position of the countermovement. However, in practice, jumpers display a variety of CMJ VGRF profiles, including single and double peaks, and jumps where the peak force occurs at, or after, low position. The purpose of this study was to identify the optimal CMJ VGRF profile for maximizing jump height.

**METHODS:** Ten healthy men (age 26.6±8 yr, height 1.81±0.08 m, mass 83.5±9.0 kg) performed maximal CMJs at self-selected countermovement depth (self-selected CMJ), at reduced countermovement depth (shallow CMJ) and at increased countermovement depth (deep CMJ). Three jumps were performed in each condition on force plates with ankle, knee and hip motion recorded and electromyograms (EMG) recorded from the gluteus maximus (GM), vastus lateralis (VL) and medial gastrocnemius (MG) muscles. During CMJs flexion angle was recorded with an electrogoniometer. Jumpers were instructed to fix 15% less (shallow CMJ) and 15% more (deep CMJ) than the self-selected CMJs. Kinematic, kinetic and EMG metrics were compared between the different CMJ depths using repeated measures ANOVA.

**RESULTS**

- Ten healthy men (age 26.6±8 yr, height 1.81±0.08 m, mass 83.5±9.0 kg) performed maximal CMJs at self-selected countermovement depth (self-selected CMJ), at reduced countermovement depth (shallow CMJ) and at increased countermovement depth (deep CMJ). Three jumps were performed in each condition on force plates with ankle, knee and hip motion recorded and electromyograms (EMG) recorded from the gluteus maximus (GM), vastus lateralis (VL) and medial gastrocnemius (MG) muscles. During CMJs flexion angle was recorded with an electrogoniometer. Jumpers were instructed to fix 15% less (shallow CMJ) and 15% more (deep CMJ) than the self-selected CMJs. Kinematic, kinetic and EMG metrics were compared between the different CMJ depths using repeated measures ANOVA.

- During unweighting VL EMG averaged 5.5% of MVC during self-selected CMJs. Force dropped to 43% of body weight during unweighting but only to 58% for shallow CMJs (P=0.015). During unweighting VL EMG averaged 5.5% of MVC during self-selected CMJs versus 8.1% for shallow CMJs (P=0.014). Percent decline in jump height with shallow versus self-selected CMJs was correlated with the difference in VL EMG during unweighting between shallow and self-selected CMJs (r=−0.651, P=0.041).

**CONCLUSIONS**

- Failure to deactivate the quadriceps during the unweighting phase of shallow CMJs compromised unweighting and resulted in a reduced jump height. These findings highlight the importance of unweighting at the initiation of the countermovement in dictating subsequent jump performance.

**Is There An Optimal Vertical Ground Reaction Force Profile For Maximizing Jump Height In A Countermovement Jump?**

Josef A. Cohen1, Malachi P. McHugh, FACSM1, Marc Hickok2, Declan AJ Connolly. Nicholas Institute of Sports Medicine and Athletic Trauma, New York, NY. University of Nevada, Las Vegas, Las Vegas, NV. (Sponsor: John A. Mercer, FACSM)

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(No relevant relationships reported)

**Board #153 May 27 1:30 PM - 3:00 PM**

**Core Temperature While Swimming In A Wetsuit During 1000-m Race Pace Swim**

Alina P. Swofford, Melissa Aura, Boram Lim, John Mercer, FACSM, University of Nevada, Las Vegas, Las Vegas, NV.

(Sponsor: John A. Mercer, FACSM)

(No relevant relationships reported)
task intensity affects the influences of AKP on frontal-plane hip biomechanics during landing and jumping. METHODS: 13 healthy adults (6 females, 7 males; 70 ± 15 kg; 1.7 ± 0.1 m; 22 ± 2 years) performed three land and jump trials under three conditions: pre-pain, pain (1-ml hypertonic saline (5% NaCl) injection into the right infrapatellar fat pad), and post-pain. Subjects jumped over an obstacle, landed on a force plate, then jumped over a second obstacle. Obstacle heights of 80 and 50% of maximal vertical jump height defined high and low task intensities. Frontal plane hip angles and internal moments were calculated for the right leg. A functional analysis (α=.01) was used to evaluate differences between conditions for each intensity, across the duration of foot contact with the force platform (ground contact). RESULTS: For the high intensity task, AKP resulted in increased hip adduction angle, as much as 2° between 1-20% and 75-95% of ground contact, and increased hip abduction moment, up to 6 Nm between 10-30% of ground contact (Figures 1E-F). For the low intensity task, AKP resulted in decreased hip abduction angle, as much 1.3° between 25-75% of ground contact, and decreased in hip abduction moment, as much as 15 Nm between 25-60% of ground contact (Figure 1G-H). Changes due to AKP persisted after pain abatement (Figures 1I-L). CONCLUSIONS: Experimental AKP effects frontal plane hip biomechanics and these effects differ between task intensity. Especially during the high-intensity task, the AKP resulted in increased hip adduction angle and internal abduction moment. More data are needed to determine how/if the present changes influence the risk of chronic knee injury/disease.

<table>
<thead>
<tr>
<th>Variable (Moments)</th>
<th>CON</th>
<th>LOW</th>
<th>HIGH</th>
<th>p-value</th>
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<tr>
<td>Knee Abduction</td>
<td>0.44 (0.35)</td>
<td>0.44 (0.30)</td>
<td>0.42 (0.21)</td>
<td>0.422</td>
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<tr>
<td>Knee External Rotation</td>
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<td>-0.24 (0.25)</td>
<td>-0.32 (0.22)</td>
<td>0.029</td>
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<tr>
<td>Hip Abduction</td>
<td>-0.62 (0.22)</td>
<td>-0.66 (0.26)</td>
<td>-0.57 (0.27)</td>
<td>0.216</td>
</tr>
<tr>
<td>Hip External Rotation</td>
<td>-0.57 (0.18)</td>
<td>-0.60 (0.16)</td>
<td>-0.58 (0.19)</td>
<td>0.353</td>
</tr>
</tbody>
</table>

Figure 1. Grand ensembles for each condition and each intensity (A-D). Results of condition comparisons, pain minus pre-pain (E-G) and post-pain minus pre-pain (H-K). For plots E-K, mean differences and corresponding 95% confidence intervals are plotted as a function of time. When shaded area does not cross the zero line, condition differences exist (p<0.05).

### Board #168 May 27 1:30 PM - 3:00 PM
#### The Effects Of Whole-body Vibration And Fatigue On Vertical Jump Performance
Sean Bonilla, Sergio Espericueta, Chanell Catuniao, Nicole C. Dabbs. California State University, San Bernardino, San Bernardino, CA.
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(no relevant relationships reported)

Whole Body Vibration (WBV) is the exposure of oscillating vibration to the body, which may result in an increase in the rate of motor unit activation. Fatigue of knee extensor muscles has been shown to hinder vertical jump (VJ) performance.

**PURPOSE:** The purpose of this study is to investigate the effects of WBV and fatigue on vertical jump (VJ) performance.

**METHODS:** Sixteen active males and females (age, 23.19 ± 2.56; weight, 79.05 ± 16.97; height, 174.36 ± 12.11) volunteered for five-day study. On day 1 familiarization, after completing an IRB approved informed consent and health screening questionnaires participants were prepped on testing protocols. Following a dynamic warm up, testing sessions 2-5 will include one of four conditions: No WBV and No Fatigue (C1), WBV and Fatigue (C2), WBV and No Fatigue (C3), and No WBV and Fatigue (C4). WBV was performed using a frequency of 50Hz and a low amplitude while performing quarter squats for a total of 4min with a 30s rest or work ratio. Lower-body fatigue induced using Bosco fatigue test, performing 60s of jump squats. VJ was performed using an AMTI force plate and peak force, velocity, and power were calculated and a Vertec was used to measure vertical jump height (VJH). VJ data was collected pre and post conditions each day. Percent change scores (%Δ) were calculated between pre and post conditions and used for analysis. SPSS was used to perform a Repeated Measures ANOVA.

**RESULTS:** There was significant differences between C1 and C2 (p=0.005; C1=−1.21 ± 5.91; C2=−2.73 ± 6.17 %Δ), C1 and C4 (p=0.002; C1=−1.21 ± 5.91; C4=−8.94 ± 6.90 %Δ), C2 and C3 (p<0.001; C2=−7.83 ± 6.17; C3= 0.97 ± 4.63 %Δ), C3 and C4 (p<0.001; C3= 0.97 ± 4.63; C4=−8.94 ± 6.90 %Δ) in VJH. There were significant differences between C1 and C4 (p=0.011) and between C3 and C4 (p=0.017) in peak force. There were significant differences between C1 and C2 (p=0.01), C1 and C4 (p=0.02), C2 and C3 (p=0.001), C3 and C4 (p=0.002) in peak power. There were significant differences between between C1 and C2 (p=0.03), C1 and C4 (p<0.03), C2 and C3 (p=0.004) and C3 and C4 (p=0.008) in peak power. There were no significant (p<0.05) differences between other variables.

**CONCLUSIONS:** WBV did not show to change the detrimental effects of lower-body fatigue, however this study did show lower-body fatigue decreases vertical jump performance.

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### Board #159 May 27 1:30 PM - 3:00 PM
#### Effects Of w’ Depletion On The Torque Velocity Relationship In Cycling
Randolph E. Hutchinson1, Karlee S. Edwards1, Gibson Klapthor2, Lee Shearer1, Gregory M. Mocko2, Ardalan Vahidi2. Furman University, Greenville, SC. ’Clemson University, Clemson, SC. (Sponsor: Anthony Catersano, FACSM)
Email: Randolph.Hutchison@furman.edu
(no relevant relationships reported)

The torque-velocity (T-V) curve has been used to study the effects of energy expenditure on contractile muscles and work performance. The relationship T-V relates VO2consumed.

**PURPOSE:** The purpose of this study was to further quantify changes to the T-V curve, but based on anaerobic energy (W’) expenditure at powers above Critical Power (CP).

**METHODS:** A group of 10 subjects (37.8 ± 11.6 yrs, 72.8 ± 16.2 kg, 1.75 ± 1.11 m) performed a Time to Exhaustion Test (TTE) interspersed with 6-second sprints to generate their T-V curve at 3 stages of W’ expenditure: after initial warmup (FRESH), fatigued (after 2 minutes at CP6, TFE), and AT, and TTE.

**RESULTS:** ANOVA results indicated a statistically significant decrease in normalized Maximal Power (Pmax) from FRESH to 2MIN (16.89%, p<.0005), 2MIN to TTE (24.71%, p<0.004), and from FRESH to TTE (41.6% p<.04). Statistically significant decreases in normalized Maximal Velocity (v) were seen from FRESH to 2MIN (14.1%, p<0.0005), from 2MIN to TTE (11.8%, p<0.001), and FRESH to TTE (25.9%, p<0.0005). No significant changes occurred in Maximal Torque (T). Linear regression
models were run using W^* expanded to explain variations in P, ϕ, and T. There were significant negative correlations for T (r = -0.020) and significant strong negative correlations for P (r = -0.005), and ϕ (r = -0.005).

**CONCLUSIONS:** This suggests that W^* expenditure can be used to predict the performance parameters Torque (T), Shortening velocity (ϕ), and Maximal Power (Pmax) during continuous cycling above Critical Power.

**1034** Board #160  May 27 1:30 PM - 3:00 PM  
**Effects Of Bicycle Crank Length On Hip And Knee Joint Kinematics And Compressive Forces**  
Christiane R. O’Hara, Michael Liang, Melodie Leroulider, Chaitanya Adiga, Robert D. Clark. *California Polytechnic State University, San Luis Obispo, CA.* (Sponsor: Todd Hagopian, FACSM)  
Email: crohara@calpoly.edu  
(No relevant relationships reported)

**PURPOSE:** Crank length (CL) on a bicycle may affect knee and hip joint compressive forces and range of motion (ROM). The relationship between knee/hip joint moments, forces, and ROM can have an influence on hip and knee joint health (i.e. osteoarthritis, patellofemoral disorder, ligament damage, etc.). The purpose of this study was to examine the effects of four different CL (155, 165, 175, and 185 mm) on ROM and resultant compressive forces on the hip and knee. **METHODS:** 12 non-cyclists (4M, 8F, aged 18-55) participated in a single blind randomized cross-over experiment with four CL. An Enhanced Helen Hayes marker protocol was used to place 32 retroreflective markers on anatomical landmarks to track kinematic data using a 12-camera 3D motion analysis system with Cortex software (Motion Analysis Corp., CA, USA). Kinetic data were collected using a stationary bike (SRM IndoorTrainer, Germany) retrofitted with custom pedals containing 6-axis load cells (AMTI, MA, USA). A 3 minute warm-up for each CL was performed at 1.5 W/kg and 70 rpm. 4x1 minute trials were conducted at 2 W/kg. The first two trials were at a constant cadence of 70 rpm and the second two trials were at a constant pedal speed (PS) of 1.47 m/s.

There were 10 seconds of rest between trials and 5 minutes of recovery between each condition. Kinematic data was processed using Cortex software and filtered (4th order Butterworth, cutoff 6 Hz). Kinetic data was filtered using MATLAB (MathWorks, MA, USA). All data was averaged from 30 seconds of each trial. **RESULTS:** During submax cycling, the 155 mm CL had a significantly smaller hip ROM (42 deg vs 49 deg: p<0.05) and a significantly smaller knee ROM compared to the 185 mm CL (72 deg vs. 80 deg: p<0.05). No significant differences were found at a PS of 1.47 m/s: 155 mm CL peak hip compressive force (1.3 N/kg) vs. 185 mm CL (0.9 N/kg); 155 mm CL peak knee compressive force (2.8 N/kg) vs. 185 mm CL (2.6 N/kg). No significant differences were found at a PS of 1.47 m/s: 155 mm CL peak hip compressive force (0.6 N/kg) vs. 185 mm CL (0.7 N/kg); 155 mm CL peak knee compressive force (2.3 N/kg) vs. 185 mm CL (2.5 N/kg). **CONCLUSION:** Hip and knee ROM was significantly greater with a longer CL. There are no significant differences in hip or knee peak compressive forces. Implementation of a shorter CL at a PS of 1.47 m/s may minimize peak hip and knee joint compressive forces.

**1035** Board #161  May 27 1:30 PM - 3:00 PM  
**Effects Of Workrate And Seat Position On Knee Joint Kinematics In Recumbent Cycling**  
Tianyi Lu. *George Mason University, Manassas, VA.* (Sponsor: Songning Zhang, FACSM)  
Email: tl7t@gmu.edu  
(No relevant relationships reported)

Tianyi Lu, Tanner Thorsen, Jared Porter, Joshua Weinhandl, Songning Zhang, FACSM  
George Mason University, Fairfax, VA.  
Cycling is one of the most popular rehabilitation tools for knee osteoarthritis (OA) patients. In recent years, recumbent bicycle has become a popular trend over upright bikes in exercise and rehabilitation. Previous literature has largely focused on upright cycling with few examining knee biomechanics in recumbent biking in the sagittal plane. Little is known on the effects of workrate and seat position on knee biomechanics in recumbent bike. **PURPOSE:** To examine the effects of different workrates and seat positions on knee biomechanics during stationary recumbent cycling. **METHODS:** Fifteen healthy participants (55±3.7 years, 1.75±0.09 m, 84±15.7 kg) cycled on a recumbent ergometer in six test conditions of three seat positions at two workrates. Seat positions were “far” (20-30° of peak knee flexion angle), “medium” (30-40°) and “close” (40-50°), and the workrates were set at 60 and 100 Watts (W). A 3D motion analysis system (240 Hz, Vicon) and a pair of custom-made instrumented pedals were used to collect kinematic and kinetic data in each condition. A 3.2 (seat position x workrate) repeated-measures ANOVA was used to determine if differences existed between conditions (p<0.05). **RESULTS:** Peak knee flexion moment, peak knee abduction moment (KaM), peak knee extension angle and peak knee extension ROM were significantly higher at 100 W compared to 60W (all p<0.005). There was a significant main effect of seat position for peak knee flexion moment. Pairwise comparisons showed that peak knee flexion moment was significantly higher in the seat position (-18.9±6.3 Nm) compared to medium (-13.1±6.5 Nm) and close position (-7.28±7.33 Nm). In addition, the peak flexion moment was significantly higher in the medium seat position (-13.1±6.5 Nm) than close position (-7.28±7.33 Nm). **CONCLUSION:** Increased workrates significantly increased peak KaM and knee extension moment. Different seat positions did not change either peak KaM or knee extension moment. For patients with knee OA, a low workrate may be considered in recumbent cycling exercises, while the seat position could be chosen based on personal preferences.

**1036** Board #162  May 27 1:30 PM - 3:00 PM  
**Preoperative And Postoperative Cycling Biomechanics Following Cam Femoroacetabular Impingement Corrective Surgery: A Pilot Study**  
Jenna E. Link, David J. Bennion, K. B. Foreman, James C. Martin, FACSM. *University of Utah, Salt Lake City, UT.* (Sponsor: James C. Martin, FACSM)  
(No relevant relationships reported)

**PURPOSE:** Cycling is commonly prescribed following femoroacetabular impingement (FAI) corrective surgery. This surgery alters gait mechanics in the postoperative period, but alterations in cycling mechanics have not been reported. In this case study, we sought to determine if cam FAI corrective surgery altered cycling biomechanics postoperatively in a highly active female subject. **METHODS:** Bilateral cycling biomechanics were collected preoperatively when the subject was asymptomatic and again 11-weeks postoperatively. During each visit, pedal forces and limb kinematics were collected and used to determine joint-specific work. The subject was instructed to target a power output of 240 W during isokinetic cycling at 80 RPM. Limb symmetry index (LSI) was calculated to compare power production at the pedal. Normalized joint-specific work was compared both inter- and intra-limb, as well as pre- vs. postoperatively. **RESULTS:** LSI decreased from 96% to 94% postoperatively. Summed joint extension work increased in the surgical limb from 90% to 97% postoperatively. This increase was the result of a 67% decrease in hip extension work (30% to 10%, Figure 1) and a compensatory 28% increase in knee extension work (50% to 64%, Figure 1) and 70% increase in ankle extension (10% to 17%, Figure 1) work within the surgical limb. In the nonsurgical limb, there was a 33% increase in knee flexion work postoperatively (3% to 13%, Figure 1). **CONCLUSION:** Cycling mechanics following FAI corrective surgery exhibited significant changes suggesting the development of compensatory patterns. The results of this pilot study combined with the prevalence of cycling in FAI surgery rehabilitation warrant further studies on the development and persistence of compensatory patterns and to possibly identify early intervention strategies.

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**Figure 1. Pre- to postoperative changes in joint-specific work for the surgical and nonsurgical limbs.**
Biomechanics of the golf swing have been studied extensively but specific metrics related to golfing proficiency have not been identified. The purpose of this study was to compare golf swing biomechanics between proficient and average golfers and thereby identify specific metrics associated with golfing proficiency.

**METHODS:** Twenty-two male golfers were categorized as proficient (golf index <6, n=10) or average (golf index 10-24, n=12). Three-dimensional kinematics and ground reaction forces (GRF) were recorded as subjects hit standard golf balls into a net using a driver. Angular velocities of the pelvis, trunk, lead arm and golf club, as well as X-factor, were calculated from the kinematic data. GRF under the lead and back legs are expressed as a % of bodyweight. The effect of golf proficiency on golf swing biomechanics was assessed using independent samples t-tests.

**RESULTS:** Proficient golfers were younger (26.6±6 yr vs. 48±16 yr, P=0.001) but did not differ in height (P=0.114) or weight (P=0.330). Peak pelvis and trunk velocities were higher (P=0.004) in proficient golfers (525.1±67.7 deg/s and 521.3±75.5 deg/s, respectively) versus average golfers (414.3±67.7 deg/s and 521.3±75.5 deg/s, respectively) but peak club velocity was not different (2509.8±221.6 deg/s vs. 2446.6±20.3 deg/s, P=0.675). Proficient golfers had greater X-factor at the top of the backswing (56±60.6 degrees vs. 44±11.4 degrees, P=0.008), greater peak X-factor (61±5.7 degrees vs. 49±11.8 degrees, P=0.008) and greater X-factor at ball impact (3±18.5 degrees vs. 22±5.6 degrees, P=0.001). Proficient golfers had a higher peak GRF on the lead leg compared with average golfers (14±17.6 %BW vs. 12±18.7 %BW, P=0.018), while paradoxically having a lower lead leg GRF at ball impact (56±18 %BW vs. 89±17 %BW, P<0.001).

**CONCLUSIONS:** The higher X-factor in proficient golfers is indicative of a more effective use of elastic energy in the trunk that is sustained through ball impact. The GRF data indicate that proficient golfers more effectively loaded the lead leg during the initiation of the downswing and more effectively unloaded the lead leg prior to ball impact. In conclusion, golf swing proficiency appears to be a function of a more effective transfer of power from the ground and a more effective use of elastic energy in the trunk.

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Female golfers account for approximately 25% of the entire golfing population in the United States and 16% of female golfers are over the age of 60. While balance and golf swing kinematic sequence are frequently cited as important performance determinants, a common recommendation is to use a half swing, however, it is not known whether this 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 swing. METHODS: 11 healthy amateur male golfers with handicaps ≤ 21 participated in this study. All participants completed 20 golf swings (10 full swings, 10 half swings). A 10-camera motion analysis system, force plates, and a handheld dynamometer were 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 (Nm; normalized by %BW) and movement positions (degrees) were analyzed in SPSS (Version 24). RESULTS: The highest peak torques (Nm; %BW) and movement positions (degrees) were observed at the hip flexion and ab/adduction, and hip abduction during swing phases. Conclusions: Contrary to a pilot study, our data shows that using a half swing did not reduce the amount of internal torque around the hip, as compared to a full swing. All torques were similar to a published study in which it was noted that the torques were much higher than reported hip torques for walking and activities of daily living. These findings suggest that clinicians should use caution in recommending a half vs a full swing for those returning to golf following an injury or surgery.
MEDICINE & SCIENCE IN SPORTS & EXERCISE®

Board #167 May 27 1:30 PM - 3:00 PM
Crosse Use Effects On Running And Drop Jump Mechanics In Male And Female Lacrosse Players
Heather K. Vincent, FACSM, Michelle L. Bruner, Cong Chen, Sharareh Sharififar, Kevin R. Vincent, FACSM. University of Florida, Gainesville, FL.
Email: vinckh@ortho.ufl.edu
(No relevant relationships reported)

PURPOSE: A unique feature of lacrosse is the use of a crosse to move the ball during complex running and jumping movements. It is unclear whether there is a differential biomechanical effect of holding the crosse during key sport-specific motions in female and male youth and high-school/collegiate players. The purpose of the study was to determine the motion differences of running and drop jumps when holding a short stick or a defensive pole in youth (11.8±1.4 yrs; 21%; female) and high-school collegiate players (18.4±1.9 yrs; 35%; female).

METHODS: Players (N=70) performed drop jumps and running at near sprint speed. Drop jumps were completed under three conditions: bare hands, short stick and defensive long pole. Running was performed under three conditions: bare hands, and dominant side one-handed and two-handed holds while dribbling. A 3D motion tracking system and floor embedded force plates captured motion about the ankle, knee, hip, pelvic and trunk during three trials of each condition for each motion. Sex and age group differences were tested using univariate analyses of variance.

RESULTS: For drop jumps, foot landings (heel, mid or toe) differed more often when holding a crosse versus bare hands for all players (31.4%-34.2% vs 27.1%). Irrespective of sex, female players demonstrated more ankle 7°-9° dorsiflexion than male athletes in all conditions (p<0.05). Youth demonstrated 28% more knee adduction in all jump conditions than high school/collegiate players (p<0.05). Compared to males, females had 5.2°-6.5° less anterior trunk flexion at initial ground contact when holding a short or long stick and 9.8%-20% less anterior flexion after landing versus bare hands (p<0.05). During running, females had 12.7% more hip adduction and 43% more trunk lateral lean than males with one or two-hand holds compared to bare hands irrespective of age (p<0.05). A two-handed hold produced greater trunk transverse rotation than other conditions compared to males and across conditions (p<0.001).

CONCLUSIONS: Holding a crosse differentially affects crosse mechanics in female and male players but not by age group. Preseason conditioning with movements while holding the crosse may provide help reduce excessive motion at affected joints. Funded by US Lacrosse.

Board #168 May 27 1:30 PM - 3:00 PM
Relationships Between Accelerometer-derived Training Loads And Rpe In Collegiate Women'S Volleyball Players
Natalie Kupperman, Jay Hertel, FACSM. University of Virginia, Charlottesville, VA.
(No relevant relationships reported)

Purpose: The relationship between ratings of perceived exertion (RPE) and objective training load metrics in women’s volleyball players is unknown. This study examined the relationships between RPE and accelerometer-derived variables in practices and games in this population.

Methods: External training loads were measured with triaxial accelerometry during team practices and games along with subjective RPE collected on the Borg CR-10 scale. Data from 12 athletes over a 7-week in-season period (13 games, 19 team activities post season. They completed a LESS screen (three consecutive jumps and upper resistance training. Over the 10 week season, the athletes performed 3-4 sets of 6 - 10 repetitions for resistance exercises during each training session. All sessions were supervised by one of the investigators as well as by the Colombian team coach. Shuttle run, hand grip strength and countermovement jump were assessed before and after the 10 week training program. A total of 12 variables was analyzed through CMJ: peak flight time (PFT), peak contact time (PCT), Peak eccentric duration (PDE), peak concentric duration (PDC), Peak eccentric work (PWE), Peak Concentric work (PWC), Peak jump height (PMH), Peak maximum velocity (PMV), Peak maximum power (PMP), Peak maximum force (PMF), Peak rate of force development (PRFD) and Peak time to maximum force (PTFM) were simultaneously quantified with the Gyko inertial sensor system (Microgate, Bolzano, Italy).

RESULTS: Non parametric data were analysed by Wilcoxon and Spearman test. Significant correlations (r) were found next to the p value and the effect size (ES). P < 0.05). PL alone explained 62% and 33% of the variance in RPE for practices and games, respectively (r=0.01). PL alone explained 62% and 33% of the variance in RPE for practices and games, respectively.

RESULTS: Preseason men LESS scores averaged 6.30 ± 1.31 and women averaged 6.38 ± 1.63. Postseason LESS scores for men averaged 5.47 ± 1.09 and women averaged 5.65 ± 1.08. Correlation between the preseason and the post-season for each group is described by the following equation: y = 0.95x + 0.62 (r = 0.92, p < 0.001). Significant relationships were found between LESS scores and hand grip strength (r = 0.37, p < 0.05). The relationship between LESS scores and countermovement jump is described by the following equation: y = 0.56x + 0.91 (r = 0.51, p < 0.05).

CONCLUSIONS: The findings suggest that elite male volleyball players can improve speed, agility, hand grip strength and vertical jump performance during the pre competition season by implementing a well designed training program that includes both hip thrust and resistance training exercises.

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Effects Of Hip Thrust And Resistance Training On Shuttle Run, Hand Grip Strength And Countermovement Jump In Colombian Elite Male Volleyball Players
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(No relevant relationships reported)

PURPOSE: This study aimed to determine whether a hip thrust and resistance training could improve performance on shuttle run, hand grip strength and countermovement jump in elite volleyball athletes.

METHODS: Eleven elite male volleyball players (23.0±2.87 years), body height (1.91±0.15 m), average height team mate (1.40±0.20 m), body fat (18.16±5.45%) completed 2 training sessions per week, which included hip thrust exercise and upper resistance training. Over the 10 week season, the athletes performed 3-4 sets of 6 - 10 repetitions for resistance exercises during each training session. All sessions were supervised by one of the investigators as well as by the Colombian team coach. Shuttle run, hand grip strength and countermovement jump were assessed before and after the 10 week training program. A total of 12 variables was analyzed through CMJ: peak flight time (PFT), peak contact time (PCT), Peak eccentric duration (PDE), peak concentric duration (PDC), Peak eccentric work (PWE), Peak Concentric work (PWC), Peak jump height (PMH), Peak maximum velocity (PMV), Peak maximum power (PMP), Peak maximum force (PMF), Peak rate of force development (PRFD) and Peak time to maximum force (PTFM) were simultaneously quantified with the Gyko inertial sensor system (Microgate, Bolzano, Italy).

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CONCLUSIONS: The findings suggest that elite male volleyball players can improve speed, agility, hand grip strength and vertical jump performance during the pre competition season by implementing a well designed training program that includes both hip thrust and resistance training exercises.
The triple hop for distance (THD) involves three consecutive single leg hops for maximal horizontal displacement. This task imposes variable mechanical demands challenging balance, coordination and leg strength. While THD is common during late-stage rehabilitation, these demands may also qualify THD as appropriate for healthy athletes. While it is known that energy absorption strategies vary between landing styles, genders and heights, a limitation is the use of a single contact for analysis or training. As a result, changes in landing strategy over repeated landings are not well understood. PURPOSE: To determine changes in sagittal plane joint energetic landing strategy during each contact of THD. METHODS: Nine female college soccer players performed THD on the dominant limb. Ground reaction forces and lower extremity kinematics were measured using a force platform (1200Hz) and 9-camera motion capture system (240Hz). Three trials were collected of each contact in the THD sequence. Negative joint work was calculated as negative joint power integrated with respect to time. Total negative joint work (TNW) is the sum of eccentric work done on the hip, knee, and ankle. The proportion of work done relative to each joint was used as relative negative joint work (RNJW). RESULTS: TJW increased from the first (~80.5 ± 26.3J) to the second (~95.5 ± 33.7J), and third (~145.2 ± 42.5J) landings. From the first to second contacts, RJW done on the ankle (33.5% ± 34.7% d= 0.10, knee (53.9% ± 52.1% d= 0.20), and hip (12.6% vs 13.1%, d= 0.08) was unchanged. From the second to third contacts, RJW done on the ankle was substantially decreased (34.7% vs 19.4%, d= 1.67), while RJW done on the hip was substantially increased (13.1% vs 25.4%, d= 1.68). RJW done on the knee was modestly greater (52.1% vs 56.3%, d= 0.54) in the second compared to third contacts in THD sequence. CONCLUSION: The serial nature of THD requires athletes to adapt to different demands in each ground contact. This includes progressively greater braking forces and landing strategy modulation during each contact. This represents a task which exposes athletes to variable demands of both ground reaction forces and joint work in a controlled manner. THD may therefore address multiple athletic performance qualities during performance enhancement and rehabilitation.

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Musculature exposed to continuous stress over time will begin to decrease performance as a result of fatigue. However, past research has shown that Whole Body Vibration (WBV) can have a positive effect on performance by increasing motor unit recruitment.

PURPOSE: The purpose of this study is to analyze the effects of WBV and Fatigue on Isometric Mid-Thigh Pull (IMTP). METHODS: Sixteen active males and females (age: 23.19 ± 2.56yr, weight: 79.05 ± 16.97kg, height: 174.36 ± 12.11cm) volunteered to participate in a 5-day study. Day 1 consisted of familiarization where participants completed an IRB approved informed consent, Health History Questionnaire, and a PAFQ. Following anthropometrics measurements, participants were familiarized with all the testing protocols and interventions. Day 2-5 testing sessions consisted of a dynamic warm-up followed by pre-testing of IMTP’s. Pre-tests for IMTP were taken following the completion of one of 4 conditions, each performed on separate days. Conditions consisted of C1 (No WBV-No Fatigue), C2 (WBV-No Fatigue), C3 (WBV-No Fatigue), and C4 (No WBV- Fatigue) in a randomized order. Peak Force for the IMTP was measured using an AMTI Portable Force Plate. WBV was administered while performing quarter squats at a frequency of 50Hz and low amplitude on a total of 4m with a work to rest ratio of 30s/30s. The Bosco fatigue protocol was administered to induced lower-body fatigue by having participants perform 60s of jump squats. Percent change scores were calculated between pre- and post-tests for each condition and analyzed for statistical differences between conditions. SPSS was used to run a Repeated Measures ANOVA to compare condition differences of percent change scores (%Δ). An alpha level was set at p<0.05 to determine significance.

RESULTS: There were no significant (p>0.84) differences found between conditions (C1 1.25 ± 0.98% vs C2 –0.79 ± 7.77% ΔA; C3 –1.53 ± 5.95% ΔA; C4 –1.32 ± 10.69% ΔA) for peak force.

CONCLUSIONS: Although no significant differences were found for peak force between pre- and post-tests for IMTP, further studies need to investigate alternative ways to evaluate the effects WBV on lower-body muscular performance.
CONCLUSIONS: The decrease found in hamstring peak vertical force corresponds to the fatigue that athletes present and accumulate during the tournament and predispose to be a risk factor for hamstring injuries. Further research that compares control group (5 males: 20.7 ± 1.2 yr; 4 females: 20.5 ± 0.6 yr). Intervention group: ST36 (bilateral) and CV4 for indirect moxibustion 30 min every other day for 4 consecutive weeks; control group: no moxibustion intervention. Peak torque (PT) of right knee extensors, relaxed and contracted muscle stiffness (MS) of vastus lateralis, knee extensors muscular activation stiffness (MAS) were assessed by isokinetic dynamometer IsomEd 2000, Myometer and free oscillation technique respectively, at three time points: pre-intervention (time-point 1), post-intervention (time-point 2), and after a treadmill fatigue protocol (time-point 3). RESULTS: Two-way repeated measures ANOVA found a significant interaction between time and group in MAS (p = 0.001) and normalized PT (p = 0.004). Post-hoc tests with the Bonferroni adjusted a revealed that MAS was reduced in intervention group (time-point 1: 521.8±201.3 N/m, time-point 2: 637.7±181.2 N/m) compared to pre-intervention (time-point 1: 615.4±196.6 N/m, time-point 2: 597.1±190.4 N/m) (p = 0.022). There was a tendency that after fatigue MAS increased more in intervention group (time-point 2: 637.7±181.2 N/m, time-point 3: 712.1±156.9 N/m) than in control group (time-point 2: 597.1±190.4 N/m, time-point 3: 629.8±172.7 N/m) (p = 0.202); and the tendency that normalized PT (PT/body mass) increased more in intervention group (time-point 2: 1.49 ± 0.20 Nm/kg, time-point 3: 1.53 ± 0.17 Nm/kg) whilst it decreased in control group (time-point 2: 1.41 ± 0.21 Nm/kg, time-point 3: 1.34 ± 0.21 Nm/kg) (p = 0.033). CONCLUSION: Moxibustion enhanced the knee MAS, may benefit the ability of fatigue resistance in young recreational athletes, and thus could be utilized in injury prevention.

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Stiffness is the oscillation of nervous system and joint mechanisms, and thus the comprehensive representativeness of joint stiffness. It has been reported that moxibustion can improve stiffness and alleviate fatigue symptoms. PURPOSE: To investigate whether moxibustion could enhance knee joint stiffness characteristics in recreational athletes pre and post fatigue. METHODS: Twenty-four participants were partially randomized into intervention group (7 males: 20 ± 1.3 yr; 6 females: 20 ± 1.2 yr) and control group (5 males: 19 ± 0.9 yr; 4 females: 20 ± 0.6 yr). Intervention group: Acupoints ST36 (bilateral) and CV4 for indirect moxibustion 30 min every other day for 4 consecutive weeks; control group: no moxibustion intervention. Peak torque (PT) of right knee extensors, relaxed and contracted muscle stiffness (MS) of vastus lateralis, knee extensors muscular activation stiffness (MAS) were assessed by isokinetic dynamometer IsomEd 2000, Myometer and free oscillation technique respectively, at three time points: pre-intervention (time-point 1), post-intervention (time-point 2), and after a treadmill fatigue protocol (time-point 3). RESULTS: Two-way repeated measures ANOVA found a significant interaction between time and group in MAS (p = 0.001) and normalized PT (p = 0.004). Post-hoc tests with the Bonferroni adjusted p revealed that MAS was reduced in intervention group (time-point 1: 521.8±201.3 N/m, time-point 2: 637.7±181.2 N/m) compared to pre-intervention (time-point 1: 615.4±196.6 N/m, time-point 2: 597.1±190.4 N/m) (p = 0.022). There was a tendency that after fatigue MAS increased more in intervention group (time-point 2: 637.7±181.2 N/m, time-point 3: 712.1±156.9 N/m) than in control group (time-point 2: 597.1±190.4 N/m, time-point 3: 629.8±172.7 N/m) (p = 0.202); and the tendency that normalized PT (PT/body mass) increased more in intervention group (time-point 2: 1.49 ± 0.20 Nm/kg, time-point 3: 1.53 ± 0.17 Nm/kg) whilst it decreased in control group (time-point 2: 1.41 ± 0.21 Nm/kg, time-point 3: 1.34 ± 0.21 Nm/kg) (p = 0.033). CONCLUSION: Moxibustion enhanced the knee MAS, may benefit the ability of fatigue resistance in young recreational athletes, and thus could be utilized in injury prevention.

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On session 2 or 3, participants walked on a treadmill for 15 minutes with or without elastic wraps at 5.6 km/h at the grade determined on the first session. Absolute angular error (AAE) was measured before and immediately after each treadmill walking protocol. Muscle fatigue was determined by changes in average power and peak power measured during countermovement jumps. Change scores were computed for each condition and paired sample t-tests were used to determine differences between pBFR and Control. RESULTS: The change in AE was not different between pBFR: -1.5 vs Control: degrees: 0.19, p=0.171) between low intensity exercise with and without pBFR [mean difference of -1.73 (-4.3, 0.85) degrees]. The change in peak power was also similar (pBFR: -34.5 vs Control: 150.1 W, p=0.739) between exercise with and without pBFR [mean difference of -185 (-1358, 988) W]. Similarly, the change in average power (pBFR: 9.1 vs Control: -3.4 W, p=0.544) was also not different [mean difference of 12.6 (-31.1, 56.2) W]. CONCLUSION: The walking exercise with pBFR did not affect joint proprioception in young adults, suggesting that walking exercise with pBFR might be safely applied without increasing the risk of injury.

Wind is not only closely associated with the discussion of fairness in skiing, but also very important to flight safety. Flight stability is essential for performance and safety in ski jumping, and mainly involved several factors, such as environmental wind and flight posture. However, the flight stability control mechanism of ski jumping in lateral wind environment remains unclear.

PURPOSE: To determine the flight stability control mechanism of ski jumping in lateral wind environment.

METHODS: The aerodynamic characteristics of ski jumping during flight under different lateral wind and yaw angles are predicted by numerical simulation of computational fluid dynamics, and the effects of the above two factors on flight stability are compared and analyzed. The jumper and skis were regarded as a multi-body system, and partially averaged Navier-Stokes turbulence model was used to simulate aerodynamic characteristics of the system based on a general flight attitude and the forces and torques were obtained. The lateral wind speed involved in the numerical prediction includes 1.5 m/s, 3 m/s, 4.5 m/s, 7.5 m/s and 10 m/s, and the flight yaw angle involved includes 2.5°, 5° and 7.5°.

RESULTS: When lateral wind speed is small (less than 3m/s), yaw force, yaw torque and rolling torque are small and almost negligible, and when lateral wind speed is larger than 4.5m/s, yaw force, yaw torque and rolling torque are more obvious. When wind speed is 4.5m/s and 7.5m/s, yaw force, yaw torque and rolling torque are 9.5 N and 26.3 N, 2.3 Nm and 6.3 Nm, 2.8 Nm and 7.8 Nm, respectively. When yaw angles are 2.5° and 5°, yaw force, yaw torque and rolling torque are 6.8 N, 12.9 N and 21.9 N, 2.5 Nm, 5.0 Nm and 6.8 Nm, 2.7 Nm, 5.7 Nm and 8.3 Nm, respectively. When wind speed is 4.5 m/s and yaw angle is 2.5°, yaw force, yaw torque and rolling torque results of these two conditions are close to each other. Similarly, When wind speed is 7.5 m/s and yaw angle is 7.5°, yaw force, yaw torque and rolling torque results of these two conditions are close to each other.

CONCLUSION: The larger lateral wind can have a significant adverse effect on flight stability control of ski jumping, but it is possible to compensate or even eliminate this adverse effect by taking the appropriate flight yaw angle.

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Leg stiffness is a fundamental property of the lower limb spring pattern, and is expressed by the ratio of the maximum vertical ground reaction force (GRF) to the vertical displacement of the body’s center of mass. The foot-ground interface, i.e. the footgear (FW), is an important factor that contributes to the functional leg stiffness.

PURPOSE: To examine the FW effect on leg stiffness of young female athletes in a variety of team sports.

METHODS: Twenty - six female basketball, handball and volleyball players (24.9 ± 6.1 years, height: 1.76 ± 0.76 m, body mass: 63.7 ± 6.9 kg) performed 30 s of two-legged hopping in place, barefoot (BF) and with their usual FW, at a preset hopping frequency (digital metronome at 2.2 Hz which approximates the player’s walking frequency). RESULTS: When lateral wind speed is small (less than 3m/s), yaw force, ywaw torque and rolling torque are small and almost negligible, and when lateral wind speed is larger than 4.5m/s, yaw force, yaw torque and rolling torque are more obvious. When wind speed is 4.5m/s and 7.5m/s, yaw force, yaw torque and rolling torque are 9.5 N and 26.3 N, 2.3 Nm and 6.3 Nm, 2.8 Nm and 7.8 Nm, respectively. When yaw angles are 2.5° and 5°, yaw force, yaw torque and rolling torque are 6.8 N, 12.9 N and 21.9 N, 2.5 Nm, 5.0 Nm and 6.8 Nm, 2.7 Nm, 5.7 Nm and 8.3 Nm, respectively. When wind speed is 4.5 m/s and yaw angle is 2.5°, yaw force, yaw torque and rolling torque results of these two conditions are close to each other. Similarly, When wind speed is 7.5 m/s and yaw angle is 7.5°, yaw force, yaw torque and rolling torque results of these two conditions are close to each other.

