

## 1. The Effect of Walking Duration on Gait Biomechanics in Children

Alissa A. Ackerman<sup>1</sup>, Wayne J. Board<sup>1</sup>, Zachary F. Lerner<sup>2</sup>, Raymond C. Browning, FACSM<sup>1,2</sup>

<sup>1</sup>Department of Health and Exercise Science, Colorado State University, Fort Collins, CO 80523-1582

<sup>2</sup>School of Biomedical Engineering, Colorado State University, Fort Collins, CO, 80523-1582

Children are encouraged to participate in 60+ minutes of physical activity per day. Continuous bouts of walking (e.g. 10 minutes) are commonly recommended. However, we don't know if children walk differently as duration increases. **PURPOSE:** To evaluate the effects of walking duration on gait biomechanics in children.

**METHODS:** Eighteen children (9.1 (1.4) years, 1.37 (0.9) m, 34.4 (10.0) kg, mean (SD)) walked on a dual-belt force measuring treadmill at 1.00 m/s for 20 minutes. Data were collected at 6 minutes and 19 minutes. We measured three-dimensional lower extremity kinematics and ground reaction forces. Joint moments were computed via inverse dynamics. **RESULTS:** Gait mechanics changed over time (Table 1). Participants walked with slightly longer strides and greater double support time at the 19<sup>th</sup> compared to the 6<sup>th</sup> minute of the trial. There were also small but significant increases in peak ankle plantar flexion, ankle inversion, and early stance knee adduction joint angles across the two time points. Peak early stance knee extension, peak early and late stance knee adduction, and peak hip flexion joint moments were significantly greater at the 19<sup>th</sup> versus the 6<sup>th</sup> minute of walking. **CONCLUSION:** The increase in the early stance peak knee extension and adduction moments may indicate that knee loads increase and become more medially distributed as walking duration increases. These findings may have implications in prescribing appropriate exercise bout durations for children, particularly those who have altered gait mechanics due to excess adiposity. More research is needed to determine how adiposity and walking duration affect gait mechanics in children so that safe and effective physical activity recommendations can be developed.

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Table 1 – Gait Parameters at 6 and 19 Minutes

<i>Parameter</i>	6 minutes	19 minutes
<i>Stride Length (m)</i>	1.02 (0.02)	1.05 (0.02)
<i>Double Support Time (s)</i>	0.11 (0.01)	0.12 (0.01)
<i>Peak Knee Extension Moment (Early Stance)(Nm/kg)</i>	0.32 (0.03)	0.37 (0.03)
<i>Peak Knee Abduction Moment (Early Stance)(Nm/kg)</i>	0.19 (0.02)	0.25 (0.025)
<i>Peak Knee Abduction Moment (Late Stance)(Nm/kg)</i>	0.07 (0.02)	0.12 (0.09)
<i>Peak Hip Flexion Moment (Early Stance) (Nm/kg)</i>	0.67 (0.04)	0.61(0.04)

Values are mean (SE). p<0.05 for all parameters.

## 2. The Association Between Sleep, Morning Cortisol, and Insulin Resistance in Obese Adolescents: A Pilot Study.

Ayres, CL, Byra, MM, Guseman, EH

Current research states that sleep deprivation is associated with insulin resistance and elevated morning cortisol. **PURPOSE:** The purpose of this study was to examine the inter-relationships between sleep, cortisol, and insulin resistance in a sample of obese adolescents. **METHODS:** Fifty obese adolescents were asked to wear the SenseWear Pro2 armband 24 hours a day for 7 days and to collect saliva samples at 6 specific times (e.g., immediately upon waking, 30 minutes after waking, and 3, 6, 9, and 12 hours after waking) on one weekend day. Participants with complete cortisol data and sleep data for the night preceding saliva sampling ( $n=18$ , mean age  $14.9 \pm 1.9$  y) were included in the present analysis. Pearson's correlations were used to examine the relationship between sleep and cortisol variables. Median splits were used to create four sleep x waking cortisol groups to examine the joint role of the sleep and cortisol in insulin resistance (homeostasis model assessment of insulin resistance [HOMA\_IR]) by ANOVA. **RESULTS:** Waking cortisol was inversely correlated with sleep duration ( $r = -0.56$ ,  $p < 0.05$ ) and varied significantly between low and high sleep groups (mean = 0.24 vs 0.13, respectively  $p < 0.05$ ). No significant differences were found when examining HOMA\_IR by sleep duration, although a non-significant visual pattern did emerge. **CONCLUSIONS:** Salivary cortisol measured immediately upon waking is inversely correlated with sleep duration over the previous night. Results from this small study suggest that further study is warranted regarding the role of the sleep x cortisol interaction in insulin resistance among obese youth.

Category A

Mentor: EH Guseman, PhD

## 3. MUSCLES OF THE LOWER BODY ARE ACTIVATED NON-UNIFORMLY FROM ORIGIN TO INSERTION DURING WALKING.

JM Benson, JH Kindred, NB Ketelhut, T Rudroff

Jmbenson@rams.colostate.edu

Department of Health and Exercise Science, College of Health and Human Sciences, Colorado State University, Fort Collins, Co, 80523

Muscle injuries can occur during any type of physical activity. A common method in evaluating these injuries is to measure the activity of the muscle during task performance. Previous techniques in studying muscle activity have not been able to determine the uniformity of muscle activation due to their limited spatial resolution. Positron Emission Tomography (PET), with the glucose analogue tracer [ $^{18}\text{F}$ ]-Fluorodeoxyglucose (FDG), is a novel approach allowing the investigation of activity throughout entire muscles. **PURPOSE:** To determine region specific activity within the major muscles of the lower body during walking using FDG-PET. **METHODS:** Eight healthy people (4 men) walked on a treadmill at a self-selected speed for 15 minutes. After 2 minutes of walking each participant was injected with  $\approx 322$  MBq of FDG. Within 2 minutes after walking PET/Computed Tomography (CT) imaging was initiated. Regions of interest (ROI) were drawn on CT images for each muscle of the lower body. Each ROI was divided into 10 sections of equal length, and the activity of each was defined as the mean Standardized Uptake Value (SUV) from the PET images. Greater SUV signified greater activity. **RESULTS:** One-way analysis of variance tests between the sections of each muscle revealed significant  $f$  statistics ( $P < 0.042$ ). These findings were within the rectus femoris, vastus medialis, vastus lateralis, biceps femoris long head, gracilis, sartorius, tensor fascia latae, and the iliopsoas. Post-hoc testing showed that, proportionally, the proximal regions of each of these muscles ( $P < 0.050$ ) had greater activity, except the iliopsoas which had lower activity within the middle sections ( $P < 0.041$ ). **CONCLUSIONS:** This data indicates muscle activity is proportionally greater in the proximal regions of 8 major muscles involved in walking. In order to achieve uniform muscle adaptations with physical activity it

may be necessary to supplement walking with exercises that show increased distal region activation. Understanding non-uniform muscle activation during different activities may allow physical and sports medicine therapists to design effective interventions to reduce muscular injuries during exercise.

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Category A

Mentor: T Rudroff, PhD

#### **4. UPHILL CYCLING: SEATED VS STANDING ECONOMY AND HEART RATE**

Berkemeier, Q.N., Alumbaugh, B.W., and Smith, G.A.

Email: qnberkemeier@mavs.coloradomesa.edu

Department of Kinesiology, Colorado Mesa University, Grand Junction, Colorado

**PURPOSE:** Compare economy ( $VO_2$ ) and heart rate (HR) for seated and standing cycling positions when riding uphill at constant speed. **METHODS:** Three male collegiate team cyclists ( $21.3 \pm 1.7$  yrs;  $68.0 \pm 4.6$  kg) participated in a pilot study of a single continuous bout of uphill riding which used both seated and standing positions. Cycling was at sub threshold intensity with fixed speed (8 mph; 3.58 m/s) and grade (8%) on a large treadmill (length 3 m). After a 10 minute warm up, a 20 minute trial began which alternated 5 minute stages of either seated or standing cycling. Specific gears generating cadences of about 66 and 60 rpm (seated and standing respectively) were required during each 5 minute stage.  $VO_2$  and HR data were collected continuously throughout the test but the last two minutes of each stage were compared using single-subject analyses.  $VO_2$  was recorded at 15 s intervals using a Parvo Medics metabolic cart; HR was recorded at 1 s intervals using a Garmin Edge 800 and chest strap. **RESULTS:** Each rider required greater oxygen uptake and had higher heart rates when standing compared to seated ( $p < .05$ ). Mean  $VO_2$  values were  $3.06 \pm 0.37$  L/min and  $3.17 \pm 0.43$  L/min whereas mean HR values were  $166 \pm 5$  bpm and  $175 \pm 4$  bpm for seated and standing trials, respectively. RPE was less consistent; two riders increased RPE while standing, while one increased RPE when seated. **CONCLUSION:** Elite cyclists require greater oxygen uptake and have higher heart rates when climbing in a standing position compared to seated. However, in a real world scenario, muscle fatigue, pedaling technique, and air drag forces may also impact a cyclist's decision to ride seated or standing.

Category A

Mentor: G.A. Smith, PhD

#### **5. MUSCLES ALIVE! A NOVEL, EXPERIENTIAL NEUROSCIENCE EDUCATION OUTREACH PROGRAM FOR ELEMENTARY, SECONDARY, AND UNIVERSITY STUDENTS**

Bost, BE, EJ Cumler, LR Jankowski, DV Rasicci, KE Timroth, and BL Tracy Department of Health and Exercise Science, Colorado State University, FORT COLLINS, CO

**PURPOSE:** An effective strategy to improve neuroscience education is to make lessons fun, interactive, and immersive. Experiential, auditory, and visual modes of information transmission can optimize learning in diverse student groups. Our lab conducts EMG studies that involve expensive lab-based equipment not suitable in the field or public education setting. In 2012, a collaboration between our CSU group and Backyard Brains (BYB), Inc., resulted in BYB's new EMG Spikerbox, an inexpensive bioamplifier that for the first time allows students of all ages to experience, see, hear, and record their own muscle electrical activity in school and community settings. The EMG signal is detected with electrodes made from common materials, displayed via a free app on smart phones or tablets, and played through hobby speakers. The novel EMG kits are the centerpiece of our two yr-old program Muscles Alive!

**METHODS:** Offering vivid visual and audio feedback, our participatory demonstrations include, in part:

- 1) Live display of EMG from hand, arm, leg, and face muscles during different tasks
- 2) Jaw muscle activity - chewing experiments with foods of different consistencies.
- 3) Weight lifting and arm wrestling
- 4) Occasional successful recording of single motor unit spike trains, allowing observation of single neuron discharge behavior

5) Tendon vibration demos with handheld massagers that target afferent muscle sensors: The Phantom Limb (tonic vibration reflex) and the Neurophysiology Trust Fall (proprioceptive illusion).