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the vertical GRF. The variables used for the statistical analysis of the FW effect were extracted from 10 consecutive hops, and were analyzed using two-way ANOVA (p < 0.05). RESULTS: Speed was significant condition in both absolute (BF: 32.7 ± 8.5 kN/m, FW: 36.9±18.3 kN/m, p = 0.014) as well as in relative to body mass values (BF: 0.478 ± 0.101 kN/kg, FW: 0.520 ± 0.110 kN/kg (p = 0.017). Also, despite the instruction to follow the same hopping frequency as set by the digital metronome in both the BF and the FW, hopping duration was shortened (BF: 0.469 ± 0.022 s, p < 0.001) and the propulsive vertical GRF was increased (BF: 32.4 ± 4.7 kN/kg, FW: 33.7 ± 5.6 kN/kg, p = 0.048) in the FW condition. CONCLUSIONS: FW appears to increase leg stiffness, which may favor the myotendinous force transfer and contribute to a more effective lower limb spring pattern.

The aesthetics in Irish dance have evolved to create greater physical demands on dancer’s bodies. Irish dancers must land from difficult movements without letting their knees bend or heels touch the ground, causing large forces to be absorbed by the body. The majority of injuries incurred by Irish dancers are due to overuse (79.6%).

PURPOSE: The purpose of this study was to determine loads on the body in female Irish dancers, including peak force, rise rate of force, and impulse in selected Irish hard shoe and soft shoe dance movements. It was hypothesized that the 8 movements would produce different GRF characteristics. METHODS: Sixteen female Irish dancers were recruited from the three highest competitive levels. Each performed a warm-up, reviewed 8 common Irish dance movements, and then performed each movement three times upon a force plate. Of the 8 movements, 4 were performed in soft shoes and 4 were performed in hard shoes. Ground reaction forces (GRFs) were measured using a three-dimensional force plate recording at 1000 Hz. Peak force, rise rate, and vertical impulse were calculated. GRFs were normalized by each dancer’s body weight.

RESULTS: Peak forces, rise rates, and impulses were significantly different across movements (F = 65.4, p < 0.01; F = 65.0, p < 0.01; and F = 67.4, p < 0.01 respectively). The movement with the highest peak force was the stomp. The movement with the highest rise rate was the double-toe. The movement with the highest impulse was the leap. The skip had the lowest values for all GRFs measured. Individual peak forces ranged from 0.67-9.86 times body weight. Individual rise rates ranged from 10-147 body weights per second. Individual impulses ranged from 0.12 to 0.32 body weight seconds. Years of experience was not correlated with peak force, rise rate, or impulse (p > 0.40).

CONCLUSIONS: There is a large range in GRF characteristics created by Irish dancers. Dance movements that have high average peak forces may be associated with higher risk of overuse injury. Irish dancers should use appropriate training methods to strengthen the tissues at greatest risk of overuse injury.

The evaluation of change of direction ability should not merely rely on the measurement of total sprinting time, but it should focus also on the understanding of specific movement patterns. PURPOSE: To evaluate the transition phase (TP) during a 180° change of direction (COD) task. METHODS: Fourteen recreational basketball athletes (age: 21.4±2.6 years) were evaluated during a 10-m COD test. TP has been identified considering 3 consecutive steps (i.e., final decelerating foot contact [DFC], turning foot contact [TFC], first accelerating foot contact [AFC]), using two force platforms. Differences in total (TCT), braking (BCT), and propulsive (PCT) contact time, vertical braking (VBRG) and propulsive (VPGRG) ground reaction force (relative to body mass), and vertical braking (VBI), propulsive (VPI), and total (VTI) impulse (relative to body mass) were evaluated in relation to leg preference, the 3 steps, and groups (slower vs. faster defined as those below and above the 50th percentile of total sprinting time). RESULTS: No differences emerged for leg preference. TP (1.199±0.11 s) contributed for an average of 42.6±3.4% to the total sprinting time (2.817±0.14 s), with DFC involving only a braking action, whilst TFC and AFC comprising both a braking and propulsive action. Differences (p<0.05) among the 3 steps emerged for TCT (DFC: 0.380±0.07 s; TFC: 0.525±0.06 s; and AFC: 0.303±0.04 s), VBRG (DFC: 22.7±5.7 kN/kg; TFC: 20.3±2.8 kN/kg; and AFC: 8.1±2.7 kN/kg), VBI (DFC: 2.1±0.4 m·s⁻¹; TFC: 2.5±0.5 m·s⁻¹; and AFC: 0.4±0.2 m·s⁻¹), and VPI (DFC: 2.1±0.4 m·s⁻¹; TFC: 5.6±0.6 m·s⁻¹; and AFC: 2.6±0.3 m·s⁻¹). Furthermore, differences (p<0.05) between TFC and AFC were evident for VPGRG (TFC: 14.1±2.9 N·m/kg; and AFC: 15.6±1.7 N·m/kg) and VPI (TFC: 3.1±0.6 m·s⁻¹; and AFC: 2.2±0.4 m·s⁻¹). Differences between groups emerged in the TFC only, with faster individuals demonstrating shorter TCT (1.03±0.1 s) and AFC (1.2±0.1 s), with AFC contributing specific movement patterns during the TP of a COD task and the central role played by the turning step in differentiating faster and slower recreational basketball athletes, with potential further implications for future testing and training procedures.

Compression garment (CG) has been now viewed as a potential tool for enhancing performance and recovery. CG may boost lactate removal and enhance oxygen supply. However, there are only small amounts of research on the potential benefits of CG. PURPOSE: To determine the effect of different pressure CG on oxygen uptake during running and lactate removal after exercise. METHODS: 12 recreational male long-distance runners (age 22.5±1.9 years, height 1.78±0.04 m, mass 70.7±4.9 kg) participated in this study. Subjects performed 3 maximal incremental exercise test (Bruce protocol) on a treadmill wearing 3 different garments: 1) compression trial with 100% elastane (200 g/m²) compared to slower individuals (TCT: 0.54±0.1 s; PT: 0.339±0.1 s; and VPI 3.4±0.6 m·s⁻¹). CONCLUSIONS: Findings revealed specific movement patterns during the TP of a COD task and the central role played by the turning step in differentiating faster and slower recreational basketball athletes, with potential further implications for future testing and training procedures.

Effects Of Different Pressure Compression Garments On Oxygen Uptake And Blood Lactate

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Most of the injuries in the military parachuting course (MPC) occur during the landing phase because of intrinsic or extrinsic variables. It is important to assess the lower limbs neuromuscular (NM) impact of the MPC to understand the muscular adaptations and the eccentric work, because via the reflex activated by the eccentric phase, it can strengthen the elastic characteristics of the muscle-tendon complex (MTC). Besides, the evaluation of the ground reaction forces (GRF) allows to evaluate the NM characteristics of the lower limb extensor in response to the eccentric force. However, the variables that defined the power and the GRF showed a negative effect over NM characteristics of lower limb extensor in response to the eccentric force. However, there were no significant differences on the maximum lactate and lactate elimination rates between 3 conditions at any other time point. There were no significant differences on the maximum lactate and lactate elimination rates between 3 conditions at any other time point.

**METHODS:** A prospective study was performed in 43 male cadets from the military school who went to the MPC (4 weeks). Each cadet performed 5 drop jump (DJ) test before and after the course, and landed in uniaxial force platforms. For the statistical analysis a paired t-student was performed to determine the changes in the variables before and after the course, and to calculate the RMSE of the deep residual recurrent network (DRRN). Negative changes were found in the mean peak landing force (3836.4±825.1 vs. 4461.5±1032.2 N, p<0.01). However, the other 15 subjects’ data were divided into two groups, i.e., 80% for training data and 20% for test data. As the objective variable, sagittal right knee torque was calculated using inverse dynamics. Explanatory variables were sagittal body position data. Parameters of DRRN were determined by an optimization calculation that aimed to reduce the difference between actual and estimated torque. To evaluate the predictive performance of DRRN, R² score (R²) and root mean square error (RMSE) were calculated. RESULTS: R² and RMSE of whole validation data were 87.7%±6.2 and 0.23±0.07, respectively. These indicators suggest DRRN model has a consistency in estimating the sagittal right knee torque as MO. Datasets were established for training and evaluating DRRN. Eighteen young males performed VCMJ under 3 conditions (make counter movement freely, deeply and shallowly) with arm swing. Body position data and GRFs were recorded by motion-capture system (250Hz) and force-plates (1250Hz). Three out of 18 subjects’ data were randomly chosen as validation data (validation subject A, B, and C). The motion-capture system (250Hz) and force-plates (1250Hz) were used to record the GRFs without laboratory setting because force-plates are usually quite expensive. Because of this device-dependent issue, it is hard to obtain MO in the common sporting scenes.

**PURPOSE:** To create and develop an artificial neural network that is possible to estimate MO in the common sporting scenes. Vertical counter movement jump (VCMJ) is often used to evaluate the lower limbs neuromuscular impact of the MPC in military cadets. METHODS: A prospective study was performed in 43 male cadets from the military school who went to the MPC (4 weeks). Each cadet performed 5 drop jump (DJ) test before and after the course, and landed on uniaxial force platforms. For the statistical analysis a paired t-student was performed to determine the changes in the variables that described the DJ due to the MPC. **RESULTS:** Positive changes were found in the reduction of contact time (0.43±0.1 vs. 0.38±0.1 s, p<0.01) and the increase of the eccentric mean force (1513.5±281.4 vs. 1642.9±289.1 N, p<0.01). However, negative changes were observed in the reduction of the jump height (27.7±3.9 vs. 24.3±3.6 cm, p<0.01), concentric impulse (165.7±26 vs. 153.1±23.7 Ns, p<0.01) and vertical velocity at takeoff (2.34±0.18 vs. 2.17±0.16 m/s, p<0.01) and an increase in the peak landing force (3836.4±825.1 vs. 4461.5±1032.2 N, p<0.01). **CONCLUSION:** There is an improvement in the myotatic reflex related to the adaptations of the lower limb extensor in response to the eccentric force.

**RESULTS:** The Oxygen uptakes were significantly lower with CG at 6 min time point (P<.05, HCG 22.0±1.5, LCG 21.3±2.0 vs CON 23.2±2.7 ml/min·kg), and there were no significant differences on VO2 between 3 conditions at any other time point. There were no significant differences on the maximum lactate and lactate elimination rates between 3 conditions at any other time point. CONCLUSIONS: Different pressure CGs have no significant effect on the maximum oxygen uptake during running, but it is possible to reduce oxygen consumption during exercise at low intensity. CGs have no significant effect on the removal of blood lactate after running.

**TABLE 1 Oxygen uptake (ml/min·kg) during maximal incremental exercise**

<table>
<thead>
<tr>
<th>TIME</th>
<th>HCG</th>
<th>LCG</th>
<th>CON</th>
</tr>
</thead>
<tbody>
<tr>
<td>3min</td>
<td>15.45±1.03</td>
<td>14.87±1.09</td>
<td>15.04±0.74</td>
</tr>
<tr>
<td>6min</td>
<td>22.04±1.49</td>
<td>21.34±1.96</td>
<td>23.23±2.74</td>
</tr>
<tr>
<td>9min</td>
<td>34.16±2.80</td>
<td>33.41±2.06</td>
<td>35.22±3.59</td>
</tr>
<tr>
<td>12min</td>
<td>49.01±4.03</td>
<td>46.52±2.68</td>
<td>48.50±2.67</td>
</tr>
<tr>
<td>15min</td>
<td>56.85±4.34</td>
<td>55.67±2.35</td>
<td>56.50±3.48</td>
</tr>
<tr>
<td>V0-MAX</td>
<td>59.24±5.10</td>
<td>58.50±3.62</td>
<td>59.59±3.91</td>
</tr>
</tbody>
</table>

**Note:** significantly different from Control

**TABLE 2 Blood lactate concentration (mmol/L) measured during recovery**

<table>
<thead>
<tr>
<th>Post exercise</th>
<th>HCG</th>
<th>LCG</th>
<th>CON</th>
</tr>
</thead>
<tbody>
<tr>
<td>1min</td>
<td>14.7±3.2</td>
<td>13.2±2.5</td>
<td>14.1±2</td>
</tr>
<tr>
<td>4min</td>
<td>14.5±3.3</td>
<td>14.3±3.4</td>
<td>13.7±2.2</td>
</tr>
<tr>
<td>7min</td>
<td>13.8±3.2</td>
<td>13.4±3.5</td>
<td>13.4±2.7</td>
</tr>
<tr>
<td>10min</td>
<td>12.9±3.2</td>
<td>12.6±3.2</td>
<td>12.1±2.5</td>
</tr>
</tbody>
</table>

**RESULTS**

Mechanical outputs (MO) exhibited explosively in the lower limbs are important in many sports. Vertical counter movement jump (VCMJ) is often utilized to evaluate the ability to exhibit MO. To calculate MO, inverse dynamics is performed with body position data and ground reaction forces (GRFs) recorded by the motion-capture system and force-plates. However, it is difficult to obtain GRFs without laboratory setting because force-plates are usually quite expensive. Because of this device-dependent issue, it is hard to obtain MO in the common sporting scenes.

**PURPOSE:** To create and develop an artificial neural network that is possible to estimate MO in the common sporting scenes. Vertical counter movement jump (VCMJ) is often utilized to evaluate the lower limbs neuromuscular impact of the MPC in military cadets.

**METHODS:** A prospective study was performed in 43 male cadets from the military school who went to the MPC (4 weeks). Each cadet performed 5 drop jump (DJ) test before and after the course, and landed in uniaxial force platforms. For the statistical analysis a paired t-student was performed to determine the changes in the variables that described the DJ due to the MPC. **RESULTS:** Positive changes were found in the reduction of contact time (0.43±0.1 vs. 0.38±0.1 s, p<0.01) and the increase of the eccentric mean force (1513.5±281.4 vs. 1642.9±289.1 N, p<0.01). However, negative changes were observed in the reduction of the jump height (27.7±3.9 vs. 24.3±3.6 cm, p<0.01), concentric impulse (165.7±26 vs. 153.1±23.7 Ns, p<0.01) and vertical velocity at takeoff (2.34±0.18 vs. 2.17±0.16 m/s, p<0.01) and an increase in the peak landing force (3836.4±825.1 vs. 4461.5±1032.2 N, p<0.01). **CONCLUSION:** There is an improvement in the myotatic reflex related to the adaptations of the lower limb extensor in response to the eccentric force. However, the variables that defined the power and the GRF showed a negative effect over NM characteristics of LL performance, increasing their risk of injury because of high impacts that are not transfer properly to other soft tissues.
Three-dimensional, Isotonic Comparison Of Dominant And Non-Dominant Upper Limb Force Production


Athletes and coaches have traditionally relied on isokinetic devices to compare dominant and non-dominant strength ratios; the information provided is limited in its application. Recent technology permits strength and power comparisons in an isotonic, three-dimensional environment that is more compatible with the body's loads experienced during sport performance. **PURPOSE:** To determine the difference in power between dominant and non-dominant arms across various loads, motions, and planes. **METHODS:** 206 subjects performed 3,727 unilateral sets of 10 repetitions in upper-extremity movements on Proteus (Proteus Motion, USA). Loads were applied through magnetic resistance and ranged from 5-25 lbs; they were divided between dominant (n=1,975) and non-dominant (n=1,747) arms. The performance variables were explosiveness (peak force development rate), peak power, and braking (rate of deceleration). Descriptive statistics characterized mean performances. Linear regression models predicted the effect of arm dominance on performance parameters, holding the load and exercise constant. **RESULTS:** Across all sets, explosiveness was 852.61 ± 629.46 watts/sec, peak power was 206.40 ± 112.42 watts, and braking was 1059.90 ± 766.63 watts/sec. Dominant and non-dominant arms were different in explosiveness (p=0.005), peak power (p=0.041), and braking (p=0.035). With confounding variables held constant, linear regression found use of the non-dominant arm to predict a 10-watt decrease in peak power (R²=0.691; p<0.001), a 46-watt/sec decrease in mean explosiveness (R²=0.553; p<0.001), and a 65-watt/sec decrease in braking (R²=0.668; p<0.001). **CONCLUSIONS:** In an athletic population, the independent use of dominant and non-dominant limbs is often critical to success. It is important to know the non-dominant performance deficit in a setting applicable to sport performance. This information can contribute to optimal training protocols and return-to-play testing batteries.

Recovering upper extremity function following spinal cord injury (SCI) is one of the most important outcomes for quadriplegics with regards to enhancing quality of life. To facilitate locomotor recovery through increased activation of the lower limb muscles, ground reaction forces are commonly manipulated to optimal levels. Using similar mechanisms, manipulating power production during arm cycling exercises could facilitate activation of the upper limb muscles after SCI. **PURPOSE:** To determine if upper limb muscles activation is modulated during arm cycling exercises after SCI. **METHODS:** Five participants with chronic SCI at C4; classified as AIS A (1), B (2), C (1) and D (1) according to the American Spinal Injury Association Impairment Scale performed arm cycling exercises at four power levels (0, 5, 10, 15W) with their hands securely attached to the handles. Surface EMG signals were recorded during a series of 10 consecutive cycles from one muscle above the lesion: medial trapezius (C2-C4), and six muscles below the lesion: deltoid posterior (C5-C6), biceps brachialis (C5-C6), triceps brachialis (C6-C8), extensor digitorum (C6-C8), flexor carpi radialis (C6-C8) and extensor carpi radialis (C6-C8). **RESULTS:** Arm cycling exercises were successfully performed at cadences ranging from 30 to 50 rpm. EMG signals were detected in all muscles across SCI in rehabilitation programs should be considered to take advantage of spinal circuitry available below the level of injury and facilitate the recovery of upper extremity function after SCI.

Quantifying Kinematic Fidelity Of Demonstrated Therapeutic Shoulder Exercises Between Therapist And Patient

Dain P. LaRoche, FACSM, Momotaz Begum, Paul Gesel, Sajay Arthanat, Victoria M. Bandera, Francis J. Gesel, Lisa M. Giroud, Sarah M. Mayer, Casey L. Poirier, Benjamin M. Surman. University of New Hampshire, Durham, NH.

Reduced cost and greater portability of 3D motion tracking technology increases the likelihood of its use in clinical settings to evaluate therapeutic exercise quality in reference to an ideal movement pattern. It must first be determined how accurately healthy individuals can mirror a demonstrated exercise to understand the inherent variability of this approach. **PURPOSE:** To test the kinematic fidelity between therapeutic shoulder exercises demonstrated by a therapist and mirrored by patients. **METHODS:** Ten, healthy, young (21.4 ± 0.5 yr, 70.2 ± 12.3 kg, 168 ± 0.08 m) men and women with a history of resistance exercise training simulated the roles of therapist and patients. A physical therapy aid performed unloaded forward and lateral raise shoulder exercises while a 2D video camera and 12-camera, 3D motion capture system recorded shoulder kinematics. The 2D video recording of the therapist was played back on a life-size screen to each patient who emulated the therapist’s demonstrated exercise. Upper-body marker data of both therapist and patients were recorded at 250 Hz, smoothed with a 6 Hz low-pass filter, and shoulder joint kinematics were obtained. Custom software was used to time normalize kinematic data, obtain cross-correlations between patients’ joint positions and the therapist’s as a global measure of agreement, calculate the mean absolute error across the range of motion, and error at peak joint excursion. Shoulder angles were compared in the sagittal plane for forward flexion and frontal plane for lateral flexion exercises. **RESULTS:** The mean cross-correlation coefficient for the forward raise was r= 0.98, 95% CI [0.96, 1.00], the mean error across the range of motion was 11.9 deg, 95% CI [7.8, 16.0], and error at peak excursion was 7.1 deg, 95% CI [1.6, 12.5]. The mean cross-correlation coefficient for the lateral raise was r= 0.96, 95% CI [0.95, 0.99], the mean error across the range of motion was 1.46 deg, 95% CI [1.16, 1.77], and error at peak excursion was 4.4 deg, 95% CI [0.6, 8.2]. **CONCLUSIONS:** After time normalization, cross-correlations revealed healthy, young people have an excellent ability to replicate the shape of demonstrated uniaxial shoulder exercises. Yet, a modest amount of absolute position error exists across the range of motion and at peak joint excursion. Supported by NSF Grant 1830597.
Repetitive overhead motions in combination with heavy loading were identified as risk factors for the development of shoulder pain. However, the underlying mechanism is not fully understood. Altered scapular kinematics as a result of muscle fatigue is suspected to be a contributor. PURPOSE: To determine scapular kinematics and scapular muscle activity at the beginning and end of constant shoulder flexion and extension loading in asymptomatic individuals. METHODS: Eleven asymptomatic adults (28.4±3.4yrs; 1.74±0.13m; 74±16kg) underwent maximum isokinetic loading of shoulder flexion (FLX) and extension (EXT) in the sagittal plane (ROM: 20°-180°; concentric mode; 180°/s) until individual peak torque was reduced by 50%. Simultaneously 3D scapular kinematics were assessed with a motion capture system and scapular muscle activity with a 3-lead SEMG of upper and lower trapezius (UT), serratus anterior (SA). Scapular position angles were calculated for every 20° increment between 20-120° humerothoracic positions. Muscle activity was quantified by amplitudes (RMS) of the total ROM. Descriptive analyses (mean±SD) of kinematics and muscle activity at begin (taskA) and end (taskB) of the loading task was followed by ANOVA and paired t-tests.

RESULTS: At taskA, activity ranged from 589±343mV to 605±250mV during FLX and from 105±41mV to 164±73mV during EXT across muscles. At taskB, activity ranged from 594±304mV to 875±276mV during FLX and from 97±33mV to 147±57mV during EXT. Differences with increased muscle activity were seen for LT and UT during FLX (meanₐ=141±113mV for LT, p<0.01; 191±153mV for UT, p<0.01). Scapula position angles continuously increased in upward rotation, posterior tilt and external rotation during FLX and reversed during EXT both at taskA and taskB. At taskA,scapula showed greater external rotation (meanₐ=3.6±3.7°; p=0.05) during FLX and decreased upward rotation (meanₐ=1.9±2.3°; p=0.05) and posterior tilt (meanₐ=1.0±2.1°; p=0.05) during EXT across humeral positions.

CONCLUSIONS: Force reduction in consequence of fatiguing shoulder loading results in increased scapular muscle activity and minor alterations in scapula motion. Whether even small changes have a clinical impact by creating unfavorable subacromial conditions potentially initiating pain remains unclear.
**METHODS**

Participants were divided into three age groups based on their age: pre-youth (18-28yrs), middle youth (29-40yrs), late youth (41-50yrs). Each group was divided into three regions: central municipality, suburban/rural, and urban. The Fitness Environment App Study was conducted in 54 provinces (central municipality, suburban/rural, and urban) and involved 10,685 employees (age 40 ± 11 yrs, body weight 76.9 ± 4.4 kg). Participants were surveyed and monitored for 12 weeks. No other control was made on participants’ lifestyle variables.

**RESULTS**

The study found that 95% of employees were willing to adopt a fitness lifestyle, with 91% of employees engaging in regular physical activity. The study also found that 93% of employees reported improved health and wellness, and 97% reported reduced stress levels. The study concluded that the Fitness Environment App Study is an effective intervention to promote physical activity and improve health and wellness among employees.

**CONCLUSIONS**

The study has several implications for future research and practice. First, the Fitness Environment App Study provides evidence that app-based longitudinal research can be an effective tool for promoting physical activity and improving health and wellness. Second, the study highlights the potential for app-based interventions to be scalable and sustainable, with the potential to reach large numbers of employees and be integrated into workplace culture. Finally, the study underscores the need for continued research to evaluate the long-term effects of interventions on physical activity and health outcomes.
Investigation of Physical Activity Instruction in United States Nurse Practitioner Curricula

**Purpose:** The purpose of this study is to investigate formalized physical activity (PA) training in United States (US) Nurse Practitioner (NP) curricula. There are over 270,000 currently certified NPs with over 72% delivering primary care. PA is an important lifestyle behavior that can aid in prevention and treatment of chronic conditions therefore, having primary care providers trained in PA assessment and counseling to patients is vital in disease prevention and chronic conditions management.

**Methods:** Data was collected in 3 faculty-student teams in the Pacific Northwest, Eastern, and Southern US from 1083 NP training programs through website evaluation. Examined program descriptions, course titles and course descriptions for mention of general health knowledge, PA, and nutrition. General health key words included: health promotion, chronic disease, disease prevention. Exclusion criteria included: programs uncredited at time data extraction or with non-primary care focus. Chi-square and Fisher’s exact tests were used to compare differences in keywords within course titles and descriptions by institution type, program type, program specialty, and program delivery were assessed.

**Results:** There was a dearth PA keywords in program descriptions. Differences were found for general keywords in course titles by program specialty (p<0.001) and program delivery (p=0.001); general keywords in a course descriptions by program specialty (p<0.001) and program delivery (p=0.011); and nutrition keywords in a course descriptions by institution type (p=0.038).

**Conclusion:** These results are the first step in the process of ensuring that NPs have a working knowledge of PA and the skills to provide PA counseling to their patients. Direct assessment of NP programs should be done to corroborate findings. The presence of general keywords is promising and can be built upon, and this will lead to the next step of confirming findings through survey collection.

**Conclusions:** Although there was no difference in arterial stiffness between obese women and normal weight women in resting state, the vascular elastic function of obese women was better than normal weight women during exercise. Vascular function of healthy women in the same intensity exercise was more adaptable than that of obese recessive women. Aerobic exercise at the intensity of 65% HRR could ameliorate arterial stiffness and improve vascular elasticity of recessive obese women, which was beneficial to prevent cardiovascular disease in early life. Supported by Scientific Fitness Guidance Program of General Administration of Sport(2017B064).

1071
**Efficacy Of Smartphone App In Worksite Physical Activity Intervention And Anthropometric Changes In Obese Women**

Joan A. Cebriick-Grossman, Debra Fetherman. University of Scranton, Scranton, PA.

(No relevant relationships reported)

**Methods:** Thirty nine young women (21.8±1.9 yrs) participated in the study that was approved by IRB at Beijing Sport University. There were twenty recessive obese women (RO group) and nineteen normal weight women (NC group). Everyone completed 30min walking exercise at the intensity of 65% HRR on the treadmill. The exercise began after two hours of the meal. The pulse wave velocity (PWV) and ankle brachial index (ABI) were determined before exercise, immediately after exercise, then every 5 minutes for half an hour.

**Results:** (1) There were no significant differences between the participants of two groups in age, height, weight, body mass index, PWV or ABI at rest. However, the percent body fat in the RO group were significantly higher than in the NC group (P<0.01). (2) Immediately after the exercise, the RO group demonstrated significantly decreased level of PWV (9.2±8.8 vs. 1.1±0.16 cm/s, P<0.01). And 30 minutes after the exercise, the level of PWV in the RO group returned to the baseline level. Whereas PWV level in the NC group remained unchanged (P<0.05). (3) Immediately after the exercise, participants in the RO group had a significant reduction in the ABI level (13.6%, P<0.01). 30 minutes after the exercise, participants in the RO group demonstrated significantly increased level of ABI (13.6±2%, P<0.01). Participants in the NC group had the same trend. Moreover, there were significant differences in changes in ABI level between the two groups (13.6% vs 9.5%, P<0.05).

**Conclusion:** This work is suggestive that the incorporation of a smartphone app into a worksite physical activity intervention may change anthropometric measures via increasing steps and ultimately reduce adverse health concerns.

1072
**Effects Of Aerobic Exercise On Vascular Function Of Recessive Obese Women**

Peizhen Zhang. Beijing Sport University, Beijing, China. (Sponsor: Xiangrong Shi, FACSM)

(No relevant relationships reported)

**Purpose:** To examine the efficacy of a smartphone and worksite physical activity intervention program to increase daily physical activity with the goal of reducing sitting time via walking or increased steps on anthropometric changes over an 8-week period.

**Methods:** Subjects (N=22) were obese, female volunteers, all of whom had access to a smartphone and the Stridekick™ app, that recorded steps, with a progressive goal of 7,500-15,000 daily steps. Relative (%) body fat was measured via DEXA scan, along with five anthropometric measurements, biceps, waist, abdomen, hips and thigh, prior to and after 8 weeks. Dependent samples t-tests probed for significant differences at the p<0.05 level. Values expressed as mean±standard deviation.

**Results:** Significant changes were determined for the pre-post anthropometric measurements: biceps, hips and thigh (12.9±1.1 vs. 11.5±1.3, 42.8±5.1 vs. 42.2±5.2, 24.9±2.7, vs. 23.8±2.8 in, respectively). Pre-post BMI, waist, abdomen measurements and % relative fat were not significantly different (31.0±2.7 vs. 30.5±5.7 kg/m², 34.1±4.8 in, 39.2±4.7 vs. 39.0±4.8 in in, respectively). In the NC group, the same trend were followed. Moreover, there was no significant difference in changes of ABI level between the two groups (13.6% vs 9.5%, P<0.05).

**Conclusion:** In this study of middle school students, motivators for activity were friends (32.1%, 27.7%) and looking good (21.4%, 25.5%) for 7th and 6th graders were friends (32.1%, 27.7%) and looking good (21.4%, 25.5%) and feeling good (15.4%). Evaluating motivators by grade for females showed the top motivators for 8th graders to be looking good (36.4%) and feeling good (27.3%); while the top motivators for 6th graders were friends (32.1%, 27.7%) and looking good (21.4%, 25.5%).
CONCLUSIONS: Student suggestions to enhance engagement in physical activity on campus included better advertisement of Campus Rec programs and reduced costs for intramurals and group exercise classes suggested increasing opportunities to engage more in organized sports and activities.

### Board #201

**May 27 2:30 PM - 4:00 PM**

**Relationship Between Different Bouts Of Physical Activity And Physical Fitness In Preschool Children**

Minghui Qian, Chunyi Fang, Tang Zhou, Longkai Li, Peijie Chen. Shanghai University of Sport, Shanghai, China.

Email: quanminghui@163.com

(No relevant relationships reported)

**Purpose:** To examine the relationship between bouts of physical activity and physical fitness in preschool children. **Method:** Sporadic sessions (2-4 seconds) of moderate-to-vigorous physical activity (MVPA), short bouts (5-9 seconds) of MVPA; and medium-to-long bouts (>10 seconds) of MVPA were measured over 7 days using ActiGraph GT3X accelerometers. Physical fitness was assessed by a 20-meter multistage shuttle run test (cardiorespiratory fitness), handgrip and standing long jump tests (musculoskeletal fitness), and the 25-10-meter shuttle run test (speed/ agility). A composite score of physical fitness was created from the mean of the standardized values of all physical fitness tests. The bouts of physical activity and composite scores were categorized into quartiles (Q1-Q4) by sex; the highest quartile (Q4) of composite scores were assigned as high healthy fitness (HPF). Logistic and linear regression were used to investigate the relationship between bouts of MVPA and HPF. **Results:** A total of 265 participants were included in the final statistical analysis (boys, 149; girls, 116; 57.19 ± 5.53 months). After adjusting for confounding factors, relative to Q1, the odds ratios (OR) for a HPF in Q4 were 11.72 (95% CI: 2.27-60.53), 7.53 (95% CI: 1.83-30.90) and 9.86 (95% CI: 1.78-45.39) for sporadic MVPA, short bouts and medium-long bouts of MVPA in boys, respectively. Similar results were also observed in girls, 11.85 (95% CI: 2.33-60.19), 12.34 (95% CI: 2.47-61.57) and 8.58 (95% CI: 1.70-43.41), respectively. There was a non-linear relationship between overall MVPA and HPF in boys. When the total MVPA ≤ 65 min/day, the OR of achieving HPF increased by 17% (OR = 1.17, 95% CI = 1.02-1.35) for every 1 minute/day increment in total MVPA; no increases in HPF with increased MVPA were observed for >65 min/day. This non-linear relationship was not found in girls. **Conclusion:** There is a significantly positive relationship between bouts of MVPA and HPF in preschool children. To achieve HPF in preschool children, it is recommended that boys accumulate total MVPA 65 minutes or longer every day.

Supported by National Natural Science Foundation of China (81703252)

### Board #202

**May 27 2:30 PM - 4:00 PM**

**Injury Rates For Novice Half And Full Marathoners As A Function Of Increased Distance**

Marissa Grace Becker. University of Wisconsin-Eau Claire, Eau Claire, WI.

(No relevant relationships reported)

**Purpose:** To examine the change in training load, i.e. the increase in distance from week to week, that causes injury in half-marathon and full marathon runners. **Methods:** Runners, N=292, wore foot pods tracking distance and duration of runs. The runners also submitted to-vigorous physical activity (MVPA), moderate (missed one day of training), severe (three or more days of training), or dropping out (did not train). The runners also had access to a physical therapist during the lecture and the run. Runners excluded from the study did not have at least three consecutive weeks of training, including the week of the injury. **Results:** The data indicates that the runners ran erratically, with an average 1 week distance increase for uninjured runners of 27.9% and a 2 week increase of 58.9%. In contrast, injured runners (N=41) changed their distance from the week prior to injury to the week of reporting the injury by 0.95% and 2 weeks prior to injury to the injury by -1.1%. **Conclusion:** This data was derived from novice runners with a lack of correlation to previous studies which show a 10% increase in mileage week to week, or a 30% increase over 2 weeks, leads to an increased risk of injuries rather than the lack of mileage difference seen in this study. What was apparent, rather than week to week mileage, was cumulative load over the duration of the class appears to have led to the injury, as the average time to injury was 11.2 weeks and standardized distance increase prescriptions are not applicable to novice runners.

### Board #203

**May 27 2:30 PM - 4:00 PM**

**Exercise Patterns And Perceptions Among South Asian Adults In The Us: The Shape Study**

Jennifer K. Frediani1, Nida I. Shaikh2, Mary Beth Weber2. 1Emory University, Atlanta, GA. 2Georgia State University, Atlanta, GA.

Email: jfrediani@emory.edu

(No relevant relationships reported)

**Purpose:** Our objective was to determine biological differences and perceptions about exercise among a immigrant South Asian population living in the southeastern United States (US). **Methods:** This is a descriptive study of exercise patterns and perceptions using baseline data from a diabetes intervention study with immigrant South Asian adults now living in the US. The sample included middle aged, predominantly male, well-educated, immigrant South Asians. Participants were recruited through advertisements in local South Asian magazines, information sent through community organization listservers, and in-person outreach at health fairs and screening, diabetes information events, and South Asian stores. Participants reported to the Georgia Clinical and Translational Science Alliance General Clinical Research Center at Emory University Hospital and completed a baseline visit for the South Asian Health and Prevention Education pilot study. **Results:** The mean age of this cohort was 44.6 [10.6] years and 35% female. Of the 52 people included in this analysis, 81% did not exercise at least 150 minutes per week to meet the US Physical Activity Guidelines. Of those that did meet the Physical Activity Guidelines, 90% reporting walking as their primary form of exercise. Overall, 65% reported preferring walking to other modes of exercise. There were no differences between exercisers and non-exercisers when asked about the benefits or barriers of exercise. **Conclusion:** South Asians living in the southern US do not meet the US Physical Activity Guidelines. The preferred mode of exercise is walking close to home. Although barriers to exercise are similar to those of other races in the US, preferred mode of exercise and preferences of women should be considered when implementing physical activity interventions.
High volumes of sedentary instructional time during the school day contradicts research supporting the role of physical activity (PA) in enhancing students' attention, academic achievement and executive function (EF).

**PURPOSE:** To describe PA, EF and academic performance in 5th grade student participants prior to a multimodal classroom curriculum called POWER that incorporates both PA and the teaching of EF skills.

**METHODS:** A convenience sample of six 5th grade classes in two diverse schools in New Jersey were studied. Three classes in one school received POWER starting September 2019 (POW); 3 waitlist control classes in the other school (CON) will begin POWER in January 2020. Students were wrist-worn accelerometers for a full school week and completed the Youth Activity Profile (YAP). EF was assessed by 3 cognitive tests from the NIH Toolbox (NIHTB). Academic performance was assessed via STAR math tests. Data are reports as mean (standard deviation). Groups comparisons were made by independent samples t-test.

**RESULTS:** 86 students (POW n = 49; CON n = 37; mean age = 10.2 (0.2) years) completed the YAP and NIHTB cognitive tests at baseline. A subset of 70 students (n = 35 in each group) wore accelerometers. POW spent 77.4% (2.6%) of the school day in sedentary behavior and 20.2% (2.6%) in MPVA, while CON spent 87.2% (1.4%) and 11.39% (1.3%) respectively in sedentary and MVPA. The YAP activity score at school was 3.55 for POW and 3.25 for CON. The age-corrected composite score for NIHTB was 94.1 (10.8) for POW, and 97.4 (9.5) for CON (national average=100). Students' scaled score for the STAR math assessment was 735 (86.3) for POW, and 97.4 (9.5) for CON; 3 waitlist control classes in the other school (CONT) will begin POWER in September 2019. POW spent 77.4% (2.6%) of the school day in sedentary behavior and 20.2% (2.6%) in MPVA, while CON spent 87.2% (1.4%) and 11.39% (1.3%) respectively in sedentary and MVPA. The YAP activity score at school was 3.55 for POW and 3.25 for CON.

**CONCLUSIONS:** POW PA was significantly higher than CON (p = .001), possibly due to intervention teachers' implementing some aspects of POWER earlier than instructed. Students tested below age-corrected national averages on both the NIHTB and academic tests; there were no significant differences between groups (p = .15 and p = .81).

**It is well known that High-Intensity Interval Training, such as CrossFit, positively influences physical and mental well-being. However, few rigorous studies evaluated both psychological and physical fitness variables in young people.**

**PURPOSE:** To investigate if 8 weeks of CrossFit training program could positively influence the psychophysical well-being in adolescents.

**METHODS:** 30 healthy participants (18 males and 12 females) were matched into pairs based on gender and randomly allocated into an intervention group (n=15; 18.2 ± 0.8 years) that performed the 8 weeks CrossFit training program or control group (n=15; 18.3 ± 0.8 years). At baseline and after 8 weeks, physical fitness tests (i.e. squat, push-up, lunge, and 20-meter run) and psychological measures (PCS and MCS indexes of the Short Form-12, and Regulatory Emotional Self-Efficacy scale (RESE, negative and positive)) were performed.

**RESULTS:** After 8 weeks, the intervention group showed significant improvements in the number both of maximal repetitions for the squat test (Δ 6.66 ± 2.58, p < .001), push-up test (Δ 5.87 ± 4.23, p < .005), and lunge test (Δ 7.89 ± 3.11, p < .001) and of maximal laps for the 20-m run test (Δ 3.60 ± 2.27, p < .001). Also, higher scores for the PCS (Δ 4.7 ± 1.3, p < .001) and MCS (Δ 5.2 ± 0.9, p < .001) indexes, and the RESE negative (Δ 6.0 ± 3.9, p < .001) and RESE positive (Δ 4.0 ± 2.7, p < .001) scales were found in the intervention group. No statistical differences were detected in the control group for all dependent variables.

**CONCLUSION:** Findings suggest that an 8-week CrossFit intervention program could positively affect the general physical well-being and mental attitude and improve the emotional perceived self-efficacy in managing negative affect and in expressing positive emotions in healthy adolescents.

**Purpose:** The purpose of this study was to examine the relationships linking motivational variables with BMI percentile (BMI%) via segmented physical activity (PA) and sedentary behavior (SB) in adolescents using path analysis.

**METHODS:** Secondary data analysis was performed using participants from the Family, Life, Activity, Sun, Health, and Eating (FLASHE) study. A non-probability panel balanced to the US population on sex, Census division, household income and size, and race/ethnicity were screened for eligibility. The final sample consisted of 1,643 adolescents (822 girls, 821 boys). Motivational variables consisted of PA enjoyment, self-efficacy, and peer social support. Mediator variables consisted of segmented weekly PA and SB assessed using the Youth Activity Profile (YAP). BMI% was the outcome. A recursive bootstrapped path analysis was conducted to examine the relationships between motivational variables, segmented PA and SB, and BMI% with indirect effects calculated via bootstrapped mediation analyses.

**RESULTS:** The relationships between motivational variables and segmented PA and SB were stronger than relationships between segmented PA and SB and BMI%. Three mediated paths were observed: self-efficacy and BMI% using sedentary YAP as the mediator (IE = -0.38, 95%CI: -0.65, -0.18), enjoyment and BMI% using weekend YAP as the mediator (IE = -0.62, 95%CI: -1.14, -0.12) and social support and BMI% using weekend YAP as the mediator (IE = -0.53, 95%CI: -1.00, -0.07).

**CONCLUSIONS:** The relationship between adolescent motivational variables and segmented PA and SB is relatively strong and specific motivational variables’ relationships with BMI% is mediated through segmented PA and SB. This is one of the few studies to examine these relationships using a large U.S. sample of adolescents, supporting strong external validity evidence to the U.S. adolescent population. It also adds to the knowledge base regarding the relative strength of the inter-relationships among the observed variables. The relationships among motivation, PA, and health outcomes are complex and this study provides some new information that can be used to promote PA and reduce SB in the adolescent population.

**Purpose:** With about 80% of women over age 50 reporting little/no regular physical activity (PA), this group is the most sedentary population in the U.S. Social media and new technologies provide an opportunity for home-based health promotion and behavioral interventions. **Purpose:** Use a qualitative approach to explore how women over age 50 use social media and online activities to access health information and participate in PA.

**METHODS:** Telephone interviews were conducted on a sample of healthy women over the age 50 years. A semi-structured interview guide was used to acquire information on common internet use, online health information search history, and history of accessing physical activity programming. Responses were transcribed and examined for recurring themes and language-based sentiments using established qualitative content analytic procedures.

**RESULTS:** All women were in their mid-50’s with a mean age was 55.5 years (range 53-56 years). All women were peri- or post-menopausal, and were either married or widowed. Facebook was the most commonly used online social app and was used to “keep up” with family and friends, to access support groups and read health articles. Fitbit was used by the majority of interviewees to track daily steps, sleep patterns, and calories burned during workouts. The participants also liked the goal-setting, self-monitoring, and social component (competition/social comparison) provided by Fitbit. MyFitnessPal was a commonly used app to track activity and monitor the relationship between calories consumed and calories expended. A number of women, particularly those with health conditions, accessed online sources to research medications/drug interactions and learn more about their condition. Participants reported that they were distrustful of much online information and were skeptical of many health web sites. Additionally, the women indicated that they would like to see more age-related content and access to communities of women of similar age.
Two thirds of children do not meet physical activity (PA) guidelines in China. The fundamental motor skills (FMS) level is a good predictor of physical activity levels and weight status in children. Also, early motor skill has long-term effect on individual’s PA level. So, understanding the relationship of FMS and PA is important for physical activity intervention planning. 

**PURPOSE:** To analyze the relationship of daily physical activity participation and the motor ability of children aged 7-8 years.

**METHODS:** The Movement Assessment Battery for Children-2 (M-ABC-2) and the Test of Gross Motor Development - 2nd edition (TGMD-2) were used to test the motor ability of 91 children aged 7-8 years. The ActiGraph GT3X+ accelerometer was used to measure the physical activity participation for 7 consecutive days.

**RESULTS:** The total time of boys spent in moderate physical activity (MPA) and moderate-to-vigorous physical activity (MVPA) was 21.4±7.5min and 27.3±11.2min, respectively, which was higher than those of girls (17.5±7.4min and 22.2±9.7min, P<0.05). The score of object control subscale in boys was 6.73±2.49, which is better than that of girls (5.71 ± 2.14, P<0.05); children’s fine motor skill and locomotor skill were positively correlated with the parents’ PA enjoyment with subsequent completion of the PA at home. Parents reported their dyad’s participation in the PA for the following week. Separable logistic regression analyses were performed to examine the association of children’s and parents’ PA enjoyment with subsequent completion of the PA at home.

**CONCLUSIONS:** Parents’ enjoyment of PA may be more important than children’s enjoyment of PA in predicting whether dyads complete activities at home. This could inform future exercise promotion research of parent-child dyads by focusing on PAs that the parents enjoy.
Physical education (PE) remains one of the most effective strategies for promoting school-based physical activity. Fewer than 10 states mandate public schools meet current public health recommendations for PE. Moreover, it remains unknown how implementing such mandates affects PE offerings. In 2007, Oregon passed legislation requiring elementary schools to provide 150+ min/week of PE by fall of 2017. No funding was offered to support this mandate.

**Purpose:** To evaluate time-based changes in PE offerings among Oregon public elementary schools for 8 years (2009-10 to 2016-17) preceding required compliance to the legislative mandate requiring 150+ min/week of PE.

**Methods:** A total of 752 Oregon public elementary schools reported yearly minutes of PE offered and the total number of school weeks in session per year. Mean PE min/week were calculated by dividing yearly PE minutes by weeks in session. Additional publicly available explanatory variables including rurality (rural vs. non-rural county designations) and school schedule (four vs. five-day school week) were collected. A linear-mixed effects model was fit to evaluate time based-changes in PE with min/week of PE as the dependent variable, school year, rurality, and school schedule as fixed effects, and school as a random effect.

**Results:** Although significant year-to-year variability in PE minutes was observed \(p < 0.001\), between 2009-10 to 2014-15 mean PE minutes remained relatively stable at 74 to 77 min/week before experiencing two larger year-to-year increases in 2015-16 \(+3.9 \text{ min/week from } 2014-15 \approx 80.8 \pm 1.8 \text{ min/week}\) and 2016-17 \(+4.0 \text{ min/week from } 2015-16 \approx 84.8 \pm 1.9 \text{ min/week}\). Schools located in rural counties were offered significantly more PE than non-rural schools (80.7 \pm 1.7 \text{ vs. } 74.6 \pm 1.8 \text{ min/week}, respectively, \(p < 0.001\)). No significant difference in mean PE min/week was observed between four vs. five-day school week formats (77.7 \pm 2.3 \text{ vs. } 77.5 \pm 1.3 \text{ min/week}, respectively, \(p = 0.924\)).

**Conclusion:** Despite having a 10-year lead-in period to increase PE time to 150+ min/week, Oregon elementary schools were only offering about half the required PE min/week (56.7\%) in the year prior to mandatory compliance. Unfunded mandates requiring large increases in PE offerings may not effectively increase PE min/week to the required level.

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Physical literacy is a growing concept in the United States and is vital for a child’s long-term physical activity participation. Physical literacy is the ability, confidence, and desire to be active. There is little known about the relationship between confidence and physical ability in children. To evaluate this relationship between a child’s self-reported confidence and movement competency. **Methods:** A cross-sectional design with a single test session was used. Children (ages 5-14) recruited from local schools volunteered to participate. The Physical Literacy Assessment for Youth (PLAY) Self survey was completed by the student with an adult. Children were asked to rate “I’m confident when doing physical activities” with the following options: not at all, not usually true, true, and very true. Responses were coded as: confident (“very true”) or not confident (all other responses). Participants completed the PLAY assessment in a randomized order, which evaluates movement competency in 5 domains: balance, lower extremity object control, upper extremity object control, running, and locomotor. Each task was scored on a 100cm visual analogue scale (VAS). Tasks were dichotomized into “not competent” (≤50cm) or “competent” (>50cm). Total and domain-specific competency were calculated as the average total score across all tasks, or within each domain, respectively. Chi-square tests were used to evaluate associations between confidence (Yes, No) and competency (Yes, No). Sensitivity and specificity were calculated to evaluate the ability of confidence to predict competency. **Results:** A significant association was observed between confidence and competency for lower extremity object control \((p<0.001, \text{specificity} = 899, \text{sensitivity} = 289)\), upper extremity object control \((p=0.020, \text{specificity} = 872, \text{sensitivity} = 247)\) and running \((p=0.041, \text{specificity} = 883, \text{sensitivity} = 235)\). No other significant associations were present. Correlated associations between self-reported confidence and competency are important both for intervention and policy makers. Further research is needed to evaluate these results if can improve the efficiency of measuring physical literacy, and identify the causal factors leading to confidence and competence.
Virtual reality (VR) has become a popular modality for exercise, physical therapy, and rehabilitation. VR-based exercise is becoming more available and could be a viable form of exercise. In addition, the self-determination theory (SDT; Deci & Ryan, 1985) has been used to examine college student’s motivation to exercise. However, more empirical research evidence is needed to examine college students’ motivation to participate in VR-based exercise from the SDT perspective.

**PURPOSE:** The purpose of this study was to examine the relationship between college student’s situational motivation and intention to participate in VR-based exercise.

**METHODS:** Seventy-two college students (Male = 39, Mage = 20.72, SD = 1.66) experienced at least 5 minutes of VR-based stationary bike gaming using the VirZoom Arcade. Afterward, they were assessed on situational motivation and intention to participate in VR-based exercise via a validated survey. The Situational Motivation Scale (Guay, Vallerand, & Blanchard, 2000) was used to assess situational motivation and one question was used to assess their intention for future participation in VR-based exercise. In order to determine the relationship between situational motivation (i.e., intrinsic, identified, external, amotivation) and intention to exercise, a multiple linear regression was performed to investigate motivation to predict intention to exercise.

**RESULTS:** The multiple regression model showed a statistically significant effect, F(2, 69) = 12.920, p < .001, R2 = .272, indicating that 27.2% of the variation in intention can be explained by identified regulation (β = .43) and amotivation (β = -.23).

**CONCLUSIONS:** The results suggest that the intention for further participation in VR-based exercise is strongly predicted by the identified regulation or importance college students place on VR-based exercise. As with other modalities of exercise, lack of motivation and intentions can be a deterring factor for participation in VR-based exercise. Further research is needed to understand how to empower college students who are amotivated to participate in VR-based exercise. Finally, these results confirm the theoretical tenets of the SDT.

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**Physical Activity Changes Before And After Connection Of A Multi-use Trail In Rural Appalachia**

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Physical inactivity is a significant global health issue. The State of Kentucky, one of the 13 Appalachian states has a greater rate of physical inactivity than the national average. Most research directed at the built environment and recreational opportunities for physical activity has focused in urban areas with little attention to rural settings. **PURPOSE:** To examine the changes in physical activity before and after the connection of two multi-use trails in a rural Appalachian city. **METHODS:** The primary outcome measures were mode (walking, jogging, or cycling) of physical activity, distance and duration. A valid and reliable survey was used to intercept and interview trail users, modeled after a rails to trails conversion of the American Tobacco Trail. Data were collected on each of the trail segments during the months of May, June and July in 2017, 2018, and 2019. **RESULTS:** During the 3-year study period, 51% of users were female, 93% were white, and the age range of users was 18-85 years. Physical activity time: there was no significant differences in total physical activity time before or after the connection of the trail. Average activity time was 58.2 ± 35.5 minutes in 2017 (n = 95), 64.5 ± 62.7 minutes in 2018 (n = 140) and 62.3 ± 30.3 in 2019 (n = 80). There were no significant differences in mode of trail use, or trail use by gender. However, after connecting the two one-mile segments total distance significantly increased. In 2017, walkers (n = 84) average 2.4 ± 1.2 miles, after trail lengthening participants walked an average of 3.12 ± 1.7 miles (p = 0.27) in 2019. Thirteen runners statistically significantly lengthened runs in 2017 an average of 3.40 ± 2.40 miles (p = 0.28). Cycling length did not change. **DISCUSSION:** The results indicate that in the two years that the trail was not expanded, physical activity usage patterns did not change. Yet, once the one-mile connector was completed and lengthened to three miles, trail users significantly increased the distance traveled on the trail. Given the emphasis on built environments to improve community physical activity, further analysis is warranted to estimate health impact and return on investment for municipalities.
Commercial physical activity (PA) tracking devices have gained popularity both in the general public and research settings to monitor and increase PA. High tech versions automatically track and record data while low tech versions require regular manual logging to retrieve the data. Different types of activity trackers require different data engagement, which may influence PA levels. Purpose: The purpose of the study was to investigate if the differences in data engagement from two types of activity monitors influenced PA levels. Methods: Employees at a midwestern university (N = 39) enrolled in a four-week worksite walking intervention. A 2-arm randomized study design was used to compare the influence of type of data engagement on average weekly steps between two types of activity monitors: 1) manual log (MANUAL) utilizing a standard hip accelerometer (NL-1000) and 2) digital log (DIGITAL) utilizing a wrist accelerometer (FitBit Charge 2). Participants wore a blinded activity monitor for week to determine baseline averages. Then participants were randomly assigned to track activity wearing one of the two types of activity trackers, unblinded, for four additional weeks. The MANUAL group recorded their steps by hand daily in an activity log. The DIGITAL group was asked to monitor their steps through the activity tracker’s app which was downloaded to their personal smart phones. Results: Significant increases in weekly step averages was found for both the MANUAL (t (20) = 2.089, p < .001) and the DIGITAL (t (19) = 5.74, p < .001) groups from Week 1 to Week 4. There were no significant between group differences found for Week 1 step averages (t(39) = -2.14, p = .099) or Week 4 step averages (t(39) = 0.99, p = .20). Conclusion: Steps were significantly increased for both groups during the intervention but there was no statistical difference found between the groups. To our knowledge, no other study has examined if data engagement influences PA. With so many types of activity trackers on the market these findings indicate that cheaper, high tech counterparts. Since differences in data engagement does not appear to impact short-term step increases individuals can choose either high tech or low tech options depending on resources and preferences.

Purpose: The purpose of this study was to investigate the physical activity preferences of middle school students. Methods: Participants were 219 students in grades 6-8 at a public, urban middle school. Data were collected via self-report questionnaire that included questions with specified options and questions with write-in opportunities assessing demographic information, physical activity preferences, and activities students would like to learn. Results: Results indicated that the middle school boys (n=113) were 12.65 (± 1.63) years old and overall preferred basketball (38.3%) and football (25.2%) and wanted to learn more about basketball (19.8%), football (12.9%) and soccer (11.9%). Eight grade boys (n=26) preferred basketball (19.8%) and football (12.9%) and wanted to learn basketball (21.7%), football (17.4%) and baseball (13.0%). Seventh grade males (n=43) preferred jogging (44.4%), basketball (28.8%) and football (15.6%) and wanted to learn basketball (20%), baseball (12.5%), soccer (17.5%), tennis (10.0%) and swimming (10.0%). Sixth grade boys (n=42) preferred basketball (32%) and football (28%) and wanted to learn basketball (21.7%), football (17.4%) and baseball (13.0%). Girls (n=106) were 12.57 (SD = 1.05) years old and overall preferred basketball (28.3%), jogging (23.2%) and dancing 12.1%, and wanted to learn about basketball (29.2%) tennis (15.2%) and soccer (13.0%). Sixth grade girls (n=28) preferred basketball (33.3%), jogging (29.6%) and dancing (11.1%) and wanted to learn baseball (30.4%) and soccer (13.0%). Seventh grade girls (n=30) preferred dancing (17.9%), jogging (17.9%), swimming (17.9%) and basketball (14.3%) and wanted to learn about baseball (36%), soccer (16%), swimming (12%) and tennis (12%). Sixth grade girls (n=47) preferred basketball (34.9%) and jogging (23.3%) and wanted to learn about basketball (25.6%), tennis (20.9%) and soccer (11.6%).

Exergaming has been evident to be a novel and interesting channel to enhance young adults’ affection and emotion while engaging in physical activity, yet no known research has been conducted to compare its efficacy versus traditional exercise modality. In response, this project investigated mean differences in young adults’ rating of perceived exertion (RPE) and mood in different exercise modalities (exergaming aerobic dance vs. traditional aerobic dance). Methods: Forty young adults (20 females; M age = 20.38) were recruited from a Chinese university and completed two separate 12-minute dance sessions: 1) non-stop exergaming aerobic dance (Xbox 360 Kinect Just Dance - Just Sweat around the World) and 2) traditional aerobic dance led by an experienced instructor. Participants’ RPE was assessed via the Borg Rating of Perceived Exertion (14-point Likert scale) every 4 minutes and mood was measured by the Brunel Mood Scale (5-point Likert scale; anger, confusion, depression, fatigue, tension, and vigor) during each session. MANOVA with repeated measures was used to detect mean differences in these outcomes between the two dance sessions. Results: Significant differences were identified between dance sessions for the overall model, Wilks’ Lambda = 0.13, (F(7,33) = 31.05, p < 0.01, η² = 0.87). In detail, participants had significantly lower RPE toward exergaming dance (9.06 ± 1.07) compared to aerobic dance (11.36 ± 0.85), F(1,39) = 209.45, p < 0.01, η² = 0.84. In terms of mood, exergaming dance showed significantly lower confusion (3.00 ± 1.72) compared to aerobic dance (4.25 ± 1.50), F(1,39) = 4.97, p < 0.05, η² = 0.11. Similarly, participants reported significantly lower fatigue in exergaming dance (3.00 ± 1.43) versus aerobic dance (4.00 ± 1.78), F(1,39) = 7.58, p < 0.01, η² = 0.16. No other significant differences were detected for other outcomes. Conclusion: Findings suggest that exergaming dance may lead to less perceived RPE, confusion and fatigue among young adults compared to traditional aerobic dance. The findings have practical implications, as young adults might be more likely to engage in game-like exercise when less effort, confusion and fatigue are perceived.

Physical Education (PE) plays a critical role in promoting physical activity participation of school students. There is a need to understand student motivation towards PE and how this motivation work in student PE activities engagement. Purpose: To apply the self-determination theory (SDT) to test the hypothesized relationships between three basic psychological needs (i.e., autonomy, competence, and relatedness), self-determined motivation, and student moderation-to-vigorous physical activity (MVPA) during elementary and secondary school physical education (PE) in Shanghai, China. Gender and school level differences were also explored. Methods: The participants were 1829 Grade 3-9 students (872 boys and 957 girls) aged six to 15 years in Shanghai. Accelerometers were used to measure the MVPA duration of the students in PE. The Self-regulation questionnaire and Psychological Needs Satisfaction Scale were completed by the participants. Results: The model of hypothesized relationships demonstrated a good fit with the data [χ² = 29.323, df = 3, p < .001; CFI = .958; IFI = .958; SRMR = .026; RMSEA = .069]. The results from the multi-group path analysis revealed none of the paths in the model was found to be significantly different in regard to male versus female students. However, the relationship between self-determined motivation and MVPA was stronger for secondary school students (b = .390, p<.001) than elementary students (b = .093, p<.01), η² = .048. No other significant differences existed in the other paths across elementary and secondary school students. Conclusion: These findings supported the applicability of SDT in understanding and promoting physical activity of Chinese school students in PE. Practitioners should consider tailoring intervention to address school level differences to increase physical activity participation of students in PE.
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Evaluation Of Sitting Time On Faculty And Staff In A Small Private University

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Sedentary Death Syndrome (SeDS) is the 2nd greatest, yet preventable threat to public health, resulting in multiple chronic diseases and millions of premature deaths annually. Work-related environmental conditions have been implicated as factors related to declines in physical activity (PA) in the United States and abroad. Staff and faculty in a university setting may experience greater quantity of sitting time at work, which would impair the ability to achieve recommended levels of PA. Few studies exist that have evaluated sitting levels among university personnel.

PURPOSE: The purpose of this investigation was to explore sitting levels among working members of Biola University.

METHODS: Eligible survey respondents (N = 393) were men (n = 154, 44.9 ± 12.8 years of age, 178.7 ± 8.3 cm in height, 85.3 ± 15.0 kg in weight, and an average body mass index (BMI) of 26.7 ± 4.5 kg/m²) and women (n = 239, 40.9 ± 13.1 years of age, 164.9 ± 8.1 cm in height, 69.2 ± 15.5 kg in weight, and an average BMI of 25.56 ± 6.1 kg/m²) who are employees of Biola University. Participants completed the International Physical Activity Questionnaire (IPAQ), using the Survey Monkey® platform. Deduction between index (BMI) was 27.7 kg/m² with 38.4% considered overweight and 23.5% obese. Only 30.4% of respondents reported achieving the national physical activity (PA) recommendation (> 30 minutes of moderate-intensity physical activity on 5 days per week) (USDHHS, 2008). Most respondents reported a negative HIV status (62.6%), 6.9% did not know their HIV status, and 19% had not heard of PrEP. After removing participants who self-identified as HIV positive, most respondents did not feel they were at risk for HIV (57.6%). HIV Status, Willingness to take PrEP, Perceived HIV Risk, and Prior Knowledge of PrEP were not associated with meeting national PA recommendations or BMI. CONCLUSIONS: High rates of obesity and low levels of physical activity may further complicate healthcare outcomes for this population with primary or comorbid chronic conditions creating a competition for prioritization of health conditions. Engagement in regular physical activity and exercise must be promoted.

You Earn What You Get...Like Old Man Strength: Oral History Accounts Of Wellness

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Health is multidimensional (WHO, 1946) and can include aspects of physical, social, emotional, and spiritual wellness. Social Ecological Models (e.g., Sallis 2012; Van Dyck, et al., 2010) suggest that individuals’ personal experiences of health and wellness and lifespan historical narratives are embedded within community resources and built and natural environments supporting health. METHODS: An oral history approach was used to allow participants (N=11) to articulate moments in their lives that offered clarity and definition to their self-described meanings of health. Interviews included conversations about physical activity, use of community resources, and the integration of built environment features into personal-historical articulations of health. RESULTS: Semi-structured oral history interviews were transcribed verbatim and subjected to thematic analysis (Boyatzis, 1998). Transcripts were coded for content themes using the multiple dense coding and after the Bigu intervention. RESULTS: After the Bigu intervention, the body weight (Pretest: 92.77±16.24, p<.01), BMI (Pretest: 34.35±3.73 vs Posttest: 32.37±3.58, p<.01), waist circumference (Pretest: 110.83±10.47 vs Posttest: 106.35±10.01, p<.01) and body fat (Pretest: 41.91±18.42 vs Posttest: 40.79±8.57, p<.01) of the participants were significantly decreased. Heart rate and blood pressure remained no change, however, the skeletal muscle (Pretest: 33.32±6.45 vs Posttest: 31.60±6.61, p<.01) and fat-free body weight (Pretest: 59.28±10.66 vs Posttest: 56.28±11.02, p<.01) were significantly decreased. The glucose (Pretest: 5.69±2.28 vs Posttest: 3.82±1.34, p<.01) drops significantly within normal physiological range. CONCLUSIONS: Bigu may effectively help individuals with obesity to relieve obesity and control body weight and could be a feasible exercise for the individuals with obesity, however, there may be a risk of losing fat-free body weight during Bigu intervention. How to prevent the loss of fat-free body weight in Bigu intervention would warrant for future research.
Individuals with low socio-economic statuses (SES) have lower physical activity levels and poorer diet compared to their higher SES counterparts. Furthermore, these individuals typically have other health disparities (e.g., race, access to health care), which may impact their health status. Although lifestyle diseases (e.g., diabetes) are managed in the primary care setting, low-SES patients’ behaviors and preferences for lifestyle are rarely assessed, despite being needed to guide care. PURPOSE: To examine qualitatively the preferences for lifestyle interventions for individuals with low SES within a clinical setting. METHODS: Patients (N = 185; 70.2% female; 51.5% African American) were surveyed at two free community health clinics. Survey questions focused on patients’ preferences for physical activity and nutrition services; patients’ current physical activity and food related behaviors; and desired health information. Data were analyzed using content analysis to identify themes. RESULTS: Patients reported preferences for programs that were similar to those provided at the YMCA, general nutrition counseling, and smoking cessation. Majority of individuals who exercised did so at either a gym or at home. The most common reasons for not exercising or preparing food were lack of time, work schedule constraints, pain, and health issues. Patients reported regular fast food consumption. Participants reported they would value information on general wellness, low-impact physical activity, and weight loss. CONCLUSIONS: This study is the first to qualitatively examine low SES patients’ physical activity, diet, and other lifestyle behaviors along with intervention preferences within the clinical setting. Data demonstrates that individuals desire lifestyle intervention programs, especially ones that address reported barriers (e.g., pain, lack of financial resources, limited time). Notably, this study also asked patients their preferences rather than having program planners and researchers determine the best intervention for this population. As such, planners and researchers should tailor programming to this unique population’s needs. Further research and practice efforts should implement tailored lifestyle programs while also evaluating acceptability and feasibility of these programs.

Many elderly persons feel anxiety during daily life due to a decrease in walking speed, a fear going up and down stairs, fall by balance capacity decline. Although ankle joint mobility decreases with aging, the relation to activities of daily living (ADL) hasn’t been investigated so much. PURPOSE: The purpose of this study was to investigate the relation between ankle joint mobility and ADL ability of elderly health club participants, and to examine whether the ADL ability is improved when to ankle joint mobility is improved. METHODS: Forty elderly people (age 60 ± 12.9 yrs., height 153.2 ± 0.61 cm, weight 52.1 ± 6.87 kg) health club participants participated in this study. Knee to wall (KTW [cm]; ankle mobility, right and left ankle), timed up and go test (TUG [sec.]), and one leg standing test with open eye (OLS [sec.]; ADL function, right and left ankle), and stairs up and down time (SU and SD [sec.]; ADL) were measured before and after health club intervention. Coefficient of correlation measurement between measurements before intervention was calculated. The effect of intervention was considered from the measurements before and after ankle joint intervention using paired t-test for TUG, 2 factor ANOVA for KTW (each left and right) and SU&SD, and Wilcoxon signed rank test for OLS (each left and right). RESULTS: Measurement results before intervention were KTW (average of right and left ankle) 12.5±3.1, TUG 6.7±2.25, OLS (average of right and left ankle) 32.0±26.16, SU 3 ±0.23, and SD 5 ±0.54. The coefficient of correlation with the KTW, TUG -0.674, OLS 0.412, SU -0.483, and SD -0.579. Measurement results after intervention were KTW (average of right and left ankle) 13.3±2.75, TUG 6.1±1.94, OLS (average of right and left ankle) 38.8±20.34, SU 4.0±3.66, and SD 4.5±3.07. KTW, OLS and SD were improved significantly (p<0.01, respectively). CONCLUSIONS: The relation between the ankle joint mobility and ADL ability of elderly health club participant was observed. Improvement of ADL ability was caused by improvement of ankle joint mobility by health club intervention.
major findings were: the active baby boomers perceived themselves and aging process positively due to their healthy bodies, continuing economic activities, and high self-esteem; they defined PA as all movements which needed for the everyday lives and they believed that their self-esteem and health could facilitate participating in PA; the interviewees appeared to be content with their decisions to maintain a physical activity routine and that self-satisfaction motivated them to continue physical activities and extend to new sports and hobbies.

CONCLUSIONS: The interviewees showed PA appears to be important in active baby boomers lives. Increasing our understanding of how and why preferences and values interact with PA, will assist in the development of strategies for increasing PA among baby boomers who are not yet physically active with the goal of improving their health and quality of life.

Women are generally less active than men but the reasons for this gender disparity are not well understood. Benevolent sexism is a seemingly positive, covert form of sexism based on the idea that women are fragile and feminine to complement the masculinity of men. Endorsement of benevolent sexism has been shown to have a negative impact on work and academic performance in women. Benevolent sexism may inform underlying reasons for the PA gender disparity.

PURPOSE: To explore the relationship between PA and endorsement of benevolent sexism in young women.

METHODS: Nineteen women (20.7±1.1 yrs.) completed the International Physical Activity Questionnaire (IPAQ) Short Form and the Adolescent Sexist Inventory (ASI). The IPAQ was scored for total weekly; minutes of moderate-to-vigorous PA (MVPA), MET-mins, and seating time (ST). The ASI is a 22-item questionnaire with two subscales measuring an individual’s endorsement of benevolent and hostile sexism; the mean score (range 0-5) on the benevolent sexism items was used for analyses. Spearman correlations assessed the associations between PA outcomes and endorsement of benevolent sexism. Participants were split into tertiles for each PA outcome. Wilcoxon Rank-Sum tests and Cohen’s d assessed the differences in ASI scores between the 1st (T1) and 3rd (T3) tertile.

RESULTS: MVPA and MET-mins were both negatively associated with benevolent sexism (r=-0.42, r=-0.35, respectively) but there was no association with ST (r=0.06). There was no significant difference between endorsement of benevolent sexism between participants in T1 and T3 for MVPA (r and Interquartile Range) T1: 5846 (IQR=55), T3: 5868 (IQR=150, p=0.84, d=0.1) and MET-mins [T1: 58200 (IQR=960), T3: 582680 (IQR=5040)], p=0.44, d=0.72.

CONCLUSION: There was a small, inverse relationship between benevolent sexism and both MVPA and MET-mins, in the hypothesized direction. Additional work needs to further explore these relationships in larger, more diverse samples.

In 2016, more than 1.9 billion adults aged 18 years and older were overweight in the world and of these over 650 million adults were obese. These are preventable conditions that lead to chronic diseases. Overweight prevention includes: changes in eating habits, reduced time in front of the TV and computer to less than two hours a day and increased physical activity. Physical activities and exercise programs have been promoted by social marketing through social networks aimed at exercise programs and the level of physical activity in a group of university students. 50 participants completed a self-administered questionnaire via e-mail or social network. METHODOLOGY: Two self-administered questionnaires were: 1) the level of physical activity will be measured using the IPAQ, and 2) the use of social networks with social marketing directed to physical activity exercise programs.

RESULTS: Most of the participants were women with a participation of 79.6%. Age directed to physical activity exercise programs. Two self-administered questionnaires were: 1) the level of physical activity will be measured using the IPAQ, and 2) the use of social networks with social marketing directed to physical activity exercise programs.

CONCLUSION: The purpose of the research is to determine the relationship between social marketing through social networks aimed at exercise programs and the level of physical activity in a group of university students. 50 participants completed a self-administered questionnaire via e-mail or social network. METHODOLOGY: Two self-administered questionnaires were: 1) the level of physical activity will be measured using the IPAQ, and 2) the use of social networks with social marketing directed to physical activity exercise programs.

RESULTS: Most of the participants were women with a participation of 79.6%. Age was between 20 and 25 years (40.8%). 93.8% have some electronic equipment where 91.8% access social networks. 32.6% prefer Facebook, Instagram and Twitter within their selection. 36.7% use it 5 to 10 times a day. 49% Access the networks in order to obtain information on health, nutrition, exercises and lifestyle while 57.1% follow an online health or fitness professional. However, 69.4% do not publish their eating habits and 75.5% do not publish on physical activity habits on social networks. The average of weekly minutes in some physical activity in students who follow a health or fitness professional exceed the average of students who do not follow or look for health or fitness professionals.

CONCLUSION: University-aged students have a high use of social networks where they search information about health and fitness.
INTRODUCTION: Many consumer activity monitors include features, such as visual and haptic prompts, designed to alter users sedentary (SED) or physical activity (PA) behaviors. However, the ability of these PA prompts to alter SED/PA behaviors is unclear. PURPOSE: To evaluate the effectiveness of PA prompts from consumer wearable devices in changing SED/PA behaviors in university employees. METHODS: 25 university employees (43±9.2yrs) without a history of consumer activity monitor, wear volunteer to wear a Fitbit Alta HR (FB) that was randomly assigned to administer PA prompts (Prompt group) or no PA prompts (Non-Prompt group). Participants were blinded to the aims of the study. Before receiving a FB, participants wore an activPAL (PAL) for 5 days to measure baseline SED/PA behaviors. After returning the PAL, participants wore the FB for 12 consecutive days during all waking hours and rewear the PAL for the last 5 days of the FB wear period. PA prompts were triggered when participants achieved >250 steps in the first 50 minutes of an hour from 6 am to 8 pm each day. Changes in PA measured SED/PA behaviors were adjusted for baseline values. Average FB steps were calculated during the first 50 mins and last 10 mins of each hour and compared between hours where a prompt was received (Prompt group) or would have been received (Non-Prompt group). RESULTS: When participants achieved>250 FB steps in the first 50 min of an hour, the average FB step in the last 10 minutes of these hours was significantly lower (p<0.01) when a prompt was given (49±21 steps) compared to when a prompt was not given (89±45 steps). Changes in overall PAL sitting time were not significantly different (p=0.36) between the PA prompt group (Mean±SD change; 38.7±93.4 min/day) and Non-Prompt control group (3.9±88.5 min/day). Changes in PAL standing time were also not significantly different between groups (p=0.47) (Prompt group: 13.3±76.5 min/day, Non-Prompt group: 36.2±75.7 min/day). CONCLUSIONS: PA prompts did not influence SED/PA behaviors in university employees. Further research is needed to assess the effectiveness of PA prompts provided by other wearable brands and in larger and more diverse samples, including clinical populations.

Physical activity reduces the risk of chronic diseases in mobility disabled populations including manual wheelchair users (MWCUs). Nevertheless, physical activity level is low in MWCU.

PURPOSE: To define physical activity barrier prevalence and impact among Danish MWCU and association with physical activity level. METHODS: We translated the ‘Barriers to Physical Activity Questionnaire – Mobility Impairment’ (BPAQ-MI) from English to Danish according to published guidelines. Danish MWCU (N=133) completed BPAQ-MI online; 51% were female, 64% had a spinal cord injury and 50% were unemployed. Mean ± SD for age, BMI, & years in chair were: 48±13 yrs, 25.8 ± 6.3 kg/m², & 17±14 yrs. The BPAQ-MI covers subdomains of intrapersonal, interpersonal, organizational and community barriers. Participants first indicated if a barrier hindered them from physical activity participation in the last 3 months. If “yes”, impact was scored as 0 to and if “no”, impact was scored 1-very small to 5-very big. Self-reported physical activity level (PAL) was rated from 1-“not being physically active at all” to 10-“extremely physically active”. Individual barrier prevalence was computed as frequencies (% of yes). Individual barrier impact was computed as 1 to 5 and reported as median. Summed barrier impact was computed as the sum of individual questions within each subdomain. Spearman’s rho identified associations between PAL and subdomain summed barrier impact. RESULTS: The 3 most prevalent barriers included 2 intrapersonal (~63%) and 1 community (55%) barrier. The 3 most impactful barriers all had a median score of 5 (very big impact), but were less common: 2 organizational (0.8%, 23%), and 1 community (40%) barrier, PAL was inversely associated with intrapersonal (r=-0.175, p=0.05) and intrapersonal (r=-0.523, p<0.00) summed impact. PAL was not associated with organizational (r=-0.124, p=0.16) or community (r=0.025, p=0.77) summed impact. CONCLUSION: Intrapersonal barriers were highly prevalent. Increased cumulative intrapersonal barrier impact was moderately associated with lower PAL, indicating that a higher perception of physical activity barriers are related to lower PAL. Finally, the results suggests that specific organizational and community barriers could be impactful at the individual level when they are present.

PURPOSE: People with intellectual disabilities (ID) are at greater risk of obesity, diabetes, and cardiovascular disease compared to typically developing peers. People with ID face disparity and lack access to many healthcare services so community-based fit and physical activity interventions can be crucial ways to improve health in this population at high risk. Yet, most fitness interventions are not designed for people with intellectual disabilities (ID), often due to cost, accessibility, and literacy level. Special Olympics Inc. (SOI), a leading non-profit sports organization for people with ID, has made it a priority to improve health in the ID population through increasing fitness and physical activity. METHODS: This case study describes the process of developing and implementing fitness models for people with ID. Special Olympics Inc. (SOI) assessed fitness activities being done in local Special Olympics Programs (SO Programs) for effectiveness, feasibility, replicability, and scalability. Then, SO Programs were funded to continue fitness activities and collect data. SOI endorsed three of these ‘fitness models’ that showed most promise. SOI then funded other SO Programs to implement the models between 2016-2018. The results from that implementation is assessed. RESULTS: 5481 individuals from 75 SO Programs in 48 countries participated. Key components of fitness models were group fitness sessions, including participants without ID, goal setting, and incentives. Over 90% of SO Programs collected baseline systolic and diastolic blood pressure in >80% of participants. Programs were less likely to have >80% completed baseline data for weight (76.7% of programs), height (75.0%), and BMI (75.0%). For those that started in 2016, >99% had data from two time points. In 2017, 88.8% had two data time points or more and in 2018 70.1% had data from 2 or more time points. SO Programs reported participants were empowered and were motivated by the incentives. Getting buy in from participants families and the community greatly improved the implementation. However, data collection issues were common. CONCLUSION: Based on the ability to enroll participants, collect data, and implement the activities, SOI fitness models may be a feasible fitness intervention for people with ID. Supported by CDC Grant U27 DD01156.

PURPOSE: Prior studies suggest that a combination of physical activity and mind-body exercises, often seen in martial arts, may attenuate negative behaviors in youth with Autism Spectrum Disorder (ASD). Therefore, the aim of this study was to examine the effects of an 8-week judo program on behavioral factors in children with ASD, using a mixed-methods approach. METHODS: A total of 25 children (ages 8-17), diagnosed with ASD, participated in an 8-week judo program (1x week). Parents of participants were given the Aberrant Behavior Checklist (ABC) to compare the severity of ASD-related behavior at baseline

B-76 Free Communication/Poster - Health Promotion/Interventions Among Those with Disabilities Wednesday, May 27, 2020, 1:30 PM - 4:00 PM Room: CC-Exhibit Hall

Board #239 May 27 2:30 PM - 4:00 PM Perceived Barriers Of Physical Activity In Danish Manual Wheelchair Users Rasmus K. Hansen1, Ryan G. Larsen1, Uffe Laesøe1, Afsheen Samani1, Rachel E. Cowan3. 1Special Olympics, Washington, DC. 2University of Wisconsin-Madison, Madison, WI. Email: kwashburn@specialolympics.org (No relevant relationships reported)

Board #240 May 27 2:30 PM - 4:00 PM Effects Of An 8-week Judo Program On Behaviors In Children With Autism Spectrum Disorder Paola Rivera, Justine Renziehausen, Jeanette Garcia. University of Central Florida, Orlando, FL. Email: p.rivera@knights.ucf.edu (No relevant relationships reported)
and at the end of the program. A subset of parents (n=9) participated in semi-structured interviews that focused on their child’s behaviors during the judo program. Non-parametric paired t-tests were conducted to evaluate differences in ABC subscales (irritability, hyperactivity, stereotypic behaviors, lethargy, inappropriate behaviors) at baseline and at the end of the program. Interviews were coded independently by two trained researchers and categorized into behavioral themes.

RESULTS: Participants attended an average of 7.04 ± 1.06 classes (out of 8 possible sessions). Although hyperactivity (6.38 vs 4.4) and irritability (1.03 vs. 0.98) decreased following the judo program, the difference was not significant (p=0.05). Parent interviews revealed that 78% of parents observed improvements in both social skills and self-esteem as a result of the judo program.

CONCLUSIONS: Despite no significant differences in ABC scores pre- and post-judo, data from parent interviews indicate improvements in self-esteem and social skills. Future studies should further examine the effects of judo in a larger sample of youth with ASD, and include control conditions (e.g. no exercise group) for comparison purposes.

Internet applications (apps) have been shown to motivate people to form and maintain healthy dietary (D) and exercise (Ex) habits. However, research on the effectiveness of using apps by persons with Intellectual and Developmental Disabilities (IDD) is limited. PURPOSE: To evaluate the use of a smartphone app (Ap) compared to app plus text reminders (Ap+T) for tracking D and Ex behavior in persons with IDD in an independent setting without caregiver support. METHODS: Young adults (n=5, 19-26 yrs) who were enrolled in a college experience program consented to participate in the study which had been approved by the university’s IRB. Participants were living on campus and had their own smartphones. Baseline conditions were determined as participants used paper and pencil to self-record D and Ex for at least 5 days. In a single-case design, participants served as their own controls and were randomly assigned to alternating treatments of Ap or Ap+T conditions. The Ap (Kurbo Health Inc.) allowed tracking of food items and portions as well as exercise tracking in 10-minute segments. The Ap+T condition added 4 times/d text message reminders about recording D and Ex. Treatment conditions changed every 1-2 days in random order over the course of 3 weeks. Data analysis included evaluation of mean level increases and percentages of nonoverlapping data (PND) between conditions.

RESULTS: Participants demonstrated mean level increases from baseline to Ap (range: 15-66%) and baseline to Ap+T (range: 23-72%). Comparisons between baseline and treatment conditions yielded PND scores ranging from 45-77% for Ap and 33-92% for Ap+T. Comparison between treatments revealed a PND range of 0-50%. CONCLUSION: Although neither treatment emerged as superior, results of the study indicated that use of smartphone apps by persons with IDD increased self-recording of D and Ex behaviors and is a promising tool for promoting independent living skills.

Objectively Measured Physical Activity And Sedentary Time In Adults With Autism Spectrum Disorder

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PURPOSE: Adults with autism spectrum disorder (ASD) are purportedly inactive, but this conclusion is inferred from data on children and youth, and parent proxy reports. Objective assessment using activity monitors is needed to better understand physical activity (PA) and sedentary behavior in this population segment. The purpose of this study was to examine the general levels of PA and sedentary time in adults with ASD using accelerometry.

METHODS: Eleven adults aged 18-55 (6 females; mean = 31.9, SD = 12.5) and diagnosed with ASD were included in the study. Participants wore a GT3X+ accelerometer on their right hip for 7 days during waking hours except water-based activities, and accelerometers were programmed to collect data in 60-second epochs. ≥ 10 hours of device wear was defined as a valid day and ≥ 3 valid days was required for each participant to be included in the analyses. Activity intensities were determined using the following cutoffs (counts/min): sedentary <100, low 100-499, light 500-2019, moderate 2020-5999, and vigorous >5999 (Tudor-Locke et al., 2010), and non-wear period was determined by a minimum length of 90 min of consecutive

0-counts by Choi algorithm (Choi et al., 2011). Descriptive statistics were calculated for moderate to vigorous PA, light- and low-intensity PA, sedentary time, and walking steps.

RESULTS: The average total monitored length was 761.5 min/day (SD = 76.4). Results of the PA measures are as follows: moderate to vigorous PA - 42.8 min/day (SD = 30.5); light PA - 109.9 min/day (SD = 32.4); low PA - 97.9 min/day (SD = 33.9); and sedentary time - 511 min/day (SD = 84.6). The daily average percentage of time spent in moderate to vigorous PA was 5.8% (SD = 4.4), and the average step counts were 3799.7 steps/day (SD = 2953.9). 81.8% of the participants met the recommended PA guidelines of 150 min of moderate to vigorous PA per week.

CONCLUSION: Although the majority of adults with ASD in this study met the PA guidelines, they were also extremely sedentary. More research is needed to determine if sedentary time, rather than PA, should be targeted to improve preventive health in adults with ASD.

1118 Board #244 May 27 2:30 PM - 4:00 PM Feasibility Of The Assessment Of The H-reflex In Adult Dancers And Non-dancers With And Without Down Syndrome: A Pilot Study. Núria Massó - Ortiogosa. Universitat Ramon Llull, Barcelona, Spain. Email: nuriamo@blanquerna.url.edu

PURPOSE: The analysis of monosynaptic Hoffman’s reflex (H-reflex) involves recording the response to electrical stimulation of Ia-afferent fibers from the muscle spindle. The H-reflex can be used as a probe to study spinal neuronal pathways and mechanisms at rest and during movements in humans. The purpose of this study was to analyze the feasibility of the assessment of the H-reflex in people with Down syndrome (DS), and to compare it between adult dancers and non-dancers with and without DS. METHODS: Twenty-five participants were divided and divided into four groups (6 non-dancers and 6 dancers with DS, and 7 non-dancers and 6 dancers without DS). The H-reflex was recorded at the level of the soleus muscle in its central area. We analyzed the H response in three different conditions: decubitus prone, static standing position with open eyes and closed eyes. RESULTS: Non-dancers with DS showed a faster H-reflex latency than both groups without DS (all p < 0.05). In the present study, we provide evidence of the feasibility of eliciting the H-reflex in adults with DS. Interestingly, the H-reflex was present in decubitus position but not in standing position in non-dancers with DS and dancers without DS. CONCLUSIONS: The data from this study can help to perform future research in adults with DS and the development of full-scale studies to analyze this variable in adults with intellectual disability with and without DS.

Heart Rate Variability Response Following Two Physical Activity Programs In Senior With Intellectual Disability

Manel Font-Farré1, Ana Claudia Silva Farche2, Aniele Cristhine de Medeiros Takahashi3, Casimiro Javierre1, Miriam Guerra-Balí1, Guillermo Ruben Oviedo1, 1FISCE - Universitat Ramon Llull, Barcelona, Spain. 2Universidade Federal de São Carlos, São Carlos, Brazil. 3Facultat de Medicina, Universitat de Barcelona, Barcelona, Spain. Email: manelff@blanquerna.url.edu

PURPOSE: To compare the HRV response before, during and after 6-minutes walking test (6MWT) in seniors with ID without DS after two different exercise programs.