**RESULTS:** With accompanying age-appropriate tutorials, our demos teach students about 1) biological electricity and excitable cells, 2) the relation between brain command and muscle activation, 3) how action potentials are transmitted efferently to muscle and converted to force, 4) the role of muscle sensors (spindles) in reflexes and proprioception, and 5) the essential role of voluntary muscle control in everything that makes us human. **CONCLUSION:** We have interacted with >3,000 9-18 year-olds during > 42 events in public schools, science fairs, expos, and after school programs. The concepts have been successfully translated to large adult audiences and university neuromuscular physiology and kinesiology courses.

## 6. Implementing a Structured Curriculum in After School Physical Activity Programs

Boyd M, TK Behrens FACSM, JM Schuna Jr., DJ Miller, E Epstein, ML Liebert

Email: boydm09@gmail.com

University of Colorado at Colorado Springs, Colorado Springs, CO

**PURPOSE:** To increase physical activity (PA) through implementing a structured curriculum in afterschool programs (ASP) in low-SES elementary schools. **METHODS:** Using a cross-sectional analysis five schools in a low-SES school district in Southern Colorado were recruited to implement a structured curriculum into their existing ASP for 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> graders (N=338). Schools were randomly selected to receive the curriculum as a delayed intervention, with two schools receiving the intervention immediately following baseline measurements. Observations were taken approximately 6 weeks apart at each site. Four observations were taken at each school. During each observation a range of 19-24 students were randomly selected to wear accelerometers. Accelerometer data were collected in 30 second intervals; PA levels were analyzed using Evenson's (2008) cut points for youth. Descriptive statistics and ANOVA's were calculated. **RESULTS:** Students wore accelerometers an average of  $45.72 \pm 10.28$  min-session<sup>-1</sup>. Overall PA increased significantly from  $35.62 \pm 6.66$  min-session<sup>-1</sup> to  $41.14 \pm 6.76$  min-session<sup>-1</sup> ( $p < .001$ ). Light PA increased significantly from  $17.91 \pm 7.02$  min-session<sup>-1</sup> to  $23.49 \pm 8.94$  min-session<sup>-1</sup> ( $p < .001$ ). Moderate PA increased significantly from  $9.41 \pm 3.98$  min-session<sup>-1</sup> to  $12.10 \pm 5.97$  min-session<sup>-1</sup> ( $p < .001$ ). Although overall PA increased, vigorous PA decreased significantly from  $8.29 \pm 4.38$  min-session<sup>-1</sup> to  $5.54 \pm 5.32$  min-session<sup>-1</sup> ( $p < .001$ ). **CONCLUSION:** Findings indicate an overall increase in PA during the structured curriculum. Paradoxically, a simultaneous decrease in vigorous PA was observed. The reasons for this discrepancy are unclear. Future research should investigate the impacts of structured versus unstructured ASP on PA intensity levels.

Category A

Mentor: TK Behrens, PHD

## 7. EFFECTS OF A TWELVE WEEK AEROBIC AND COGNITIVE TRAINING INTERVENTION ON COGNITIVE FUNCTION IN APPARENTLY HEALTHY OLDER ADULTS

Brennecke, AP, BM Peterson, J Sones, D Anderson, C Beebe, J Medrano, JM Brown, DYK Shackelford, and R Hayward

Email: bren0230@bears.unco.edu

Rocky Mountain Cancer Rehabilitation Institute, University of Northern Colorado, Greeley, CO.

**INTRODUCTION:** Apparently healthy older adults are a segment of the population who may experience impairments in various aspects of cognitive functioning throughout the normal aging process. Recently our group defined this as age-related cognitive impairment (ARCI). Research has indicated that the normal aging process may play a role in observed impairments in information processing speed, memory, concentration, reaction time, attention, cognition, organizational skills, linguistic abilities, executive function, and activities of

daily living. The benefits of physical activity in this population have been well established in the literature. Researchers have observed acute and chronic improvements in executive function, planning, and working memory, with aerobic exercise interventions in children, adolescents, and older adults. However, to our knowledge there have not been any studies evaluating the effects of combined aerobic and cognitive training on cognitive function in apparently healthy older adults. **PURPOSE:** To examine the effects of a 12-week aerobic and cognitive training intervention on cognitive function in older adults. **METHODS:** Fourteen participants (40-75 years) were included in this pilot study. Each individual was placed into one of the following training groups: 1) aerobic, cognitive, and flexibility (AER/COG); 2) aerobic and flexibility (AER); or 3) cognitive and flexibility (COG). A comprehensive physical assessment and cognitive assessment were completed pre- and post- 12-week intervention. Individuals were trained three times per week or 36 sessions total for one hour each session. **RESULTS:** Kruskal-Wallis non-parametric analyses revealed no significant ( $p > 0.05$ ) main effects for between group comparisons, however, pre- to post- improvements were observed in several cognitive tests, physiological, and psychosocial measures. **CONCLUSION:** Within group measures revealed that aerobic training resulted in the greatest overall amount of pre- to post- improvements in cognitive, physiological, and psychosocial variables. Results suggest that, individually, aerobic or cognitive training may reduce age-related cognitive impairment. However, the results of the combined training suggest that even for apparently healthy older adults, training of this nature may be excessive due to the overall difficulty of concentrating on cognitive games while attempting to pedal a cycle ergometer.

Category A

Mentor: R Hayward, PhD

## 8. WHAT DID YOU DO AT SCHOOL TODAY? ACTIVITY CLASSIFICATION AND DISTRIBUTION IN A CLASSROOM

H. Bridgewater, J. Valencik, E. Strutz, C. Schaefer, R. Browning, FACSM

Email: [hdbridge@rams.colostate.edu](mailto:hdbridge@rams.colostate.edu)

Department of Health and Exercise Science, Colorado State University, 220 Moby B Complex, Fort Collins, CO 80523

The elementary school classroom has been considered a sedentary environment, but there have been few attempts to quantify the types of activities that occur in the classroom setting and their distribution. **PURPOSE:** To apply direct observation techniques to determine the relative amount of time 4<sup>th</sup> grade students engage in various activities while in the classroom, and to determine if time spent sedentary correlates with BMI status. **METHODS:** We collected a single day of video data in a 4<sup>th</sup> grade classroom. Classroom activities were observed and coded using a seven-code activity classification system on a sample of children (n=7 boys & 6 girls: BMI<sub>z</sub>= -0.064, SD=1.402). The seven activities included: 1) sitting on the floor, 2) sitting quietly, 3) sitting actively, 4) standing quietly, 5) standing actively, 6) walking, and 7) running/skipping/jumping. The average amount of in-class time, coded time, and the average time children spent in each activity were determined. We used bivariate correlations to explore the relationship between BMI<sub>z</sub> score and percent of time spent in sedentary activities (sitting, standing). **RESULTS:** Of the 5 hours of classroom video, 3 hours were spent in the classroom. Of the in-class time, 1.2 hours (38.5%) were classified and 1.8 hours (61.5%) were not classified due to children missing from the video, performing an activity not classified, or transitioning between activities. Of the video data that were classified, children spent an average of 16.2% of the time sitting on the floor, 48.9% sitting quietly, 6.9% sitting actively, 9.3% standing quietly, 11.9% standing actively, 6.5% walking, and 0.3% running/jumping/skipping. There was no relationship ( $r=0.264$ ,  $p=0.383$ ) between BMI<sub>z</sub> score and relative amount of time spent engaged in sedentary activities. **CONCLUSION:** Direct observation highlights the challenges of classifying children's movement, quantifying children's activities, and estimating PA intensity in a classroom setting. Despite these challenges, our data suggest that, although a majority of class time is likely spent sedentary (72%), children engage in non-sedentary activities during the remaining classroom time. While these estimates may be conservative, extrapolated across a school day, this could be a meaningful amount (nearly 2 hours) of time spent standing or moving.

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Category A

Mentor: Ray Browning, Ph. D

## **9. EFFECT OF PACE ON STABILIZATION AFTER RISING FROM A CHAIR IN YOUNG AND OLDER ADULTS**

Burke, KM, BL Tracy, and RF Reiser II

Email: [Kimberly.burke@colostate.edu](mailto:Kimberly.burke@colostate.edu)

Department of Health and Exercise Science, College of Health and Human Sciences, Colorado State University, Fort Collins, CO

Falls are a significant concern for an aging population, with 14% of falls thought to occur during the transition from sitting to standing. **PURPOSE:** To determine the effect of chair rising speed on stabilization in young and older adults. **METHODS:** Twenty healthy older (71.8±4.2 yrs) and 20 young adults (22.5±2.7 yrs) were first assessed for functionality using the Short Physical Performance Battery (SPPB). Then, each performed 4 single repetitions each of comfortable pace (CSTS) and maximal fast pace sit-to-stand (FSTS) in a randomized block design while on a force platform. The stabilization phase was defined as the period from when the vertical ground reaction force returned to bodyweight after knee extension until center of pressure (COP) variability was within 2 standard deviations of their quiet stance. The anterior-posterior (A-P) and medial-lateral (M-L) directions were assessed independently. **RESULTS:** While still high functioning, the older adults had higher scores on the SPPB (11.3±0.8 vs 12.0±0.2; p=0.002). The stabilization phase was significantly longer in the A-P direction during FSTS (3.13±1.01 vs 2.70±0.88 s; p=0.039), with no differences between groups or within the M-L direction. However, the older adults did have significantly greater movement of the COP during the first 2s of stabilization, regardless of pace (A-P Path Length: 5.17±1.47 vs 3.96±1.17, p=0.002; M-L Path Length: 3.35±0.94 vs 2.57±0.64 % standing height, p=0.001). Furthermore, this A-P Path Length was significantly correlated between the CSTS and FSTS amongst the older adults, but not for the young (r=0.598, p<0.01 vs r=0.438, p>0.05). **CONCLUSION:** Although a healthy and high functioning group of older adults were examined, differences between groups existed during the STS, most notably at the beginning of the stabilization phase. It also appears that performance during CSTS and FSTS are more closely coupled in the older adults than the younger adults. This coupling suggests that older adults might dynamically control slow and fast STS similarly with a singular strategy while younger adults may have multiple strategies. This reduced flexibility of response may be adding to the increased risk of falls in older adults during the STS task.

Category A

Mentor: RF Reiser II, Ph.D.