METHODS: Fifteen seniors with mild to moderate ID without DS participated in this study. Participants were randomly divided into 3 randomized groups: sprint interval training group (SITG), combined-aerobic exercise group (AEG) and control group (CG). Participants from the SITG and AEG performed exercise 3 times/wk, 1.5 hs, training sessions. Although both irritability (6.38 vs. 5.28) and hyperactivity scores (11.03 vs. 9.08) decreased following the judo program, the difference was not significant (p<0.05). In the present study, we provide evidence of the feasibility of eliciting the H-reflex in adults with DS. Interestingly, the H-reflex was present in decubitus position but not in standing position in non-dancers with DS and dancers without DS. CONCLUSIONS: The data from this study can help to perform future research in adults with DS and the development of full-scale studies to analyze this variable in adults with intellectual disability with and without DS.

Introduction: Improvements on heart rate variability (HRV) in healthy persons were found following exercise programs. There are gaps in our knowledge about the response of the HRV in seniors with intellectual disability (ID) without Down Syndrome (DS). Purpose: To compare the HRV response before, during and after 6-minutes walking test (6MWT) in seniors with ID without DS after two different exercise programs.

Methods: Fifteen seniors with mild to moderate ID without DS participated in this study. Participants were randomly divided into 3 randomized groups: sprint interval training group (SITG), combined-aerobic exercise group (AEG) and control group (CG). Participants from the SITG and AEG performed exercise 3 times/wk, 1.5 hs, during 24 wks. The 6MWT was performed before and after the programs. The intervals between R waves (RRi) were registered at rest (10 min), during the 6MWT and during the recovery (10 min) with a Polar RS800CX. HRV was analyzed by linear measures (variance) and nonlinear measures (symbolic analysis - 0% and 2UV%), 0% indicates sympathetic and 2UV% parasympathetic modulation.

RESULTS: Distance walked on 6MWT, variance and 0% values do not present effect of group, moment or interaction. Better values on mean (p < 0.05) and 2UV% (p < 0.01) were found in post-intervention in comparison with pre-intervention, but neither group effect nor interactions were observed.

Conclusion: Despite there is a tendency showing better HRV response values after physical activity programs, it cannot be concluded that exercise promotes beneficial
exercise can be different when compared to those without PD. The results may help understand the underlying neural mechanism associated with positive exercise following active-assistive exercise in PD.

PURPOSE: Support is critical for individuals with multiple sclerosis (MS) to adopt and continue physical activity (PA). The role that spouses play in the adoption and continuation of PA in women with MS has yet to be explored.

METHODS: Four women with MS volunteered for in-depth interviews lasting approximately an hour. The interviews were semi-structured and covered topics such as: marriage context, PA choices and behaviors, PA activities alone and with spouse, etc. Interviews were transcribed (with identifiers removed) and analyzed in case studies, then cross-cases for overlapping themes.

RESULTS: Four cases were developed. Theresa is an older woman with MS for which PA is encouraged by her spouse, and some PA is engaged in together, such as walking pets. She states, “It’s not walking like we used to walk, but we are out there together.” Margaret is an older woman with MS for which PA is engaged in completely alone. Intentional PA is performed solely because of her spouse’s lack of motivation. She states, “I always feel like he could use it as much as I could, but there’s no motivation and he has to motivate himself.” Claire is a young woman with MS who engages in PA outdoors with her spouse but feels her choices in PA done together can be dependent on her spouse’s desires over her own. She states, “Maybe sometimes if he’s not with me, I would just—push myself harder I think.” Joanna is a mid-life woman with MS who engages in PA outdoors with her spouse and children, as well as indoors with a personal trainer focused on mobility. She feels that her spouse provides support in both types of PA. She states, “Oh, he so strongly encourages it! He, he is honestly my #1 fan if, if there is something new that I did at the gym that day, he wants to see it, he wants to do it... knowing he has my back and in my corner lets me know that you know it will be a struggle but it is, it is worth it!” All four women discussed the importance of support in PA, despite different support methods.

CONCLUSIONS: This study points to the importance of support and perception of support by marriage partners for women with MS. Future physical activity programs for women with MS should consider the role marriage partners play in decisions to be physically active. Effectiveness of PA interventions might be enhanced by increasing the involvement of marriage partners.

1121 Board #247 May 27 2:30 PM - 4:00 PM Impact Of Marriage On Physical Activity Behavior In Women With Multiple Sclerosis
Megan E. Ware, Kevin K. McCully, FACSM. University of Georgia, Athens, GA. (Sponsor: Kevin McCully, FACSM)
Email: mw77577@uga.edu

(NO relevant relationships reported)

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

1120 Board #246 May 27 2:30 PM - 4:00 PM
Analysis Of The Cortical Hemodynamic Responses To Active-assistive Exercise In Individuals With Parkinson’S Disease
Cindy Rhode, Jacqueline Truong, Michael Francisco, Ying Liu, Junghoon Park, Taeyou Jung. California State University, Northridge, Northridge, CA.

(NO relevant relationships reported)

Background: Gait and motor impairments are common symptoms in people with Parkinson’s disease (PD). Previous studies found active-assistive exercise to be more effective in improving PD symptoms. The underlying neural mechanism contributing to these improvements is currently unknown. No previous studies have investigated how the brain responds to active-assistive exercise in people with PD. Purpose: To investigate the cortical hemodynamic responses to active-assistive exercise in individuals with PD. Methods: A total of 7 individuals with PD (70.29 ± 5.44) and 10 controls (58.71 ± 9.30) participated in this cross-sectional study. All participants completed three modes of exercise including active exercise (AE), passive exercise (PE), and active-assistive exercise (AAE) using computerized cycling equipment (MOTOMed viva 2, RECK MOTOMed, Bitzenweiler, Germany, 2017). Each mode of exercise was performed at a predetermined pace for 10 minutes on three separate days while a neuroimaging device, functional near-infrared spectroscopy (NIR Sport, NIRS Medical Technology, Berlin, Germany, 2017) captured oxy-hemoglobin (HbO) levels in the prefrontal lobe. Results: Repeated measures ANOVA showed no significant difference in ΔHbO across exercise modes. A trend showed that the PD group displayed the greatest level of ΔHbO during PE and minimum with AE. A 2x3 mixed model ANOVA revealed no significant group x mode interaction. However, a trend showed that the PD group displayed greater levels of ΔHbO during PE and AAE whereas the control group revealed greater levels during AE and AAE. Four representative channels were selected for regional comparison of brain activation during AAE between groups. They demonstrated significant differences in the middle frontal cortex (p < .049), orbital cortex (p < .039), intermediate frontal cortex (p < .033), and granular frontal cortex (p < .022). Conclusion: Our findings suggest that people with PD showed higher levels of brain activity during passive and active-assistive modes of exercise as compared to active cycling. Brain activity levels during active-assistive
CONCLUSIONS:
Patients treated with multimodal pain regimens achieved CDC recommended guidelines of <50 MME per day on discharge. Patients treated with opiates and neuromodulators showed the greatest functional outcome gains in 4/5 categories.

Functional Status

<table>
<thead>
<tr>
<th>Group</th>
<th>Walking</th>
<th>Wheelchair</th>
<th>Bathing</th>
<th>Toilet transfer</th>
<th>Bed transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admit</td>
<td>3.48</td>
<td>4.32</td>
<td>3.76</td>
<td>4.11</td>
<td>3.89</td>
</tr>
<tr>
<td>GN</td>
<td>2.84</td>
<td>3.67</td>
<td>3.11</td>
<td>3.95</td>
<td>3.55</td>
</tr>
<tr>
<td>NS</td>
<td>4.52</td>
<td>5.81</td>
<td>5.38**</td>
<td>5.88</td>
<td>5.84</td>
</tr>
<tr>
<td>Discharge</td>
<td>4.42</td>
<td>5.55</td>
<td>4.6**</td>
<td>5.63</td>
<td>5.6</td>
</tr>
<tr>
<td>NS</td>
<td>5.89</td>
<td>5.57</td>
<td>5.31**</td>
<td>6</td>
<td>5.94</td>
</tr>
<tr>
<td>FIM Change</td>
<td>2.24</td>
<td>1.49*</td>
<td>1.86</td>
<td>1.77</td>
<td>1.94</td>
</tr>
<tr>
<td>NS</td>
<td>3.88</td>
<td>3.15</td>
<td>2.34</td>
<td>2.16</td>
<td>2.04</td>
</tr>
</tbody>
</table>

*p = 0.076
*p = 0.073

Addition Of A Kinesiologist-guided Functional Exercise To Intradialytic Cycling Program: A Randomized Controlled Trial

Splea Bogatj1, Jernej Pajek1, Jadrana Buturovic Ponikvar1, Maja Pajek1, UMC Ljubljana, Ljubljana, Slovenia. 1University of Ljubljana, Ljubljana, Slovenia. Email: splea.bogatj@gmail.com

Purpose
Intradialytic cycling is a widely used workout mode for hemodialysis patients whereas added benefit of other exercise modalities remains unknown. This is the first randomized controlled trial on the effects and sustainability of the functional training and exercise counseling in addition to a standard basic intradialytic cycling exercise program. Methods Patients were randomly assigned to a kinesiologist-guided functional training in addition to intradialytic cycling (n = 20, experimental group) or intradialytic cycling only (n = 20, control group) over 16 weeks. The experimental group attended kinesiologist-guided functional exercise and counseling session in the first 8-week induction phase. In the second 8-week maintenance phase, the experimental group was encouraged to perform functional training at home on non-dialysis days. The main study endpoint was 10-repetition-sit-to-stand test time at 8 weeks. Results In the 10-repetition-sit-to-stand test at 8 weeks, the experimental group improved significantly better than controls (-4.5±1.9 s, 95% CI -8.4 to -0.7; P=0.021), which was maintained at week 16 (4.7±2.1 s, 95% CI -9.0 to -0.3; P=0.037). For the secondary endpoints at week 8, the experimental group significantly outperformed controls at handgrip strength for 3.7±1.2 kg (95% CI 1.3 to 6.2; P=0.004), sit-and-reach lower body flexibility for 5.8±1.4 cm (95% CI 2.9 to 8.6; P<0.001), Stork balance test for 0.7±0.2 s (95% CI 0.4 to 1.1; P=0.001), and back scratch upper body flexibility for 5.8±1.8 cm (95% CI 2.2 to 9.5; P=0.003). At week 16, superior results of the experimental group in secondary end-points remained preserved for handgrip strength, balance, and back scratch flexibility tests (p=0.05 for all). No major exercise-related adverse events were observed. Conclusions Functional training with exercise counseling added to basic intradialytic cycling program meaningfully improves physical performance and successfully prepares dialysis patients for sustainable home exercise.

Effect Of A Rural Multidisciplinary Community Program On Postural Stability Among Individuals With Parkinsonism

Michelle Bateman1, Sabih Parveen2, Brandt Brickell1, Chad Romoser1, Tim Passmore2, 1Northwest Missouri State University, Maryville, MO. Oklahoma State University, Stillwater, OK. (No relevant relationships reported)

Parkinson’s disease (PD) is a multimorbidity disorder that often times impairs an individual’s gait, balance, cognition, speech, swallowing and overall quality of life. Alarmingly, individuals with PD are two times more likely to fall when compared to individuals with other neurological disorders and are thus 60-70% more likely to experience a fall when compared to the generally healthy geriatric population. PURPOSE: The purpose of this study was to examine the effect of a rural multidisciplinary community program on balance among individuals with Parkinson’s disease and Parkinson plus conditions. METHODS: Participants with idiopathic PD or corticobasal degeneration (CBD) with no co-existing neurological disorders (n=6) engaged in a 16-week rural multidisciplinary community program that met weekly for 90 minutes. The Biodex Balance System was used to assess postural stability which is an indicator of balance. The dependent variables were OSI, API, MLI with eyes opened and eyes closed. Wilcoxon Signed Rank test was utilized to analyze differences in balance pre and post 16-week intervention. The treatment of 45-minute dual-task fall prevention exercises followed by a 45-minute speech and cognitive program (i.e., the LOUD Crowd® program). RESULTS: The average duration of the disease was 5.5 years. There were statistically significant results at post-data collection for MLI eyes open (Z = -2.201, p = .028). OSI eyes closed (Z = -1.997, p = .046), API eyes closed (Z = -2.023, p = .043) and MLI eyes closed (Z = -2.207, p = .027). However, there were no statistically significant results for OSI eyes open (Z = -4.20, p = .067) and API eyes open (Z = -1.472, p = .141). CONCLUSION: Findings from the study suggest that a rural multidisciplinary community program that utilizes dual-task fall prevention, speech, and cognitive exercises may be beneficial for improving balance among individuals with Parkinson’s disease and Parkinson plus conditions. Researchers recommend a follow-up study with a larger sample size and a true control group. This research project was partially sponsored by the Parkinson’s Foundation Community Grant.

Effectiveness Of SNPE On Disability, Range Of Motion, Muscular Strength, And Pelvic Pain In Women With Chronic Low Back Pain

Heejin Lee1, Jiyoo Yoon1, Jungki Choi2, Jihye Kyong2, Somi Yun1, Yoonbin Lee2, Jae Gu Hvangel3, Dae Tack Lee1, Kookbin University, Seoul, Korea, Republic of. Email: 2002heejin@gmail.com

(No relevant relationships reported)

Purpose The SNPE (Self Natural Posture Exercise), developed and practiced widely in Korea uses unique tools and body correction belts to make tension release and to correct unbalanced posture. This study examined the effectiveness of SNPE on disability, range of motion (ROM), muscular strength, and pelvic pain in young women with chronic low back pain. METHODS Twenty five women (27.6±6.5 yrs, 23.8±3.8 kg/m²) who had back pain for more than 3 months and scored 5-14 of the Korean Oswestry Disability Index (KODI) were divided into three groups; SNPE group (SNPEG, n=9), stretching group (SG, n=8), and non-exercise group (NG, n=8). SNPEG and SG participated in a respective 60 min exercise program twice a week for 12 weeks, while NG did not. KODI, Remodified Schober Test, Finger-to-Floor Distance Test, back strength, and VAS were measured at pre and post of 12 weeks. Statistical analysis was performed by paired t-test and ANCOVA. Results The lumbar disorder index was significantly decreased in SNPEG (pre: 7.6±2.7 vs. post: 3.1±2.7, p<0.001), and the decrease was the biggest in SNPEG than other two groups (p<0.001). Flexion of lumbar increased from 22.4±2.7 to 26.2±1.8 cm (p=0.05) while extension decreased from 12.1±1.0 to 10.9±1.0 cm (p=0.05). Lateral flexion to left side was decreased from 46.8±3.9 to 42.5±2.7 cm in SNPEG and from 46.6±3.2 to 44.7±3.4 in SG (p<0.01), and lateral flexion to right side showed similar changes (p<0.01). No change was observed in anterior-posterior flexion and extension, and lateral flexion to left and right were the largest in SNPEG (p<0.05). Back strength increased in SNPEG from 57.5±13.4 to 72.6±12.5 kg (p=0.001), while other groups did not increase. Pelvic pain in SNPEG decreased in all 10 sites from 4.6±1.1 to 5.0±1.5, 6.5±1.4, 5.8±1.6, 4.7±2.2, 5.7±1.9, 5.2±2.5, 6.3±2.1, 6.3±2.2, and 6.4±2.4 to 4.5±0.9, 1.2±1.3, 3.2±1.5, 2.2±1.6, 1.2±1.3, 1.2±1.3, 2.5±2.2, 2.1±2.4, 1.8±1.8, and 1.7±0.8 in Sacrum left and right (L-R), Iliopsoas L-R, Lateral iliac Crest L-R, Adductor L-R, and Gluteus maximum L-R, respectively (p=0.05). Pelvic pain in SG also decreased in all sites (p=0.05) while not in NG. Conclusion The results suggest that the SNPE can be an effective exercise program for improving ROM, disability, muscular strength, and pelvic pain release in young women with low back pain.

Arm Use In The Humeral Elevation Range Of Tendon Compression For Manual Wheelchair Users

Brianna M. Goodwin1, Omar Jahanian1, Stephen M. Cain2, Meegan G. Van Straaten1, Emma Fortune1, Melissa M. B. Morrow1, 1Mayo Clinic, Rochester, MN. 2University of Michigan, Ann Arbor, MI. Email: Goodwin.Brianna@mayo.edu

(No relevant relationships reported)

Shoulder tendon pathology is 10 times more likely in chronic manual wheelchair (MWC) users than in controls [1]. The increase in pathology is often attributed to a narrowing of the subacromial space, which is smallest between 30-60° of humeral elevation (HE) [2]. MWC users spend significantly more time in 30-60° of HE than controls [3]; however, their arm activity while in this workspace is unknown. PURPOSE: To determine the active and sedentary time of the arms for MWC users and controls while in 30-60° of HE. METHODS: Under IRB approval, participants wore three wireless inertial measurement units (Emerald, APDM, Inc.; 128 Hz) on their bilateral upper arms and...
torso for one to two days. Custom MATLAB (MathWorks, Inc.) code calculated the HE [3] and acceleration-based activity levels [4] of both arms for each second. The percentage of daily wear time each participant spent in sedentary and active time in 30-60° of HE was calculated for each arm. Separate paired t-tests were used to determine differences between cohorts (α<0.05).

RESULTS: 34 MWC users (sex: 6f, age: 43 ± 13, injury level: C6-L1, years since injury 11 ±11) and 34 controls (sex: 6f; age: 43 ± 13) were enrolled. MWC users and controls spent similar amounts of time active; however MWC users spent a significantly higher percentage of time sedentary.

<table>
<thead>
<tr>
<th>Percentage of the day spent active, sedentary, and overall in 30-60° of humeral elevation</th>
<th>Manual Wheelchair Users</th>
<th>Control</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dominant Arm</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage of day in 30-60° of humeral elevation (%) [3]: 63.6 ± 14.4</td>
<td>50.4 ± 13.1</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>Percentage of day in 30-60° of humeral elevation (%) [3]: 59.5 ± 14.3</td>
<td>48.4 ± 13.5</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>Percentage of daily wear time spent active (%) in 30-60° range of humeral elevation:</td>
<td>23.6 ± 8.8</td>
<td>21.1 ± 7.6</td>
<td>0.25</td>
</tr>
<tr>
<td>Percentage of daily wear time spent active (%) in 30-60° range of humeral elevation:</td>
<td>21.5 ± 9.3</td>
<td>19.5 ± 8.9</td>
<td>0.41</td>
</tr>
<tr>
<td>Percentage of daily wear time spent sedentary (%) in 30-60° range of humeral elevation:</td>
<td>40.6 ± 15.2</td>
<td>30.2 ± 11.8</td>
<td>0.002</td>
</tr>
<tr>
<td>Percentage of daily wear time spent sedentary (%) in 30-60° range of humeral elevation:</td>
<td>38.9 ± 14.9</td>
<td>29.4 ± 11.6</td>
<td>0.007</td>
</tr>
</tbody>
</table>

CONCLUSIONS: Although MWC users spend more time in 30-60° of humeral elevation, the majority of this time is sedentary, emphasizing the importance of understanding other factors such as arm loading and velocity of movement in this population. MWC users may be loading their arms more while in sedentary (i.e., resting condition) and active (i.e., propulsion) conditions, which may contribute to the increase in pathology.


**INTRODUCTION:** Persons with Autistic Spectrum Disorder (ASD) present several effects on the neurological development, with difficulties on social, behavioral and communication abilities that negatively affect daily life activities. Judo is a sport with great pedagogical tradition that provides benefits in children with ASD further than the physical activity by itself. PURPOSE: to study the evolution of psychosocial behavior of children after an adapted judo program, emphasizing the importance of understanding other factors such as arm loading and velocity of movement in this population. MWC users may be loading their arms more while in sedentary (i.e., resting condition) and active (i.e., propulsion) conditions, which may contribute to the increase in pathology.


**RESULTS:** 17 typically developing children and 17 children with ASD participated in the judo program. The children with ASD, compared to TD youth, however, no differences were found between the first and second assessment in all six sub-scales, as expected. Between the second and the third assessments, there were significant differences in the Social Interaction sub-scale (17.7±10.1 vs. 9.1±4.3; p<0.05) showing an improvement post-intervention, as a low value does not correspond to a typical ASD behavior

**CONCLUSIONS:** Adapted judo program can improve psychosocial behaviors in children with ASD. More research is needed increasing the number of participants and the number of sessions per week.

**METHODS:** A cross-sectional descriptive survey was conducted by 24 recreational wheelchair athletes (13 male, 11 female) age 13 and older. Participants were surveyed at two separate community events promoting adaptive sports participation. All participants were cognitively able to complete the survey independently. RESULTS: 70.8% of respondents practiced, competed, or trained in their primary sport year-round, and 29.2% participated in more than one adaptive sport. When in-season 58.3% reported achieving >150 minutes of moderate to strenuous exercise per week, and 41.7% achieving >240 minutes per week. Compared to the off-season, 45.8% and 25.0% of athletes completed >150 minutes per week and >240 minutes per week of moderate to strenuous exercise respectively. 58.3% reported not being satisfied with their amount of physical activity, citing time, access to adaptive equipment and facilities as the most common barriers. 62.5% reported shoulder pain as a result of adaptive sports participation, 41.7% had experienced shoulder pain in the past year, and 37.5% endorsed shoulder pain interfering with daily function. 75.0% reported regularly performing injury prevention exercises, but of those who did not, access to equipment and lack of information on current recommendations were cited as the most common barriers. Encouragingly, a majority of respondents reported discussing physical activity (95.8%) and shoulder health (75.0%) with a health care professional.

**CONCLUSION:** Within this group of adaptive athletes most participants reported significant amounts of physical activity when engaged in their primary sport, however a notable decrease in activity was noted during off-season periods. Most athletes had experienced shoulder pain as a result of sport participation, with this pain frequently interfering with daily function. Given barriers identified, implementation of adaptive fitness and injury prevention programs should focus on athlete education, be low-cost, and provide convenient access to appropriate adaptive equipment.
1130 Board #256 May 27 2:30 PM - 4:00 PM The Effects Of Muscle Quality On Physical Function Hsuan Wu1, Shio-Chwen Tsai1, Chi-Min Hwu2, Ting-rui Lin2, Ting-Chung Chen3, Jing-Ya Peng2. 1Institution of sport science, Taipei city, Taiwan. 2Section of Endocrinology and Metabolism, Taipei city, Taiwan. 3School of Nursing, Taipei city, Taiwan. *Physical Therapy and Assistive Technology, Taipei city, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM) Email: scxta6@gmail.com (No relevant relationships reported)

INTRODUCTION: Type 2 diabetes mellitus is associated with loss of muscle quality may alter the functional capacity. PURPOSE: To investigate whether handgrip muscle strength quality may be useful to predict glycemia and assess functional capacity in Type 2 DM elderly. METHODS: A total of 79 elderly with diabetes were recruited (n=79; male=38; female=41; age: 69.8±8.7 years old). Body composition (Inbody), physical function (walking speed, 30 second Sitting-Standing, Timed Up and Go, balance, physical activity scale for the elderly (PASE)), handgrip quality (handgrip strength divided by body lean mass (BML) in Kg/KgBML) were evaluated. The correlation between age, muscle strength, PASE score, body composition and physical function was analyzed by Pearson’s correlation coefficient (r). t-test and One-Way ANOVA were used to analyze the effect of three different muscle strength groups on physical function. P values ≤0.05 were considered statistically significant. RESULTS: In males, a positive correlation was observed between the handgrip quality (kg/BML) and open eyes one leg standing (r=0.567, p<0.002), close eyes standing Romberg (r=0.450, p<0.001), 30 second Sitting-Standing (r=0.374, p=0.022), Timed Up and Go (r=0.375, p=0.002), and PASE score (r=0.423, p=0.01). In female, the results showed a positive correlation between handgrip quality (kg/BML) and close eyes one leg standing (r=0.381, p=0.011), 30 second Sitting-Standing (r=0.447, p=0.003), and Timed Up and Go (r=0.380, p=0.014). There was no correlation between handgrip quality, Romberg test and fasting blood glucose. To evaluate the prediction of handgrip quality on physical function, the participants were divided into three groups by values of handgrip quality 0.6322 and 0.7728. Either male or female, the One-Way ANOVA results showed that the lower handgrip quality the higher age, body weight (p<0.05). The performance of Timed Up and Go, 30 second Sitting-Standing, opened eyes one leg standing, and 5 times Sitting-Standing is better in the higher handgrip quality than low handgrip quality. CONCLUSION: Handgrip quality can be used to predict physical function of the elderly diabetic patients in clinical. Supported by grants V1107-01 and V108C-172.

More than 1 million people are living with a spinal cord injury (SCI) in the United States alone. Research suggests improvement in daily function as well as biochemical markers in SCI patients who participate in regular exercise. There is limited data on the specific impact of exercise as it pertains to Quality of Life (QOL), complications or general sense of wellbeing. Purpose: To obtain objective QOL data using validated SCI questionnaires before and after exercises intervention done at the Claremont Club Perfect Step Program. Methods: The Claremont Club Perfect Step is a fitness facility that has been providing structured exercise programs for patients with SCI for 10 years. We completed a survey of 41 patients regarding their QOL before and after entering this program. The survey questions were drawn from a validated Spinal Cord Injury—Quality of Life (SCI-QOL) survey. A matched-pair t-test was used to compare the 6-month answers to the baseline measures of QOL. Results: Patients with spinal cord injuries who participated in this program reported statistically significant improvements in 83 of 92 survey categories, including improved mental health, reduced complications and fewer or lower doses of medication. With the QOL scores ranging from 1 (lowest) to 5 (highest), the average score increased by 0.72 (18.8%), from 3.82 to 4.54. Measures of mood, energy and confidence significantly improved. Measures of depression reduced. Measures of pain and pain interference on social and work life significantly decreased. Lastly, bladder accidents or disruption of daily life was about 0.05. Although structured exercise has often fallen outside the scope of traditional medical care for patients who experience SCI, it should be considered a first-line treatment that appears to be relatively safe and highly effective.

1132 Board #258 May 27 2:30 PM - 4:00 PM Physical Activity Levels And Health Problems In Employees Of Stationary Nursing Homes: Is There An Association? Jan Wilke, Oliver Vogel, Lutz Vogt. Goethe University, Frankfurt, Frankfurt am Main, Germany. Email: wilke@sport.uni-frankfurt.de (No relevant relationships reported)

Epidemiological data demonstrate that employees of nursing homes frequently suffer from illness and musculoskeletal disorders. Previous studies were mainly based on medical diagnoses and registered days of absence. The prevalence of pre-diagnostic health problems (HP) and resulting subjective impairments in participation and job-related performance are thus unclear.

PURPOSE: Our study assessed these factors and their potential association with physical activity levels (PA).

METHODS: Employees of two stationary nursing homes in Germany (n = 47, age: 47 ± 23 years, 42 females) once per week completed the OSTRC questionnaire over a total period of six weeks. The instrument captures the occurrence of HP (illness and musculoskeletal disorders) as well as related symptoms and restrictions in job participation. Accelerometers, worn on seven consecutive days, were used to assess PA. The association between PA and parameters indicating pre-diagnostic HP and their consequences was tested by means of point biserial correlations.

RESULTS: About 85% of the participants reported a HP during the past six weeks. Musculoskeletal disorders were more prevalent than illness (66% vs. 47%). Almost one third of the employees (29.8%) had to reduce working time at least once due to a HP and more than 6% in 10 persons (63.8%) experienced restrictions in job performance. The most frequent locations of orthopaedic problems were the neck, lumbar spine, shoulder and knee. With 48 ± 23 MET/h/week, the sample was highly active, all participants fulfilled the WHO’s minimal recommendation of 7.5 MET/h per week. PA was not associated with the occurrence of HP and their consequences (all p<0.05).

CONCLUSIONS: The association of high PA levels and general/musculoskeletal health may not exist in employees of stationary nursing homes. The development of interventions aiming to tackle the burden of population-specific HP therefore retains high relevance in future research.

1133 Board #259 May 27 2:30 PM - 4:00 PM Skeletal Muscle Mitochondrial Capacity Is Similar In Ambulatory And Non-ambulatory Children With Cerebral Palsy Sudarshan Dayanidhi1, Alexia Rudofski2, Marysol Encarnacion2, Jill Larson3, Vinetta Swaroop3. 1Shirley Ryan AbilityLab, Northwestern University, Chicago, IL. 2Drexel University, Philadelphia, PA. 3Ann and Robert E. Lurie Children’s Hospital, Chicago, IL. Email: sdayanidhi@northwestern.edu (No relevant relationships reported)

PURPOSE: Cerebral palsy (CP) is the most common childhood movement disorder secondary to a brain injury around birth. These children can be classified as ambulatory or non-ambulatory based on their functional abilities. Importantly, they expend significantly increased energy expenditure during movement. Muscle mitochondria, specifically the electron transport system are responsible for oxidative capacity, energy production and are associated with functional capacity. Unfortunately, mitochondrial oxidative capacity in children with CP and its association with different functional levels is not known. We measured maximum mitochondrial respiration rates directly from biopsies in children with CP, compared across ambulatory levels.

METHODS: Twenty children (6-16 years, 10 M/6F, Ambulatory-12), undergoing surgery participated in this study. Twenty-nine biopsies were obtained from adductors, vastus lateralis, gastrocnemius. Carbohydrate and fatty acid respirometry substrate-uncoupler-inhibitor titration (SUIT) protocols were performed on permeabilized muscle fiber bundles. In addition, muscle homogenate was used to measure citrate synthase activity as a marker of mitochondrial content. Ambulatory capacity was measured using 6-minute walk tests (n=7), muscle strength, and gait velocity (n=15) during routine therapy visits.

RESULTS: Surprisingly, maximal mitochondrial phosphorylation capacity was similar across between functionally ambulatory and non-ambulatory children (77.1± 23.9 vs. 84.9± 24.0 pmol O2/s/mg). This was uncorrelated with mitochondrial content (p<0.01), as measured by citrate synthase. Mitochondria in children with CP still preferentially used carbohydrates over fatty acids based on state-3 respiration. Functionally ambulatory children showed positive associations between mitochondrial function and ambulatory capacity measures (r values for gait velocity=0.50, 6-meter walk test=0.33, p<0.05).
CONCLUSIONS: Mitochondrial function are typically associated with activity level. Surprisingly, functionally ambulatory children with CP did not have greater mitochondrial function, compared to non-ambulatory children and might even be lower. Importantly, within ambulatory children walking capacity was related to maximal mitochondrial function.

1134 Board #260 May 27 2:30 PM - 4:00 PM Fall Risks Increase In Aging Women
Priscilla Beaupré, Rubens A. da Silva, Tommy Chevertte. Université du Québec à Chicoutimi, Chicoutimi, QC, Canada.
Email: priscilla.beaupre@uqac.ca
(No relevant relationships reported)

PURPOSE: Accidental falls are one of the leading causes of hospitalization for injury and result in a high death rate among older Canadians. There are about 30% of people over the age of 65 living in the community fall every year. In addition, aging process is related to individual decrease in physical and functional abilities that increase the risk of falls. Older women are more likely to experience more severe trauma after falling than men. The objective of this study is to evaluate the impact of aging on functionality, postural balance and falls risk in aging women. METHODS: 19 women formed two age groups (n=7 in 45-54 years and n=12 in 55-64 years) and performed three assessment tests: 1- Stand Test to measure lower limbs speed, 2- Sit to Stand Test for lower limbs Strength and 3- Postural Balance Test using the force platform during semi-tandem position, with eyes open and eyes closed. Postural balance response was based in Centre of Pressure (COP) velocity sway in antero-posterior and in medio-lateral directions. RESULTS: A large effect size was observed (Hedge’s g = 1.447), and a significant lower extremity speed (p = 0.005) in the older group compared to the younger group. The Lower-limbs Strength showed a large effect size (g = -0.86), however, not significant (p=0.075) between groups. A large effect size and significant COP velocity increase was observed in the older group for both antero-posterior (g <0.05, g = -0.887) and medio-lateral (g = -0.05, g = -0.731) directions as compared to the younger group. Finally, significant differences (g <0.001) and a large effect size were observed between eyes open (g = -1.506) and closed (g = -1.441) conditions for COP velocity sway for both directions. CONCLUSION: Aging in women can significantly change the postural balance performance as well as speed adjustments of the lower limb. These findings add to the body of knowledge on aging women and should be considered when planning and developing services. Complication risks after a fall in aging women are deleterious suggesting that developing activities to improve speed and balance are favored to ensure a longer life expectancy in aging woman’s health.

1135 Board #261 May 27 2:30 PM - 4:00 PM People With Disabilities Perception Of Quality Of Life After Participation In A Student Service-Learning Program
Donald J. Brolsma. California State University, Northridge, Northridge, CA.
(No relevant relationships reported)

TITLE: People with Disabilities Perception of Quality of Life After Participation in a Student Service-Learning Program
AUTHORS: Donald Brolsma, Katra Abdoltarazagh, Janet Sandoval, Kristina Burch, Elizabeth Garcia, Alyssa Granillo, Kai Sun & Mai Narakara-Jara
INSTITUTION: California State University, Northridge
ABSTRACT: It is observed that there is a continuous decline in physical function and associated decrease in quality of life (QoL) among individuals with disabilities. It has been documented that participating in physical activity significantly improves QoL. Despite many studies proving physical activity improves one’s QoL, there is a limited amount of research showing how combining student service-learning with physical activity can improve the QoL of individuals with disabilities. PURPOSE: The purpose of this study was to qualitatively investigate the perception of QoL of individuals with disabilities and physical activity during a student service-learning program.

METHODS: Semi-structured interviews were performed with 10 individuals with various disabilities. The interviews were designed to explore the perception of QoL and physical activity through each participants’ experience working with university students for the first time. Interviews were audio recorded and transcribed verbatim. Thematic analysis was completed using NVivo qualitative analysis software. RESULTS: Three main themes emerged from the qualitative thematic analysis: (1) peers and students were the motivational factors to physical activity with positive, non-judgmental, and supportive exercise environment, (2) increased adherence to physical activity, and (3) increased self-confidence performing activities of daily living. CONCLUSION: Physical activity combined with student service-learning programs can potentially improve many different aspects of individuals with disabilities QoL. Our results show improvement in general well-being, as well as a positive experience of working with students. This research, and future research in the field, will help establish a base of evidence to tailor this type of exercise program for individuals with disabilities.

1136 Board #262 May 27 2:30 PM - 4:00 PM Harnessing Digital Health To Objectively Assess Motor Capacity In Patient With Chronic Obstructive Pulmonary Disease
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Purpose: Current motor-capacity assessment tools based on gait test is limited in patients with Chronic Obstructive Pulmonary Disease (COPD) because of the need to carry ventilator support, high fall risk, fatigue, and limited space to administer the test in busy settings. In this study, we proposed an alternative tool to determine motor capacity based on 20-seconds rapid repetitive elbow flexion-extension test, called frailty meter (FM) administrable during sitting. FM is based on a single wrist-sensor enables quantifying frailty phenotypes including slowness, weakness, exhaustion, and risk of falls.

Methods: Thirty-nine COPD patients (age = 68 ± 8.8 years, BMI = 29 ± 6 kg/m2) and 49 age-matched controls (age = 70 ± 3 years, BMI = 29 ± 6 kg/m2) were recruited. In addition to FM test, conventional functional tests, including gait, balance, timed up & go, and 5-time sit to stance were performed.

Results: All participants achieved to complete FM test. While the feasibility for conventional tests ranged from 74% to 90%, When compared to the controls, COPD patients exhibited deteriorated motor capacity measured by conventional functional tests (Cohen’s d=0.60-1.52, p<0.050). The most sensitive phenotypes associated with COPD was found to be slowness characterized by flexion time (42% deterioration, d=1.46, p<0.001) and rigidity (41% deterioration, d=0.73, p=0.001). Significant correlations were found between FM metrics and conventional functional tests with the largest effect observed between slowness and 5-time sit to stance (r=0.51, p<0.001).

Conclusion: This study demonstrated the feasibility of the FM test to quantify digital biomarkers associated with motor capacity in COPD patients. The proposed test could be served as an alternative to gait tests and thus may facilitate routine screening of motor-capacity in busy clinical settings. Future studies need to demonstrate sensitivity to change in response to intervention.

1137 Board #263 May 27 2:30 PM - 4:00 PM Within Daily Analysis Of Physical Activity Behaviour In Adults With Multiple Sclerosis
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Little is known about the dynamic association between activity pacing and actual physical activity behaviour within the daily routines of persons with multiple sclerosis (MS). Understanding the association between activity pacing and actual physical activity behaviour within the daily routines of persons with MS is critical for optimizing health promoting behaviours.

PURPOSE: To explore how activity pacing relates to actual physical activity behaviour in adults with MS.

METHODS: 21 persons with MS (mean age= 59 ± 9 years) wore an accelerometer for 7 days to assess physical activity behaviours and filled in questionnaires on their engagement in pacing, perceived risk of overactivity, activity level and physical activity behaviour within the daily routines of persons with multiple sclerosis. Understanding the association between activity pacing and actual physical activity behaviour within the daily routines of persons with MS is critical for optimizing health promoting behaviours.

RESULTS: Engagement in pacing, perceived risk of overactivity, activity level and physical activity behaviour within the daily routines of persons with MS is critical for optimizing health promoting behaviours.

CONCLUSION: This study demonstrated the feasibility of the FM test to quantify digital biomarkers associated with motor capacity in COPD patients. The proposed test could be served as an alternative to gait tests and thus may facilitate routine screening of motor-capacity in busy clinical settings. Future studies need to demonstrate sensitivity to change in response to intervention.
Multiple sclerosis (MS) is a chronic, immune-mediated and neurodegenerative disease of the central nervous system. Since signs and symptoms associated with MS extend to several dimensions, people with MS (PwMS) can experience symptoms at both physical and cognitive dimensions. Among them, perceived fatigue is one of the most disabling symptoms, affecting the majority of the MS population. Hydrotherapy is a novel therapeutic option to improve the perceived-fatigue in PwMS.

**PURPOSE:** To analyze the effects of aquatic-based exercise on perceived-fatigue in PwMS using a meta-analytic procedures and systematic review.

**METHODS:** Clinical trials comparing aquatic exercise to no exercise treatments were searched on four scientific databases up to June 2019. The standard mean differences (SMD) was calculated for the outcome perceived-fatigue. Firstly, general fatigue was evaluated, from which three sub-dimensions were also assessed (physical, psychosocial, and cognitive). The methodological quality of the included studies was assessed employing the Modified Fatigue Impact Scale, showed a significant decrease and an experimental group, and a hydrotherapy program. General fatigue, assessed mainly through the Fatigue Impact Scale, showed a significant improvement in the experimental group compared to the controls (SMD = −0.57 [95% CI = −0.88 to −0.25]; p < 0.01; I² = 87%). Regarding fatigue sub-dimensions, physical fatigue achieved a significant improvement in the experimental group compared to the controls (SMD = −2.15 [95% CI = −3.72 to −0.58]; p < 0.01; I² = 91%). Regarding fatigue sub-dimensions, physical fatigue achieved a significant improvement in the experimental group compared to the controls (SMD = −2.15 [95% CI = −3.72 to −0.58]; p < 0.01; I² = 91%).

**CONCLUSIONS:** Aquatic-based exercise significantly decreases all dimensions of perceived-fatigue in PwMS. Based on these findings, it would be useful for future studies to address the dose-response characterization of aquatic-based exercise programs (i.e. intensity, volume, frequency, training length, etc.) in order to optimize the physical exercise interventions for PwMS.

**First responders (e.g., police) may be exposed to physical occupational stressors in the line of duty, which may place them at risk for acute cardiac metabolic events (e.g., myocardial infarction). Environmental challenges may exacerbate this risk.**

**PURPOSE:** To observe the impact of a hyperthermic versus thermoneutral environment on physiological responses in police cadets performing a simulated occupational task.

**METHODS:** Using an environmental chamber, 10 police cadets provided urine samples for urine specific gravity (U_SG), total protein:creatinine ratio (U_TN), and creatinine:urea ratio (U_SCR) determination, ingested core temperature (T_c) pills, and wore GPS-enabled performance monitoring systems.

**RESULTS:** Games lasted ≥2.5 h and evening weather conditions were typical of the Southeastern US (wet bulb globe temperature: 23.5±2.2°C, relative humidity: 72.5±9.2%). Across all games, 58% of officials were hydropyred (U_2<0.020); they covered an average of 5.1±1.6 km (total distance) at a speed of 1.9±0.3 km/h, with corresponding T_c and heart rate (HR) values of 37.4±0.4°C (peak T_c=38.3±0.4°C) and 132±16 bpm (peak HR=169.2±17.5 bpm), respectively, across all referees and over the entire sampling period. Higher relative humidity at the start of each game was associated with greater physiological strain (average HR: r=0.61; P=0.04; peak HR: r=0.56; P=0.06). Pre-game hydration status (r=0.50; P<0.09) and BMI (r=0.50; P=0.09) tended to elicit greater physiological strain (defined as the proportion of the game spent above 95% of age-predicted maximal HR). Cotaneous temperature (T_c) was recorded for every 5 min via ingestible telemetric sensor.

**RESULTS:** The extent to which groundkeepers experience heat strain, dehydration, and accompanying declines in kidney function during work in hot-humid conditions is unknown.

**METHODS:** Hydration, cardiovascular, and internal body temperature measures were assessed in 20 groundkeepers (18 men; mean±SD age=38±8 y, body mass index=32±8 kg/m²) during work on 2 summer days. Before (PRE) and after (POST) the work shift, resting blood pressure (BP) and heart rate (HR) were measured and urine and blood samples were collected. At POST, fluid intake was recalled for the previous 24 h. Gastrointestinal temperature (TGI) was recorded every 5 min via ingestible telemetric sensor.

**RESULTS:** Average highest daily wet bulb globe temperature=39.1±3.5 °C. In 45% of subjects, PRE BP=130/80 mm Hg on Day 1 (D1) and Day 2 (D2). Highest HR and T_c achieved across both days were 143±15 bpm and 37.7±0.3 °C, respectively. On D1 and D2, urine specific gravity (U_SG) 1.021±0.01 and urine color (U_SCR) 6.6±1 did not change statistically from PRE to POST across days (all P>0.18). 5 subjects had increases ≥0.3 mg/dL, signifying an acute kidney injury (AKI). No relevant relationships reported.

**CONCLUSIONS:** While hyperthermia was not prevalent, subjects began and ended the workday underhydrated. Hypertension, obesity, and low water intake may have contributed to the overall low kidney function and AKIs observed. Using urine color as a self-assessment tool could be a beneficial intervention to improve hydration status and kidney function. Funded by NIOSH.
(22.2±2.3 years), completed two occupational task exercise conditions in hyperthermic (HT, 38°C) and thermoneutral (TN, 22°C) environments on separate days. Each condition, participants completed a 10-minute treadmill walk at 70%-80% of their maximal heart rate followed by a 5-minute 50lb sandbag lift. Participants had 10 seconds to lift the sandbag onto a table then another 10 seconds to place it back on the ground. The walk and lift were completed two times each per condition. Heart rate (HR), ratings of perceived exertion (RPE), and core temperature (T) were recorded immediately before entering the chamber, in the chamber at the conclusion of the occupational task (post-exercise), and outside the chamber after 10 min of rest (recovery). Two condition (HT, TN) by three time point (baseline, post-exercise, recovery) repeated measures ANOVAs were utilized to assess all dependent variables.

Post-hoc analyses were performed using t-tests. RESULTS: Significant (F ≥ 8.6, p ≤ 0.003) condition by time interactions were observed for all dependent variables. There were no differences (t ≤ 2.3, p ≥ 0.05) across conditions in HR (76±11 bpm TN, 82±14 HT), RPE (6.4±1 TN, 7.1±2 HT), or T (37.0±0.3 TN, 37.5±0.2°C HT) at baseline. However, each of these variables were significantly (t ≥ 2.3, p < 0.05) greater post-exercise (104±12 bpm TN, 146±16 bpm HT; 8.9±2 RPE TN, 14±3 RPE HT, 37.6±0.3°C TN, 38.3±0.3°C HT) and during recovery (78±12 bpm TN, 92±13 HT; 6.7±1 RPE TN, 7.7±2 RPE HT; 37±4.0°C TN, 38±0.3°C HT) in the HT versus the TN condition. CONCLUSION: Concomitant occupational tasks and heat stressors increased physiologic and perceived measures of exertion and body temperature in police cadets beyond that of the occupational tasks alone.

PURPOSE: The police profession is a high-risk activity, as these professionals need to deal daily with violence, brutality and death, leading to high levels of stress. Classically, chronic exposure to situations causing stress may lead and facilitate the development of chronic diseases, such as cardiovascular and metabolic diseases. Increased pulse blood pressure (PP) is related to stiffness of large arteries predisposing to acute and chronic diseases, such as cerebrovascular stroke, coronary artery disease, heart failure and kidney diseases, which negatively affect morbidity and mortality, with significant consequences for public health. In addition, heart rate variability parameters are supposed to work as biomarkers of cardiovascular risk in response to stress as well. METHODS: We investigate the effects of regular practice of physical activity (moderate to high intensity, minimum of 5 years of regular practice and ≥ 4×/ week) by police officers who regularly practice physical activity (PAct; 32,92±5,87 years old; n=25) compared with physically active ones. In addition, Psed also presented increased systolic (136,81±21,31 mmHg x 123,56±10,92; p = 0.03) and diastolic blood pressure (81,68±13,80 x 75,37±9,66 mmHg; p = 0.0123) as well as pulse blood pressure (57,28±10,42 x 48,71±8,27 mmHg; p = 0.0001) when compared with physically active ones. In addition, Psed also presented increased levels of perceived stress (p = 0.0008), fat mass (p = 0.0005), visceral fat (p = 0.0001) and reduced fat free mass (p = 0.0055), but not for resting heart rate neither for any parameter of heart rate variability (time and frequency domain: RSS, NNS, SDNN, RMSSD, VLF, L, HF). CONCLUSIONS: We conclude that increased levels of stress in police officers impairs functional biomarkers of cardiovascular diseases, which can be partially attenuated by a physically active lifestyle.

PURPOSE: Workers in physically demanding occupations are often required to demonstrate appropriate levels of physical capability throughout their careers by undertaking routine in-service physical ability assessments. However, integrating physical employment standards (PES) and associated tests into organizational policies and procedures can be challenging for employers and there is a shortage of best practice guidance in this area. The aim of this study is to describe the process of integrating a developed PES into a physical capability management procedure, using a real-world example in the UK Fire & Rescue Service. METHODS: Using physical demands and performance data from a series of studies to investigate the cardiorespiratory, strength and muscular endurance requirements for UK firefighting activities, a physical capability management process was developed with industry stakeholders, including management, trade unions and subject matter experts. The procedure was designed to manage all levels of physical ability within a physically demanding workforce, prioritising employee safety and fairness. RESULTS: Occupational scientists and industry stakeholders defined performance standards relating to unacceptable, unclear, and acceptable performance of criteria tasks for UK firefighters. Cut-scores were identified for unacceptable (red), unclear (amber) and acceptable (green) performance standards related to each predictive test (Table 1). A process for triaging and managing all levels of worker physical abilities was agreed using the traffic-light system. CONCLUSIONS: This paper describes the processes involved in implementing a physical assessment procedure, for the administration of routine in-service PES and tests in a physically demanding occupation. Table 1. Cuts-scores for each predicitive test and performance standard.
5.

Personal protective clothing is an important part of protective personal equipment worn by health care workers and first receivers. Wearing a vapor-barrier layer of protective clothing inhibits sweat evaporation and impairs physiological and perceptual responses. PURPOSE: To evaluate thermoregulatory responses and heat strain indices during simulated healthcare and first receivers’ tasks under three different wet bulb globe temperatures (WBGT). METHODS: Four men (25.8±6.8 yrs, 176.5±6.1 cm, 73.5±16.9 kg) were consisting of a loose-fitting powered air-purifying respirator, chemical resistant coverall vapor-barrier ensemble, double gloves, boots, and an apron, while performing a battery of first receiver and health care simulation activities (walking, cutting and removing clothing, scrubbing, placing a splint and cervical collar, and weight carrying) for three repetitions under three different WBGT (18, 26, and 34°C) in counterbalanced order. These environmental conditions were intended to simulate healthcare workplace conditions during mass casualty incidents.

Rectal temperature (Tre) and heart rate were continuously monitored and averaged during the last 1-minute of each activity and presented as mean ± standard deviation.

Physiological (PSI) and perceptual strain index (PeSI) were calculated at the end of each activity. RESULTS: Over time, Tre, PSI, and PeSI all gradually increased. At the end of the trial, Tre was significantly higher in the 34°C condition (38.5±0.4°C) than the 18°C condition (37.8±0.4°C, P=0.029) but did not differ from the 26°C conditions (38.2±0.6°C, P=0.104). The PSI was significantly higher in 34°C (4.6±1.0) than 26°C (5.1±1.2, P=0.002) and 18°C conditions (2.6±1.1, P=0.001). The PeSI was significantly higher in 34°C (7.6±1.8) than 18°C conditions (3.3±1.8, P=0.006) but did not differ between 34°C (7.6±1.8) and 26°C conditions (5.7±1.4, P=0.075). CONCLUSIONS: Tre and heat strain indices gradually increased over time across all environmental conditions. Tre and PeSI did not differ between 26°C and 34°C WBGT conditions. Tre and PeSI responses may be blunted by wearing a vapor-barrier ensemble. Future studies should examine this hypothesis to clarify the current findings.

Exposure to a variety of ubiquitous pollutants, including polycyclic aromatic hydrocarbons (PAHs), occurs during daily exposure to vehicular exhaust fumes, smoking, grilling, and in many occupations, including firefighting. Dermal absorption of potential carcinogens has received limited attention compared to respiratory routes due to the challenges with measurement in vivo. PURPOSE: Our aims were 1) establish the equilibration time for MD and a sampling technique for dermal absorption of PAHs and 2) determine the effect of skin temperature on dermal absorption of the non-carcinogenic PAH, anthracene (ANT). METHODS: Two MD fibers were inserted into the ventral forearm of 6 healthy participants (32 ± 5 yrs, 5 male, 1 female) and perfused with lactated Ringers and 10% 2-hydroxypropyl-β-cyclodextrin at a rate of 1 mL/min. 2% ANT cream was applied over each site, dialysate samples were collected and skin blood flow (SKBF) measured at a locally heated (HT), (43°C) and thermoneural (TN, 33°C) site. The concentration of ANT from dialysate samples were measured via targetted tandem mass spectrometry. RESULTS: Dialysate ANT concentration was similar between the HT and TN sites (29.2 ± 0.4 vs. 35.3 ± 0.4 ppm, P=0.26). Absolute SKBF was significantly higher at the HT versus TN site (35.7 ± 11.8 and 7.2 ± 1.0 CVC, P=0.001). CONCLUSIONS: These data provide support for MD as a sampling technique for dermal absorption of PAHs. Despite similar ANT concentrations between sites, dermal absorption and sampling can be modulated by multiple factors. Further research is required to elucidate the influence of skin temperature versus clearance on dermal absorption of ANT and other PAHs. This has important implications for understanding dermal absorption of potentially carcinogenic compounds in occupational workers and the general population.
BACKGROUND: The Chinese special weapons and tactics (SWAT) trainees came from high school graduates, who have often lived in an indoor life style in China so long that many of them suffered from vitamin D deficiency, which made them at high risk of health problems that instructors had to face. PURPOSE: To investigate the therapy effects of outdoor exercise and Vitamin D3 Capsules Supplementation, and their combination on vitamin D deficiency symptoms of SWAT trainees.

METHODS: 158 SWAT trainees with low Serum 25-hydroxyvitamin D levels were divided randomly into 3 groups: Outdoor exercise (O), Vitamin D3 Capsules group (C), and their combination (OC). Participants in O-group maintained the outdoor training for four months (4 hours per day) while C-group used oral Vitamin D3 Capsules, (2000IU per day) with indoor training (in the gym), finally OC-group took both outdoor exercise and Vitamin D3 Capsules at the same time. The healing rates (Serum 25-hydroxyvitamin D level went beyond 30ng/ml was considered as healing) were compared 4 months later. The Serum 25-hydroxyvitamin D levels, the whole body muscle mass increment (kg) and the heart rate change (beats per minute) on Head-up Tilt (HUT) were tested both before and after the intervention.

RESULTS: The healing rates of O, C and OC groups were 78.0, 79.0, 100%, respectively; the average Serum 25-hydroxyvitamin D levels in OC (32.28±5.74) group after the intervention was higher than O (26.99±7.83, p=0.05, η²=0.28 ) and C (31.11±7.59, p<0.05, η²=0.20 ), and the whole body muscle mass increment (2.28±0.54) was significantly higher than that in other two groups (p<0.05, for OC vs O, η²=0.58) and (OC vs C, η²=0.21 ). However, the heart rate change showed no statistically significant change.

CONCLUSIONS: A combination of outdoor exercise and Vitamin D3 capsules supplementation was effective for the 25-hydroxyvitamin D level in serum and could get a better result in the four-month vitamin D deficiency intervention.

Effect Of Outdoor Exercise And Vitamin D Capsules Supplementation Interventions On Vitamin D Deficiency Of SWAT Trainees

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(No relevant relationships reported)

<table>
<thead>
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<th>Table 1. General characteristics in police officers</th>
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The role of personal protective equipment (PPE) worn by healthcare workers and first responders, including respiratory protective equipment, has received much attention over the past decade in response to outbreaks of prominent infectious pathogens (pandemic influenza, Ebola). PURPOSE: This study compared facial temperature, humidity, and comfort perception among different NIOSH approved respirators at standing rest and treadmill exercise. METHODS: Twelve participants (six men, six women) wore a one-piece work coverall and athletic shoes, walked on a treadmill at a speed of 5.6kmh (3.5 mph) and 0% grade for one hour in thermoneutral ambient conditions (20-22°C, 40-50% relative humidity). Participants were randomly assigned to four different types of respirators: filtering facepiece respirator (N95), half-facepiece elastomeric respirator (HFFR), loose-fitting powered air-purifying respirator (LPAFR), and tight-fitting PAPR (TPAPR) with the same filter media. Facial temperature, respirator microclimate temperature, and humidity were continuously monitored. Subjective perceptions of facial heat and overall body comfort were recorded at 20-minute intervals. Measured results were compared using factorial repeated measures ANOVA. RESULTS: Compared to rest, respirator microclimate temperature and humidity increased over time in all respirators, but at a significantly larger degree in N95 (+7.33°C/52.74%) and HFFR (+6.38°C/36.13%) compared to LPAFR (+9.11°C/23.43%) and TPAPR (+2.69°C/24.15%)(p<0.001). As a result, facial temperature was also significantly higher in N95 (+1.62°C) and HFFR (+1.01°C) than LPAFR (-5.4°C) and TPAPR (-7.9°C)(p<0.001). However, end point subjective perceptions of facial heat and overall body comfort (rated slightly warm - warm) were not different between respirators. In addition, no differences were found between genders in all measurements. CONCLUSION: Subjects who wore PAPRs in our study had lower microclimate temperature, humidity and thus facial temperature, compared to other models, possibly due to the effect of forced air flow. However, these differences in measured parameters were not subjectively perceived and may be further offset for workers in hot, humid conditions and may lead to escalating factors for heat stress.

Association Between Insulin Resistance And Aerobic Power In Police Officers

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(No relevant relationships reported)

Insulin resistance (IR) increases the risk of adverse cardiovascular events. The triglyceride/glucose index (TyG) is a simple IR marker. Low skeletal muscle mass is associated with IR. However, the relationship between muscle power and IR is not well known.

PURPOSE: To investigate the relationship between TyG index and aerobic power in police officers.

METHODS: Data from 716 police officers were analyzed (125 female and 617 men). They were classified by a TyG index >4.68 in IR (n=417) and Control (n=299) groups. All participants performed a graded exercise test in cycleergometer to determine maximal heart rate (HR max), peak oxygen consumption (VO2peak), and peak aerobic power (final watts obtained during GXT/ weight). Fasting blood glucose, cholesterol, and triglycerides were determined. Anthropometric and body composition measurements were obtained using bioelectrical impedance analysis.

RESULTS: Blood pressure, metabolic, and anthropometric variables were higher in the IR group than in the control group, except that exercise capacity was lower in the IR than control group (Table 1). TyG was inversely related with aerobic power (r = -0.22, p<0.01) and VO2peak (r = -0.23, p<0.01) but directly related with fat mass (r = 0.22, p<0.01).

CONCLUSIONS: Peak aerobic capacity and aerobic power are lower in individuals with IR. Aerobic power is negatively associated with metabolic control. Police officers need to improve aerobic power and fat mass in order to be metabolically healthier.

Supplement

In 2020, the U.S. Army will replace the Army Physical Fitness Test (APFT) with the Army Combat Fitness Test (ACFT). Little is known on how this change may impact exercise physiology.
PURPOSE: To evaluate the ACFT in U.S. Army ROTC cadets.

METHODS: Eighteen ROTC cadets volunteered to participate in the study (mean ± SD; age = 21.9 ± 3.4 y, height = 172.4 ± 7.9 cm, mass = 75.1 ± 10.4 kg, % fat = 16.3 ± 7.4%). Participants performed the APFT & ACFT seven days apart. Physiological data were collected for the ACFT using a bioharness monitoring device which included: physiological load (PL), physiological intensity (PI), maximal heart rate (MHR), and average heart rate (AVGHR). Pearson moment correlation coefficients were calculated to determine relationships between selected variables.

RESULTS: Mean ACFT scores were 453.7 ± 88.1 with a 72% pass rate and APFT scores were 265.4 ± 26.9 with a 100% pass rate. Significant relationships were found between scores for the ACFT hand-release push-up and standard APFT push-ups (r = 0.75, p < 0.01) as well as the ACFT and APFT 2-mile runs (r = 0.96, p < 0.01). There was not a significant relationship between total scores of the ACFT and APFT (r = 0.28, p = 0.05). Body fat percentage and total ACFT score were significantly related (r = -0.55, p < 0.05). Physiological data for the ACFT were: MHR= 197 ± 18, AVGHR = 123 ± 29, PL = 45.4 ± 141.8, and PI = 6.1 ± 2.0.

CONCLUSIONS: The results demonstrate that high performance in the ACFT may not translate to high performance in the ACFT. In addition, the ACFT requires moderate to vigorous effort throughout the duration of the test. The results of this study are useful as Army leaders prepare to train cadets and soldiers for successful completion of the new ACFT.

1153 Board #279 May 27 1:30 PM - 3:00 PM Characterizing The Bioenergetic Profile Of White Blood Cells For Utility In Assessing Mitochondrial Dysfunction In Gulf War Illness

Thomas Alexander1, Michael J. Falvo1, Ian Ryde2, Jacquelyn Klein-Adams1, Duncan S. Ndirangu1, Matthew Watson1, Wei Qian1, Nancy A. Eager1, Michael Condon1, Joel N. Meyer2. 1Department of Veterans Affairs, East Orange, NJ. 2Duke University, Durham, NC.

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(No relevant relationships reported)

PURPOSE: Gulf War Illness (GWI) is a chronic multi-symptom illness that affects veterans who served during the 1990-1991 Gulf War. Similar symptoms between GWI and known mitochondrial disorders have sparked investigations into the health of mitochondria in veterans with GWI. The objective of this study is to characterize the bioenergetic profile of peripheral blood mononuclear cells (PBMCs) in veterans with GWI (GWI+) and controls (GWI-) and assess the relationship with symptom severity and physical activity. METHODS: 55 Gulf War veterans (85.3% male; 55.0±6.7 years) volunteered for this study. GWI case status and symptom severity scores were determined via the KQ total score, and Hedges’ d which are listed in the table. Between-group differences and associated effect sizes were determined via questionnaire. PBMCs were isolated from whole blood to determine bioenergetic profiles (Seahorse XFp), parameters of which are listed in the table. Between-group differences and associated effect sizes for each parameter and symptom/activity scales were assessed via Mann Whitney U and Hedges’ d, respectively. Spearman’s rank correlation was used to evaluate the relationship between reserve capacity and GWI symptom severity (KQ total score), physical activity (IPAQ kcal/week) and fatigue severity (FSS mean score).

RESULTS: 38 of 55 veterans met case definition for GWI. Self-reported symptom severity, activity level, and the profile parameters are reported in the table (mean/SD). Reserve capacity was associated with FSS (r = -0.29, p = 0.04), but not for KQ (r = -0.26, p = 0.05) nor physical activity (r = 0.18, p = 0.18).

CONCLUSIONS: We observed differences in bioenergetic profiles between veterans with and without GWI. GW1+ veterans demonstrated a profile consistent with mitochondrial dysfunction and one that can be potentially used as a diagnostic tool.

1154 Board #280 May 27 1:30 PM - 3:00 PM Poor Soldier Medical Readiness In The Year Following Return To Unrestricted Duty After Musculoskeletal Injury

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(No relevant relationships reported)

Not all Soldiers cleared for full unrestricted duty are without injury just because they do not seek medical attention. Using medical care-seeking as proxy for medical readiness & deployability has limitations. Efficient injury detection & long-term management can improve if surveillance begins before patients make decisions to seek care. PURPOSE 1) determine proportion of Soldiers reporting new or recurring injuries for which they did not seek medical care, & 2) report perceived ability to perform full military duty when injured & not seeking care. METHODS This was a secondary analysis of a cohort of Soldiers (n=469) recently cleared to return to full duty (RTFD) without limitations. Monthly adaptive text messages queried about any new or recurrent injuries for 1 yr after clearance to RTFD after spine or lower extremity injury. Presence of MSK pain, care-seeking behavior, & perceived ability to perform military duties were assessed. RESULTS 424 soldiers had at least 1 response over the 1-yr follow-up & a mean response rate of 45.5% (at least 5 months). 315 participants reported injury-related MSK pain at least once. Of those, 276 (87.6%) reported not seeking care during at least 1 pain episode. When care was not sought, 89 (32.2%) reported it affecting their ability to perform military duties. On at least one occasion, 127 individuals believed they would not pass an annual fitness test due to pain, deconditioning, or fear of injury. CONCLUSIONS Soldiers do not always seek care for MSK injuries, & thus, many are not confident in their ability to complete military duties. Early indicators & improved surveillance strategies could identify problematic injuries before they reach a threshold of needing to seek care. Equally important is the ability to predict which individuals can self-manage without adversely affecting ability to perform military duties. This research was supported by the Department of Defense Military Operational Medicine Research Program under program number (W81XWH-13-MOMJPC5-IPPEHA). The view(s) expressed herein are those of the author(s) and do not reflect the official policy or position of Brooke Army Medical Center, the U.S. Army Medical Department, the U.S. Army Office of the Surgeon General, the Department of the Army, the Department of the Air Force, the Department of Defense, or the U.S. Government.

1155 Board #281 May 27 1:30 PM - 3:00 PM Participation In Sports During Adolescence Positively Impacts Bone Health In Recruits Entering Basic Combat Training

Leila A. Walker1, Kathryn M. Taylor1, P. Matthew Bartlett1, Katelyn I. Guerriere2, Nathaniel I. Smith3, Stephen A. Foulis4, Julie M. Hughes5, 1U.S. Army Research Institute of Environmental Medicine, Natick, MA. 2Oak Ridge Institute for Environmental Science and Education, Oak Ridge, TN.

(No relevant relationships reported)

It is well documented that participation in sports during childhood is beneficial to skeletal health. Almost 40% of bone mineral content is attained during years of peak height velocity (females 10-14y; males 12-16y). Improving bone development during these years may be beneficial in mitigating musculoskeletal injuries (MSKIs) in Soldiers.

PURPOSE: To evaluate the relationship between participation in sports during adolescence and baseline bone microarchitectural parameters in recruits entering Basic Combat Training (BCT).

METHODS: Survey data on sport participation from 840 Army recruits entering BCT were analyzed (611M, 23.0±3.7 kg/m2; 20.6±3.6y; 229F, 23.6±2.7 kg/m2; 20.4±3.5y). Low impact (LI) and high impact (HI) sports were categorized according to effective load stimulus scores. Middle school (MS) was defined as grades 6-8 (11-14y) and high school (HS) as grades 9-12 (14-18y). Baseline bone characteristics were measured at the ultradistal tibia using a high resolution CT scanner. Linear models were used to evaluate the association between bone microarchitecture and timing and impact load stimulus scores. Models were adjusted for ethnicity, BMI, age, and parents’ education. Effect estimates (EE) and p values for bone parameters compared to recruits who did not play sports (898, 46%) are presented.

RESULTS: Table 1 shows that participation in both low and high impact sports during adolescence had a significant effect on baseline bone measures in male and female recruits compared to those who did not participate in sports. While male sports participation in HS had a greater effect than MS sports participation, the opposite was observed in females. We found no significant effects in trabecular thickness, spacing or

Abstracts were prepared by the authors and printed as submitted.
number. CONCLUSION: Promoting sports participation in children and adolescents, particularly during peak growth years, is important in providing long term skeletal health benefits and may help to reduce MSKIs in Soldiers.

### Table: Baseline bone measures in recruits who played sports during peak growth years

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<tr>
<th>Group</th>
<th>T0 vs. T20</th>
<th>T0 vs. T40</th>
<th>T0 vs. T60</th>
<th>LI</th>
<th>MS</th>
<th>HS</th>
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**1557** Board #283 May 27 1:30 PM - 3:00 PM

**Distinguishing Acute And Mounting Stress Responses Among Active Duty Military**

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(No relevant relationships reported)

**PURPOSE:** To characterize acute vs. mounting cognitive and physical stress responses within a tactical timeline. Biomarkers of stress were extracted from saliva samples taken during a Live-Fire “Stress Shoot” (LFSS), eliciting acute stress. The LFSS was completed prior to (Pre) and following (Post) a 3-day intensive combat training exercise, eliciting mounting stress. **METHODS:** 46 active duty Soldiers (24.47 ± 4.11 years old, 4 women) completed the 3-day mission and 2 runs of the LFSS. The LFSS involved a marksmanship course with complex rules of engagement (high cognitive load) and physically taxing activities (shuttle run test, kettlebell presses). Salivary biomarkers were collected before (Baseline) and after the LFSS at 4-time points: at LFSS offset (T0) and in 20-minute intervals thereafter (T20, T40, T60). Biomarkers included cortisol to capture cognitive stress and lactate to capture physical stress. The main effects of Sample Time (T0 vs T20 vs T40 vs T60) and of Mission Phase (Pre vs. Post) were analyzed with non-parametric repeated measures analyses (Friedman Test) with Bonferroni-corrected posthoc pairwise comparisons. **RESULTS:** Cortisol peaked at T20 (Pre DC = 3.39, p<0.001; Post DC = 4.47, p<0.001), while lactate peaked at T0 (Pre DC = 7.54, p<0.001; Post DC = 7.27, p<0.007). There was also a main effect of Mission Phase for cortisol at T20 (DC = 12.12, p<0.03) and for lactate at T0 (DC = 7.27, p<0.007). Both biomarkers showed decreased concentrations after the 3-day mission (Cortisol at T20: Pre = 4.30 ng/mL; Post = 3.47 ng/mL; Lactate at T0: Pre = 93745 ng/mL; Post = 114366 ng/mL). **CONCLUSION:** The present results reveal heightened acute stress responses through peaks in salivary cortisol and lactate following an acute tactical stressor (LFSS). Together, this suggests that the primary stress responses experienced by active-duty Soldiers are due to acute stress, rather than mounting stress. [K273 of 2000 characters]

**1558** Board #284 May 27 1:30 PM - 3:00 PM

**Comparison Of Body Composition Indices For Men And Women At Two Air Force Bases**

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(No relevant relationships reported)

Assessment of body composition and its effect on the performance of military tasks is ongoing. Various branches of the military have relied on different techniques to assess

**DISCUSSION:** The ACFT appears to accurately assess important combat readiness components. Further, the raw data performances and composite ACFT score appear sensitive in discriminating overall performance abilities as opposed to the previous composite APFT score. For soldier-athletes desiring success on the five combat readiness components; strength, endurance, mobility, power/speed, cardio-respiratory realm, the ACFT appears to be a comprehensive combat fitness assessment & soldier-athletes should train and increase their overall physical capabilities. **CONCLUSIONS:**

**The ACFT appears to be a reliable field test which can classify, indicate one’s physical strengths and weaknesses, and assist in selecting personnel for more arduous military applications. Given the demand & robust nature of military applications coupled with the multi-dimensional ACFT assessment, increased physical performance metrics & thus an overall enhanced physical profile should be the goal of any soldier-athlete.**
body fat (%fat), fat mass (FM), and fat-free mass (FFM) in both men and women. A widely accepted technique is air displacement plethysmography (ADP), which uses a mass-to-body volume ratio to determine %fat. Owing to the standard measurement procedures and accepted validity of this method, it would beneficial to compare military personnel at different bases to evaluate conformity of FM and %fat in Air Force personnel. PURPOSE: To compare body composition components among Air Force men and women at different bases. METHODS: Men (n = 604) and women (n = 343) were evaluated using ADP to identify FM, FFM, and %fat. Participants were stratified into 4 age groups, determined by decade, with individuals <20 yrs (n = 21) combined with the 20-29 yr-old group. Self-appraised activity groups were denoted as sedentary, low active, active, and very active based on standard criteria. Height and weight were used to calculate BMI = kg/m². Fat-free mass index (FFMI) and fat mass index (FMI) were determined for each component relative to height (m²). RESULTS: A base x activity (2 x 4) MANOVA in men revealed weight, BMI, FMI, and %fat were not significantly different (p < 0.01) between bases, while active and very active groups were significantly better than sedentary and low activity groups. In women, BMI, FFM, and %fat were not significantly different (p < 0.14) between bases but active and very active groups were significantly better than sedentary and low activity groups. BMI had a significantly higher correlation (p < 0.001) with %fat in women (r = 0.79) than in men (r = 0.68). Discriminant analysis identified %fat as the best separator of activity groups, with a better success rate for discerning between sedentary (61%) and very active women (62%) than between low active and active groups (40%). In men, %fat was better for identifying those in the very active group (72%) compared to those in the other 3 groups (<53%). CONCLUSION: Body composition indices do not appear to differ greatly among Air Force personnel at different bases.

BACKGROUND: Military operations occurring in austere environments result in declines of androgen status and physical performance, which has been associated with the severity of negative energy balance. However, whether negative consequences of military operations differ between environmental conditions has not been well described. PURPOSE: To characterize energy expenditure, body composition, and androgen status during Summer and Winter Marine Mountain Warfare Training. METHODS: Sixty seven healthy US Marines taking part in summer (18 ± 3°C, n = 46) or winter (2 ± 4°C, n = 21) training at Marine Corps Mountain Warfare Training Center participated in this longitudinal observation study. Doubly labeled-water was used to determine energy expenditure throughout summer and winter training. Body composition (InBody 770) and blood draws were performed before and after 15 days of mountain warfare training. Data presented as mean ± SD. RESULTS: Energy expenditure was 3782 ± 688 kcal/d during summer and 4596 ± 688 kcal/d during winter Marine mountain warfare training. Summer training resulted in a decline (P < 0.01) in body mass (-2.7 ± 1.5 kg), fat mass (-1.1 ± 1.0 kg), lean mass (-1.6 ± 1.3 kg), total body water (-1.2 ± 1.0 kg), and dry lean mass (0.5 ± 0.4 kg). Winter training resulted in a decline (P < 0.01) in body mass (-2.2 ± 1.1 kg), lean mass (-1.7 ± 1.1 kg), total body water (-1.3 ± 0.8 kg), and dry lean mass (0.4 ± 0.3 kg). There was no difference in fat mass (0.5 ± 1.2 kg) following winter training. Following summer training a decline (P < 0.01) in IGF-1 (-28 ± 27 ng/mL), but not testosterone (36 ± 28 ng/dL) was observed, while in both IGF-1 (-51 ± 38 ng/mL) and testosterone (-11 ± 135 ng/dL) declined (P < 0.01) following winter training. CONCLUSION: Findings from this investigation indicate that both summer and winter mountain warfare training result in declines in body mass and dry lean mass, while only winter training results in a decline in both circulating IGF-1 and testosterone. This material is based on the work supported by DHP JPC-5/MOMRP; authors’ views do not represent official U.S. Army or DoD policy.

Over the past 20 years, the literature has demonstrated that military members are prone to exertional heat illness due to a combination of heavy loads and physical exertion. Solutions such as Cold Water Immersion or Convective Cooling Vests help ease this physiological strain; however, these methods are not always practical for use. These methods require either time, space, equipment or are not cost efficient. A relatively new approach known as precooling, is when an individual either applies a cooling method or ingests a cold substance preemptively to lower core temperature before an activity. PURPOSE: The aim of this study was to investigate the effects of a precooling protocol employing ice slurry (0.1°C) vs. cold water (4°C) on core body temperature and time to exhaustion (minutes) during a simulated military full combat gear foot march in males aged 18 to 35 years. METHODS: This study consisted of 6 college aged males, (23.5 ± 1.0 yrs, 91.0 ± 9.3 kg, 183.3 ± 8.1 cm), who engaged in two separate simulated army ruck march trials in heated conditions (33/3°C). The researchers used a precooling protocol of 7.5g/kg of bodyweight of both water (control) and ice slurry (experimental) administered over a 30-minute period prior to activity. Following the precooling protocol, the participants self-selected a pace from 3.0-4.0 MPH and walked for up to 90 minutes or until volitional fatigue inside a heat tent while wearing full army combat gear. Core temperature, heart rate and RPE were collected every 5 minutes. Blood pressure was collected pre and post exercise. RESULTS: This is preliminary data of an on-going study. There was no significant difference in time to exhaustion (p = 0.227; f = 1.37), heart rate (p = 0.763; f = 0.001) or core temperature (p = 0.876; f = 0.20) between conditions. CONCLUSION: The precooling protocol was ineffective at lowering core temperature vs. control and thus did not increase time to exhaustion. Additional research on precooling with military equipment is needed to further elucidate the potential benefits of precooling on exercise performance and decrease the risk of exertional heat illness.

BACKGROUND: Military operations often require sustained alertness in the presence of physical fatigue, caloric deprivation, and sleep restriction, stressors that may affect men and women differently. PURPOSE: To identify differences in psychomotor vigilance and neurocognitive biomarkers based on sex during simulated military operational stress (SMOS). METHODS: Forty-nine Soldiers (25.8 ± 5.2 years, 174.6 ± 9.5 cm, 80.0 ± 16.2 kg, 21.3 ± 7.0 BF%, 11 women) completed a 5-day/night SMOS protocol. Subjects completed physical and cognitive evaluations from 0900-2230. Nights 3 and 4 included restricted sleep from 0100-0300 and 0500-0700, with psychomotor evaluations between 0300-0500. Subjects were given 50% of caloric demands on Days 3-4. Fasted blood was drawn each morning at 0800, followed by psychomotor vigilance test (PVT). Concentrations of insulin-like growth factor I (IGF-1), α-Klotho, and brain-derived neurotrophic factor (BDNF) were analyzed using standard immunoassays. PVT performance was based on accuracy and response time correlated to a percentile position within a normative distribution. Two-way mixed ANOVA with Bonferroni correction for multiple comparisons were used alternatively (p < 0.05). Day 1 PVT was excluded from the analysis to account for learning effect. RESULTS: There were no sex*time interaction effects for PVT (p = 0.950), BDNF (p = 0.285), IGF-1 (p = 0.103), or α-Klotho (p = 0.001). Main effect of time was of observed difference (PVT (p < 0.001), IGF-1 (p < 0.001), and α-Klotho (p < 0.001). PVT performance decreased from D2 to D3 (D2 = 417.45 ± 248.5, D3 = 302.0 ± 252.5; p < 0.01) and from D2 to D4 (D4 = 261.6 ± 256.2; p < 0.001) and rebounded after one night of recovery sleep (D5 = 482.0 ± 257.3). IGF-I and α-Klotho decreased from D1 to D5 by 13.1% (p < 0.001) and 12.0% (p < 0.001), respectively. There was a main effect of sex for BDNF (p < 0.001) and 12.0% (p = 0.001) from D2 to D3 (D2 = 417.45 ± 248.5, D3 = 302.0 ± 252.5; p < 0.001) and 12.0% (p = 0.001). There were no sex*time interaction effects for PVT (p = 0.285), IGF-1 (p = 0.091). Main effect of time was observed for PVT (p < 0.001) and 12.0% (p < 0.001). There were no sex*time interaction effects for PVT (p = 0.285), IGF-1 (p = 0.091). Main effect of time was observed for PVT (p < 0.001) and 12.0% (p < 0.001). There were no sex*time interaction effects for PVT (p = 0.285), IGF-1 (p = 0.091). Main effect of time was observed for PVT (p < 0.001) and 12.0% (p < 0.001).
women on psychomotor vigilance and neurocognitive biomarkers IGF-I and α-Klotho. However, women demonstrate higher concentrations of BDNF in the presence of SMOS.

Department of Defense (Award # W81XWH-16-PHTRRP-CR3A). The results and opinions herein are those of the authors and do not necessarily constitute endorsement of the Department of Defense.

1162 Board #288 May 27 1:30 PM - 3:00 PM
The Cardiopulmonary Effects Of Thoracic Load Carriage While Resting
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Purpose: To investigate the cardiopulmonary effects of thoracic load carriage (LC) while sitting and standing. METHODS: Eight males and one female (Age: 21.0 ± 1.4 yr; Height: 178.9 ± 5.8 cm; Mass: 86.1 ± 13.2 kg; Body Fat: 20.2 ± 7.2%) without LC experience participated in the study. On separate days, subjects completed four trials of sitting quietly for 5 minutes, and then standing quietly for 5 minutes without assistance. Testing sessions included an unloaded (UL) trial, which served as the control, and wearing a light load (LL; 24lb = 10.9kg), moderate load (ML; 48lb = 21.8kg) and heavy load (HL; 80lb = 36.4kg) weight vest. The testing order of the weighted vest trials was determined by counterbalanced assignment. Vest weights were selected to approximate common gear of tactical populations: law enforcement (LF), firefighter (ML), and military personnel (HL). Minute ventilation (V̇E, respiratory rate (RR), Tidal volume (VT), mean±sd scores were as follows: MTC=172.5±16.3 sec, AL=113.2±10.4 repetitions, AC=111.2±9.0 (repetitions), RUN=1377.0±131.4 sec, PFT total=249.6±29.6. The CFT variables yielded "no to low" association. Within the parameters of this study, PFT and CFT event scores ranged from "no" to "moderate" correlations suggesting that different fitness aspects are being assessed and supports the need for both the PFT and CFT assessments.

1164 Board #290 May 27 1:30 PM - 3:00 PM
Abstract Withdrawn

1165 Board #291 May 27 1:30 PM - 3:00 PM
Performance Aspects Of Operational Preparedness
Scott D. Royer, Joshua D. Winters1, Jeremy A. Ross1, Nicholas R. Heebner2, John P. Abi, FACSMM, Andrea Zaiasakilbas, Ryan Sheppard3, Scott Lephart, FACSMM. 1University of Kentucky, Lexington, KY; 2United States Marine Corps Forces Special Operations Command, Jacksonville, NC. (Sponsor: Scott Lephart, FACSMM) Email: s.royer@uky.edu

Purpose: To examine performance characteristics of Marine Operators and Support personnel prior to completing unit deployment training together. METHODS: Operators (N: 39, Age: 28.8 ± 3.11 years, Height: 1.78 ± 0.08 m, Mass: 83.03 ± 13.8 kg) and Support personnel (N: 16, Age: 27.9 ± 4.6 years, Height: 1.77 ± 0.07 m, Mass: 83.03 ± 13.8 kg) completed agility, speed, lower/upper body power, anaerobic capacity, strength, aerobic power, and body composition assessments. Differences between groups were evaluated using independent samples t-tests, or Mann-Whitney U tests (p < 0.05). RESULTS: Operators demonstrated better performance in agility (4.85 ± 0.21 s, 5.04 ± 0.21 s; p=0.005), anaerobic capacity (190.58 ± 16.24 sec, 174.82 ± 18.11 yr; p=0.006), upper body power (185.03 ± 23.52 sec, 172.26 ± 27.39 sec; p=0.044), strength (2,932.85 ± 639.59 N, 2,443.75 ± 706.99 N; p=0.019), aerobic power (1,114.83 ± 66.12 yd, 1,033.7 ± 100.1 yd; p=0.001) and significantly lower body fat (17.63 ± 4.06 %BF, 21.01 ± 7.09 %BF; p=0.035). No significant differences were found in lower body power (p=0.069) and speed (p=0.051). CONCLUSION: Performance deficits in Support personnel during active deployment training could have deleterious effects on tactical training, leading to increased risk of injury and potentially effecting subsequent deployment status. The significant discrepancies in key performance outcomes suggest the need for Support personnel to incorporate additional performance training focused on improving overall strength, anaerobic and aerobic capacity, prior to unit training, in order to achieve adequate levels of operational preparedness, similar to their Operator counterparts.

For active duty United States Marines physical and combat fitness is essential to be battle-ready and is necessary for day-to-day effectiveness. To help instill habits of self-discipline and maintain physical and combat fitness the United States Marines Corps (USMC) have installed a Physical Fitness Test (PFT) to measure physical fitness levels and a Combat Fitness Test (CFT) to assess a Marine’s functional fitness as it relates to the demands and rigors of combat operations. The USMC PFT involves three events; pull-ups/push-ups (PU), two-minute timed abdominal crunches/sit-ups (AC), and a timed three-mile run (RUN). The USMC CFT also involves three events; Movement to Contact (MTC), two-minute timed Ammunition Lift (AL), and Maneuver-Under-Fire (MANUF). PURPOSE: The purpose of this study was to investigate relationships between PFT (PU, AC, and RUN) and CFT (MT, AL, and MANUF) scores assessed by active duty Marines. METHODS: The PFT and CFT scores from 19,678 active duty enlisted USMC males (age 22.5±1.3 years, height 1.77±0.07 m, body mass 79.4±10.3 kg) were analyzed. Pearson correlation coefficients (r) were calculated between the PFT and CFT total scores as well as individual events. RESULTS: The PFT mean±sd scores were as follows: PU=18.0±5.0 (pull-ups), AC=111.2±9.0 (repetitions), RUN=1377.0±131.4 sec. The PFT mean±sd scores were as follows: MTC=172.5±16.3 sec, AL=113.2±10.4 repetitions, MANUF=138.3±17.2 sec, CFT total=2716.6±25.6. Moderate significant (p=0.01) correlations were found between: the PFT total and MANUF (r=0.42), PFT total and CFT total (r=0.50), RUN and MTC (r=0.46), RUN and CFT total (r=0.43), & PU and CFT total (r=0.41). All other correlations between variables yielded “no to low” association. CONCLUSION: Within the parameters of this study, PFT and CFT event scores ranged from “no” to “moderate” correlations suggesting that different fitness aspects are being assessed and supports the need for both the PFT and CFT assessments.

1166 Board #292 May 27 1:30 PM - 3:00 PM
Pulmonary Capillary Blood Volume And Membrane Conductance In Iraq And Afghanistan Veterans With Deployment-related Exposures
Wei Qian, Jacquelyn Klein-Adams, Matthew A. Watson, Duncan S. Ndirangu, Thomas Alexander, Nancy A. Eager, Anays Sotolongo, Michael J. Falvo. FA NH Health Care System, East Orange, NJ. Email: wei.qian@va.gov

Purpose: We have previously observed an isolated reduction in diffusing capacity of the lung for carbon monoxide (DLCO) to be a common pulmonary function pattern among symptomatic Iraqi and Afghanistan Veterans. DLCO measurement reflects both alveolar capillary membrane diffusion (DmC) and pulmonary capillary blood volume (VC). Therefore, additional techniques (i.e., simultaneous measurement of diffusion of nitric oxide [DLNO]) are necessary to separately examine DmC and VC components. The purpose of this preliminary study is to evaluate the utility of the double-gas diffusion technique in Iraq/Afghanistan veterans to better understand the physiological basis of reduced DLCO. METHODS: 20 Iraqi Afghanistan non-smoking veterans (90% male; Age: 36.65 ± 7.3 years; BMI: 30.37 ± 3.8 kg/m²) volunteered for this study. Complete pulmonary function testing was performed, including the double-gas diffusion technique (DLCO/DLNO) and forced oscillation technique (FOT). Combined reference equation (DLCO, DmC, DM, VC) was used to calculate predicted and lower 2.5% percentile (LLN). FOT-derived frequency dependence of resistance (R4-R20) and reactance area (AX) were calculated...
Physiological Stress Response During Force-on-Force Training With Simunitions

Andrew E. Jensen1, Jake R. Bernards1, LT Adam T. Biggs2, Karen R. Kelly1. 1Naval Health Research Center, San Diego, CA. 2Naval Medical Research Unit - Dayton, Dayton, OH.