## **10. The association between measures of fitness and metabolic health in treatment-seeking obese youth.**

Samuel Cauffman, Emily Hill Guseman, Jared M Tucker

University of Wyoming, Laramie, WY

Helen DeVos Children's Hospital, Grand Rapids, MI

Previous studies have shown that both cardiorespiratory fitness (CRF) and measures of muscular fitness are associated with metabolic syndrome. However, limited information exists about these relationships in severely obese youth, who are at increased risk of metabolic dysfunction. **PURPOSE:** The purpose of this study was to examine the relationship between measures of fitness with metabolic health in obese, treatment-seeking youth. **METHODS:** Data for this analysis were collected at the time of baseline visits at a stage 3 pediatric weight management center. Maximal voluntary contractions were obtained using isometric hand-grip dynamometry and CRF was obtained from a maximal treadmill test. Resting blood pressure and fasting measures of blood lipids, glucose, and insulin were used to calculate a continuous metabolic syndrome score (cMetS); HOMA-IR was calculated from fasting insulin and glucose. Relationships between measures of fitness and metabolic

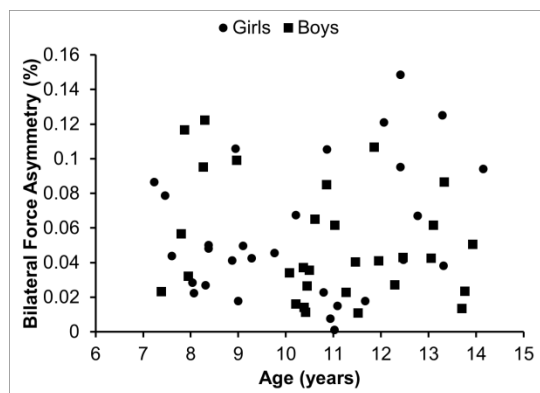
health were evaluated using partial correlations adjusted for age. **RESULTS:** Sixty-nine participants (21 boys, 48 girls) are included in this analysis. Of these, 46% (n=32) met criteria for metabolic syndrome. No differences were found between boys and girls for any variable analyzed. Muscular strength was positively associated with cMetS ( $r=0.35$ ), while CRF was inversely associated with HOMA-IR ( $r=-0.26$ ) and fasting insulin ( $r=-0.27$ ). Body fat percentage was positively associated with insulin ( $r=0.31$ ). No significant relationship was found between CRF and cMetS. **CONCLUSION:** Contrary to previous studies, CRF was not associated with metabolic syndrome in this group. Muscular strength, however, was associated with cMetS. Notably, CRF was associated with both HOMA-IR and fasting insulin, which are associated with metabolic risk and were not included in the cMetS score. These results suggest that CRF and muscular strength influence metabolic function through different mechanisms.

Category A  
Mentor: EH Guseman, PhD

## 11. AGE AND SEX EFFECTS ON FORCE ASYMMETRY DURING JUMP IN YOUTH SOCCER PLAYERS

Cosgrove, MJ, ML Stephenson, TJ Hinshaw, KL Overton, AL Roberts, EA Meyer, and B Dai  
Email: mcosgrov@uwyo.edu

Division of Kinesiology and Health, College of Health Sciences, University of Wyoming, Laramie, WY  
Increased asymmetry in lower extremity bilateral strength is associated with increased risks for lower extremity injuries. A countermovement jump is a validated tool to assess asymmetry in lower extremity bilateral strength. **PURPOSE:** To investigate the effects of age and sex on bilateral force asymmetry during a countermovement jump in youth soccer players aged 7 to 14 years. **METHODS:** Thirty males and 29 females (7-14 years old) performed three trials of a countermovement jump on two Bertec force plates and the vertical ground reaction force produced by each leg was quantified. The maximum force produced by the dominant (preferred kicking leg) and non-dominant leg was extracted and the bilateral force asymmetry was calculated and expressed as a percentage of the stronger leg. **RESULTS:** Paired t-tests indicated that the dominant leg ( $1.26 \pm 0.19$  body weight (BW)) tended to demonstrate increased maximum force compared with the non-dominant leg ( $1.24 \pm 0.18$  BW,  $p = 0.08$ ). Regression analysis revealed that the bilateral force asymmetry was not significantly correlated with age ( $p = 0.77$ ), nor different between the sexes ( $p = 0.36$ ). **CONCLUSIONS:** Preliminary results from this study indicate a potential asymmetry in lower extremity strength between the dominant and non-dominant legs in youth soccer players aged 7 to 14 years old. The asymmetry, however, did not tend to change as age increased. Males and females also demonstrated similar asymmetry. The findings suggest that screening for asymmetry in lower extremity strength should be initiated in childhood and adolescence in soccer players. An individual-based strategy may be needed for screening and injury prevention instead of simply using age and sex to classify the injury risk.



Category A Mentor: B Dai, PhD

## 12. FACTORS ASSOCIATED WITH NCAA DIVISION I CROSS-COUNTRY TEAM RANKINGS

Cousineau, SA, Clarke, SB, Guseman, EH, Drum, SN.

A number of factors contribute to team success in NCAA athletics. Team funding, coaching influence, and team cohesion have been shown to influence team success in certain sports such as NCAA football, basketball, and volleyball. Less studied is how these characteristics and others influence the success of NCAA cross country programs. **PURPOSE:** The purpose of this study was to analyze factors that may contribute to the success of collegiate running programs by surveying a variety of collegiate team coaches including top, middle, and bottom level teams. **METHODS:** Voluntary surveys with 8 questions regarding specific team characteristics and values (financial support, injury/drop out, recruiting, team chemistry and cohesion, athletic training facilities, maintaining a team's legacy, geographical location, and race quality) were sent via email to 150 NCAA Division 1 cross country head, and/or assistant coaches. Coaches were asked to respond to questions establishing the importance of each quality in regards to the team's overall success. Coaches could answer from 5 possible choices: strongly disagree, disagree, neutral, agree, and strongly agree. Teams were split up into 3 groups based on their overall team rankings from 1961-2010, with group 1 being teams in the top 50 spots, group 2 among teams 51-100, and group 3 among teams 101-150. Differences between the three groups response in terms of importance for each question were analyzed using the Kruskal-Wallis test. **RESULTS:** Of the 150 schools contacted, 33 completed the survey. Eleven were in each group. Significant differences emerged regarding the importance of maintaining the team's legacy, with group 3 showing this as less important than the others. This suggests that there might be a relationship between a team's values of maintaining its legacy and overall rank and success. Groups did not differ in any of the other parameters assessed. This was surprising especially in regards to financial support and athletic training facilities, which were expected to vary between the differently ranked groups. This suggests that there may be other underlying factors not assessed in this survey that may contribute to a cross-country team's success and overall rankings. Additional analysis of qualitative data collected from this survey is currently underway.

Category A

Mentor: Emily H Guseman and Scott N Drum

## 13. LACTATE ACCUMULATION AND REMOVAL FOLLOWING 1.5 MILE RUN FOR TIME IN HIGHER AND LOWER FIT ATHLETES

English, S, A Bull, and L Hartshorn

Email: Samuel.English@coloradocollege.edu

Department of Human Biology and Kinesiology, Colorado College, Colorado Springs, Colorado

Relationships between lactate accumulation and lactate removal, and aerobic fitness are highly researched topics in the field of sports science. **PURPOSE:** To investigate relationships between the 1.5-mile run for time, maximal oxygen consumption rate ( $VO_2$  max), lactate accumulation, and lactate removal in college students and student athletes. **METHODS:** 14 Colorado College students (Ages 18-22 years old) completed a maximal 1.5-mile run on a 400-meter track or treadmill. Lactate concentrations were collected at rest and 3, 6, 12, 30, 45, and 60 minutes after the completion of the maximal run.  $VO_2$  max was estimated from the time of completion of the 1.5 mile run. **RESULTS:** Completion times for the run ranged from 7:38 to 11:29 (Min:Sec) and  $VO_2$  maximums ranged from 50.29 to 66.38 ml/kg/min. Peak lactates ranged from 5.2 to 16.2 mmol/L. Participants were equally divided into higher fit ( $n=7$ ) and lower fit ( $n=7$ ) groups based on their  $VO_2$  max values. Lactate levels were higher 3 min post run in the high fit group (HF: 12.2 mmol/L vs. LF: 8.67 mmol/L), however this difference was not significant ( $P > 0.05$ ). Correlation coefficients were calculated between  $VO_2$  max and peak lactate ( $r=.72$ ),  $VO_2$  max and the difference between peak lactate values and values at 30 minutes following the 1.5 mile run ( $r=.36$ ), and  $VO_2$  max and the difference between peak lactate values and values at 60 minutes following the 1.5 mile run ( $r=.64$ ). **CONCLUSION:** A variety of research has been conducted on lactate removal rates in trained vs. untrained individuals during submaximal exercise, however little research has been conducted on the same participants during a near maximal effort. The results of our



study did not show significant differences between higher and lower fit groups in our sample, however subsequent research could be conducted with a larger group of participants with more separation between fitness levels.

Category A

#### **14. FALL PREVENTION EXERCISES CAN BE BENEFICIAL TO A VARIETY OF AGES AND FUNCTIONAL ABILITIES IN ADULTS**

Fryc, PH, MA Kluge

[pfryc@uccs.edu](mailto:pfryc@uccs.edu)

Center for Active Living, Beth El Nursing and Health Sciences, University of Colorado at Colorado Springs  
Education and appropriate exercises that enhance balance and agility can help decrease fall risk among middle aged and older adults. **PURPOSE:** To assess fall risk and improve balance among men and women utilizing the N'Balance fall prevention program. **METHODS:** Functional assessments (20 items) were used to determine pre-post lower body strength, gait, posture, vision dependency, and vestibular disproportions. A balance confidence questionnaire was also distributed and analyzed pre-post. A total of 26 adults with a mean age of  $62.5 \pm 11.8$  completed the pre-assessments; of those, 24 adults completed the health history form, which showed 33.3% (n=8) had fallen once and 37.6% (n=9) had fallen more than once in the last year; 16.7% (n=4) were depressed; 25.0% (n=6) did not exercise on a regular basis; 91.7% (n= 22) wore glasses; 50.0% (n=12) have high blood pressure; and, 33.3% (n=8) are taking four or more medications. The 6-week fall prevention intervention was one-time per week, and lasted 60 minutes per session. Classes consisted of a warm up, balance and agility exercises, and a cool down following the N'Balance protocol. **RESULTS:** A paired-sample t-test and Spearman's Rho Correlation were used to determine the improvements among the pre-post chair stands ( $12.5 \pm 3.1$ ,  $16.2 \pm 5.7$ , respectively), eight-foot up-and-go ( $6.36 \pm 1.61$ ,  $5.69 \pm 1.12$ , respectively) 30-foot walk test, and the Fullerton Advanced Balance (FAB) scale. Not all pre-post assessments were significant; however, observations of improvements in balance and agility were noted throughout the course of the program. **CONCLUSIONS:** Pre-assessments determined that most participants needed to improve lower body strength, hand-eye coordination, and inner ear imbalances, revealing that even middle aged adults (45.8%, n=11) were not aware of how compromised their balance was. Fall prevention programs are well known to target adults 65 years and older, however, middle-aged adults can also benefit from fall prevention programs. Future research needs to be focused on when adults should start utilizing fall prevention methods.