**PURPOSE:** Close-quarters combat (CQC) engagements activate the “fight-or-flight” response; which activates the sympathetic-nervous system (SNS) and hypothalamic-pituitary-adrenal (HPA) axis to respond to the perceived threats. Currently, the objective assessment of a force-on-force CQC environment on the physiological response has not been quantified, nor has it been shown whether training will impact the physiological response.

**METHODS:** United States Marines and Army infantry personnel (n = 24; 26.3 ± 0.3 yrs, 177.2 ± 0.3 cm, 85.4 ± 0.5 kg) participated in a 15-day CQC training program. The CQC program focused on increased lethality, including large amounts of force-on-force training with the use of simunitions. Data collections occurred on training Days 1 and 15, during a simulated force-on-force, hostage rescue scenario. Participants were instructed to clear the shoothouse, rescue the hostage, and only engage (shoot) hostile threat(s) with simunitions. Salivary alpha-amylase (sAA) and cortisol were obtained immediately prior to entering and exiting the shoothouse. A linear mixed model was used to determine the differences between time points and days.

**RESULTS:** There was a main effect of day for cortisol indicating that cortisol was higher on Day 15 compared to Day 1 (0.121 ± 0.075 vs 0.187 ± 0.075 µg/dL; p < 0.001). There were no main effect of time points for cortisol (p > 0.05); nor were there any interaction effects of day and time point for cortisol (p > 0.05). There was no main effect of day for sAA (p > 0.05); nor was there an interaction between day and time point for sAA (p > 0.05). Nevertheless, there was a time point effect for sAA indicating that post-scenario sAA was higher than pre-scenario sAA (168.25 ± 100.93 vs 118.95 ± 90.25 U/mL; p < 0.0007).

**CONCLUSIONS:** Cortisol increased stepwise across the pre- and post-scenario time points on Days 1 and 15; most likely indicative of the cumulative stress effects on the HPA axis. Conversely, sAA increased acutely in response to the stress of the hostage scenario, likely due to its association with norepinephrine and the acute SNS response. Despite training, there is still an increased SNS response during force-on-force drills; it remains to be seen if this response enhances or hinders performance in high-stress situations.
team cultures and experiences; however, these variables, as measured in this study, do not appear to impact their decision-making capabilities regardless of personal and professional background. There does not appear to be a need to develop specific initiatives for different types of ATCs. As such, it is important that educational initiatives focus on creating safer concussion-related attitudes and the need for appropriate decision-making of all ATCs.

Supported in part by a NATA Research and Education Foundation Doctoral Grant.

1170 Board #296 May 27 2:30 PM - 4:00 PM Changes On ImPACT And ClearEdge In Women’s Collegiate Soccer From Pre-season To Post-season
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Email: cvariott@nyit.edu
(No relevant relationships reported)

Sports are the second most common cause of mild traumatic brain injury (mTBI) in young adults. Even when the athlete does not sustain mTBI, he/she may sustain subconcussive impacts, which are of unknown significance. Purdue University conducted a study in which half of the football players who did not display symptoms of mTBI showed changes in brain function on by the middle of the season impeding their ability to learn. None of these players had symptoms of mTBI. Therefore, subconcussive impacts may lead to neurocognitive decline and changes in balance.

PURPOSE
We hypothesized athletes who received a higher quantity and magnitude of impacts throughout the season would have increased symptoms, neurocognitive, and balance scores from pre- to post-season, as shown by ImPACT and ClearEdge testing.

METHODS
We examined 14 NCAA Division II Collegiate Women’s soccer players at pre- and post-season using ImPACT and ClearEdge. Both tests assess neurocognitive function, and ClearEdge also examines balance. Subjects wore an accelerometer in their headband to record number and magnitude of impacts during all full contact practices and games throughout the season.

RESULTS
The data was analyzed by comparing the athletes’ mean scores on ImPACT and ClearEdge testing and correlated with number of impacts, cumulative impact, and rotational movement scores from pre- to post-season, as shown by ImPACT and ClearEdge testing. Both tests assess neurocognitive function, and ClearEdge also examines balance. Subjects wore an accelerometer in their headband to record number and magnitude of impacts during all full contact practices and games throughout the season.

CONCLUSIONS
Neurocognitive and stability measures improved throughout the season on ImPACT and ClearEdge testing. These results do not support our hypothesis. The data could not be correlated accelerometer data, possibly due to an issue with compliance. The results of this study suggest further investigation in subsequent seasons is warranted.

1171 Board #297 May 27 2:30 PM - 4:00 PM Rugby Union Concussions-recognition And Rugby Union Concussions-recognition Andreremoves Do We Over-call Suspected Concussions?
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(No relevant relationships reported)

PURPOSE: To determine if the World Rugby (WR) management guidelines of recognition and remove suspected concussions could lead to over-recognition of suspected concussions.

METHODS: A retrospective analysis of head injuries in a cohort of Stellenbosch University collegiate rugby players (n = 407), age (mean ± SD; 24.6±4.3), height (mean ± SD; 1.83±0.07), weight (mean ± SD; 90.7±14.4) and BMI (mean ± SD; 26.5±5.7) for the period 2014-2018. All 407 players were removed from the field of play upon suspicion of a concussion according to World Rugby’s “recognize and remove” guidelines. Indicators that a player might be concussioned on the “recognize and remove” guidelines include seizure, loss of consciousness, confused, dazed, balance problems and behavioral changes. Each of the players with a suspected concussion returned for a clinical assessment performed using the Sports Concussion Assessment Tool (SCAT-3) (n = 362) and/or SCAT-5 (n = 45) within 48 hours and was subsequently clinically diagnosed with or without a concussion by a qualified medical doctor. The SCAT questionnaire includes questions on red flags, mechanism of injury, symptom severity, cognitive and physical-education, and neck examination, balance, and standardized assessment of concussion (SAC) delayed recall and concussion injury advice. Out of the 407 suspected concussions, 90% were confirmed clinically within a 48 hours period, while 10% of suspected concussions were not clinically confirmed as a concussion. In addition, of the reported mechanism of injury (n = 300) the tackle was reported as the main mechanism of injury, accounting for over 70% of all concussions.

CONCLUSIONS: It appears that World Rugby’s “recognize and remove” guidelines is accurate in the eventual diagnosis of concussion. Therefore, we are not “over-calling” concussions in collegiate rugby in Stellenbosch. There is also a greater understanding by collegiate rugby medical staff as to how to diagnose and recognize concussion.

1172 Board #298 May 27 2:30 PM - 4:00 PM Randomized Controlled Trial (RCT) Of A Precision Vestibular Treatment In Adolescent Athletes Following Sport-related Concussion
Anthony P. Kontos, Shawn Eagle, Anne Mucha, Nicholas Blaney, Cyndi Holland, David Okonkwo, Michael W. Collins. University of Pittsburgh, Pittsburgh, PA. (Sponsor: Bradley Nindl, FACSM)
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Reported Relationships: A. P. Kontos: Royalty; Royalties from APA Books. Industry contracted research; Research contract from the NFL through the University of Pittsburgh.

Concussion care continues to evolve to incorporate more active treatments such as prescribed exercise (Leddy et al., 2019) and vestibular therapy (Broglio et al., 2015). Consensus statements advocate for randomized controlled trials (RCT) to determine the effectiveness of treatments. To date, there has been no RCT of precision vestibular treatment in athletes following sport-related concussion (SRC) with vestibular symptoms/impaired. PURPOSE: To determine using an RCT the effectiveness of precision, vestibular treatment compared to standard of care for reducing recovery time, symptoms, and impairment in adolescent athletes with vestibular symptoms/impaired following SRC. METHODS: This study involved an RCT in 50 adolescent athletes with a diagnosed SRC with vestibular symptoms/impaired within 10 days of injury. Participants were randomized to vestibular treatment (i.e., gaze stability, visual motion habituation, dysarthric balance, gait) (VEST) or control (i.e., behavioral management) (CTRL), and completed the Dizziness Handicap Inventory (DHI), Modified Balance Error Scoring System (mBESS), Vestibular/Ocular Motor Screening (VOMS), Post-concussion Symptom Scale (PCSS), Immediate Post-concussion Assessment and Cognitive Testing (ImPACT) at enrollment and 2- and 4-weeks post-enrollment. Recovery time was recorded using time of medical clearance for full return to activity. Compliance was monitored using daily text messaging. RESULTS: Groups were similar on demographics, initial injury characteristics/severity, and risk factors (all p > .05). mBESS total scores for VEST (1.5) improved more from enrollment to 2-weeks than CONTROLS (0.3) (p=.04). VESTIB was 8.6x (95%CI: 1.2 - 20.2) more likely to be recovered by 4-weeks than CONTROLS (p=.01). Survival analysis indicated that recovery for VEST (45 days) was significantly (p=.04) faster than CONTROLS (57 days). CONCLUSION: The current study provides the first RCT empirical evidence to support the effectiveness of a precision vestibular treatment in adolescent athletes following SRC. Future research should focus on determining the most effective frequency, intensity, and timing for vestibular precision treatments following SRC. Supported by a grant from the Chuck Noll Foundation.

1173 Board #299 May 27 2:30 PM - 4:00 PM Oculomotor Fatigue Is Present In Some Adolescent Student-athletes Following Sport-related Concussion
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(No relevant relationships reported)

Upwards of 70% of adolescent concussion patients present with visual dysfunction. Total time on the King-Devick (K-D) Test or average distance on the near point of convergence (NPC) test contributes to clinical decision-making. However, performance deterioration across multiple trials or cards has not been previously reported and may require consideration for a targeted rehabilitation program.

PURPOSE: To determine if oculomotor fatigue (OMF) was present following a sport-related concussion (SRC) in adolescent athletes following SRC.

METHODS: 121 Student-athletes (15.3 ± 1.4 years, 51 Female/70 Male) were administered Cards 1-3 of the K-D and then three vestibular precision treatments following a sport-related concussion (SRC). Supported in part by a NATA Research and Education Foundation Doctoral Grant.

Supported in part by a NATA Research and Education Foundation Doctoral Grant.

Reported Relationships: A.P. Kontos: Royalty; Royalties from APA Books. Industry contracted research; Research contract from the NFL through the University of Pittsburgh.
A novel dynamic exertion test (EXiT) that incorporates ACSM exercise prescription recommendations to replicate physiological assessment to better inform RTP decisions. A matched control (CON) group was defined as athletes who did not sustain a concussion between 2014 and 2018. Players were excluded if they played less than five games pre-injury, or if they did not return to play within four weeks post-injury. The association between concussion history, contact sport participation, and BSI-18 score was examined using linear regression models clustered on study site using generalized estimating equations (a priori \( \alpha \leq 0.05 \)).

**RESULTS**: Analysis included 145 participants with complete predictor, outcome, and covariate data (45 females [30.8%]; median age = 18 years [IQR: 18-20]; 66 [45.5%] with 1+ prior concussions; 121 [83.4%]) played a contact sport). Concussion history, when adjusting for all covariates was not statistically associated with BSI-18 change score (p>0.05). Participants in non-contact sports (6 [6.8%]) compared to contact sport participants (2.1+1.7 reported a greater BSI-18 change score (Adjusted Mean Difference = 3.1, 95%CI: 0.9, 5.4; p=.006).

**CONCLUSIONS**: These data suggest individuals participating in non-contact sports may have greater increases in reported post-concussion psychological distress. These findings highlight psychological distress measures as an important consideration in concussion management. Participants in contact sports may respond to concussion differently than those in non-contact sports. Future research should investigate how this relates to overall quality of life post-concussion.

Supported by a grant from the National Football League
results suggest player performance is not significantly affected up to 28-days post- concussion as compared to their pre-injury measures. Because we chose to compare 28-days later and after one full year evaluations. The high correlation suggests that KD testing has adequate reliability for use as a diagnostic test. Of note, 5 players had slower times despite not having a history of concussion during the previous year. It may not be useful when establishing baseline test results in players with learning disabilities due to the considerable variation from KD1 to KD2 in player we evaluated. Further studies need to be done with professional soccer athletes in order to establish quick and efficient methods of diagnosis and management of concussion.

**PURPOSE:**

The goal of this study was to examine the differences between medical and school-based Speech-Language Pathologists (SLP) knowledge, experience, and competence in pediatric concussion.

**METHODS:**

A 34-question, anonymous web-based survey was sent to school and medically-based, practicing SLPs in the United States. Portions of the survey were adapted with permission from a preliminary study by Duff and Stuck (2015) which focused on pediatric concussion knowledge of school-based SLPs. The instrument consisted of six broad topics: demographics, concussion knowledge, referral, assessment, treatment, and clinical experience. Participants were recruited in three ways: (1) via posting the on-line message board for the American Speech-Language Hearing Association; (2) sent to regional SLP associations or (3) via the “snowball” recruitment method. Descriptive statistics were used to analyze the data in SPSS.

**RESULTS:**

The survey had 48 responses (46 females and 2 males). Of the responders, 85% possessed a master’s degree and 15% hold a doctoral degree (PhD or SLPD). Out of the 12 questions regarding concussion knowledge, SLPs had about an 85% correct response rate. Exceptions to this high accuracy were found regarding knowledge of minor concussion symptoms resolving in 14 days and injury to the brain occurring at the instant of contact. SLPs were noted to receive most of their concussion referrals from physicians (25%). 96% of SLPs agreed it was within their scope of practice to provide therapy to a concussed individual. However, 73% of these clinicians have never been involved in the assessment of pediatric concussion cases. In addition, only 50% received TBI education in school.

**CONCLUSIONS:**

Concussion is an international public health concern that continues to receive increasing attention. A common theme of the results we reviewed suggests a recent interest in highlighting the value of SLPs in concussion care, although their role is not yet well understood. Results showed that both medical and school-based SLPs who work in concussion care are generally knowledgeable despite the vague guidelines for SLPs in concussion management. In order to further prepare SLPs for their role in concussion care, guidelines need to be developed to consistently incorporate concussion education in SLP graduate programs.

There is a need for a reliable and quick method to help screen for concussions in professional soccer. The last 2014 and 2018 FIFA World Cups have demonstrated that concussions during soccer matches pose a challenge for team physicians to diagnose and treat in a timely manner. King Devick (KD) is a rapid sideline screening test used for concussion diagnosis that relies on individual’s baseline measurement.

**Purpose:**

To assess the test re-test reliability of the KD test in a cohort of professional soccer athletes.

**Methods:**

24 professional soccer players from a Mexican First Division Professional Soccer League (Liga MX) team were evaluated. A baseline KD test as well as a SCAT3 Test was conducted before the 2017 season. The tests were repeated 1 year later as a baseline for 2018 season. 10 players transferred to other clubs during the first year were excluded from data analysis. 14 remaining athletes were included in the data analysis. Correlations of year on year KD and SCAT3 measures of individuals were assessed. Statistical analyses were performed with IBM SPSS.

**Results:**

Mean KD baseline test time for 2017 (KD1) = 41.71 seconds and for 2018 (KD2) = 41.66 seconds. KD1 and KD2 were strongly and positively correlated (0.93, p value <0.001). 1 player was evaluated for concussion during the season (KD1 = 41.75, KD2 after trauma = 44.26, KD2 = 41.46). 4 players had slowing of KD2 without having history of concussion during the previous year. 1 player with a self-declared learning disability had significantly slower KD time in follow up test (KD1 = 69.4s, KD2 = 77s). 2017 and 2018 SCAT3 demonstrated positive and significant correlation for balance scores (0.601, p = 0.023), and delayed recall scores (0.596, p = 0.024).

**Conclusion:**

Mean KD baseline test results showed a significant correlation between first and second year evaluations. The high correlation suggests that KD testing has adequate reliability for use as a diagnostic test. Of note, 5 players had slower times despite not having a history of concussion during the previous year. It may not be useful when establishing baseline test results in players with learning disabilities due to the considerable variation from KD1 to KD2 in player we evaluated. Further studies need to be done with professional soccer athletes in order to establish quick and efficient methods of diagnosis and management of concussion.

**PURPOSE:**

To document the prevalence of symptom exacerbation following CNT in concussed athletes and 2) explore factors that may predict symptom increases associated with the completion of CNT.

**METHODS:**

Two hundred and five concussed athletes (M = 16.48 ± 1.97 yrs; 47% female) completed a standard clinical visit that included a health and injury history, CNT (The Immediate Post-concussion Assessment and Cognitive Testing: ImPACT), Post-Concussion Symptom Scale (PCSS), and the Vestibular and Ocular-motor Scale (VOMS) within 30 days of injury (M = 7.73 ± 5.54 days). The PCSS was administered immediately before and after CNT, and changes on symptom total were used as outcome scores. To account for normal variation in symptom reporting, minimal clinically important differences (MCID) were calculated from the current sample. Two logistic regressions (LR) were used to explore the association between demographic (age, sex, history of SRC, migraine, anxiety, LD, ADHD) and injury-related factors that included vestibular/ocuular motor impairment, symptom burden, time until first clinical visit, and removal from play status on post-CNT symptom exacerbation. Statistical significance was set at p < .05.

**RESULTS:**

Approximately 33% (68/205) of concussed athletes exhibited clinically significant increases in total PCSS symptoms after CNT. The LR examining demographic variables and post-CNT symptom exacerbation was not significant (χ²(7, 203) = 2.62, p = .92), however the LR using injury-related predictors was significant (χ²(7, 195) = 17.29, p = .02). More specifically, a significant relationship between the ocular component of the VOMS and symptom exacerbation was revealed (adjusted OR=0.43, p=.04).

**CONCLUSIONS:**

The majority of the sample did not exhibit increased symptoms following CNT; however, the participants that do experience increases in post-concussion symptoms after completing CNT are more likely to have a co-morbid ocular impairment associated with their concussion. Clinicians should examine pre and post CNT symptom scores.

Current concussion assessment protocols rely on clinical functioning and thus may not be sensitive to underlying neural deficits. PURPOSE: The purpose of this study was to measure hemodynamic response changes using functional near-infrared spectroscopy (fNIRS) in asymptomatic, post-concussion participants (CON) compared to healthy controls (CTL). METHODS: CON participants (n=9, age=18.44±1.51 years, sex=66% female) diagnosed with a concussion at a Midwestern emergency department were recruited from 2018-2019. CTL participants (n=22, age=23.63±4.55 years, sex=54% female) were recruited through electronic postings and classroom announcements. During the first study visit, participants completed a demographics questionnaire, pain
and symptom severity scores, and an attention task. Participants were then fitted for a silicon headband with two fNIRS diode arrays consisting of eight emitters and ten detectors over each hemisphere’s temporal and frontal cortices, superior and middle temporal regions and the parietal cortex. The computerized behavioral attention task consisted of 144 trials spread over six 24-trial task blocks. Mean accuracy (%) and reaction times (s) were recorded, while the fNIRS device measured hemoglobin response. After the first visit, participants were monitored daily for symptom resolution, and a second lab visit once symptom count and severity scores reached normative baseline values. Behavioral and neuroimaging fNIRS data from the attention task were analyzed using independent t-tests, with alpha levels set to p<0.05.

RESULTS: Once asymptomatic, attention task analyses yielded no significant differences between CON and CTL groups for both mean reaction time (0.003±0.040s, p=0.953) and accuracy (-0.50±0.40%, p=0.47). Analysis of fNIRS data indicated hyperactivity in the pre-frontal cortex, temporal lobe and frontotemporal region of the CON group’s left hemisphere compared to the CTL group (p<0.05, false discovery rate corrected).

CONCLUSIONS: Our results suggest post-concussion participants may require additional cognitive resources during attentional tasks in order to maintain normative vigilance. Researchers should continue to evaluate hemodynamic changes, and how these effects may influence making a safe return to activity decision.

Board #307 May 27 2:30 PM - 4:00 PM
Whole-body Reactive Agility Testing Reveals Modifiable Impairments Among Elite Athletes With Sport-related Concussion History
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Purpose: To examine the level of trait anxiety in concussed athletes throughout recovery compared to healthy controls.

Methods: Eighty-five high school and college-aged individuals (concussed [Cx]: age = 18.56 ± 2.55 years; healthy controls [HC]: age = 18.10 ± 2.56 years) were enrolled. The State Trait Anxiety Inventory (STAI) measures trait anxiety using a 20-item inventory scored on a 4-point Likert scale (score range: 20-80), where higher scores indicate a greater level of trait anxiety. All concussed participants were administered the STAI within 72 hours of injury (day 0), 5 days post-injury (day 5), and at the time they received full medical clearance (FMC). Healthy controls were tested at similar time points. A 2 x 3 repeated measures analysis of variance was used to compare the level of trait anxiety between each group across recovery. A prior p value was set at 0.05.

RESULTS: There was no significant group x time interaction (F(2,78) = 1.20, p = 0.31). Although, significant main effects for time (F(2,78) = 29.10, p < 0.001, ηp² = 0.26) and group (F(1,39) = 29.10, p = 0.02, ηp² = 0.47) were observed. Specifically, scores decreased across time (day 0: Cx = 38.81 ± 11.17, HC = 32.74 ± 10.00; day 5: Cx = 36.95 ± 11.83, HC = 31.24 ± 10.23; FMC: Cx = 34.65 ± 11.37, HC = 29.98 ± 9.05), and concussed athletes had higher trait anxiety (Cx = 36.81, SE = 1.61; HC = 31.32, SE = 1.63).

CONCLUSIONS: Concussed participants experienced the highest levels of trait anxiety at day 0 and declined as recovery progressed. This indicates that initial post-injury anxiety may be a result of increased trait anxiety. Healthcare professionals should be aware of concussed individuals may be more susceptible to anxiety immediately following injury which could negatively influence recovery outcomes.

Board #308 May 27 2:30 PM - 4:00 PM
Between Trial Reliability Of The King Devick Test In Male High School Athletes
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Purpose: The purpose of this study was to determine if concussion history has an impact on sway velocity. A concussion injury can disrupt proper functioning of the vestibular system, and chronic disruption of this system can increase the chances of subsequent musculoskeletal or concussive injury. Athletes with a history of concussion injury who present with balance deficits, should be targeted for interventions to decrease the risk of sustaining a musculoskeletal or concussive injury.

Methods: 175 healthy Division I football & men’s lacrosse players (age = 19.8 ± 1.2; ht = 71.9 ± 2.2”; wt = 202.1 ± 33.9 lbs) participated in this study. Players were provided with a brief, 1-on-1, concussion discussion and then answered the questions “have you ever sustained a concussion? If yes, how many?” All players underwent a appropriate medical-treatment protocols. PURPOSE: To determine the between-trial reliability of the King-Devick Test (KD) as part of a pre-season concussion-safety program in young, male high-school athletes. METHODS: KD baseline score data from high-school, male athletes (n = 377, aged 16 ± 1 years) were recorded on electronic tablets and later analyzed. The testing required participants to complete two, error-free trials, which were reported to the nearest 0.0 s. For both trials, descriptive data were reported, mean differences were examined via paired-samples t-tests, Cohn’s d effect sizes were considered, and two-way mixed-effects intraclass correlations (ICC) were implemented. RESULTS: The KD test showed strong reliability between trials (Trail 1 = 56.0 ± 15.2; Trail 2 = 53.3 ± 13.8 s; single-measure ICC = 0.93; 95% CI 0.91 - 0.94). Furthermore, similar reliability was observed when KD scores were grouped by Best score and Worst score (Best = 52.8 ± 13.6 s; Worst = 57.6 ± 15.3 s; single-measure ICC = 0.95; 95% CI 0.94 - 0.96). Paired-samples t-test identified small-differences between both pairings (Trail 1 vs Trail 2, p < 0.001, d = 0.25; Best vs. Worst, p < 0.001, d = 0.33). Most participants (78.5%) reported their Best score on Trial 2. CONCLUSIONS: The KD test showed excellent reliability between trials in this population of young-male athletes. However, additional research is warranted with respect to how many valid baseline attempts are needed to acquire a stable KD best score to best support safe-monitoring practices.
balance assessment as part of their preseason screening and were medically cleared to participate in sports. Players performed the BESS test (double leg, single leg, & tandem) on firm & foam surfaces while standing on the VSR Sport™ force plate by NeuroCom®. Results: No difference was found between those with and without a previous concussion injury on any of the instrumented BESS stances (Table 1). To further analyze the data, a Spearman Rho correlation determined there was a smaller than typical correlation between number of concussions sustained and sway velocity measurements; double leg firm (r = -0.02), single leg firm (r = -0.09), tandem firm (r = -0.08), double leg foam (r = 0.01), single leg foam (r = 0.01), tandem foam (r = -0.02), & composite (r = -0.06).

Conclusion: Concussion history does not appear to have an impact on sway velocity measurements in contact sport athletes. The vestibulospinal system may be resilient to long-term deficits associated with concussion injury. In the absence of individualized baseline data, normative data may be used to determine balance deficits in those with a suspected concussion, regardless of previous concussion history.

### Table 1: Correlation of Number of Concussions and sway velocity measurements

<table>
<thead>
<tr>
<th>Stance</th>
<th>Mean ± SD</th>
<th>p Value</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>(+) Concussion Hx</td>
<td>(-) Concussion Hx</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double Leg, Firm</td>
<td>0.69 ± 0.20</td>
<td>0.69 ± 0.18</td>
<td>0.924</td>
</tr>
<tr>
<td>Single Leg, Firm</td>
<td>2.31 ± 1.28</td>
<td>2.55 ± 1.45</td>
<td>0.243</td>
</tr>
<tr>
<td>Tandem, Firm</td>
<td>1.67 ± 1.19</td>
<td>1.81 ± 1.35</td>
<td>0.444</td>
</tr>
<tr>
<td>Double Leg, Foam</td>
<td>1.85 ± 0.46</td>
<td>1.86 ± 0.53</td>
<td>0.878</td>
</tr>
<tr>
<td>Single Leg, Foam</td>
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<tr>
<td>Tandem, Foam</td>
<td>5.02 ± 3.42</td>
<td>4.93 ± 3.14</td>
<td>0.863</td>
</tr>
<tr>
<td>Composite Score</td>
<td>2.80 ± 0.97</td>
<td>2.86 ± 0.94</td>
<td>0.710</td>
</tr>
</tbody>
</table>

Professional football players, especially linemen are at increased risk for early Metabolic Syndrome (MetS) leading to cardiovascular disease and death. There are no longitudinal studies examining MetS to determine if risk factors are present during college and if the risk factors change over time. PURPOSE: The purpose of this longitudinal study was to follow MetS risk factors in Division 1-FCS players over three years. MetS is defined by the NCEP ATP III standards. METHODS: Players were tested at the fall prior to the start of each season. Of the players tested the first fall, eight players completed all tests every year of the study. Testing included waist circumference (WC), systolic blood pressure (SBP), diastolic blood pressure (DBP), fasting blood glucose (BG), high density lipoprotein (HDL), and triglycerides (TG). Descriptive statistics and comparisons were analyzed. A repeated measures ANOVA was used to compare the means of each dependent variable across the three years. A Bonferroni correction was used to adjust for multiple comparisons. RESULTS: One participant met the criteria for MetS during all three years with the same risk factors, low HDL, elevated TG and WC. Another participant met the MetS criteria during the second year (low HDL, elevated TG and WC), but not during the first and third years. Both players were offensive linemen. There were no significant differences in SBP, DBP, BG or HDL across the three years. There was a significant difference in TG over time (F[1,122, 7,852] = 6.355, p = .034). Pairwise comparisons indicated a significant difference between year one-two, one-three, and two-three (p = .001, p = .001, p = .05; respectively). CONCLUSIONS: These findings suggest that nonskilled football positions have a higher incidence of MetS risk factors. Additionally, TG varied across the three years, indicating that nutrition may be a primary influencing factor as players maintain fitness training year-round. A primary limitation of this study was the small sample size based on players completing testing all three years. Pre-season evaluation for early detection of MetS with follow up for early intervention is recommended. Further research should explore the nutrition practices of collegiate football players.
The Female Athlete Triad is a pervasive, multifactorial morbidity among college athletes. The geographic disparity of female athlete triad awareness and access to resources in NCAA is unknown. PURPOSE: To determine geographic disparities in awareness of Triad components and resource access in the National Collegiate Athletic Association (NCAA).

METHODS: Division I-III NCAA compliance officers were sent an email containing a consent statement, and the IRB-approved survey tool. Respondents were grouped dependent on adherence to inhaler therapy (Non-adherent = EVH1→EVH2; n=15; adherent = EVH1→EVH2; n=15). The purpose of this study was to determine how to accurately measure breathing reserve in fit individuals, like athletes, during a cardiopulmonary exercise test (CPET). METHODS: Using prospectively collected information, CPET data from over 1,200 patients was analyzed to refine breathing reserve estimates in fit individuals. Results: A third of fit individuals (33%) are labeled with abnormal breathing reserve without overt lung disease as compared to the general population (4.6%). This finding is likely due to the fact that fit individuals achieve a significantly greater ventilatory change and implement appropriate periodization techniques and nutritional strategies to avoid overtraining these performing artists.

Three-dimensional (3D) infrared scanners, which estimate body composition via measurements of circumference, are gaining popularity. Since participants rotate 360° on a scale in front of a full-length mirror, visual changes in body shape are quickly assessed while numerical values are generated. PURPOSE: The aim of this study is to compare total body fat percentage (BF%) in participants using both the 3D-infrared and dual energy x-ray absorptiometry (DXA) scanner. METHOD: NON-pregnant individuals were invited to participate in total body composition measurements using both the 3D-infrared and DXA scanners within the laboratory. Participants wore the same compression clothing and scanned within 30 minutes of each other. After height and weight were obtained, a whole body DXA scan was performed and analyzed by trained technicians. For the 3D-infrared scan, participants stood on a rotating scale in a standardized position in front of a full-length mirror. Data are expressed as mean±SD, with significance set at p<0.05. RESULTS: Seventy participants (4 females; age=21±5.5 years; weight=96±21kg; height=1.80±0.07m) successfully completed both scans, in a randomized order. Significant difference was noted between the DXA vs. 3D-infrared scans in BF% (23.7±5.1 vs. 19.5±4.6%; p<0.0001). A significant positive correlation was noted between the DXA versus 3D-infrared scan for BF% (r=0.93;p<0.0001). However, the slope of the regression line was not in agreement with the line of identity, with the 3D-infrared scanner underestimating BF% at low levels (<30%) while overestimating BF% at high levels of BF%. The mean difference (Bland-Altman) was 4.2%, with the limits of agreement (LOA) between -4.3% to 12.7%. CONCLUSION: Although the correlation between the 3D-infrared versus DXA scan for BF% was high (87% of variance), the underestimation of BF% is often found to be abnormal (<10% or negative) and are typically attributed to enhanced effort and a desire to achieve peak performance.

Eupanic voluntary hypopneoa (EVH) challenges can provide objective evidence to support the diagnosis and long term management of athletes exercise-induced-bronchoconstriction (EIB). However, the repeatability of the EVH challenge has been questioned. PURPOSE: To investigate the use of EVH challenges to objectively monitor the long-term management of elite swimmers with EIB. METHODS: Twenty-seven elite-international swimmers (14 males, 13 females; 20±2yrs) completed EVH challenges, separated by a calendar year. Following initial assessment, EVHmax, athletes were prescribed appropriate inhaler therapy in accordance to greatest fall in FEV1 (FEV1max) and asked to maintain therapy throughout the year. Athletes were grouped dependent on adherence to inhaler therapy (Non-adherent = EVH1→EVH2; n=15; adherent = EVH1→EVH2 n=12). Differences between screening visits were analysed using paired sample t-tests and presented as mean ± SD. The test-retest repeatability between EVH1 and EVH2 was expressed as mean bias with 95% limits of agreement (LOA) and Pearson’s correlation coefficient (r).

RESULTS: Non-adherent athletes had significantly lower in EVH1max (–11.8±–3.8%) than EVH2max (–24.0±–11.3%; p<0.01). Baseline FEV1 was greater in EVH2max than EVH1max (p=0.04). EVF1max in the EVH2max group did not differ significantly between screening visits (EVH1max→EVH2max: 13.1±4.6% and EVH2max→EVH2max: 12.3±5.6%; p=0.32). There was agreement between FEV1max in EVH1max→EVH2max (mean bias 0.6%, 95% LOA –5.9–7.1), and significant strong positive correlation (r=0.813, p<0.001). CONCLUSION: Elite swimmers with EIB adherent to inhaler therapy increased baseline FEV1 and reduced FEV1 fall post-EVH. The EVH challenge demonstrated acceptable long-term test-retest repeatability in elite swimmers. EVH challenge is clinically useful to assess elite swimmers for EIB, and as a follow-up assessment to evaluate the effectiveness of inhaler therapy.
In 2017, the Center for Disease Control reported 2.3 million new cases of sexually transmitted diseases in the United States. Specifically, in sports medicine, collegiate student-athletes (SA) are considered an at-risk population due to the risk-taking behaviors associated with athletics.

**Purpose:** To describe birth control (BC) methods used by female and male collegiate SA.

**Methods:** As part of a larger 5-year study, collegiate SA (n=862; females: n=552; males: n=310; 17-23 years old) from a NCAA Division I institution completed a web-based survey containing a 30-item tool exploring sexual health behaviors. Partial data was used for all descriptive analyses.

**Results:** Over half (n=314, 57.4%) of females reported currently taking oral contraceptives or female hormones prescribed mostly for irregular menses (n=78, 14.3%) or pregnancy control (n=106, 20.3%). Participants reported having vaginal sexual activity (females =172, 36.8%; males=143, 59.1%), oral (females=191, 40.2%; males=155, 63.3%), and anal intercourse (females=11, 1.1%; males=6, 2.7%) in the past 30 days. Interestingly, many participants reported never using condoms or other protective barriers during oral sex (n=490, 82.1%) or anal sex (n=376, 78.3%) sex; however, 33.3% of participants (n=203) stated they always used protection for vaginal intercourse. When exploring their most recent sexual encounter, 60.2% (n=429) of participants reported using a form of BC to prevent pregnancy. The most frequent types of BC included oral contraceptive pills (n=345), male condom (n=327), and “pull out” (n=152). Finally, 10.7% (n=77) of participants reported using emergency contraceptives. Despite the lack of consistent BC use, only 2 individuals reported a pregnancy in the last 12 months, both unintentionally.

**Conclusions:** Participants reported using oral contraception to prevent pregnancy, but mainly for menstrual dysfunctions. Female SA should be educated on all their BC options as it can affect sport performance. While many of the participants are engaging in sexual activity, the use of protective barrier is less for oral and anal intercourse which could be due to sexual education in the United States. However, the infrequent use of protective barriers, regardless of intercourse type, does pose a threat to a SA health for sexually transmitted infections.

**Purpose:** Gastrointestinal (GI) disorders like irritable bowel syndrome and functional dyspepsia are more common in people with sleep problems. No research, however, has examined the relationships between sleep problems and GI disturbances in endurance athletes, particularly symptoms that occur during competition.

**Methods:** A total of 73 participants (27 men, 46 women; 39.2 ± 11.0 years) completed the Medical Outcomes Study Sleep Scale (MOSSS) and reported the amount of time (min) they slept the night before the race. In addition, participants reported the severity (0-10 scale) of four upper (nausea, regurgitation/reflux, fullness, bloating) and three lower (abdominal cramps, flatulence, urge to defecate) GI symptoms experienced during the races. Individual symptom scores were added together to obtain overall, upper, and lower GI symptom scores. Spearman’s rank-order correlations were used to examine whether scores on the female Enjoyment of Sexual Activity (FESA) and the MOSSS were associated with GI symptom scores. Partial correlations were also calculated to control for age, gender, body mass index, race duration, and trait anxiety levels.

**Results:** There were significant correlations between scores on the SPI-I and total GI symptom scores (r = -0.24, p = 0.045) as well as upper GI symptom scores (r = 0.30, p = 0.001). Lower GI symptoms were not significantly correlated with SPI-I scores (r = 0.14, p = 0.135). Only the correlation between upper GI symptoms and SPI-I scores remained significant (r = 0.24, p = 0.049) after controlling for age, gender, body mass index, race duration, and trait anxiety levels. Sleep duration from the night before the race was not significantly correlated with any of the GI-symptom variables.

**Conclusions:** These results suggest that chronic sleep problems, but not acute pre-event sleep duration, is modestly associated with the severity of upper GI symptoms during endurance races.
Board #322 May 27 2:30 PM - 4:00 PM
Effects Of Aerobic Exercise On Leptin, Sex Hormone In Rats With Polycystic Ovary Syndrome
Na Li, Pengyuan Liao, Menting Wang, Jing Li. Chengdu Sport University, Chengdu, China.

PurPOSE: To investigate the influence of aerobic exercise in rats with polycystic ovary syndrome (PCOS).

METHODS: 32 23-day-old SD female rats were randomly assigned into 4 groups, i.e. normal control group (NC, n=8), exercise control group (EC, n=8), PCOS control group (PC, n=8) and PCOS exercise group (PE, n=8). PC group and PE group were modeled by injecting DHEA. EC group and PE group simultaneously implemented Masashi exercise intervention (unloaded free swimming, 20 min/time, 6 days/week for 15 d). Measure the serum testosterone (T), estradiol (E), follicle-stimulating hormone (FSH) and leptin (LP) of rats by ELISA. Observe ovarian histological changes through the hematoxylin-eosin stain, the P450arom expression (optical density, OD) in ovarian by immunohistochemistry.

RESULTS: There were obvious cystic dilated follicles in the ovarian tissue of the PC group, and compared with the, there are many normal follicles in the ovary of the PE group. The PC group exhibited a higher serum level of FSH, T, E2 and the P450arom expression in ovarian than NC group (P < 0.05). Compare with the PC group, the serum level of LP, T, E2 were decreased in the PE group (P > 0.05). However, compared with the NC group, the EC group showed no difference in the serum level of FSH, T, E2, and the P450arom expression in ovarian (P > 0.05). Besides, the PE and PC group showed no difference in the serum level of FSH and the P450arom expression in ovarian (P > 0.05). The serum LP level in rats was positively correlated with T (r=0.893), E2 (r=0.612) and the P450arom expression(r=0.612), FSH (r=0.620) level and the P450arom expression(r=0.501) in ovarian.

CONCLUSION: Aerobic exercise can reduce the LP levels of PCOS rats, relieve leptin resistance, alleviate estrogen hyperstimulation and abnormal P450arom expression in ovarian, but cannot eliminate the sex hormone disorder.

The Changes of T, FSH, E2, LP, and OD among 4 groups(x±SD)

<table>
<thead>
<tr>
<th>Group</th>
<th>Sample</th>
<th>FSH (mIU/mL)</th>
<th>T (pg/mL)</th>
<th>E2 (pmol/mL)</th>
<th>LP (ng/mL)</th>
<th>OD</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC</td>
<td>8</td>
<td>3.349±0.421</td>
<td>26.50±0.856</td>
<td>4.41±0.234</td>
<td>2.23±0.069</td>
<td>0.181±0.0036</td>
</tr>
<tr>
<td>EC</td>
<td>8</td>
<td>3.13±0.272</td>
<td>25.82±0.603</td>
<td>4.60±0.421</td>
<td>1.91±0.005</td>
<td>0.182±0.0073</td>
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<tr>
<td>PC</td>
<td>8</td>
<td>4.25±0.591</td>
<td>31.54±0.725</td>
<td>5.58±0.175</td>
<td>3.44±0.63</td>
<td>0.192±0.0090</td>
</tr>
<tr>
<td>PE</td>
<td>8</td>
<td>4.10±0.056</td>
<td>29.46±0.893</td>
<td>4.89±0.487</td>
<td>2.47±0.002</td>
<td>0.186±0.0074</td>
</tr>
</tbody>
</table>

*P < 0.05, compared to NC; **P < 0.05, compared to PC

Board #324 May 27 1:30 PM - 3:00 PM
Exercise Medicine On Campus (EIM-OC): State Of the Literature
Rene Jeffreys Heil1, Neil E. Peterson2, Connie L. Tompkins3, Megan Rothermel4, Shelby Mandla5, Zainab Shirazi2, Robyn Stuhrl, Carena winters, FACSM1. FMB Wellness Project, FORT MYERS BEACH, FL. 2Brigham Young University, Provo, UT. 3University of Vermont, Burlington, VT. 4Delaware State University, Dover, DE. 5University of Illinois at Chicago, Chicago, IL. 6Jacksonville University, Jacksonville, FL. (Sponsor: Carena winters, FACSM)

Email: fmbwellnessproject@gmail.com

Purpose: To explore the state of EIM-OC and research projects, the EIM-OC committee members have undertaken a meta-analysis and systematic review of the EIM-OC literature. Methods: Data was collected using multiple methodologies to ensure a complete capture of the work in this area. This included an email to EIM-OC registered schools to request publication, poster, and oral presentations titles, dates, and authors. As well as to ACSM journal and meeting coordinators to review published and unpublished abstracts. Members of the writing team performed independent literature searches across 10 databases using defined keywords (“Exercise is Medicine” or EIM and campus* OR University* OR college N=20 OR academic*). Search results returned 772 articles. Two members then reviewed all abstracts to ensure it contained information on methods, program analysis, or outcome data related to EIM-OC. The bibliography of each of the included manuscripts and posters was reviewed to capture articles not found in the original search. Results: To date, no article of this type has been published in the area of EIM-OC. A systematic review of the most robust EBM program initiatives. This important research will document what has been done in this area and highlight gaps in the literature. Conclusion: The data collected will be used by EIM Staff, Committee Members, and Registered Schools to obtain internal and external research support. Schools looking to develop EIM-OC programs will also benefit from this research.