Category A

Mentor: MA Kluge, PhD

#### **15. DOES ARTERIAL OXYGEN SATURATION INFLUENCE THE RELATIONSHIP BETWEEN HEMOGLOBIN MASS AND VO<sub>2</sub>MAX IN ACTIVE MEN AT MODERATE ALTITUDE?**

JA Goodrich, BJ Ryan, WC Byrnes

Email: [jesse.goodrich@colorado.edu](mailto:jesse.goodrich@colorado.edu)

Department of Integrative Physiology, University of Colorado-Boulder

354 UCB, Boulder, Co 80309

**PURPOSE:** It is well established that total hemoglobin mass (tHb) plays a critical role in determining maximal oxygen uptake (VO<sub>2</sub>max). However, the total amount of oxygen in the circulation is also influenced by oxyhemoglobin saturation. We sought to examine how variation in end-exercise arterial oxyhemoglobin saturation (SaO<sub>2</sub>) as a result of moderate altitude exposure influences the tHb-VO<sub>2</sub>max relationship in active men.

**METHODS:** Eight altitude-adapted active males completed the study. The first visit was a graded exercise test (GXT) on a bicycle ergometer. The workload for the GXT began at 50W and increased by 30W every 4 minutes until subjects reached volitional exhaustion. Oxygen consumption was assessed using indirect calorimetry and VO<sub>2</sub>max was determined as the highest 30-second average VO<sub>2</sub>. SaO<sub>2</sub> was measured using forehead pulse oximetry at rest and during exercise; end-exercise SaO<sub>2</sub> was determined as the average SaO<sub>2</sub> over the final minute of the GXT. After the initial visit, subjects returned to the lab on two occasions to measure tHb using the optimized carbon monoxide rebreathing procedure. To remove the influence of body mass on the relationships between variables, tHb and VO<sub>2</sub>max were both normalized by body mass. Data were analyzed using simple and multiple linear regression.

**RESULTS:** Mean normalized values for both VO<sub>2</sub>max (49.9 ± 5.8 ml/kg/min) and tHb (12.6 ± 1.1 g/kg) were within expected ranges for active men but below mean values observed in elite endurance athletes. Mean end-exercise SaO<sub>2</sub> was 93.7 ± 1.6% (range 91.5-97.05%). Exercise induced arterial desaturation, defined as >4% decrease in SaO<sub>2</sub> from rest, was observed in 6 out of 8 subjects. As expected, tHb alone explained a large portion of the variability in VO<sub>2</sub>max (r<sup>2</sup> = 0.679, p = 0.012). However, adding end exercise SaO<sub>2</sub> increased R<sup>2</sup> to 0.779 (p = 0.023). The influence of SaO<sub>2</sub> on VO<sub>2</sub>max after adjusting for tHb trended towards significance (p = 0.19).

**CONCLUSION:** Despite our relatively small sample size and narrow range of end-exercise SaO<sub>2</sub>, our results suggest that end-exercise SaO<sub>2</sub> may explain additional variability in the tHb-VO<sub>2</sub>max relationship. Future research is warranted with larger sample sizes and at higher elevations in order to validate and further elucidate the influence of SaO<sub>2</sub> on the tHb-VO<sub>2</sub>max relationship in this population.

Category A Mentor: William C. Byrnes, PhD, FACSM

## 16. No Abstract assigned to this number

## 17. CORTISOL ACCUMULATION IN RELATION TO BLOOD LACTATE FOLLOWING 1.5 MILE RUN IN HIGHER AND LOWER FIT ATHLETES

Hartshorn, L, S English, M Brasuel, and A Bull

Email: lucy.hartshorn@coloradocollege.edu

Department of Human Biology and Kinesiology, Colorado College, Colorado Springs, Colorado

The relationships between changing cortisol and lactate concentrations in response to exercise are researched topics in the field of sports science. It has been proposed that exercise intensity and lactate accumulation stimulates the hypothalamic--- pituitary axis (HPA axis), causing downstream cortisol production. **PURPOSE:** To investigate the relationship between changing lactate concentrations and changing cortisol concentrations after a maximal 1.5---mile run for time in college students of different fitness levels. **METHODS:** 11 Colorado College students (Ages 18---22 years old) completed a maximal 1.5---mile run on a 400---meter track or treadmill. Blood lactate concentrations were collected at rest and 3, 6, 12, 30, 45, and 60 minutes after the completion of the run. Salivary samples were collected at rest and 5, 10, 15, 25, 35, 55, and 120 minutes after run completion. Salivary cortisol concentrations were determined using liquid chromatography---mass spectroscopy. VO<sub>2</sub> max was estimated from the time of 1.5 mile run completion and was used to rank fitness level. **RESULTS:** Completion times for the run ranged from 7:38 to 11:29 (Min:Sec) and VO<sub>2</sub> maximums ranged from 50.29 to 66.38 ml/kg/min. Peak lactates ranged from 3.7 to 14.7 mmol/L. Peak Cortisol ranged from 31 ng/ml to 200 ng/ml. Lactate and cortisol concentrations were subject to mean---centered normalization for subsequent analysis to account for effects of individual biochemistry. All peak lactate concentrations were at 3 min (n=11). Peak cortisol concentrations were at 28.6 ± 6.7 min (n=11). Participants were equally divided into higher fit (n=5) and lower fit (n=5) groups based on their VO<sub>2</sub> max values. There was no significant difference in the time delay between lactate peak and cortisol peak between the two fitness levels (P>0.05). **CONCLUSION:** While previously hypothesized that an increase in blood lactate levels stimulated the HPA axis, the results show a peak in cortisol between 25 and 35 minutes, following a peak in blood lactate. This supports the hypothesis that chemoreceptors in muscle, stimulated by the buildup of lactate, activate the HPA axis to stimulate downstream cortisol release. Fitness level appears to have no effect on the temporal relationship of cortisol and lactate, but more research over a greater range in fitness levels needs to be conducted.

Category A Mentor: Anthony Bull, Ph.D.

## 18. EFFECTS OF STANCE WIDTH AND VISION ON INDIVIDUAL FOOT CONTRIBUTION TO BILATERAL QUIET STANCE

Hattel II, MD<sup>1</sup>, MM Taylor<sup>2</sup>, and RF Reiser II (FACSM)<sup>1,2</sup>

Email: mdhattel2@comcast.net

<sup>1</sup>School of Biomedical Engineering, Colorado State University, Fort Collins, CO

<sup>2</sup>Department of Health and Exercise Science, Colorado State University, Fort Collins, CO

In healthy individuals, dominant (DL) and non-dominant limbs (NDL) appear to be similar in their abilities to control posture during unipedal stance. However, it is unclear if the same is true during bipedal stance, or if the relative contribution is affected by postural challenge. **PURPOSE:** To examine the effect of stance width and vision on individual limb contributions to bilateral quiet stance in young, healthy adults. **METHODS:** 18 young, healthy adults volunteered [9 men, 9 women: age = 23.5 +/- 1.7 yrs, mass = 74.3 +/- 14.0 kg, height = 173.4 +/- 9.6 cm (mean +/- SD)]. Participants completed 16 randomized, 60 sec., trials with arms relaxed by their sides, while standing as still as possible on two force platforms. Trials were performed with a narrow stance (NS) with medial malleoli touching (4 eyes open (EO), 4 eyes closed (EC)) and with a wide stance (WS) at shoulder width (4 EO, 4 EC). Vertical ground reaction force (GRFv) as well as medial-lateral (ML) and anterior-posterior center of pressure (sway, path length, and max velocity) were assessed under each foot. Forces were normalized to bodyweight and center of pressures to foot dimensions. **RESULTS:** Weight placed on each foot was not different between condition ( $p=0.591$ ) or affected by sex ( $p=0.631$ ) [DL = 49.8 +/- 1.7, NDL = 50.3 +/- 1.7 % bodyweight]. Sway, path length, and max velocity tended to increase with EC and NS ( $p \leq 0.001$ ). However, the DL was only different from the NDL in ML max velocity in NS EC [DL = 33.1 +/- 7.8, NDL = 29.0 +/- 5.5 % foot width/s]. The only sex difference was in ML path length ( $p=0.005$ ) [Women = 256 +/- 34, Men = 210 +/- 44 % foot width]. Predictively high correlations ( $r > 0.800$ ) between limbs only existed in the GRFv between WS EO and WS EC ( $p < 0.001$ ). **CONCLUSION:** These results support the unipedal stance reports that the DL and NDL can contribute similarly towards postural control. However, under extreme challenge the DL may take a greater role during bilateral stance. This may be due to its preference for fine control (i.e., it is preferred during tasks such as kicking). Furthermore, the greater ML max velocity in the women may be due to muscle morphology and pelvic width differences compared to men. Finally, the limited predictive correlations between conditions may be due to the large number of degrees of freedom available for maintaining postural control.

Category: A

Mentor: RF Reiser I

## 19. ASYMMETRIC CORE MUSCLE ACTIVITY DURING WALKING IN PATIENTS WITH MULTIPLE SCLEROSIS

NB Ketelhut<sup>1</sup>, JH Kindred<sup>1</sup>, MM Manago<sup>2</sup>, JR Hebert<sup>2</sup>, and T Rudroff<sup>1</sup>

Email: Nathan.Ketelhut@colostate.edu

<sup>1</sup>Colorado State University, Fort Collins, CO, <sup>2</sup>University of Colorado School of Medicine, Denver, CO

One of the early signs of Multiple Sclerosis (MS) is weakness on one side of the body, which may contribute to walking impairments experienced by more than 75% of patients with MS. Poor balance, muscle weakness, and less fatigue resistance also contribute to reduced walking capacity and physical activity levels within this population. Trunk control is a key component of balance to ensure safe and efficient walking. **PURPOSE:** To investigate the activity of trunk muscle groups (flexors, extensors, lateral flexors) during walking in patients with MS. **METHODS:** Eight patients (4 men) with relapsing-remitting MS (aged 44.9 ± 8.6 years) and eight (4 men) healthy controls (aged 37.9 ± 8.4 years) walked on a treadmill for 15 min at a self-selected speed, during which [<sup>18</sup>F]-Fluorodeoxyglucose ([<sup>18</sup>F]-FDG), a glucose analog, was injected. Immediately after walking, Positron Emission Tomography / Computed Tomography imaging was performed. Muscle activity was quantified by Standardized Uptake Value (SUV), with higher uptake signifying greater activity. **RESULTS:** Between the MS and control groups, no differences in individual trunk muscle activity were found ( $P > 0.33$ ). Healthy controls showed no differences between sides of the trunk muscle groups ( $P > 0.45$ ). However, side-to-side differences were identified in the MS group: lateral flexor muscle group (SUV: 0.82 SD 0.20, 0.68 SD 0.14,  $P < 0.03$ ), external (SUV: 0.76 SD 0.19, 0.62 SD 0.11,  $P = 0.03$ ) and internal (SUV: 0.86 SD 0.20, 0.68 SD 0.11,  $P = 0.01$ ) obliques, as well as the rectus abdominis (SUV: 0.79 SD 0.26, 0.70 SD 0.17,  $P = 0.05$ ). **CONCLUSION:** This data indicates that patients with MS have imbalanced activation of the trunk muscles during walking, with the less-affected side being activated more. This activation pattern suggests a compensatory mechanism used by patients with MS in order to maintain balance and postural control, which may contribute to the increased energy cost of walking reported in patients with MS. Based on these findings, trunk muscle activity should be evaluated during physical rehabilitation to identify and target factors contributing to impaired walking ability in patients with MS.