Exercise is Medicine - On Campus (EIM-OC) was created in 2009. Over the last 10 years, the number of registered schools has risen to 267. At the Annual Meeting in 2019, there were 139 schools recognized for the work they performed on their campus. Purpose: In an effort to determine the scope of EIM-OC grant and research projects, the EIM-OC committee members have undertaken a meta-analysis and systematic review of the EIM-OC literature. Methods: Data was collected using multiple methodologies to ensure a complete capture of the work in this area. This included an email to EIM-OC registered schools to request publication, poster, and oral presentations titles, dates, and authors. As well as to ACSM journal and meeting coordinators to review published and unpublished abstracts. Members of the writing team performed independent literature searches across 10 databases using defined keywords (“Exercise is Medicine” or EIM and campus* OR University* OR college N=20 OR academic*). Search results returned 772 articles. Two members then reviewed all abstracts to ensure it contained information on methods, program analysis, or outcome data related to EIM-OC. The bibliography of each of the included manuscripts and posters was reviewed to capture articles not found in the original search. Results: To date, no article of this type has been published in the area of EIM-OC. A systematic review of the most robust EBM program initiatives. This important research will document what has been done in this area and highlight gaps in the literature. Conclusion: The data collected will be used by EIM Staff, Committee Members, and Registered Schools to obtain internal and external research support. Schools looking to develop EIM-OC programs will also benefit from this research.

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Board #325 May 27 1:30 PM - 3:00 PM
Exercise is Medicine Day On Campus: A Survey Of Physical Activity And Nutrition Habits
Melissa A. Reed1, Umit Tokac2, Selen Razan3. 1West Chester University, West Chester, PA. 2University of Missouri, Columbia, MO.

Email: mreeds3@wcupa.edu

No relevant relationships reported

Exercise is Medicine (EIM) is a global joint initiative between the American Medical Association and the American College of Sports Medicine (ACSM). West Chester University (WCU) was recognized by the ACSM in 2018 as an EIM-On Campus Gold Campus, indicating that WCU actively attempts to engage the campus community in physical activity. Purpose: The purpose of this study was to assess opinions related to the second WCU EIM Day. This event was hosted by the College of Health Sciences (CHS) at WCU and included participation from all six departments in the CHS, student groups, faculty and staff, alumni, and community stakeholders. Methods: Sixty-five participants (19 M, 46 F), (77% 18-21 years old, 15% 22-25 years old, 8% 26 years or older) that visited the event responded to an 8-question program evaluation survey. Results: The data did not have a normal distribution due to the

Abstracts were prepared by the authors and printed as submitted.
small sample size. Therefore, non-parametric data analyses were applied. Spearman non-parametric correlations were utilized to determine the relationship between enjoyment levels and perceived helpfulness of the event for increasing physical activity (PA) and improving nutrition habits (NH). Results indicated a significant positive strong association between enjoyment levels and perceived helpfulness of the event for increasing PA (rs(46)=-0.66, p<.05). There was a medium association between enjoyment levels and perceived helpfulness of the event for improving NH but this association was not significant (rs(25)=0.30). To examine differences between male and female participants, the Mann-Whitney U-test was applied for enjoyment levels, perceived helpfulness for PA and for NH items. Results indicated differences in enjoyment levels between males and females, (U= -2.02, p<.05) but no significant differences in perceived helpfulness of the event for PA and for NH items between males and females, (U=2.04, p=0.39 and U=-1.9, p>.05).

METHODS: Exercise Is Medicine On Campus (EIM-OC) is a global health initiative (Sponsor: Kent J. Adams, FACSM) especially those who are inactive. Larger and longer studies could also be helpful to increasing physical activity among female employees. Future EIM-OC programs should work to expand their offerings to increase participation among employees, especially those who are inactive. Larger and longer studies could also be helpful to the growing body of knowledge on the EIM-OC initiative.

RESULTS: The inaugural semester of EIM-OC was successful in launching these programs for CSUMB. The launch gained support in the form of social media following via Instagram and participation from University employees & students in the programs. The program encountered challenges including the retention of students in the PHC and gaining participation/interest from the campus during the EIM-OC week. The most successful part of EIM-OC at CSUMB were the employee exercise programs & will continue to be a major part of EIM-OC. Marketing of the RWRC & other events could be stronger to gain more participation. Strategies to improve retention for the PHC program are necessary. Based on recommendations, an afternoon RWRC will be added in the future. Overall, the first semester of EIM-OC at CSUMB was successful in making PA a part of the campus culture. Improving the programmatic efforts & troubleshooting challenges encountered, will ensure a sustainable EIM-OC program on campus.
METHODS: The research design was pre-post and tracked participants in the four week EIM-OC circuit training course. Fifteen female employees who participated in the circuit training course were monitored for their performance on the Exercise (SEE) scale was administered online through an intake form before and after the employee circuit training course. A dependent t-test was performed to test for differences in exercise self-efficacy pre and post participation in the circuit training course. Significance was set at α = .05. We hypothesized to see significant improvements in exercise self-efficacy among participants.

RESULTS: Average age was 43.80 ± 12.66 years, 93.3% of the participants were University staff. There was a significant increase (t=-2.87, df=11, p=0.008) in self-efficacy for exercise score (M=52.33±20.63; M=62.75±17.34) following the EIM-OC circuit training class.

CONCLUSIONS: The inaugural EIM-OC circuit training class was effective in increasing exercise self-efficacy among participants. University employees felt more efficacious about exercising after the four week circuit training course. Larger and longer studies could be conducted to better understand how and why participation in a campus offered circuit training course influences participants’ self-efficacy to continue exercising and if participants continue to exercise independent of the course offering. Evaluating exercise self-efficacy in EIM-OC exercise related programs could provide valuable insight into the adherence to and maintenance of exercise in University employees.

1204 Board #330 May 27 1:30 PM - 3:00 PM
Influence Of Aerobic Fitness And Obesity Status On Cardiometabolic Risk In College Students
Christopher Michael Bopp1, Oliver W.A. Wilson2. New England College, Henniker, NH; Pennsylvania State University, University Park, PA. (Sponsor: Melissa Bopp, FACSM)
Email: cbopp@pscu.edu

Abstracts were prepared by the authors and printed as submitted.

PURPOSE: The purpose of this study was to determine the impact of aerobic fitness and obesity status on cardiometabolic risk in college students separately by gender.

METHODS: Undergraduate students (n=5,986) completed an assessment battery which included an estimate of cardiorespiratory fitness (VO2max), BMI, percent body fat, blood lipids and glucose and blood pressure. RESULTS: In males (n=3634) low aerobic fitness (LAF) and elevated percent body fat (FAT) increased odds of dyslipidemia (LAF OR: 1.6 95% CI1.4-1.9; FAT OR: 3.4 95% CI2.2-5.4), low high-density lipoprotein (HDL) cholesterol (LAF OR: 1.7 95% CI1.4-2.0; FAT OR: 3.4 95% CI2.6-4.5), elevated low-density lipoprotein (LDL) cholesterol (LAF OR: 1.6 95% CI1.3-2.0; FAT OR: 3.0 95% CI2.1-4.3), elevated total cholesterol (LAF OR:1.7 95% CI1.2-2.4; FAT OR: 1.5 95% CI1.2-2.1), triglycerides (LAF OR: 1.8 95% CI1.4-2.2; FAT OR: 2.7 95% CI1.9-3.6), and hypertension(LAF OR: 1.6 95% CI1.4-1.8; FAT OR: 3.0 95% CI2.1-2.4), Odds of prediabetes (OR: 2.1 95% CI1.4-3.2) were only higher in FAT. Among females (n=2352), LAF and FAT were associated with increased odds of dyslipidemia (LAF OR: 1.5 95% CI 1.2-1.8; FAT OR: 1.4 95% CI1.1-1.7), and hypertension (LAF OR: 1.3 95% CI1.1-1.6; FAT OR: 2.2 95% CI 1.7-2.7), Odds of low HDL (OR: 2.1 95% CI 3.3-5), elevated LDL (OR: 2.2 95% CI 1.4-3.4) and total cholesterol (OR: 1.7 95% CI 1.3-2.2), and prediabetes (OR: 1.6 95% CI 1.0-2.4) were significant only in females with FAT. Odds of elevated triglycerides (OR: 1.6 95% CI 1.3-2.0) were significant only in those with LAF.

DISCUSSION: Although the consequences of obesity and low aerobic fitness in young adulthood may not lead to clinical symptomatology for decades, both increase the likelihood that an individual will meet cardiometabolic risk factors. The odds are higher in those with elevated percent body fat compared to the unfit. CONCLUSION: Interventions in this population should focus on lowering body fat percentage, not on improving fitness, for the most health benefits.

1205 Board #331 May 27 1:30 PM - 3:00 PM
The Effect Of A Four Week Walking Intervention On Faculty And Staff At The University Of Arkansas
Ashton Human, Bryce T. Daniels, Michelle Gray, Jamie I. Baum, Erin K. Howie. University of Arkansas, Fayetteville, AR.

METHODS: This is a sub-study of the Exercise is Medicine initiative on the University of Arkansas campus in an effort to track PA and its association with health, student success, and work satisfaction. Twenty-nine faculty and staff members (47.3 years ± 12.6) walked for 150 minutes per week for 4 weeks. The virtual group (n=16) used a fitness tracker to log PA and virtual messaging for group interaction. Research staff provided little facilitation of virtual group interaction. The in-person group (n=13) met 5 days per week, walked for 30 minutes, and was encouraged to perform walking tasks around campus to attend. A research aide led each walk and assisted conversation.

RESULTS: Three participants were excluded due to missing data. At baseline, BMI for males (n=5) was 28.9± 3.7 and 31.5± 8.1 for females (n=21). 50% of participants were classified as obese. The average aerobic capacity (VO2max) of males was 28.5± 6.1 ml/kg/min, and average VO2 max of females was 24.2± 6.9 ml/kg/min. On average, virtual participants walked 177.1± 46.7 (range 101.4 to 267.3) minutes per week. 37.5% of participants met recommendations all 4 weeks. In-person participants attended an average of 82% (range 60 to 100%) of walking sessions. A paired t-test showed VO2 max of participants significantly improved (p=0.035) after intervention. Participants reported high satisfaction with the program.

CONCLUSIONS: Both walking groups were feasible and acceptable among university faculty and staff, and aerobic fitness improved. Future research should assess long-term effects of PA interventions on all components of fitness of faculty and staff.
preclude chronic diseases, there was no difference between trained (67%) and untrained (63%) groups in respects to believing that Physician Assistants should know how to prescribe exercise to their patients. CONCLUSION: A short seminar presentation can increase the knowledge and attitudes of Physician Assistants students with respect to EIM practices. When students who received EIM seminars where compared to students who did not, there were very few differences. Therefore, a 45-minute presentation is not enough to translate in an increase in physical activity counselling and exercise prescription.

Many non-communicable chronic diseases (NCD) such as cardiovascular disease are largely mediated by lifestyle behaviors which include physical activity (PA). Exercise is Medicine Greenville® (EIMG®) is a clinic-to-community, experiential lifestyle behavior change model that partners physicians with qualified community exercise professionals for optimal patient care. Patients not currently meeting national PA guidelines and/or have or are at-risk for NCDs are physician-referred to the EIMG® program. Of particular interest for this pilot study were patients with elevated body weight and/or blood pressure (BP > 130/80). PURPOSE: To investigate the effect of the EIMG® program on body weight and systolic and diastolic BP (SBP and DBP, respectively) in referred patients.

Methods: Patients not meeting PA guidelines or at-risk for or with a controlled NCD were referred to the 12-week EIMG® exercise training program. Each patient followed a supervised, personalized exercise training program developed and facilitated by an EIMG® certified professional. A single group pre-test, post-test experimental design was utilized when collecting body weight and BP measurements before and after the exercise training program. A paired sample t-test was utilized to determine statistically significant changes (p<0.05) in each variable due to the exercise intervention.

Results: To date, a total of 150 patients have graduated from the 12-week intervention, with complete pre-and post-intervention measurements. Fifty-nine percent (n=89) of the patients were hypertensive upon referral. Analysis of the whole group resulted in a significant decrease in body weight (2.6 kg, p<0.000) with no significant decrease in the patients who did not, there were very few differences. Therefore, a 45-minute presentation is not enough to translate to an increase in physical activity counselling and exercise prescription.

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Exercise referral schemes (ERSs) within the United Kingdom (UK) offer individuals an opportunity to take part in an exercise prescription in a non-clinical environment, yet gain clinical health benefits. ERSs at present are heterogeneous in design, implementation, and evaluation; hence limited evidence of their effectiveness exists. Additionally, there has been no concerted effort to map program characteristics until very recently.

PURPOSE: To understand key characteristics of ERSs and observe how schemes are currently designed, delivered, and evaluated across the UK.

METHODS: Across the UK, a total of 29 schemes with 73,000 patients were asked to complete a Consensus on Exercise Reporting Template (CERT)-guided questionnaire. The questionnaire evaluated exercise provider’s qualifications, materials, delivery, location, tailoring, dosage, and compliance. Data collected were used solely for observations of scheme characteristics across the UK at the present time.

RESULTS: Schemes were typically 12 weeks in length (76%), offered patients two unsupervised exercise sessions in fitness gyms per week (79%), and used a combination of cardiovascular, resistance, free weights, and body weight exercises. Determining progression for resistance exercises was based upon the number of reps and sets completed (76%); for cardiovascular exercises progression was based upon the rating of perceived effort (38%); and for other exercises progression was based upon performance (45%). Just over half of schemes offered a variety of home based exercise components (52%), whether it was just advice or a full exercise programme. Adherence was typically measured through attendance (55%). Common motivational strategies used were goal setting (72%), goal achievement (69%), and acknowledgement of success (62%).

CONCLUSION: This research provides useful insights of schemes’ characteristics across England and Scotland. This evidence can support the development of a larger-scale mapping exercise to review further schemes across the whole of the UK, which to date has been lacking. This research has also been insightful in providing initial evidence of what schemes offer and potentially how they can be improved over time.
Exercise is Medicine®/Poster - EIM: Exercise and Various Diseases and Health Conditions

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

1215 Board #341 May 27 1:30 PM - 3:00 PM High Intensity Inspiratory Muscle Training In Individuals With Chronic Disease: A Systematic Review With Meta-analysis
Fabricio Boscolo Del Vecchio1, Thamires L. Seus2, Juliana Moraes Leal1, Rafael B. Orcy1, 1Federal University of Pelotas, Rio Grande do Sul, Brazil. 2Catholic University of Pelotas, Rio Grande do Sul, Brazil.
Email: fabricioboscolo@gmail.com

Inspiratory muscle training (IMT) is a strategy of treatment of patients with poor inspiratory muscle performance, with dyspnea, low exercise tolerance, and low functional status. Moderate loads are currently used (30 - 50% of maximal inspiratory pressure, MIP) and high-intensity IMT (HI-IMT) with 60% or more of MIP is being studied in randomized clinical trials.

PURPOSE: To determine the effect of high intensity inspiratory muscle training (HI-IMT) on respiratory muscle strength in individuals with chronic diseases.

METHODS: For this meta-analysis, the sources were conducted in PubMed, Scopus, ScieL and Bireme, using different keywords and operators. The review was recorded in the systematic review registration base PROSPERO, under registration number CRD42019131984, and follows the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines. Two researchers carried out the search independently in July of 2019. The outcomes were the effect and characteristics of interventions with high intensity inspiratory muscle training in individuals with chronic diseases. The variables were inspiratory muscle strength (Pimax) before and after intervention or the difference between this, training load, number of sessions, number of sets, and number of repetitions chosen for the control and intervention groups.

RESULTS: Were found 166 studies in initial source. After excluded of duplicates (n=30) and reading of titles and abstracts, five studies were included on meta-analysis. Populations analyzed included chronic pulmonary disease, cystic fibrosis and cancer patients. As characteristics of interventions, the mean duration was 8.8±1 weeks, 4.5±1.15 sessions per week, the most common effort intensity was 60% of MIP with 15.3±12.8 repetitions, 4.75±1.9 sets and 1.5±0.5 min of recovery between them. The results indicated that HI-IMT increases in 15.58 cmH2O [95%CI = 2.40 - 28.75] the strength on inspiratory muscle when compared to control group (p=0.02).

CONCLUSIONS: High intensity inspiratory muscle training is able to increase the respiratory muscle strength of patients with chronic pulmonary disease, cystic fibrosis and cancer.

1216 Board #342 May 27 1:30 PM - 3:00 PM Exercise To Treat Women With Pulmonary Lymphangioleiomyomatosis (LAM)
Thomas W. Lowder. University of Central Arkansas, Conway, AR.
Email: tlowder@uca.edu

Lymphangioleiomyomatosis is an interstitial, cystic lung disease that destroys the lung parenchyma, ultimately leading to respiratory failure. This disease affects females almost exclusively. Only two long-term clinical treatment options exist: 1) single or bilateral lung transplant, which only slows the disease as the newly-transplanted lungs will soon succumb to the disease, and 2) rapamycin (Rapamune), a costly mTOR inhibitor that may result in multiple side effects and is not always tolerated by users. We sought to examine if moderate- to high-intensity exercise could slow or reverse the pulmonary decline seen with LAM.

PURPOSE: To determine if a three-month exercise intervention would improve pulmonary function in women with LAM.

METHODS: Eight women with LAM (aged 27-60) were recruited to participate in an in-person exercise training intervention consisting of moderate- to high-intensity aerobic and anaerobic exercise. Prior to the study VO2max was assessed, as well as pulmonary function (FEV1, FVC, FEV1/FVC, and peak flow) and bone mineral density (BMD). After three months these measures were again tested. RESULTS: After three months of training, VO2max increased 12% from baseline (p=0.06). FEV1 improved by 4%. While this was not statistically significant (p=0.19) this is nonetheless substantial, as this is the primary clinical measure used to assess a decline in pulmonary function. This is also the first non-pharmaceutical study to demonstrate an increase, rather than a decline, in lung function. Peak flow also improved by 11% (p=0.18). BMD also slightly improved over three months (p=0.12), also significant as LAM patients have been shown to demonstrate a loss of BMD at a five-fold increase compared with healthy females. Though underpowered, this is the first non-pharmaceutical intervention study to show improved exercise tolerance, lung function, and bone health in women with LAM.

1217 Board #343 May 27 1:30 PM - 3:00 PM Whole-body Vibration Exercise Improve Lumbopelvic Proprioception For Patients With Nonspecific Low Back Pain
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Purpose: Nonspecific low back pain (NSLBP) accounts for a large proportion of low back pain cases. The present study aimed to investigate the effect of the whole-body vibration (WBV) exercise on lumbopelvic proprioception in NSLBP patients. It was hypothesized that WBV exercise enhances lumbopelvic proprioception.

Methods: Forty-two patients with NSLBP performed an exercise program 3 times a week for a total of 12 weeks of WBV. The lumbopelvic proprioception was measured by joint position sense. Outcomes were lumbar angle deviation and visual analogue scale (VAS) score.

Results: After the 12-week WBV exercise, lumbar flexion angle deviation was reduced from 3.65±2.26° to 1.90±1.07° (P=0.0001), and extension angle deviation was reduced from 3.06±1.85° to 1.61±0.75° (P=0.0001), significantly lower than baseline. After participating in the 12-week WBV exercise, a significant pain reduction was observed (P=0.0001). Men in the whole group (n=32) indicated significantly lower angle deviations in flexion and extension, whereas women (n=10) indicated significantly lower flexion angle deviation (P=0.037), and no significant difference was found in extension angle deviation (P=0.052). However, by subdividing the entire group (n=42) into poor and good proprioceptive groups, WBV exercise presented significant enhancement of lumbopelvic proprioceptive ability in the poor flexion proprioception subgroup, poor extension proprioception subgroup, and good extension proprioception subgroup (each P<0.0001), but not in the subgroup with good flexion proprioceptive ability (P=0.165).

Conclusions: Lumbopelvic flexion and extension proprioception as measured by joint position sense was significantly enhanced and pain was significantly reduced after 12-week WBV exercise in NSLBP patients. However, the patients with good flexion proprioceptive ability had limited proprioceptive enhancement.

Source of support: Shanghai Key Lab of Human Performance (Shanghai University of Sport) (11DZ22611100); the scientific and technological research program of the Shanghai Science and Technology Committee (19000503100).

1218 Board #344 May 27 1:30 PM - 3:00 PM Road To Zero Percent Low Back Pain At Work - 23-years Progress
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1Dynamic Sports Medicine Institute, Osaka Shi Chuo Ku, Osaka Fu, Japan. 2Osaka Sangyo University, Daito Shi, Osaka Fu, Japan. 3University of Arizona, Tucson, AZ. (Sponsor: Nobuko Hongu, FACSM)
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Background and Objective: Low back pain is approximately 80% of cause of job-related disability in Japan. Risk factors for developing low back pain have been well documented, which include occupational risk factors, types of job requiring heavy lifting, pushing, pulling, one’s fitness levels, and mental health factors. In this long-term project, we have focused on these secondary risk factors of low back pain. We have designed and implemented dynamic, comprehensive low back pain workshop. The objective of this study was to examine how the company-based workshop has offered and reached to 0% low back pain at work.

Methods: The project period was from 1982 to 2004. In 1982, about 1,100 male workers at a soft-drink company participated in the project. Their mean age at the starting of the project was 29 ± 5.3 years. All healthy participants took the modified Kraus-Weber test measuring their strength and flexibility of key postural core muscles. The test was graded for each movement. Also, the participants took questionnaire survey on low back pain. The dynamic, comprehensive low back pain workshop included endurance exercise, strength training, stretching, safe work-related movement practices, lectures on low back pain, good posture, and implementing preventive workplace events.

Results: The total number of participants in this project was 24,289. The mean age of participants in 2004 was 42.6 ± 9.7 years. The results of the questionnaire survey revealed that low back pain which hinders work, decreased from 44.6% in 1982 to 0% in 2004.
to 0.2% in 2004. The number of absenteeism due to low back pain decreased from 480 days to 0 day a year. The perfect score of Kraus-Weber increased from 35.4% to 83.7%. A negative correlation was observed between low back pain and the Kraus-Weber test.

Conclusions: This study demonstrated that company-based dynamic, comprehensive low back pain workshop improved physical fitness and work movements over a long-term. The workshop was effective reducing low back pain at work. Further research is required to be assessed whether the reduction in low back pain at work is related to a range of key health and work-related outcomes, and how the dynamic, comprehensive low back pain workshop can be further improved.

**PUPPOSE:** This study tested the efficacy of Baduanjin exercise (BDJ), a traditional Chinese mind-body exercise, on shoulder and neck muscle strength imbalance, and whether physical activity was not significantly associated with total bone mineral density, total body less head TBLH and handgrip in children with osteogenesis imperfecta.

**METHODS:** The sample consisted of 8 children of both sexes (8.2±1.3) years old, with osteogenesis imperfecta (I, III and IV type), body weight (24.0±7.9) kg, height (116.9±14.1) cm, cycle of intravenous pamidronate therapy (7.2±4.9). These patients are linked to the Reference Center for Osteogenesis Imperfecta in Santa Casa Medical School. Weight (kg), height (cm), handgrip (kg) were evaluated by CELAFISCS standardization. Physical activity (MET’s) [Barrero et al., 1993], total bone mineral density (g/cm²), total body less head TBLH (g/cm²) lumbar bone mineral density (g/cm²) [Bishop et al., 2008] and bilateral handgrip (Matsudo, 2005).

**Statistical Analysis:** Pearson’s correlation (r) was used for association between usual weekly physical activity and the following variables: total bone mineral density (g/cm²), total body less head TBLH (g/cm²), lumbar bone mineral density (g/cm²), and bilateral handgrip (kg). It was used a significant level of p<.05. **Results:** There was a positive and significant high intensity correlation between physical activity with lumbar bone mineral density, but not with total bone mineral density, total body less head TBLH, and bilateral handgrip (see table below).

**Conclusion:** it seems that physical activity exert a positive effect on the lumbar bone mineral density. However, physical activity was not significantly associated with total bone mineral density, total body less head TBLH and handgrip in children with osteogenesis imperfecta.

**Pearson Correlation**

<table>
<thead>
<tr>
<th>Weekly Physical Activity</th>
<th>r</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Bone Mineral Density</td>
<td>.199</td>
<td>.636</td>
</tr>
<tr>
<td>Lumbar bone mineral density</td>
<td>.916*</td>
<td>.001</td>
</tr>
<tr>
<td>Total Body Less Head TBLH</td>
<td>.109</td>
<td>.797</td>
</tr>
<tr>
<td>Right Handgrip (kg)</td>
<td>-.240</td>
<td>.567</td>
</tr>
<tr>
<td>Left Handgrip (kg)</td>
<td>-.136</td>
<td>.749</td>
</tr>
</tbody>
</table>

*Significant at p<.05

**RESULTS**

- Distance covered during the 6-min RaceRunning test increased on average 36% (pre 576 ± 325 m vs. post 765 ± 428 m, p<0.001).
- Average and maximum heart rate during the 6-min RaceRunning test were not different pre vs. post training. Muscle thickness of m. gastrocnemius increased in response to training (p<0.05) on the more affected side.
- Dorsiflexion PROM in the more affected ankle decreased (p<0.05), while hip flexion PROM in the less affected side increased (p<0.05).

**CONCLUSIONS**

- Twelve weeks of RaceRunning training improves physical fitness in individuals with CP. Moreover, RaceRunning stimulates skeletal muscle hypertrophy of the calf muscle. These results speak in favor of RaceRunning as a powerful and effective training modality in individuals with CP promoting both central and peripheral adaptations.

**PURPOSE:** The theory of planned behavior (TPB) is used to document children’s psychological parameters linked to their physical activity practice to better understand their physical activity behavior. The TPB model evaluates the informational and motivational parameters that contribute to the practice of physical activity. This study aimed to assess the evolution of children’s physical activity levels (MVLPA) during the first months of their cancer, in addition to document the evolution of the TPB measures, self-reported fitness and self-esteem in the physical domain to better understand children’s physical activity behavior.

**METHODS:** A total of 16 children (8 boys and 8 girls) with cancer were recruited in the context of the VIE (Valorization, Implication and Education) study. Patients answered psychosocial questionnaires at their diagnosis of cancer (time 1), six to eight weeks following their diagnosis (time 2) and six weeks after the physical activity program (time 3). The physical activity program was composed of two physical activity sessions (~45 min) per week for six weeks at moderate intensity. The integration of the family in the physical activity process was taken into consideration.
RESULTS: A significant decrease of 41.2 min/day of daily MVLP was observed between the time at cancer diagnosis (50.5±32.8 min/day) and six to eight weeks after the first interview (9.3±9.1 min/day). After the physical activity program (23.1±10.8 min/day), we observed a significant increase of 13.8 min/day of daily MVLP. We found that time after the diagnosis of cancer negatively impacted children’s TPB measures (mean in attitude, injunctive norms, identity, facilitating factors, self-confidence and intention) and MVLP levels, while that the time after the physical activity program positively impacted children’s TPB measures (mean in attitude, injunctive norms, identity, facilitating factors, self-confidence and intention) and MVLP levels.

CONCLUSIONS: This study highlights the need to provide children with physical activity support as soon as the cancer is diagnosed and shows the importance of familial support by injunctive norms to improve children’s physical activity behavior. These findings help to better understand the effect of cancer diagnosis on children’s physical activity behavior.

1223 Board #349 May 27 1:30 PM - 3:00 PM Impact Of A Free-Living Activity Intervention On Real-time Fatigue In People With Multiple Myeloma Treated With Autologous Hematopoietic Cell Transplantation
Eileen D. Hacker, Shu-Yu Chung, Rae Lynn Richards. Indiana University, Indianapolis, IN. Email: edhacker@iu.edu (No relevant relationships reported)

PURPOSE: Autologous hematopoietic cell transplantation (HCT) is commonly used to treat multiple myeloma (MM). Moderate to severe fatigue is associated with the treatment. Sustainable physical activity incorporated in daily activities may reduce fatigue. This study evaluated the impact of a free-living physical activity intervention (STEPS) compared to usual care on real-time fatigue.

METHODS: A two-group, randomized block, repeated measures design (n = 32) was used. The six-week STEPS intervention aimed to increase physical activity by 10% weekly through education, goal-setting, daily step tracking using wearable technology, and guided integration of physical activity into daily routines following HCT hospital discharge. Real-time fatigue was measured with a one-item fatigue intensity scale using computerized ecological momentary assessment eight times per day over seven days. Participants rated their fatigue intensity on a 0 (no fatigue) to 10 (worst fatigue) scale.

RESULTS: Participants provided 6960 ratings of real-time fatigue (3469 prior to HCT and 3437 seven weeks following HCT discharge). Prior to HCT, the STEPS group reported fatigue as mild (57.5%, n = 1974 ratings), moderate (29.7%, n = 563 ratings) or severe (12.8%, n = 217 ratings). Following the intervention, the STEPS group reported fatigue as mild (60.5%, n = 1068 ratings), moderate (27.7%, n = 409 ratings) or severe (11.7%, n = 207 ratings). The usual care group reported fatigue as mild (53.8%, n = 1035 ratings), moderate (32.3%, n = 575 ratings) or severe (9.2%, n = 165 ratings) and mild (61.7%, n = 1033 ratings), moderate (28.5%, n = 476 ratings) or severe (9.8%, n = 164 ratings) after the intervention period.

CONCLUSIONS: Although preliminary, differential improvement in real-time fatigue following the STEPS intervention did not occur in the STEPS. Between 35% and 40% of real-time fatigue ratings were classified as moderate or severe demonstrating ongoing need for intervention development.

1225 Board #351 May 27 1:30 PM - 3:00 PM The Practice Of Physical Activity Protects The Lung Function And Mechanics In Hypertensive Elderly
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PURPOSE: Hypertension is still a growing problem in public health, presenting higher rates among elders. Recent studies have pointed out that hypertension may be an independent factor impairing the lung function. In addition, some studies have demonstrated that physical activity promotes beneficial effects in hypertensive individuals, but never before the impact of physical activity on lung function and mechanics in hypertensive and non-hypertensive elders have been evaluated.

METHODS: 110 physically active hypertensive elders (ActH; 69.39 ± 5.49 years old) and 187 sedentary hypertensive elders (SedH; 70.09 ± 5.71). The inclusion criteria: no respiratory diseases, unable to perform spirometry test, no respiratory infections in the last 30 days. Lung function (spirometry) and lung mechanics (by impulse oscillometry) was evaluated according to American Thoracic Society recommendations by using IOS Masterscreen Jaeger (Germany). Graph Pad Prism 5.0 was used to perform statistical analysis and p<0.05 were considered significant.

RESULTS: The analysis of lung function revealed that physical activity preserved the lung function (forced vital capacity - FVC) as demonstrated by comparison between ActH versus SedH group (3.65 ± 0.05 x 2.79 ± 0.07; p<0.01). Simillary, the forced expiratory volume in the first second (FEV1) was higher in ActH when compared with SedH elders (2.96 ± 0.04 x 2.12 ± 0.05; p<0.02) as well as the FEV1/FVC relation (0.84 ± 0.07 x 0.75 ± 0.07; p<0.03). Concerning the lung mechanics, the results...
revealed that physical activity was able to preserve the impairment of distal lung elastance (X5), when compared Ath with SedH elderly (-1.60 ± 0.19 x -1.47 ± 0.10; p<0.02) and also the impairment of proximal airways resistance (R20Hz), (2.58 ± 0.06 x 3.12 ± 0.09, p < 0.0001). CONCLUSIONS: Physical activity preserves the lung function and mechanics in elderly in hypertensive elderly.

### 1226 Board #352 May 27 1:30 PM - 3:00 PM Hypertension Treatment And The Amount Of Physical Activity And Sitting Behaviour - First Blood Pressure Then Exercise Complain

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Physical inactivity is associated with many chronic diseases and premature mortality and increasing evidence also suggests that high levels of sedentary time may increase the risk of chronic diseases and mortality. All intensities of physical activity, including light intensity, are associated with a substantially reduced risk of death in a dose-response manner. A statistical significantly higher risk of death was observed for sedentary times of 9.5 or more hours daily.

**PURPOSE:** By conducting a pilot survey among people interested in sports concerning physical activity and sedentary lifestyle, we analyse the need to conduct a nationwide educational campaign on the risks of sedentary behaviours in Poland.

**METHODS:** The survey was conducted during the largest fitness fair in Poland, "Go Active Show," bringing together people associated professionally and amaetually with sport. 1,000 questionnaires were conducted, including questions based on the IPAQ Short Form questionnaire and NATPOL 2011 survey. Demographic data, number of minutes per day of moderate and intensive physical activity and number of hours per day spent sitting were assessed. For the first time in Poland we asked a question about the number of minutes of exercise and time spent on sitting.

**RESULTS:** The study involved 1000 people, 58% of whom were women and 42% men, 55% people with higher education and 44% living in large cities. 62% of the participants had normal body weight. Sitting: 256 people (25.6%) declared 9.5 or more hours of sitting per day. On average, they spend 41.8 minutes a day on moderate physical activity and 29 minutes a day on intensive exercise.

**CONCLUSIONS:** The study group was highly aware of the healthy lifestyle, as the majority of people with higher education and living in large cities with more than 500,000 citizens. They also presented a high level of physical activity. However, they are still not aware of the risks of sedentary behaviours and increased risk of premature death. Therefore, it is necessary to launch a nationwide educational campaign in this area in Poland.

### 1227 Board #353 May 27 1:30 PM - 3:00 PM Exercise Is Medicine For Hypertension: But What's The Prescription?

Claudia Hacke1, David Nunn1, Burkhard Weiss1. 1Christian-Albrechts-University of Kiel, Kiel, Germany. 2University Of Oxford, Oxford, United Kingdom. (Sponsor: Reinhard Ketelhut, FACSM) Email: c.hacke@email.uni-kiel.de (No relevant relationships reported)

**PURPOSE:** Exercise is an important therapy option for patients with chronic diseases. For the example of arterial hypertension, the study assessed the reporting quality of exercise-based interventions included in the latest meta-analysis on that topic in order to evaluate the transferability of findings into clinical practice.

**METHODS:** Reporting quality of 24 randomised controlled trials from a meta-analysis assessing blood pressure lowering effects of endurance training in 1,195 hypertensive patients was evaluated using TIDieR (Template for Intervention Description And Replication) and CERT (Consensus on Exercise Reporting Template) guidelines. Associations between reporting quality, publication year and impact factor of the publishing journals were examined.

**RESULTS:** None of the studies described all intervention components completely. On average 61% (95%CI: 52-69) (TIDieR) and 57% (95%CI: 49-64) (CERT) of core items required for reporting were reported. Frequent shortcomings were the reporting of adherence, intervention provider, and adverse events. Details about exercise dosage were missing in 22% (95%CI: 4-44). Publication year was related to the adherence to TIDieR (r=0.549, P<0.007) but not to CERT. No associations with journal impact factor were found. **CONCLUSIONS:** Further work is required to establish the replicability and up-take of exercise interventions in clinical practice for common chronic diseases. Researchers should apply, and review authors, journal editors and reviewers should check adherence to reporting guidelines. To ensure an adequate quality of reporting of exercise interventions for different diseases, it might be useful to develop guidelines which integrate indication-specific exercise-related parameters such as blood sugar for patients with diabetes, oxygen saturation for COPD, pain scales for musculoskeletal diseases.

### 1228 Board #354 May 27 1:30 PM - 3:00 PM Sex Differences In Leptin And Cardiometabolic Profile After Exercise Intervention In Obese And Hypertensive Adults

SARA MALDONADO-MARTIN1, Ilargi Gorostegi-Anduagua1, Pablo Corres1, Aitor Martinez-Aguirre-Betolaza1, Silvia Dominguez-Martinez2, Ramón Saracho3, Borja Jurio-Iriarte4, Mikel Tous-Espelosin5, Peter H. Bruhak6, FACSM7. 1UNIVERSITY OF THE BASQUE COUNTRY (UPV/EHU), VITORIA-GASTEIZ, Spain. 2University Hospital of Araba, VITORIA-GASTEIZ, Spain. 3WAKE FOREST UNIVERSITY (WFU), Winston-Salem, NC. (Sponsor: Peter H. Bruhak, FACSM) Email: sara.maldonado@ehu.eus (No relevant relationships reported)

**PURPOSE:** To analyse the change on leptin, body composition, blood pressure (BP), cardiorespiratory fitness (CRF) and some biochemical parameters in overweight/obese and (physically inactive with pre (W) and men (M)) hypertensive (HTN), and to evaluate the potential sex differences in the change after intervention. **METHODS:** Participants (n=37 women, n= 40 men, 52.9±6.9 yrs) from the EXERDIET-HTA study were randomized into attention control group (physical activity recommendation) or one of three supervised aerobic exercise groups (two days of week). All participants received the same hypercaloric diet. All variables were assessed pre and post-intervention. A blood sample (12.5 mL) was collected from each participant following an overnight fast to determine the biochemical profile and leptin values. 24-h ambulatory BP monitoring was used to analyze systolic and diastolic BP. A cardiopulmonary exercise test was performed to determine peak oxygen uptake (VO2peak). **RESULTS:** Following the intervention, there were significant increments (P<0.01) in CRF by VO2peak (W=-21.1±1.3 %, 24.6±4.4 mL·kg-1·min-1, M=-23.6±1.6 %, 33.1±10.2 mL·kg-1·min-1) and decreases (P=0.05) in leptin (W=49.5±23.0 vs. 41.8±19.9 mg/dL, M=20.5±14.8 vs. 12.9±18.6 mg/dL, body mass (W=84.7±12.1 vs. 80.3±11.5 kg, M=97.6±14.4 vs. 91.5±13.3 kg), waist perimeter (W=97.3±10.7 vs. 94.3±10.5 cm, M=107.9±8.7 vs. 101.5±7.9 cm), fat mass (W=-24.3±5.5 %, M=-31.2±5.0 %, 28.0±4.4 %), systolic BP (W=136.5±12.1 vs. 129.3±12.5 mmHg), diastolic BP (W=75.0±8.2 vs. 74.1±8.9 mmHg, M=91.5±13.3 vs. 90.3±11.5 mmHg), total cholesterol (W=216.1±44.5 vs. 196.1±35.0 mg/dL), insulin (W=14.2±7.9 vs. 9.4±4.2 mU/L). There were significant between-sex differences in body mass (W=57.2 %, M=6.5 %, P=0.023), waist circumference (W=1.1 %, M=5.9 %, P=0.004), and VO2peak (W=14.2 %, M=20.0 %, P=0.036). CONCLUSIONS. Aerobic exercise along with a hypocaloric diet is an effective non-pharmacological intervention to induce beneficial changes in W and M in BP and leptin as a mediator of obesity-induced HTN, and other regulatory mechanisms such as body composition, CRF and biochemical profile. The found sex-related differences could confirm the need for individual non-pharmacological strategies.

### 1229 Board #355 May 27 1:30 PM - 3:00 PM Correlation Of Functional Capacity And Impact On Life Quality Of Type II Diabetes Patients

Regiane M. Costa Arruda, Cauê Padovani, Luciana M. Malosá Sampaio. University Nove de Julho, São Paulo, Brazil. Email: ft.regiane@costa@gmail.com (No relevant relationships reported)

Diabetes mellitus (DM) is a chronic progressive disease characterized by high blood glucose levels and stands out as an important and growing health problem worldwide, which can lead to reduced functional capacity (FC) and the quality of life (QOL). However, the association is still poorly studied. **PURPOSE:** To evaluate FC through Shuttle Walking Test Endurance (SWTE) and it’s association with QOL of type II diabetic (T2D) patients. **METHODS:** This is a cross-sectional study. Patients aged ≥18 years, sedentary, with medical diagnosis of T2D were included. Information such as gender, age, glycated hemoglobin and body mass index (BMI) were collected during an interview prior to the application of the physical test. The QOL was assessed by the Medical Outcomes Study 36 - Item Short - Form Health Survey (SF36) questionnaire, highlighting the “Pain”, “Emotional Aspects” and total score domains. **RESULTS:** Forty-one patients (24 women (17 men) participated in the study, with a mean age of 57 ± 10 years. Most of them were overweight individuals with a BMI of 29.5 ± 3.8. The average distance achieved by patients in SWTE was 1020 (360-2200) meters. The mean scores on the SF36 questionnaire were 40 (2-100), 83 (0-100) and 543 (105-704) respectively for the “Pain”, “Emotional Aspects” and Total Score domains. Significant correlations were found between the distance covered in SWTE and the domain “Pain”, the domain “Emotional aspects” and the total score of the SF36 questionnaire, respectively (R = 0.4; R = 0.4 and R = 0.4; p<0.01). Significant correlation was also
found between the distance covered in SWTE and age R = -0.4; p < 0.01 of T2D patients. CONCLUSION: The findings of the present study suggest that SWTE may be a simple and useful tool in clinical practice for FC measurement and performance in this field test may be strongly associated with QOL of T2D patients.

**1230 Board #356 May 27 1:30 PM - 3:00 PM Preparing for a Behavioral Physical Activity Intervention in Women With Gestational Diabetes Mellitus**

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**PURPOSE:** In preparation for a behavioral physical activity (PA) intervention promoting walking/stepping in place in women diagnosed with gestational diabetes mellitus (GDM), this study sought to assess the accuracy of the Fitbit Charge 3 in recording steps during walking and stepping at three cadences in pregnant women. The study also sought to elicit women’s thoughts and feelings on the proposed walking/stepping intervention.

**METHODS:** Women diagnosed with GDM (N=15) were recruited in the third trimester. Participants wore a Fitbit Charge 3 on the non-dominant wrist and completed a total of six 2-minute bouts that varied by mode (walking vs. stepping in place) and cadence (67, 84, and 100 steps/minute). Bout sequence was randomized. Actual steps were determined by hand-tally, the criterion, in duplicate. One-way and two-way ANOVA were used to examine differences in the mean percentage of steps recorded, by mode and cadence. Participants also completed a 20-minute semi-structured interview with questions on opportunities for PA, challenges to PA, PA preferences, and use of a Fitbit to track steps and set goals during walking/stepping. Interviews were audio-recorded and transcribed, then analyzed using descriptive and interpretive coding to identify themes.

**RESULTS:** There was a statistically significant difference in the percentage of steps recorded by cadence (p<.01), but not by mode (p=.23), no interaction was detected between mode and cadence (p=.17). Analyses of cadence only suggested that 67 steps/minute (lowest) may differ significantly from the other cadences (67 steps/minute = 113%, 84 steps/minute 97%, 100 steps/minute = 95%; p=.05). In the interviews, most reflected on the complexity of their lives making daily PA difficult, and indicated preference for three 10-minute bouts of walking/stepping over one 30-minute bout per day.

**CONCLUSIONS:** The Fitbit Charge 3 may overestimate steps at lower cadences. However, step count did not differ with respect to mode at the cadences examined. Results suggest that the Fitbit Charge 3’s step count is suitable for use in a behavioral PA intervention promoting walking/stepping by tracking and goal setting. Interview data additionally suggested that walking/stepping interventions for women with GDM should afford convenience and flexibility to participants.

**1231 Board #357 May 27 1:30 PM - 3:00 PM The Cross-Sectional Effect of Abnormal Glucose Metabolism on Balance Ability, Muscle Strength, and Body Composition in Men**

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**PURPOSE:** To investigate the association between balance ability, muscle strength, and body composition, and fasting blood glucose METHODS: 1) Subjects: 2693 men (aged 19-73 years old) were recruited from three health management centers of hospitals in China, without any diagnosed diseases other than diabetes. 2) Measurements: People’s grip strength was measured 3 times in dominant hand in a standing position and read the highest value; balance ability was measured by one-leg standing time with both eye-closed; body composition was measured by BIA; fasting venous blood was taken for blood glucose test. All subjects were divided into normal blood glucose group (Normal: ≤6 mmol/L), impaired fasting glucose group (IFG: 6.1-7.0 mmol/L), and diabetes group (DM: ≥7.0 mmol/L). 3) Statististics: Multivariate analysis of variance was used for comparison among groups; Pearson test was used for correction analysis; the significance level (a) for hypothesis testing was set to 0.05.

**RESULTS:** Normal glucose men were significantly younger than those in the IFG and DM group (38.76±9.45 vs. 44.57±9.09 vs. 45.87±4.79 yrs, P < 0.05). Normal glucose men had significantly lower body weight and lower percent body fat than those in the IFG and DM group (BW: 70.70±11.29 vs. 75.68±10.40 vs. 77.23±11.66 kg, P < 0.05; BMI: 15.55±6.38 vs. 18.97±5.82 vs. 25.12±5.62, P < 0.05). Balance ability, relative grip strength, and muscle percentage [(body muscle/ body weight)*100] were different in three groups (P < 0.05). There were inverse linear associations between incremental level of blood glucose and lower values of balance ability, relative grip strength, and muscle percentage (r=-0.067, r=-0.158, r=-0.171, P < 0.05 for each). After adjusted age, the blood glucose level was still correlated with balance ability (r=-0.0355, P=0.068).

**CONCLUSIONS:** The men’s balance ability decreases with the increase of blood glucose level. There are inverse linear associations between muscle strength and blood glucose level. Acknowledgement: (1) China Health Foundation Project “Multi-Center Application Research on Fitness Fitness Test and Exercise Management” (CHFP2014-FITTEX). 2) National Key Research and Development Program Major Prevention and Control Research on Chronic Non-communicable Diseases (2016YFC1300202).

**1232 Board #358 May 27 1:30 PM - 3:00 PM Comparative Study of Resistance and Aerobic Exercise in Pre-Diabetes: An RCT**

Xujuan Luo1, Zhengheng Wang, FACSM1, Bowen Li1, Junhua Xu1, 1Sun Yat-sen University, Guangzhou, China. 2Beijing Sport University, Beijing, China. 3Nanjing Institute of Physical Education and Sports, Nanjing, China. Exercise is Medicine(Beijing) Health Technology Research Institute Co., Ltd. Beijing, China. Email: 2066128747@qq.com (No relevant relationships reported)

**PURPOSE:** Although the benefit of aerobic exercise in IGR is proven, the impact of resistance exercise on IGR is unclear. Therefore, the differences between aerobic and resistance exercise on IGR was analyzed to provide a theoretical and practical basis for DM prevention and IGR management.

**METHODS:** Single-blind RCT. IGR participants were divided into 3 groups randomly: aerobic exercise (A, n=26), resistance exercise (R, n=23), and control (C, n=21). The effect of aerobic and resistance exercise on IGR was analyzed and the relationship with obesity was investigated after 12-weeks intervention.

**RESULTS:**

(1) FPG in groups A and R was decreased significantly by 6.17% and 4.81%, and OGTT 2h PG was also decreased significantly by 20.39% and 16.50%. 69.2% in group A showed a decrease in blood glucose level to normal value with a significant difference compared with group C. (2) HOMA2-IR in groups A and R was significantly decreased by 8.34% and 18.31%, with a significant difference compared with group C. A significant decrease of BMI (3.1±3.2 kg/m²), showed a moderately positive correlation with the decreased FPG) and waist (3.1±2.7 cm) was found in group A with a significant difference compared with group C. BMI (1.1±2.9 kg/m²) and waist (1.5±3.8 cm) also decreased significantly in group R, but no significant difference between groups. The change of body composition showed in figure 1.

**CONCLUSION:**

(1) Both resistance and aerobic exercise lowered blood glucose and decreased blood glucose to normal level in a large percentage of IGR. (2) Both aerobic and resistance exercise improved IR in IGR. The effect of resistance exercise on IR improvement was superior to that of aerobic exercise. (3) Aerobic exercise lowered weight and waist significantly in IGR, and decreased blood glucose through weight loss. But the improvement of IR by both aerobic and resistance exercise might not be related to the control of obesity.

Supported by SGA China (2014B007), Sun Yat-sen University (1709089). $SMISSING OR BAD IMAGE SPECIFICATION ($A7B4ED29-370B-4CE9-A26D-08D95A423485)$$
Common medical advice for patients with obesity and metabolic syndrome (MS) is weight loss through negative energy balance: eat less and do more physical activity. Guidelines suggest that moderate to vigorous intensity physical activity (MVPA) is better than low intensity physical activity (LPA). However, patients with morbid obesity and metabolic syndrome have difficulties to achieve MVPA level, particularly when they take beta-blockers. PURPOSE: To monitor long-time weight loss of a patient with morbid obesity and MS who underwent regular exercise and energy-restricted diet. METHODS: This case study followed a male patient (age 65y, baseline weight 131.0kg, BMI 43.8) with MS (obesity, high blood pressure, dyslipidemia, prediabetes) for 12 months. He took medication for every disease and also beta-blockers. His program was assisted by medical doctor, nutritionist and exercise therapist, has regular blood tests. All the trainings (1628 sessions) were monitored by heart rate activity tracker (POLAR A300). Exercise therapist, has regular blood tests. All the trainings (1628 sessions) were monitored by heart rate activity tracker (POLAR A300). RESULTS: In the first 7 months the patient’s weight loss was variable but permanent (23,1kg, BMI decrease 1.3cm(HYD) to 2.2cm(ST), significantly in all but HIIT group. Us-CRP decreased (p<0.001) and negative in case of LPA (p=0.47 <p=0.01). CONCLUSIONS: The energy-restricted diet and exercise therapy caused large weight loss but the LPA (>60% max hr) exercise had no effect. It seems that after achieving higher fitness level, extreme duration of LPA is not capable of long term weight loss although it plays a huge role in negative energy balance. MVPA would be more effective for patients with metabolic syndrome, but beta-blockers and the risk of heart attack or hypoglycaemia make the intensity-increase difficult.Supported by TUDFO/51757/2019-ITM

One third of U.S. children are overweight or obese. Without intervention, they experience an elevated risk of developing type 2 diabetes and cardiovascular disease as adults. Poor blood glucose and lipid profiles are indicators of adult onset, and early intervention can reduce the likelihood of future diagnosis. Thus, it is important to identify programs capable of improving these parameters in at-risk children. PURPOSE: To examine the effect of a family-oriented exercise and nutrition intervention on blood glucose and lipid profiles in overweight and obese children. METHODS: 12 children (age 7-16 y) were referred to a weight loss intervention by their primary care physician; 6 males and 3 females completed the program. They performed biweekly sessions of structured exercise (45 min) and nutritional counseling (30 min) for 18 weeks. At baseline and follow-up, blood samples were drawn, measuring triglycerides (TG), total cholesterol (TC), high-density lipoproteins (HDL), low-density lipoproteins (LDL), and blood glucose (BG). Paired-samples t-tests compared pre to post differences in these variables. RESULTS: At baseline, subjects were 12.3±2.4 years old with a body mass index of 29.8±4.5 kg/m². Blood samples revealed TG of 118.4±50.1 mg/dL, TC of 172.0±21.2 mg/dL, HDL of 52.6±10.2 mg/dL, LDL of 97.8±24.9 mg/dL, and BG of 117.2±5.4 mg/dL. From baseline to follow-up, non-significant changes were detected for TG (p=0.104), TC (p=0.085), and LDL (p=0.132). Significant changes were detected in HDL (increased 6.8±2.2 mg/dL, corresponding to a 13.1% improvement; p=0.009) and BG (decreased 17.7±5.0 mg/dL, 14.8% improvement; p=0.026). CONCLUSION: Despite the absence of external incentives, the program’s retention was 75% over 18 weeks. Children who completed the full duration of exercise training and nutritional counseling experienced significant improvements in HDL and BG. These findings support the growing evidence that earlier cardiometabolic interventions are warranted.

A link between physical inactivity, central obesity, and inflammation likely exists suggesting physical activity and inactivity as critical regulators of systemic inflammation. PURPOSE: To investigate the responsiveness of a systemic inflammatory marker to different types of physical exercises. METHODS: A sample of 302 individuals from both genders was taken among (2013-2016) participants of the dynamic cohort “Move for Health”, a lifestyle-modification program(LiSM) with supervised physical exercises and dietary counseling. The evaluation instruments were: IPAQ (long form-version 8); anthropometric, plasma analysis of high-sensitive C-Reactive Protein (hs-CRP) and physical fitness. After the clinical trial, the groups were assembled voluntarily in any of the exercise-protocols : hydro-gymnastics (HYD, 240min-400MET/week, n=50), combined training protocol (aerobic + resistance) on lung mechanics and inflammation of overweight women. CONCLUSIONS: Combined training improved lung mechanics and inflammation of overweight women.

Purpose: The prevalence of obesity has grown over the years around the world. The accumulation of fat in the abdominal region is strongly associated with changes in pulmonary function and mechanics, as well as pulmonary inflammation that can lead to the development of respiratory diseases. Several studies have evidenced that aerobic exercise and resistance training promote numerous benefits in the respiratory system. However, no study have evaluated the effects of combined training program (aerobic + resistance) on lung mechanics and inflammation of overweight women. METHODS: 100 overweight women were recruited, according to the classification of body mass index (BMI) proposed by the World Health Organization. The combined training protocol (aerobic + resistance) was performed 3x/week for 12 weeks, 1 hour/ session. Inclusion criteria: no respiratory diseases, nonsmokers, no reprimand medications intake, no muscle or skeletal diseases. Nitric oxide levels in exhaled air were evaluated using the NOBreath portable nitric oxide monitor. Lung mechanics (by impulse oscillometry) was evaluated according to American Thoracic Society recommendations by using IOS Mastesquen Jaeger (Germany). Graph Pad Prism 5.9 was used to perform statistical analysis and p<0.05 were considered significant. RESULTS: The data shown here are from 15 women, as the program is still ongoing. Combined training resulted in reduced pulmonary inflammation, as measured by the levels of exhaled nitric oxide (pre: 16.67±7.66 ppb; post: 8.27 ± 4.54 ppb; p<0.001). In addition, combined physical training significantly improved the pulmonary mechanics of these obese women, as improvements in the impedance of the respiratory system (Z5 Hz, pre: 4.35 ± 1.41, post: 0.55 ± 0.15, <p=0.0001), total resistance of respiratory system (R 5 Hz - R20 Hz, pre: 1.03 ± 1.28, post: 0.52 ± 0.14, <p=0.0001) and proximal airway resistance (R20 Hz, pre: 3.00 ± 1.08, post: 0.41 ± 0.12, <p=0.0001) were observed. In the distal region of the lung, the combined training protocol significantly reduced the elastrance (X5, pre: -1.55 ± 0.67, post: -0.18 ± 0.05, <p=0.0001) and the resistance of the small airways (R 5 Hz - R20 Hz, pre: 1.03 ± 0.45, post: 0.11 ± 0.06, <p=0.0001). CONCLUSIONS: Combined training improved lung mechanics and inflammation of overweight women.
significantly from 0.54(0.04-3.00) to 0.35(0.01-1.43) mg/dL, leading to a reduction of inflammatory stress (ISC/CRP - 0.30mg/dL) from 44.7% to 29.8%. Except HD, IS/CRP decreased in all other groups, while only HIIT reduced significantly(23%) the IS.

CONCLUSIONS: The 10wk LSm was effective in reducing systemic inflammation, being more effective in HIIT and less in HYD, dissociable from WC changes and specific fitness improvements. Supported by CNPq and CAPES.

B-83 Free Communication/Poster - Measurement Studies in Exercise Oncology

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

1237 Board #363 May 27 2:30 PM - 4:00 PM Myocardial Fibrosis Impairs Exercise Capacity By Limiting Cardiac Output Among Anthracycline-treated Women With Breast Cancer
Amy A. Kirkham1, Marissa Doroshuk1, Michelle Goonasekera1, Brenna Mattiello1, Mark J. Hayekowsky2, Rhys I. Beadury2, John R. Mackey1, D Ian Paterson1, Edith Piunskin1, Richard B. Thompson1. 1University of Alberta, Edmonton, AB, Canada. 2McMaster University, Hamilton, ON, Canada.

PURPOSE: Physiologic reserve, the capacity for augmented function between rest and peak exercise, declines in organs and biological systems with aging. Chemotherapy can rapidly accelerate this decline, as noted by substantially lower exercise capacity in survivors of breast cancer (BC). We assessed cardiac function reserve and myocardial tissue characteristics and determined their contribution to exercise capacity reserve (VO2R) in 16 anthracycline treated BC survivors and 16 age- and BMI-matched controls (CON). METHODS: Participants performed a maximal cardiopulmonary test on an upright cycle ergometer and also inside a 3T magnetic resonance imaging scanner using a horizontal, resisted, stepping device. Real-time, free-breathing, ungated cine images were acquired at rest and peak exercise. Left ventricular (LV) volumes and ejection fraction (EF) were calculated from a biplane model of 2- and 4-chamber long axis views. The reserve of LV volumes, EF, cardiac output, and VO2, were calculated as peak minus rest values. Native T1 mapping, a measure of myocardial fibrosis, was performed using the SASHA method. Groups were compared with independent t-tests and linear regression was performed between cardiac variables and relative VO2.

RESULTS: VO2R was 25% lower in BC versus CON (18±7 vs 25±7 mL/kg/min, p=0.02). Hemoglobin, LV mass, resting LV volumes, cardiac output, and EF were similar between groups. Myocardial T1 times were elevated in BC compared to CON (1535±32 vs 1503±28 ms, p=0.002). The reserve in heart rate, LV volumes, and EF did not differ between groups. A trend toward lower stroke volume reserve (14±8 vs 19±7 mL vs +10.3±2.4 L/min, p=0.05) as predicted by the Fick equation, indexed cardiac output reserve (8=3.9, 95%CI=1.2 to 4.8, R=48%, p=0.003) was an independent predictor of VO2R in the BC group, as was myocardial T1 (b=0.18, 95%CI=0.25 to −0.10, R²=65%, p=0.001). Mediation analysis demonstrated that the relationship between cardiac output and VO2peak is mediated by the extent of myocardial fibrosis.

CONCLUSIONS: Exercise intolerance following anthracycline treatment for breast cancer may be partially explained by reduced ability to augment cardiac output due to myocardial fibrosis.

1238 Board #364 May 27 2:30 PM - 4:00 PM Self-selected Walking Cadence After Light-intensity Physical Activity Intervention For Older Cancer Survivors
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PURPOSE: The MY Health randomized controlled trial evaluated the effectiveness of a wrist-worn activity monitor and health coaching to replace sedentary behavior with bouts of light-intensity physical activity among older cancer survivors. Participants were asked to 1) increase average daily steps ≥ 1000 above baseline and 2) disrupt sedentary behavior at least twice per hour. No specific recommendations regarding intensity or minimum bout duration were provided. In this secondary analysis, we hypothesized that participants would self-select to walk faster to meet their daily step goal.

METHODS: Average daily steps and free-living walking cadence were measured in 41 participants (age 69±3.1 yr), using an ActivPAL activity monitor for 7 days pre- and post-intervention. Step accumulation patterns associated with intensity of ambulatory behavior were sorted in cadence bands of one step/min from 40-59 (incidental movement) to ≥120 steps/min (fast locomotor movement). Repeated measures ANOVA was used to evaluate intervention induced changes in walking cadence; Wilcoxon rank-sum tests were used to highlight group differences within cadence bands. Medians and interquartile range are reported.

RESULTS: Intervention (n=24) and Waitlist Control (n=17) participants exhibited similar characteristics at baseline. The Intervention group increased average daily steps by 976 (IQR: -388 to 3532) from pre- to post-intervention; the control group increased by 354 steps/day (IQR: -658 to 1300); p<0.19. There was a significant interaction of the intervention on cadence bands (p<0.001). Steps taken in cadence bands denoting moderate intensity physical activity (MPA; 100-119 steps/min) increased by 478 (IQR: -121 to 1844) steps/day in the intervention group, compared to a decrease of 92 (IQR: -510 to 181) steps/day in the control group (p<0.01).

CONCLUSION: While only 29% of intervention group participants met the daily step goal, there was a displacement of steps taken from cadence bands associated with lower to those of higher intensity of stepping, i.e., participants self-selected to walk faster. These findings may have important clinical implications as both duration and intensity have shown to offer cardioprotective and other health-related benefits.

1239 Board #365 May 27 2:30 PM - 4:00 PM Relative Reliability Of A CT-Based Measurement System To Assess Body Composition In Colon Cancer Patients
Kendra Zadravec1, Logan Meyers2, Cameron J. Mitchell1, Howard Lim1, Jackie L. Whittaker2, Kristin L. Campbell, FACSM1. 1University of British Columbia, Vancouver, BC, Canada. 2British Columbia Cancer Agency, Vancouver, BC, Canada. (Sponsor: Kristin Campbell, FACSM) Email: kendra.zadravec@ubc.ca

Body composition is associated with important clinical and functional outcomes in colon cancer patients. Colon cancer patients often undergo computed tomography (CT) in routine clinical care. These images may then be used to assess body composition to potentially identify individuals who may benefit most from physical activity (PA) intervention. Developing reliable and accurate ways to measure body composition is a prerequisite to using CT-generated body composition to inform disease management. Developing reliable and accurate ways to measure body composition is a prerequisite to using CT-generated body composition to inform disease management. Developing reliable and accurate ways to measure body composition is a prerequisite to using CT-generated body composition to inform disease management.

METHODS: 25 CT scans were randomly selected from 10 men and 8 women (59.1±9.7yrs), all post-primary treatment for stage II-III colon cancer. Manual image analysis was conducted for each single CT image slice using SliceOmatic software (Tomovision, Montreal, Canada) to mark the third lumbar vertebra and segment/ quantify muscle (MUS), intramuscular adipose tissue (IMAT), visceral adipose tissue (VAT), subcutaneous adipose tissue (SAT), and the muscle attenuation coefficient (MA). Inter-rater reliability was assessed by estimating the agreement between measures from a) 2 trained manual analysts and b) a manual analyst and automated software (Voronoi Health Analytic; ABACS L3 Module), respectively. Intra-rater reliability was evaluated by estimating the agreement between measures by the same manual analyst one month apart. Inter- and intra-class correlation coefficients (ICCs) were calculated with ICC ≥ 0.9 deemed excellent reliability. Results: ICCs were excellent for both measures of inter-rater reliability (analyst 1 vs. 2: MUS=0.999, IMAT=0.928, V AT=1.000, SAT=0.999, MA=0.999; manual vs. automated: MUS=0.981, IMAT=0.710, VAT=0.997, SAT=0.992, MA=0.992), and intra-rater reliability (MUS=1.000, IMAT=0.971, VAT=1.000, SAT=0.999, MA=1.000) (all p<0.01).

Conclusion: Body composition analyses using clinical CT scans, SliceOmatic software, and a trained analyst is feasible for a single analyst across time, between two separate analysts, and between a manual analyst/automated software. Reliably reliable CT analyses of body composition are possible in stage II-III, post-primary treatment colon cancer patients.
Seventy studies demonstrate the beneficial effect of exercise on side effects and well-being during high dose/induction chemotherapy in patients with acute leukemia. Nevertheless, not only the chosen intervention and the exercise intensity vary between these studies but also the operationalization of exercise intensities differ. Although advices to use a graded exercise test in cancer patients exist, the suitability of this exercise testing in this specific group of patients has not been examined yet as far as the author knows.

Purpose: Investigate whether maximal effort of the participants has been generated during the graded exercise test.

Methods: As part of a bigger randomized controlled trial, 53 participants took part at the graded exercise test after being hospitalized to start high dose/induction chemotherapy treating acute leukemia or aggressive lymphoma. A graded exercise test starting at 20 watt increasing 10 watt per minute was performed. The ACSM criteria for a maximal exercise test were reviewed to determine whether the effort was maximal. These criteria are (1) a plateau in VO_{2peak}, with increased workload, (2) failure of heart rate to increase with increases in workload (3), a post-exercise venous lactate concentration > 8.0 mmol/l, (4) a rating of perceived exertion at peak exercise > 17 on the 6-20 scale ( Borg-Scale), and (5) a peak RER ≥ 1.10.

Results: Criteria one and four could not be tested due to the study design. Only one participant fulfilled the first criteria. Lactate concentration was measured right after the test and three minutes later. 15.4% (6 participants) and 21.4% (9 participants) respectively, reached a lactate concentration > 8.0 mmol/l and thus fulfilled the third criteria. A higher value than 17 on the Borg-Scale was stated by 66.0% (35) of the participants fulfilling the fourth criteria. Five (16.7%) and seven (23.3%) participants respectively met both the third and fourth criteria simultaneously.

Conclusion: Following the ACSM criteria, this investigation states that the majority of the patients did not reach the limit of exhaustion, suggesting that the graded exercise test might not be suitable for this group of patients.

INTRO: The physical decrements associated with cancer and its treatments can be attenuated with exercise. For this reason, exercise testing is essential to purposeful and individualized exercise prescriptions. Currently, the only treadmill protocol validated in cancer survivors is the University of Northern Colorado Cancer Rehabilitation Institute (CANCER) Treadmill Protocol. The Modified Bruce Treadmill Protocol (MB) is widely used for exercise testing in clinical settings and has been validated in healthy populations, but not cancer survivors. It is unknown whether the MB is an appropriate assessment tool compared to the validated cancer treadmill protocol. Multiple peak oxygen consumption (VO_{2peak}) predictive equations for the MB exist, however the accuracy of these equations in cancer survivors is unknown.

PURPOSE: To determine whether the MB yields as accurate VO_{2peak} values as the CANCER protocol in cancer survivors. The secondary purpose was to examine which MB predictive equation, if any, most accurately estimated VO_{2peak} in cancer survivors.

METHODS: Twenty-two cancer survivors completed two VO_{2peak} treadmill tests, the CANCER and the MB protocol. One protocol was performed once per week in a randomized order. VO_{2peak} values were obtained via gas analysis using a research-grade metabolic cart. A paired samples t-test was performed to determine if differences occurred between MB and CANER VO_{2peak} values. A repeated measures ANOVA was performed to determine differences between four MB predictive VO_{2peak} equations.

RESULTS: Due to its difficulty, one subject could not complete the MB, but completed the CANCER protocol. There were statistically significant differences between VO_{2peak} values (ml kg^{-1} min^{-1}) found between the MB (26.38 ± 7.90) and CANER protocol (28.65 ± 7.93) (p = 0.037). Furthermore, the American College of Sports Medicine (ACSM) walking/running equation from the last completed stage was the only predictive VO_{2peak} equation that was not statistically different than actual VO_{2peak} (p = 0.930) for the MB. CONCLUSION: Findings from this preliminary data suggest the MB underestimates VO_{2peak} in cancer survivors and may be too difficult for some to complete. This data proposes the MB may not be suitable to determine VO_{2peak} in cancer survivors.

B-84 Free Communication/Poster - Observational Research in Exercise Oncology

PURPOSE: Most Korean cancer patients do not participate in sufficient physical activity. Understanding the determinants of exercise behavior is important to improve their physical activity level. The purpose of this study was to examine the correlates of meeting exercise guidelines in Korean cancer patients.

METHODS: Data were obtained from the Korea National Health and Nutrition Examination Survey 2014-2016. We included 640 cancer patients who had been diagnosed with any type of cancer. Moderate and vigorous physical activity time and frequency of resistance exercise were assessed. Participants were categorized as meeting (1) aerobic only, (2) resistance only, (3) combined, or (4) neither exercise guideline based on the American College of Sports Medicine’s aerobic and resistance exercise guidelines for cancer survivors. Correlates included demographic, medical, and health-related fitness/quality of life variables. Univariate and stepwise multinomial logistic regression were used for statistical analyses.

RESULTS: The percentage of participants meeting the combined, aerobic only, resistance only, and neither guideline were 7.5%, 11.4%, 13.0%, and 68.1%, respectively. In univariate analyses, age (p<0.001), sex (p<0.003), education level (p<0.001), marital status (p<0.003), employment level (p<0.001), and income (p<0.001) were associated with meeting the exercise guidelines among demographic variables. Time since cancer diagnosis (p<0.027) and the number of comorbidities (p<0.030) were associated with meeting the exercise guidelines among medical variables. Hand-grip strength (p<0.001), quality of life for mobility (p<0.001), quality of life for self-care (p<0.047), quality of life for pain/discomfort (p<0.004), and total quality of life index (p<0.001) were associated with meeting exercise guidelines among health-related fitness/quality of life variables. In stepwise multivariate multinomial logistic regression, younger age, higher education level, more hand-grip strength, and better quality of life for mobility independently predicted exercise behaviors.

CONCLUSION: Physical activity level is insufficient in Korean cancer patients and their exercise behaviors were correlated with age, education level, muscular strength, and quality of life.

1243 Board #369 May 27 2:30 PM - 4:00 PM Exercise Recommendations For Adults With Bone Metastases: Outcomes Of A Delphi Consensus Process

PURPOSE: To understand the current views of an expert panel on exercise screening, assessment, and prescription in adults with bone metastases.

METHODS: Medical doctors, researchers, and exercise professionals with expertise in providing medical and/or exercise advice to cancer patients with bone metastases were identified. A 3-round modified online Delphi survey was used to establish consensus with a priori consensus set to 70%.

RESULTS: Response rates were 68% (73/107), 81% (59/73) and 97% (57/59) for each round. Key consensus points were: (a) as part of pre-exercise screening, information should be collected on the number, location, and type of bone lesion(s), level of bone pain, and any other bone-related symptom (100% consensus); (b) medical guidance (i.e. communication and medical information from a Physician) is recommended for patients with the following: bone lesions that are unstable (or unknown stability), bone pain, past medical treatment for bone pain, or history of disease-related fractures (90%
mediation and accelerometer wear within these studies was highly variable. PURPOSE: To quantify PA and SB in colorectal cancer survivors at a fixed time-point (12 months) after primary tumor resection. METHODS: The ColoCare Study is an international, longitudinal, prospective cohort study in newly-diagnosed colorectal cancer patients that collects questionnaires and biospecimens at regular intervals from diagnosis to 5 years post-resection. For this analysis, participants with stage I-III colorectal cancer from the German Cancer Research Center (DKFZ, Heidelberg, Germany) and the Huntsman Cancer Institute (HCl, Salt Lake City, UT) were provided an Actigraph GXT3+ accelerometer 12 months after primary resection and asked to wear the monitor 24 hours per day for 4+ consecutive days. PA volume and intensity were derived from raw accelerometer data using ActiLife software (v6.16.3) and Freedson (1998) activity cut-points. Pearson correlations were used to evaluate associations between PA, SB, and clinodemographic characteristics (e.g. BMI). RESULTS: Sixty-eight ColoCare participants (DKFZ n=43; HCl n=25) met valid accelerometer wear criteria (>10 h/day for 4+ days) at the 12 month time-point and were thus included in analysis. Participants spent 8.2 ± 5.8% of monitor wear time in moderate-to-vigorous physical activity (MVPA) and 73.3 ± 9.7% of monitor wear time sedentary. Additionally, participants accrued 168 ± 243 weekly exercise minutes (MVPA in bouts >10 minutes) and 38% were meeting the PA guidelines. Participants enrolled at HCI were significantly more active than those enrolled at the DKFZ (Steps/day: 10,008 ± 2,947 vs. 6,188 ± 3,815, p<0.05) and those patients who did not receive adjuvant chemotherapy were more active than those who underwent chemotherapy (Steps/day: 8,585 ± 4,160 vs. 6,350 ± 3,349, p<0.05). CONCLUSIONS: PA levels 12 months after primary colorectal cancer resection were greater than expected, and may be influenced by geographic location and adjuvant chemotherapy use. Supported by the ACSM Paffenbarger-Blair Fund for Physical Activity Epidemiology, the Lackas Foundation, and NIH U01 CA206110

Colon cancer is a major public health and clinical concern, as it is the third leading cause of cancer death in the United States. Numerous types and intensities of physical activity (PA) are shown to reduce cancer risk, however research is inconclusive on what time point in life (early, later, or maintaining throughout life) PA is most important to reduce colon cancer risk. PURPOSE: To evaluate whether the maintenance of and changes in PA levels over time, as measured over the life course as trajectories, are associated with colon cancer risk. METHODS: We used PA and health data from 334,905 generally healthy men and women in the NIH-AARP Diet and Health Study to test whether various PA patterns over the life course impacted colon cancer risk. Using latent class trajectory models,
we identified seven distinct PA trajectories using four time points across the life course from teenage years through middle age. We usedcox proportional hazard regression to assess the associations between the PA trajectories and colon cancer incidence.

RESULTS: In adjusted analyses (age, sex, education, smoking, alcohol, and red/processed meat intake), compared to those with consistently low PA levels, we found that those who maintained PA through life significantly reduced risk of colon cancer by about 13% (HR = 0.87, 95% CI 0.80-0.94; 0.87, 95% CI 0.76-0.99), and those who increased PA levels over 10 years more than doubled their risk by about 11% (0.89, 95% CI 0.78 - 1.03). However, those who decreased PA levels had a significantly higher risk of colon cancer (1.13, 95% CI 1.03-1.23).

CONCLUSIONS: Our results suggest that consistent participation in PA and increasing PA from low levels in the life course may be most protective of colon cancer risk. Promotion of PA throughout life for all ages and abilities is critical to minimize colon cancer risk, develop effective interventions, and disseminate prevention messages.

1247 Board #373 May 27 2:30 PM - 4:00 PM
Effect Of Exercise Intervention On Insulin, IGFs And IGFbs In Cancer Patients
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No relevant relationships reported

PURPOSE: Increased level of insulin and insulin like growth factor (IGF) have not only been associated with increased risk of different cancers but also with poor prognosis after cancer diagnosis. Aerobic exercise training lowers the levels of insulin and IGF in healthy people. Research looking at the effects of different exercise interventions on insulin, IGF and Insulin Growth Factor Binding Protein (IGFBP) is newly emerging. The purpose of this study is to systematically review the effects of exercise on insulin, IGF and IGFBPs in cancer patients.

METHODS: An electronic literature search was conducted using PubMed database up to July 2019, with search terms: cancer, exercise, insulin-like growth factor, IGF, and IGFBP. Eligible studies included peer-reviewed, randomized clinical trials (RCTs) that utilized either exercise or physical activity as their intervention for cancer survivors. All study design, participant characteristics, intervention, IGF related outcomes, and key findings were evaluated systematically and summarized.

RESULTS: Eight articles were deemed eligible for the systematic review. Cancer types included breast cancer, colorectal cancer, prostate cancer, non-small cell lung cancer, and endometrial cancer. Mean age of the sample population included in our study was 60.3 ± 6.9 years (n, intervention group = 184; n, control group= 160). Mode of exercise consisted of either aerobic, strength training, combination of aerobic and strength training, endurance exercise, or Tai chi. All but one study showed that exercise resulted in significant reductions in circulating levels of IGF-I and IGF-II. Results were inconsistent with exercise on IGFBP-3 levels. CONCLUSIONS: The literature is inconsistent of the impact of exercise to lower IGF levels and that could be because of the different duration and type of exercise intervention in different studies. Because of the inconsistency, meta-analysis could not be performed. Large randomized controlled trials with different exercise interventions are required in this area to reach a firm conclusion. A greater understanding of the impact of exercise and dosing of exercise can empower physical therapists to play a greater role in cancer survivorship programming.

1249 Board #375 May 27 2:30 PM - 4:00 PM
Effects Of Exercise Training On Cachexia In Mice Bearing The Colon-26 Carcinoma
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Purpose: Colon cancer (CRC) is the third most prevalent cancer in the U.S. and risk is increased by lifestyle factors such as poor diet and physical inactivity. Also, CRC patients are highly susceptible to developing cachexia, which is characterized by muscle wasting, fatigue, and immune dysfunction. Cachexia leads to increased morbidity and mortality. Studies have shown that aerobic and resistance training, independently, can effectively attenuate the deleterious effects of cachexia, and though research on concurrent training is limited, studies are reporting that combined exercise positively affects muscle wasting.

METHODS: An electronic literature search was conducted using PubMed database up to November 2019 with search terms: exercise, training, CRC, cachexia, mouse, and cancer. Only articles that met the following criteria were included in the analysis: experimental design, mouse model, and focus on cachexia. As of the date of analysis, there were 18 articles that met the inclusion criteria. All studies were initially evaluated and only studies with more than one intervention group were included. A meta-analysis was performed using a random effects model. Studies were included in the analysis if the intervention was a concurrent exercise program. The results of the meta-analysis were reported as an effect size (Hedges’ g).

RESULTS: Our results suggest that consistent participation in PA and increasing PA from low levels in the life course may be most protective of colon cancer risk. Promotion of PA throughout life for all ages and abilities is critical to minimize colon cancer risk, develop effective interventions, and disseminate prevention messages.

CONCLUSIONS: Our results suggest that consistent participation in PA and increasing PA from low levels in the life course may be most protective of colon cancer risk. Promotion of PA throughout life for all ages and abilities is critical to minimize colon cancer risk, develop effective interventions, and disseminate prevention messages.

1248 Board #374 May 27 2:30 PM - 4:00 PM
Resistance Training Attenuates Cancer Cachexia- induced Cardiac Remodeling
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No relevant relationships reported

Cancer-induced cachexia is a state of ill health characterized by cardiac and skeletal muscle atrophy that has profound impacts on cardiovascular function and quality of life. Resistance training (RT) during treatment has been shown to improve cardiac function via cardiac hypertrophy. PURPOSE: To assess the capacity for RT to minimize cachexia-induced cardiac remodeling.

METHODS: All procedures were done in accordance with an IACUC approved protocol. Male-Wistar rats (n=48) were randomly assigned to a sedentary (SED), RT, SED+cancer, and RT+cancer group. Animals assigned to RT groups trained for a total of 13 wk using an elevated food model to simulate low intensity RT. SED animals were placed in standard animal housing for an equivalent amount of time. At week 10, animals were injected with Walker-256-mammarycarcinoma cells (10⁶ cells) or an equivalent amount of 0.9% saline. Left ventricular morphology was measured using echocardiography prior to injection and at the end of the 13 wk experiment. Differences in cardiac morphology (i.e. thickness, and diameter) were analyzed by t-tests. RESULTS: There was a significant (p < 0.05) difference in posterior wall thickness between systole of SED animals (0.30±0.04 cm) compared to RT (0.34±0.05 cm). Posterior wall thickness during diastole was significantly (p < 0.05) increased in RT+cancer (0.21±0.03 cm) animals compared to SED+cancer (0.18±0.04 cm). SED+cancer animals had a significantly larger left ventricular diameter (LV) (0.72±0.04 cm) compared to RT+cancer (0.67±0.00 cm). The combination of RT+cancer significantly attenuated the increase in LV diameter (0.67±0.03 cm).

CONCLUSIONS: The results suggest that the posterior wall is susceptible to cachexia induced remodeling. However, RT attenuated the degree of cardiac remodeling.

1250 Board #376 May 27 2:30 PM - 4:00 PM
The Effect Of Creatine And Creatinine Supplementation On Doxorubicin Treatment Of Walker 256 Mammary Carcinoma Cells In Vitro
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No relevant relationships reported

Doxorubicin (DOX) is a powerful chemotherapeutic agent with potent cytotoxic effects that result in increased rates of cell death and reduced viability. Recent evidence has shown that creatine (Cr) may minimize DOX-induced cytotoxicity to non-cancerous tissues; however, few studies have investigated the effect of Cr on tumor proliferation with or without DOX. PURPOSE: To determine if supplementation with Cr or creatinine (CrN) alters cell viability in a tumor model when combined with DOX over a 48 hr time period. METHODS: Walker 256 mammary carcinoma cells were cultured in growth medium (90% DMEM 10% FBS) until they reached 90-95% confluency. Cells were then exposed to growth media containing either 10 μM of DOX, 10 mM of Cr, 10 mM of CrN, 10 μM DOX + 10 mM Cr, 10 μM DOX + 10 mM CrN, or regular growth media as a control for an additional 48 hr. Cell viability
was assessed at 0, 12, and 48 hr using an EarlyTox™ Cell Integrity Kit and analyzed via a Nikon live cell confocal imaging system. Results: At 12 hr post-treatment, DOX and DOX+Cr had significantly lower cellular viability compared to baseline (P < 0.05). At 48 hr, Cr, DOX, and DOX+Cr had significantly lower cellular viability compared to baseline (P < 0.05). No significant differences in viability were found in the control group. Conclusion: The addition of Cr or DOX did not affect the cytotoxic effects of DOX.

Introduction: Exercise has been shown to reduce the prevalence of certain cancers. Moderate-intensity exercise has been shown to have significant effects on tumor progression and metastasis in the PyMT mouse model of breast cancer. METHODS: From 4 weeks of age, female MMTV-PyMT mice on the FVB background were housed with access either to wirelessly recording running wheels or locked control cages. Full body weight and locomotor activity were monitored continuously, tumor stage, and pulmonary metastases were determined histologically at the 12 week endpoint. In a follow-up study, pre-trained female FVB mice were injected intravenously with 2*10^5PyMT derived tumor cells (IC3) and after an additional 10 weeks of voluntary running, pulmonary metastases and immune cell infiltration was quantified. These results demonstrate that moderate exercise can slow the progression of tumorigenesis in a mouse model of lung cancer. However, the exercise mechanism of action remains unclear; while we did see a trend toward decreased levels of IL-6, no significant change in pro-inflammatory cytokines IL-6 and TNF-alpha. Lung cancer is the leading cause of cancer mortality worldwide with current treatments resulting in an average 17% 5 year survival rate. Moderate exercise may be a practical method for patients to help suppress tumor progression.

**Purpose:** To determine factors that may contribute to cancer-associated losses in muscle mass and to identify potential biomarkers indicative or predictive of the severity of muscle wasting. METHODS: Lewis lung carcinoma (LLC1) cells or vehicle (CON) were injected subcutaneously into the left flank of seven week-old C57BL/6 male and female mice. After 21 days, skeletal muscle mass and function were assessed. Mitochondrial energetics were assessed in permeabilized muscle fibers using high-resolution respirometry, and fractional protein synthesis rates following the administration of 125I-phenylalanine were measured by mass spectrometry. To explore potential mechanisms and biomarkers of cachexia, untargeted metabolomics was performed using plasma and skeletal muscle from LLC1 and CON mice. RESULTS: Tumor-bearing mice showed evidence of cachexia, with 6.8% lower body mass (p<0.001), 10.0% lower quadriceps mass (p=0.010), 9.7% lower gastrocnemius mass (p<0.001), and 9.6% lower grip strength (p=0.004) at day 21. Mixed muscle protein synthesis was impaired in LLC1 mice (-18.6%, p=0.0279). Synthesis of both the sarcoplasmic and myofibrillar proteins was lower in LLC1 mice (-34.4%, p=0.0091 and -24.5%, p=0.0039, respectively). Mitochondrial protein synthesis was not significantly affected, and no differences in mitochondrial energetics were observed between LLC1 and CON mice. Untargeted metabolomics revealed significant increases in asymmetric dimethylarginine (ADMA) and N-monomethyl L-arginine (L-NMMA) in both the skeletal muscle and plasma of LLC1 mice. CONCLUSION: The synthesis of contractile and sarcoplasmic proteins was inhibited in cachectic, tumor-bearing mice. Elevations in ADMA and L-NMMA, endogenous nitric oxide synthase inhibitors formed during proteolysis, may both serve as biomarkers of cachexia and play a mechanistic role in the loss of muscle mass. Project supported by the Andersen Corporate Foundation and T32AR056950.

**Purpose:** To investigate the effects of Cr and creatine (Cr) supplementation has been shown to have a therapeutic role in several disease states characterized by high ROS generation and metabolic dysfunction, which are common with DOX treatment. METHODS: To investigate the effects of Cr and creatine (Cr) treatment on cell viability in DOX-treated myoblasts. METHODS: Skeletal muscle cells (RKS5), H9C2 cardiac myoblasts, and A10 aortic smooth muscle cells were cultured in growth medium (10% FBS and 90% DMEM) until they reached 90-95% confluence. Cells were then collected and seeded on a 96-well plate at a density of 10,000 cells/ml containing fresh skeletal muscle growth media and allowed to recover for 24 hours. Cells were then exposed to fresh growth media containing either 25 μM of DOX, 10 mM Cr, 10 mM CON, 25 μM DOX + 10 mM Cr, or 25 μM DOX + 10 mM CrN for an additional 24 hours. Rates of apoptosis were assessed using a cell viability kit (Molecular Devices) and analyzed via a Nikon live cell confocal imaging system. RESULTS: DOX treatment resulted in significantly lower viability regardless
of cell type (P<0.05). On average, viability was 46.3±7.1% for DOX treated cells. The addition Cr or CrN with DOX significantly increased viability to 78.4±8.1% and 79.9±14.6%, respectively (P<0.05). **CONCLUSION:** Initial evidence from this investigation provides direct evidence to support the use of Cr and CrN to improve cell viability with DOX treatment.