Funded by MS Society (PP 1907), NIH/NCATS Colorado CTSI # UL1 TR000154

Category A Mentor: T Rudroff, PhD

## 20. SELF-PERCEPTION AND THE EFFECTIVENESS OF THE FUNCTIONAL MOVEMENT SCREEN IN ADULTS

Kettelkamp, S.K., Kluge, M.A.

Email: sara.kkamp@gmail.com

Division of Health Promotion, Beth-el College of Nursing and Health Science, University of Colorado Colorado Springs, Colorado Springs, CO

How one's current self and ideal self are perceived has a significant effect on self-efficacy toward physical activity (PA). Knowing that self-perceptions can improve after being exposed to a task could suggest that engaging in a functional assessment such as the Functional Movement Screen (FMS), may have a positive impact on self-perception. **PURPOSE:** The purpose of this study was to determine if the FMS, a 7-item test of physical function, is suitable for the general population and if knowing the results has a positive impact on self-perception of physical abilities. **METHOD:** A 4 question pre-test of perceived flexibility, core stability, balance, and overall strength was administered to a convenience sample of 30 adults (age 20-77). The FMS was then administered. Scores were discussed in detail and a post-questionnaire was administered (same 4 initial questions plus a question about perceived benefits of the FMS). **RESULTS:** The average FMS score was a 15 out of 21 with the hurdle step being lowest scored exercise overall (1.9). The highest percentage of asymmetries was in the shoulder mobility exercise (46%). Overall 96% of participants showed some change in self-perception with 46% showing a decrease and 29% showing an increase. 70% showed change in self-perception in more than one area questioned. **CONCLUSIONS:** Results showed that nearly all participants showed some change in their self-perception (96%) with 83% expressing that they believed the information given was beneficial to them. With self-perception being a factor in behavior change and PA it appears that the FMS provides feedback on functional abilities that is beneficial and potentially motivating to the general population.

Category A

Mentor: Mary Anne Kluge

## 21. THE RELATIONSHIP BETWEEN THE USE OF SCREEN TIME AS A REWARD AND CHILDREN'S PARTICIPATION IN MODERATE TO VIGOROUS PHYSICAL ACTIVITY

Kybartas, TJ and Guseman, EH

Email: [tkybart@uwyo.edu](mailto:tkybart@uwyo.edu)

Division of Kinesiology and Health, College of Health Sciences, University of Wyoming, Laramie, WY

Approximately 32% of children and adolescents in the US are obese. In addition, many children exceed screen time (ST) recommendations and fail to engage in adequate physical activity (PA). Sedentary pursuits have been linked to many health problems including increased risk of high cholesterol, high blood pressure, and insulin resistance. These taken together increase the risk of cardiovascular and respiratory problems among obese youth. **PURPOSE:** To determine if the use of ST as a reward is associated with habitual PA among local children. **METHODS:** A total of 44 children were included in the study with an average age of  $10.2 \pm 3.8$  yrs (range = 5.0–18.0 yrs). The subjects were recruited from a local pediatric clinic between July and September of 2014. Upon their annual well-child visit, the children completed a lifestyle survey regarding moderate to vigorous physical activity (MVPA) levels, ST participation, and the use of ST as a reward.

**RESULTS:** Approximately 20% of the sample (n=9) met ST recommendations, while 77.3% (n=34) of participants met PA recommendations. Only 18.8% of the sample (n=8) met both ST and PA recommendations, while 20.4% (n=9) met neither. Sixteen (36%) of the children were rewarded with ST. The group that used ST as a reward for PA engaged in 36 min/day of more MVPA compared to the non-rewarded group and 1 h/day of more MVPA after adjusting for sex. **CONCLUSIONS:** The use of ST as a reward may not be the ideal reward choice to decrease ST levels, but it is associated with higher PA levels. The use of meaningful extrinsic rewards can be effective to increase PA. Further study is needed to determine the true extent of this relationship.

Category A

Mentor: EH Guseman, PhD

## 22. CANCER STAGE DOES NOT AFFECT EXERCISE-MEDIATED IMPROVEMENTS IN CARDIOVASCULAR FITNESS AND FATIGUE

Manikowske, TL, JM Brown, DYK Shackelford, and R Hayward

Rocky Mountain Cancer Rehabilitation Institute, School of Sport and Exercise Science, University of Northern Colorado, Greeley, CO

Higher stages of cancer generally reflect poorer prognoses and decreased physical function due to increased use of adjuvant treatments. Physical activity during and following cancer treatment has been shown to have positive effects on cardiovascular fitness and cancer-related fatigue (CRF), however, the effect of cancer stage on these improvements has yet to be investigated. **PURPOSE:** To examine whether diagnosed cancer stage has an effect on cardiovascular fitness and fatigue. **METHODS:** A total of 227 cancer survivors ( $57 \pm 12$  years of age) completed initial assessments of cardiovascular fitness ( $VO_2$ ) and cancer-related fatigue (CRF). Participants were divided into four groups based on diagnosed cancer stage. Survivors completed 3-months of supervised exercise training. Exercise was performed 3 days per week, 60 minutes per day. The intervention consisted of progressive cardiovascular and whole-body strength training. Participants were reassessed following the intervention. **RESULTS:** Pre-to-post assessments demonstrated significant increases in  $VO_2$  (11%) and decreases in CRF (-25%) across all stages ( $p < 0.01$ ). While approaching significance, increases in  $VO_2$  were not statistically significant between stages ( $p = 0.09$ ). Individually, significant improvements in  $VO_2$  were seen in stages I (16%;  $p < 0.01$ ), II (13.8%;  $p < 0.01$ ), and III (6.9%;  $p < 0.01$ ). Non-significant improvements were seen in stage IV (10%;  $p = 0.15$ ). When evaluating individual stage and CRF, significant improvements were seen from stage I to IV (-21.7%, -28.2%, -22.9%, and -26.7%, respectively;  $p < 0.01$ ). There was no difference in improvement between the stages ( $p = 0.92$ ). **CONCLUSION:** Individuals diagnosed with higher stages of cancer generally undergo greater levels of adjuvant treatments which have been found to negatively affect cardiovascular performance and increase fatigue. This study found no significant differences in exercise-mediated improvements of  $VO_2$  and CRF between cancer stages. These results suggest that improved cardiovascular fitness and reduced levels of fatigue can be observed in all cancer patients regardless of cancer stage.

Category A

Mentor: R Hayward, PhD

## 23. ASSOCIATIONS BETWEEN WORKDAY HEART RATE VARIABILITY, TRAPEZIUS MUSCLE ACTIVITY, AND ANXIETY IN OFFICE WORKERS

R J Marker and KS Maluf

email: ryan.marker@ucdenver.edu

Rehabilitation Science PhD Program, University of Colorado Anschutz Medical Campus, Aurora, CO

Psychosocial stress, or anxiety, is associated with increases in trapezius muscle activity. This relationship is important in office workers where prevalence of neck pain is high despite low physical demand. Heart rate variability (HRV) has been used to assess anxiety in this population, though the relationship between HRV and trapezius muscle activity is unknown. **PURPOSE:** To investigate the relationship between HRV, trapezius muscle activity, and anxiety during workplace recordings in healthy office workers. **METHODS:** Bilateral upper trapezius electromyography (EMG) and electrocardiogram (ECG) signals were recorded throughout the workday with a portable data monitor. Muscle activity was assessed as the mean EMG, muscular rest (% recording time), and static, median, and peak levels of EMG (10<sup>th</sup>, 50<sup>th</sup>, and 90<sup>th</sup> percentiles of the amplitude probability distribution function, respectively). HRV was assessed by calculating the low frequency (LF) and high frequency (HF) components of the RR intervals, and total power of variability. Spielberger State-Trait Anxiety Index was used to assess state anxiety (STAI-S) at the end of each workday. **RESULTS:** Two days of EMG recordings were obtained in 57 participants. Forty-eight participants reported a difference in STAI-S between days; mean, static, median, and peak EMG values in the non-dominant muscle only were all significantly higher ( $p < 0.05$ ) during the workday with higher STAI-S. The HF component of HRV was significantly lower ( $p < 0.05$ ) during the workday with high STAI-S. No significant correlations were observed between EMG and HRV measures. **CONCLUSION:** The amplitude of muscle activity during the workday was

increased during the day with higher perceived anxiety in the non-dominant trapezius muscle only. The HF component of the HRV was lower during the workday with higher perceived anxiety, indicating decreased parasympathetic activity on that day. No associations were seen between muscle activity and HRV, indicating that these systems respond separately to changes in perceived anxiety. These results demonstrate patterns of change in muscle and autonomic activity in response to changing levels of perceived anxiety in a real world setting.

Category A

Mentor: KS Maluf, PhD

## 24. EFFECTS OF AGE AND ACTIVENESS ON HEART RATE VARIABILITY

Jacob Montoya, Kyle Shepherd

[jmontoya@fortlewis.edu](mailto:jmontoya@fortlewis.edu)

[kdshepherd@fortlewis.edu](mailto:kdshepherd@fortlewis.edu)

Department of Exercise Science, Fort Lewis College, Durango, CO

Heart rate variability (HRV) is a noninvasive measure of autonomic nervous function. HRV is a good indicator of physical health and is known to differ in individuals in accordance with variables such as age, gender, level of activity, resting heart rate and others. Healthy individuals tend to yield a higher HRV than unhealthy individuals. **PURPOSE:** The purpose of this study was to independently investigate the effects that age and activity have on HRV. **METHODS:** Thirty individuals were placed in 3 age groups (younger group: ages 18-30, middle aged: ages 40-55, older group: ages 56-70). Participants were also categorized based on activity level. 15 reported being active ( $\geq 360$  minutes of weekly exercise), and 15 reported being inactive ( $\leq 200$  minutes of weekly exercise). A BIOPAC MP36RWSW Data Acquisition and Analysis Machine (Goleta, CA) was used to collect HRV data. A time-domain analysis was then used to analyze HRV and the standard deviation of normal to normal intervals was used to produce HRV values. **RESULTS:** Younger group avg. HRV =  $.155 \pm .06$ , middle-aged avg. HRV =  $.16 \pm .061$ , elder group avg. HRV =  $.138 \pm .07$ . Two-way ANOVA;  $p = .779$ ,  ${}_{24}F_2 = .252$ . Active group avg. HRV =  $.164 \pm .065$ , Inactive group avg. HRV =  $.135 \pm .055$ . One-way ANOVA;  $p = .259$ ,  ${}_{24}F_1 = 1.342$ . **CONCLUSION:** Results for both age and level of activity showed linear trends with regard to HRV. The active group exhibited a higher average SDNN HRV than the inactive group. There was a positive linear trend in HRV vs. weekly physical activity, suggesting that HRV is increased with increasing activity. With regard to age vs. HRV, a negative linear trend was found, indicating that HRV was decreased with increasing age. Both results appeal to findings from previous studies.

Category A: Melissa Knight-Maloney, PhD. Fort Lewis College

## 25. THE EFFECTS OF A 10-WEEK RESISTANCE TRAINING PROGRAM ON DOXORUBICIN-INDUCED CARDIAC DYSFUNCTION.

Pfannenstiel, KB, C Quinn, E Bredahl, D Hydock, and R Hayward

Email: [keith.pfannenstiel@unco.edu](mailto:keith.pfannenstiel@unco.edu)

Rocky Mountain Cancer Rehabilitation Institute, School of Sport and Exercise Science, University of Northern Colorado, Greeley, CO, USA

In recent decades cancer survivorship has steadily increase; however, the adverse side-effects of chemotherapy treatment can diminish a patients overall quality of life. One of the most effective and widely used chemotherapeutic agents is doxorubicin (DOX). Though highly effective its use is limited by a dose-dependent cardiotoxicity. While it is know that exercise preconditioning with endurance training models provide a cardioprotective effect to DOX treatment, little focus has been placed on the effects of a resistance training model on DOX-induced cardiac dysfunction. **PURPOSE:** The purpose of the study was to determine the effects of a 10-week resistance training program on DOX-induced cardiac dysfunction. **METHODS:** Ten-week old male Sprague-Dawley rats were randomly selected to undergo 10-weeks of resistance training (RT) or remain sedentary (SED). Twenty-four hours following the completion of the exercise training or sedentary period, animals received a 12.5 mg/kg bolus i.p. injection of DOX or a bolus i.p. of 0.9% saline. Five days



following injection, animals were sacrificed and cardiac function was measure *ex vivo* using an isolated working heart model. **RESULTS:** DOX treatment alone (SED+DOX) promoted significant ( $p<.05$ ) decreases in end-systolic pressure, left ventricular developed pressure, and the maximal rate of left ventricular pressure development as well as a significant increase in the minimal rate of left ventricular pressure development. RT provided a cardioprotective effect, evident by significant increases in end-systolic pressure and the maximal rate of left ventricular pressure development. Also observed was a significant decline in the minimal rate of left ventricular pressure development. **CONCLUSIONS:** These data suggest that 10-weeks of the resistance training model used, provided cardioprotection against DOX-induced cardiac dysfunction.

Category A

Mentor: Reid Hayward, PhD

## 26. LOWER EXTREMITY LEAN MASS ASYMMETRIES IN COMPETITIVE CYCLISTS OVER A RACING SEASON

Pimentel RP, BS Baker, and RF Reiser II (FACSM)

Email: [RickyPim@rams.colostate.edu](mailto:RickyPim@rams.colostate.edu)

*Department of Health and Exercise Science, Colorado State University, Fort Collins, CO*

Bilateral asymmetries (ASYMs), i.e. differences between left and right side, are associated with performance and injury risk. In weight bearing athletes, functional ASYMs have been linked to lean mass ASYMs. Lean mass ASYMs have yet to be studied longitudinally or among non-weight bearing athletes. **PURPOSE:** To assess lean mass ASYMs in competitive cyclists and how they change over the course of a racing season. **METHODS:** 42 competitive cyclists of USA Cycling category 4 or better underwent a DXA scan near the start (pre) and end (post) of the road cycling season. ASYMs were calculated using the Symmetry Index (%SI) where:  $\%SI = \frac{D-ND}{0.5(D+ND)} \times 100$ , D = dominant (preferred kicking), and ND = non-dominant limb. We calculated Relative ASYMs (RA), with positive values as the dominant side, and Absolute ASYMs (AA) and analyzed lower limbs by the pelvis (P), thigh (T), and lower leg (LL) segments. In addition to the whole group, we analyzed subgroups of sex [female: male (n=20: 22)], age [young vs old (with middle 1/3<sup>rd</sup> removed), n= 14: 14, mean ages= 22.4: 41.3 yrs], bike type [road: mixed styles, n= 16: 26], and racing category [Cat 1: Cat 4, n=21: 12]. **RESULTS:** ASYMs were greater in the P compared to the T and LL for pre AA, post AA, and post RA ( $p \leq 0.005$ ), favoring the dominant limb. Also at the whole group level, AA P increased pre-to-post [ $5.18 \pm 3.38$  to  $7.04 \pm 4.34$  %SI ( $p = 0.011$ )]. Within racing category, there was a pre-to-post difference, where the Cat 4s started at a higher level of AA T and ended similar to the Cat 1s [ $4.98 \pm 2.55$  to  $2.34 \pm 1.96$  %SI ( $p = 0.013$ )]. Within sex, women finished the season with higher levels of RA P compared to the men [ $7.37 \pm 5.54$  vs  $1.54 \pm 7.40$  ( $p = 0.006$ )]. Regardless of seasonal changes, the women had lower RA T compared to the men [ $0.57 \pm 3.51$  vs  $1.05 \pm 3.60$  %SI ( $p = 0.011$ )]. Significant correlations were found for all segment ASYMs pre-to-post ( $r^2 \geq 0.129$ ,  $p \leq 0.019$ ) and also between post LL and post P ( $r^2 = .116$ ,  $p = .027$ ). **CONCLUSION:** While ASYMs were generally low, the pelvis appears to be most susceptible to bilateral differences in cyclists, possibly due to postural favoring of the dominant side. While the impact on performance and injury risk is unclear, as are why men/women and Cat1/Cat4 responded differently across the season, attention to this region of the body may be warranted with specific exercises to limit ASYM development.

Category A

Mentor: RF Reiser II, PhD

## 27. THE EFFECT OF SQUAT DEPTH ON MUSCLE ACTIVATION AMPLITUDE IN THE RECTUS FEMORIS, BICEPS FEMORIS, AND GLUTEUS MAXIMUS

Pollock, TJ, JK Barney

Email: [tj-po07@hotmail.com](mailto:tj-po07@hotmail.com)

Kinesiology Department, Colorado Mesa University, Grand Junction, CO

Various biomechanical factors influence muscle activity amplitudes. These factors include the length of the muscle, the lever type being utilized, and the angle of the joint. **PURPOSE:** The objectives were to observe if increased squat depth would increase muscular activity in the rectus femoris, biceps femoris, and gluteus

maximus and which muscle at a given depth had the greatest activation during a squat exercise. It was hypothesized that, as depth increased, activation in all three muscles would increase with the greatest increase seen in the gluteus maximus. **METHODS:** Three male subjects (21-23 years), experienced with full range-of-motion squats, completed two sets of one repetition at three depths and 75% of their one-rep maximum weight. The squats performed were a half, parallel, and full squat with knee extension angles of 80°-100°, 60°-70°, and 40°-45°, respectively. Electromyography data were recorded and relative max percentages were determined for each depth. **RESULTS:** As depth increased, activation in the rectus and biceps femoris increased significantly in subjects one and three ( $p < 0.001$ ) but decreased in subject two. There was no significant difference in the activation between the biceps femoris at the half and full depths ( $p = 0.083$ ) and in the gluteus maximus at the parallel and full depths for subject two ( $p = 0.295$ ). The greatest amount of muscle activation was seen in the rectus femoris for all three subjects ( $66.3\% \pm 25.9\%$ ). **CONCLUSION:** Increasing squat depth increases activation in the rectus and biceps femoris, with the greatest activations seen in the rectus femoris.  
Category A    Mentor: GSmith

## 28. EFFECTS OF COGNITIVE AND AEROBIC TRAINING ON AGE-RELATED COGNITIVE IMPAIRMENT IN APPARENTLY HEALTHY OLDER ADULTS

JD Sage, BM Peterson, AP Brennecke, CN Beebe, D Anderson, J Sones, J Medrano, JM Brown, DYK Shackelford, and R Hayward  
Email: [sage8291@bears.unco.edu](mailto:sage8291@bears.unco.edu)  
Rocky Mountain Cancer Rehabilitation Institute, University of Northern Colorado, Greeley, CO

**INTRODUCTION:** Cognitive impairment associated with aging has been observed among older adults, but little research exists regarding how to address this issue. Age-related cognitive impairment (ARCI) has been associated with decrements in aspects of cognitive function such as delayed recall or reaction time, which may negatively affect aspects of quality of life (QOL). Independently, cognitive and aerobic training interventions have been reported to increase measures of cognitive function and QOL, respectively, in various populations such as patients undergoing cancer treatment and those suffering from Alzheimer's or dementia. However, few studies have examined the effects of a combined aerobic and cognitive training intervention on apparently healthy older adults. **PURPOSE:** To examine the effects of a 12-week aerobic and cognitive training intervention on cognitive function in apparently healthy adults. **METHODS:** Six participants (40-75 years) were included in this study. Participants were randomly assigned to one of three training groups: 1) aerobic, cognitive, and flexibility (AER/COG); 2) aerobic and flexibility (AER); or 3) cognitive and flexibility (COG). Individuals completed 36 one hour sessions in total, participating three times per week. A complete physical and cognitive assessment was administered before and after the 12-week intervention. **RESULTS:** There were no significant ( $p > 0.05$ ) main effects observed between all groups and variables. Dependent measures t-tests revealed no significant ( $p > 0.05$ ) increases in any measure for the COG group, although there were significant ( $p < 0.05$ ) increases in reaction time for the trail making test-A (TMT-A) for the COG/AER group. There were significant ( $p < 0.05$ ) increases in  $VO_{2peak}$  and a trend toward significant ( $p = 0.07$ ) improvements in delayed recall (DR) for the AER group. **CONCLUSION:** Combined aerobic and flexibility training produced the greatest overall increases in physiological and cognitive improvements observed among apparently healthy older adults. Combined cognitive, aerobic, and flexibility training also improved measures of reaction time. Results are preliminary, but suggest that combined aerobic and flexibility training or combined aerobic, cognitive, and flexibility training may positively affect aspects of physiological and cognitive function.  
Category A  
Mentor: Reid Hayward, Ph.D

## 29. INVESTIGATION OF STROKE VOLUME RESPONSE TO INCREMENTAL EXERCISE IN CYCLISTS OF VARYING FITNESS LEVELS

Schulke, FC, AR McWhorter, NP Dillon, RMIshay, O BarSimanTov, M Knight-Maloney  
[fcschulke@fortlewis.edu](mailto:fcschulke@fortlewis.edu)  
Department of Exercise Science, Fort Lewis College, Durango, CO



Stroke Volume (SV) is the amount of blood pumped out the left ventricle of the heart after each contraction and is a measure of the efficiency of the heart. Knowing SV is important for both non-athletes and athletes, because as SV increases an individual's capacity for work increases as well. Several studies have shown little change in SV with incremental exercise. However, other research has shown that SV can change with increasing levels of exercise and produce four types of response: plateau, plateau with a drop, plateau with a secondary increase, and progressive increase. It is possible that the difference in SV response observed in previous studies was due to participant fitness level. **PURPOSE:** The aim of the present study was to examine the SV response of cyclists with varying fitness levels during a bout of incremental exercise to maximal exertion. **METHODS:** Approximately 100 cyclists completed an incremental  $\text{VO}_2$  max test on a cycle ergometer. Subjects completed a 5-minute warm up at 100 watts for men and 80 watts for women. Following the warm-up, resistance was increased in 3-minute intervals by 25 watts for men and 20 watts for women, until subjects reached volitional exhaustion. Blood lactate measurements were taken during the last 30 seconds of each stage and were used to determine the lactate threshold. Expired gas samples were collected in 10 second averages using a metabolic cart, and were used to determine  $\text{VO}_2$  peak. SV was measured using bio impedance and was analyzed at three points in the test: resting value, lactate threshold and  $\text{VO}_2$  peak. **RESULTS:** Data collection has begun and will be available at the time of the conference.

### **30. A CANCER POPULATION SPECIFIC $\text{VO}_{2\text{peak}}$ ASSESSMENT: THE ROCKY MOUNTAIN CANCER REHABILITATION INSTITUTE MULTISTAGE TREADMILL PROTOCOL**

Shackelford, DYK, JM Brown, BM Peterson, J Schaffer, and R Hayward

Email: Daniel.shackelford@unco.edu

Rocky Mountain Cancer Rehabilitation Institute, College of Natural and Health Sciences, University of Northern Colorado, Greeley, CO

Many exercise testing protocols used in laboratory and clinical settings have been developed for apparently healthy (AH) populations, but may be inappropriate for cancer survivors (CS) due to cancer and treatment-related toxicities. The Rocky Mountain Cancer Rehabilitation Institute (RMCRI) developed a cancer specific treadmill protocol to specifically address this issue. **PURPOSE:** To assess the construct validity of the RMCRI multistage treadmill protocol. **METHODS:** 61 participants (45 CS, 16 AH controls) completed three different treadmill protocols, the Bruce (for AH subjects), RMCRI without gas analysis (RWO GAP), and RMCRI with gas analysis (RGAP), to compare values of peak oxygen consumption ( $\text{VO}_{2\text{peak}}$ ). Participants completed the trials one week apart in random order. Obtained  $\text{VO}_{2\text{peak}}$  values from RGAP were compared against estimated  $\text{VO}_{2\text{peak}}$  (EVACSM) from the same gas analysis (GA) test using ACSM prediction equations.  $\text{VO}_{2\text{peak}}$  from RGAP was also compared to the estimated values of  $\text{VO}_{2\text{peak}}$  achieved during the Bruce protocol. Finally,  $\text{VO}_{2\text{peak}}$  from RGAP was compared against predicted  $\text{VO}_{2\text{peak}}$  values obtained from RWO GAP. **RESULTS:** For AH participants, no significant differences were observed between any of the  $\text{VO}_{2\text{peak}}$  protocol values ( $p > 0.05$ ), and positive strong correlations occurred between all protocols ( $r > 0.8$ ). Among CS,  $\text{VO}_{2\text{peak}}$  between RGAP and the Bruce protocol were significantly different ( $p < 0.05$ ). A positive strong correlation occurred between RGAP  $\text{VO}_{2\text{peak}}$  and EVACSM ( $r = 0.90$ ), and between  $\text{VO}_{2\text{peak}}$  from the RGAP and RWO GAP ( $r = 0.81$ ). A moderate positive correlation was observed between  $\text{VO}_{2\text{peak}}$  values from the Bruce and RGAP ( $r = 0.51$ ). **CONCLUSION:** Our findings suggest that the Bruce protocol is not an appropriate protocol for CS. The observed high correlations and validity between predicted and observed  $\text{VO}_{2\text{peak}}$  values suggests that the RMCRI cancer-specific protocol is a valid method of determining  $\text{VO}_{2\text{peak}}$  and should be considered as the standard  $\text{VO}_{2\text{peak}}$  treadmill test for cancer survivors.

Category A

Mentor: R Hayward, PhD

### **31. A COMPARISON BETWEEN PLAYGROUND FEATURES AND PHYSICAL ACTIVITY INTENSITY LEVELS IN FOURTH GRADE CHILDREN**

PK Smolinski, E Strutz, J Valencik, RC Browning

Email: smolinsp@lamar.colostate.edu

Department of Health and Exercise Science, Colorado State University, Fort Collins, CO

Interventions aiming to increase physical activity (PA) levels in children require an understanding of the environmental features that promote PA. **Purpose:** To investigate how structural components of a playground facilitate PA levels among fourth grade students during recess. **Methods:** Video data were recorded as 19 students (11 boys) participated in a 20-minute recess session at an elementary school. We used direct observation of the video data to determine students' activities, which were coded by type (e.g., sitting play, standing quiet, standing active, playing catch, walking, playing tag, playing ball, running/skipping/jumping), and intensity (i.e., sedentary to light PA vs. moderate to vigorous PA (MVPA)) was inferred from the Compendium of Energy Expenditures for Youth. Location on the playground was assessed, and areas were categorized as either zone 1 for marked areas (basketball, tetherball, four-square, and swings), zone 2 for unmarked areas (sandbox and field), or zone 3 for areas containing a structure. Percentage of time spent in each zone and percentage of time spent engaged in MVPA in each zone were calculated. Differences between these values were then explored by sex. **Results:** Overall, children spent the greatest percentage of recess time in zone 1 (62.4%), followed by zone 3 (33%), and zone 2 (4.5%). This relationship was moderated by sex; although males spent most of their time in zone 1 (74.6%) and minimal time in zones 2 (2.1%) and 3 (23.3%), females split their time between zones 1 (45.8%) and 3 (46.4%) while also spending very little of their time in zone 2 (7.8%). Zone 1 demonstrated the highest prevalence of MVPA, with 51.9% of time in Zone 1 categorized as MVPA, while zones 2 (1.6%) and 3 (5.2%) exhibited the lowest. This relationship did not differ significantly by sex. **Conclusions:** These results indicate that marked areas attract more children than unmarked areas/structures and that such areas preferentially attract males versus females. Moreover, these areas also promote higher PA levels than unmarked/structured areas. This may be due to the openness of these spaces and their increased options for active games. On the other hand, unmarked/structure areas may impede PA for children. These results suggest the need to redesign playgrounds to include elements that invite all children to engage in MVPA.

Category A

Mentor: RC Browning, PhD

## 32. THE EFFECT OF PROLONGED STANDING ON WEIGHT-BEARING AND MUSCLE ACTIVATION ASYMMETRIES

KS Soliday<sup>1</sup>, WJ Board<sup>2</sup>, E Nelson-Wong<sup>3</sup>, RF Reiser II (FACSM)<sup>1,2</sup>

Email: KSoliday@rams.colostate.edu

<sup>1</sup>School of Biomedical Engineering, Colorado State University, Fort Collins, CO

<sup>2</sup>Department of Health and Exercise Science, Colorado State University, Fort Collins, CO

<sup>3</sup>School of Physical Therapy, Regis University, Denver, CO

Prolonged standing (PS) substantially increases the risk of experiencing low back pain. However, the specific factors involved, and sex related differences are not fully understood. One factor may be bilateral asymmetries in posture. **PURPOSE:** The goal of this study was to examine the effect of prolonged standing on the weight-bearing and muscle activation asymmetries within healthy young adults during static stance. **METHODS:** Twenty-four healthy, pain-free subjects (12 male, 12 female) voluntarily participated in the study (age =  $22.3 \pm 2.4$  years, height =  $1.70 \pm 0.09$  m, mass =  $69.89 \pm 11.31$  kg, BMI =  $24.1 \pm 2.5$  kg/m<sup>2</sup> [mean  $\pm$  SD]). Subjects performed two 60 sec. static standing trials separated by one 30 min. free standing trial while ground reaction forces under each foot and surface electromyography of each lumbar erector spinae (ES), gluteus medius (GM), internal obliquus, and external obliquus were measured. Muscle activity was normalized to a reference contraction (%ref). Weight-bearing (WBA) and muscle asymmetries (MA) were calculated by subtracting the non-dominant limb (ND) from their dominant limb (D). **RESULTS:** There were no differences in WBA or MA between the pre- and post-PS trials, nor between the men and the women ( $p > 0.05$ ). In both of the static stance trials, there were no significant differences between the D and ND limbs. However, the women had overall higher GM activity than the men (women =  $7.58 \pm 3.44$  %ref, men =  $4.79 \pm 2.93$  %ref;  $p=0.041$ ). Overall ES activity decreased from the pre to the post-PS trial for the men, but not the women (women =  $2.08 \pm 1.03$  %ref, pre-PS men =  $2.56 \pm 1.82$  %ref, post-PS men  $1.79 \pm 1.46$  %ref;  $p=0.002$ ). During the pre-PS trial, there was a significant correlation between the WBA and the GM asymmetry for the women ( $R^2 = 0.379$ ,  $p=0.044$ ) but not the men ( $R^2 = 0.125$ ,  $p=0.259$ ). During the post-PS trial, there was a significant inverse correlation between the GM asymmetry and the EO asymmetry for the women ( $R^2 = -0.431$ ,  $p=0.028$ ) but not the men ( $R^2 = 0.071$ ,  $p=0.401$ ). **CONCLUSION:** While these results suggest that prolonged standing does not have an effect on WBA during static stance, there appears to be sex related differences in both muscle activity and

change in muscle use. These findings shed light onto why men and women may respond differently to prolonged standing.

Category: A  
Mentor: RF Reiser II, PhD

### 33. EFFECT OF PACK WEIGHT ON ENERGY EXPENDITURE DURING UPHILL WALKING

Sorensen, MG, N, Bachman, C, Imlay

Email: Mgsorensen@mavs.coloradomesa.edu

Colorado Mesa University, Grand Junction, CO

The relationship between human load carriage and metabolic cost is often investigated because of its military applications. The body of research on this topic continues to grow as recreational pursuits involving load carriage become more popular. Other load carriage studies have demonstrated a positive relationship between load and  $VO_2$ , HR, and RPE. **Purpose:** The aim of this study was to determine the effect of pack weight on energy expenditure during uphill walking at a constant speed and grade. The authors of this study expect that energy expenditure will increase linearly with greater loads. **Methods:** In this pilot study, three male subjects performed randomly chosen 5-minute walking trials while carrying five different loads: No Pack (NP), Empty Pack (EP), 10 (10% BW), 20 (20% BW), and 30% of bodyweight (30% BW). Walking trials were conducted at 1.34 m/s and 10% grade. Oxygen consumption ( $VO_2$ ), heart rate (HR), and rating of perceived exertion (RPE) were recorded. Energy expenditure (in kilocalories) for each load condition was calculated using average  $VO_2$  data from walking trials. **Results:** Trial intensity ranged from 43 to 81% of  $VO_2$  Max. A positive linear relationship was observed between  $VO_2$ , HR, and energy expenditure and load. Oxygen consumptions during the 20 and 30% BW load conditions were statistically different ( $p < 0.025$ ) from the NP condition for all subjects. A significant ( $p < 0.05$ ) linear relationship ( $R = 0.963$ ) between relative oxygen consumption and total load (body weight + load condition) was observed for all subjects. Oxygen consumption increased by 33.6, 31.5, and 32.4% from NP to 30% BW for Subject 1, 2, and 3, respectively. **Conclusion:** Energy expenditure was >30% higher for the 30% BW condition compared to NP condition. The lowest metabolic cost occurred during unloaded walking (NP) and the greatest occurred under the 30% BW condition.

Category A  
Mentor: Gerald Smith, PhD

### 34. ISOMETRIC SQUAT PEAK FORCE IN RANGE OF KNEE FLEXION ANGLES STRONGLY RELATED TO COUNTERMOVEMENT JUMP PEAK FORCE

Stephenson, ML, H Fisher, KK Graves, TJ Hinshaw, and B Dai

Email: msteph17@uwyo.edu

Division of Kinesiology and Health, College of Health Sciences, University of Wyoming, Laramie, WY

One-repetition maximum testing is considered the gold standard of dynamic peak strength, commonly used to assess lower extremity strength in the barbell squat. Isometric squat testing has been proposed as an alternative that reduces the time and injury risk, but introduces error in estimation possibly due to only estimating strength at a single knee flexion angle (KFA). A stronger relationship should be able to be established between an IS and countermovement jump (CMJ) if multiple KFAs are tested. **PURPOSE:** To establish the relationship between isometric force output at a range of KFAs in a squat and the peak force during a CMJ. **METHODS:** Thirty-one physically-active, uninjured recreational athletes (14 males and 17 females;  $20.2 \pm 1.7$  years;  $1.73 \pm 0.12$  m;  $72.8 \pm 17.7$  kg) provided consent, performed a warm up protocol, and then three counter movement jumps with the tested limb on a Bertec forceplate. Next, participants performed a maximum IS standing on a forceplate, against a weighted squat rack in each of four external KFA ranges: 35-45°, 55-65°, 75-85°, and 95-105°. Pearson correlation tests assessed the relationship between the peak 1s average vertical GRF from the squat and the peak takeoff force in the CMJ. **RESULTS:** Significant and strong correlations were found between the IS peak force and CMJ peak force in all IS KFAs (Table 1). The peak force at 80° KFA in the IS was most strongly correlated with the peak force in the CMJ. **CONCLUSIONS:** The

findings provide implications in using isometric squat for assessing jumping performance and lower extremity strength. Subsequent kinematic analysis of both the IS and CMJ is necessary for elucidating individual differences in this relationship and how it is associated with the peak KFA during the CMJ.

**Table 1:** Pearson product-moment correlation coefficients and p values between the peak 1s force production during IS and average instant peak takeoff force during the CMJ.

	IS Peak Force @ 40° KFA	IS Peak Force @ 60° KFA	IS Peak Force @ 80° KFA	IS Peak Force @ 100° KFA
<b>CMJ Peak Force (r)</b>	0.511	0.562	0.661	0.613
<b>Correlation p-value</b>	0.0033	0.0010	0.0001	0.0003

Category A

Mentor: B Dai, PhD

### 35. EXPLORING THE RELATIONSHIP BETWEEN PARENT AND CHILD PHYSICAL ACTIVITY

Strutz, EM, S Smith, B Lohse, L Cunningham-Sabo, R Browning, FACSM.

Email: erinstrutz@gmail.com

Department of Health and Exercise Science, College of Health and Human Sciences, Colorado State University, Fort Collins, CO

In order to engage parents or children as agents of change to increase physical activity (PA) at the family level, it is critical to understand the relationship between parent and child PA. **PURPOSE:** To employ high-frequency accelerometry (ACC) to explore parent-child PA correlations across a large sample of free-living data.

**METHODS:** During the Fall of 2012 and 2013, we recorded seven days of free-living, wrist-mounted ACC data (75 Hz; GENEActiv) from 168 fourth and fifth grade children and their parents (n=336) who were participants in a school- and family-based obesity prevention program. For the present analyses, we considered baseline data. Using a custom Matlab program, we summed child and parent accelerations over 1 and 60 seconds, respectively, and applied published GENEActiv cut points to determine the amount of time spent in moderate-vigorous PA (MVPA) during the weekday, weekend day, and specific time periods (before school, school-day, after school, and evening). Bivariate correlations were run to explore the parent-child relationship between percent of time spent in MVPA. **RESULTS:** Weak positive correlations were observed between the percent of time parents and children engaged in MVPA before school (r=0.315, p<0.001), afterschool (r=0.176, p=0.023), during the evening period (r=0.211, p=0.006), and on the weekends (r=0.235, p=0.003). No such correlations were observed during the whole-day (which comprised the before school, school-day, after-school, and evening time periods) or school-day periods. **CONCLUSION:** Based on the overall weak correlation in PA between parent-child pairs, these data suggest that parents or children alone might not be successful agents of change for the entire family. Additionally, it does not appear that parent and child PA is correlated during time periods that parents and children are apart (i.e., school-day). However, our data suggest that parent-child PA correlations are strongest during the before school period, which might be explained by active transportation.

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Category A

Mentor: RC Browning, PhD

### 36. AGE DIFFERENCES IN SIT-UP PERFORMANCE AMONGST FEMALE LAW ENFORCEMENT OFFICERS.

L.Tobin, L. Heil, J.Dawes, C. Elder

Email: ltobin@uccs.edu

Beth-El College of Nursing and Health Sciences, University of Colorado-Colorado Springs, Colorado Springs, CO

The 1-minute sit-up test is an assessment frequently used amongst law enforcement officers to measure muscular endurance of the trunk. According to the Cooper Institute for Aerobics Research (2006) this assessment is predictive of the ability to perform essential job tasks for law enforcement officers in most cases. Consequently, this assessment is frequently used by law enforcement agencies as part of their pre-hire selection process, as well as volunteer fitness programs. However, at this time it is unclear whether there are significant differences in performance for this measure amongst female officers of different ages. **PURPOSE:** The purpose of this research was to determine whether there were significant difference in sit-up performance amongst female law enforcement officers of different ages. **METHODS:** Archival data on the 1-minute sit-up assessment for 32 female law enforcement officers (ages 30-49) from two different law enforcement agencies was provided to the primary investigator for analysis. Participants were divided into 2 groups according to their age (Group 1: 20-39 years [n=20]; Group 2: 40-49 years [n=12]). Using the SPSS 22.0 software package, descriptive statistical analysis was conducted to determine mean sit-up scores for officers in each age category. Additionally, an Independent T-Test was used to compare mean differences in sit-up performance amongst officers in different age categories. **RESULTS:** The total Mean sit up scores for both groups combined was  $36.22 \pm 9.2$ . The mean sit up for Group 1 was  $36.35.05 \pm 9.8$ , and Group 2 was  $36.00 \pm 8.4$ . There were no statistically significant differences between these age groups ( $p=0.92$ ). **CONCLUSIONS:** There were no significant differences in the mean sit-up performance between female officers in the selected age groups. Furthermore, it was discovered that the female officers in this study ranked in the top 85-99% when compared to age and gender norms (CIAR, 2006). These finding would suggest that on average female officers perform better than their civilian counterparts on this measurement.

Category A Mentor: J.J Dawes PhD

### **37. DEVELOPMENT AND RELIABILITY TESTING OF THE COLORADO COLLEGE ANAEROBIC CAPACITY TEST (CAT)**

Student Researchers: Kaeli Vandersluis and Rachel Herron, co-investigators

Faculty Advisor: Anthony Bull, PhD, Department of Human Biology and Kinesiology

Field based sports such as soccer involve repeated high intensity, short duration sprints which rely on a high rate of cellular ATP production and a large anaerobic capacity to do work. Various field tests are used by coaches to assess anaerobic fitness; however, many tests do not provide a quantifiable estimate of anaerobic capacity. Therefore, the purpose of this study was to develop a field test for anaerobic capacity that would be easy to administer, provide reliable results with field-based athletes, and provide coaches with useful information about athletes' anaerobic fitness. The Colorado College Anaerobic Capacity Test (CAT) was developed after multiple testing sessions of various protocols with local soccer athletes serving as participants.

In its final version the CAT consists of repeated 40-meter sprints (the width of the penalty box on a standard soccer field) at maximal speed. Athletes have 7 seconds to run the 40 meters, with 13 seconds of active recovery in between sprints. Athletes continue sprints every 20 seconds until they can no longer cover the 40 meters in 7 seconds, and their number of attempted sprints is recorded. The Colorado College Women's soccer team performed the CAT twice within a 7-day period to evaluate the test's reliability, with 14 athletes completing both trials. The mean (SD) number of sprints attempted by the athletes in the two CAT trials was 8.0 (2.8) and 7.14 (3.0), respectively. A dependent t-test revealed that there was a significant difference ( $n=14$ ,  $p=0.012$ ) between the mean sprints completed in the two trials, indicating that this test was not reliable. However, this poor reliability may be due to the fact that the soccer team had a practice on the morning that the second test was administered, but not the first. This unexpected hard effort could have affected the results in the second trial because the athletes were fatigued from a high-intensity practice. Continued testing is planned to evaluate the reliability and validity of the CAT with more subjects and with greater control over the amount of exercise done 24 hours prior to administering the test.

### **38. EFFECT OF BEETROOT JUICE ON SELF-REGULATED, MODERATE-INTENSITY EXERCISE**

AA Vanderwoude, JN Rienks, E Maas, ZM Blea, and AW Subudhi

Email: [avanderw@uccs.edu](mailto:avanderw@uccs.edu)

Department of Biology, University of Colorado – Colorado Springs, CO, USA

**PURPOSE:** Dietary nitrate supplementation, in the form of beetroot juice, has been shown to reduce oxygen consumption at a fixed work rate. We questioned whether a similar effect would be observed during variable work rate exercise at a specific rating of perceived exertion (RPE), as is commonly prescribed for aerobic training sessions. **METHODS:** Ten females ( $25 \pm 3$  years;  $VO_{2peak} 37.1 \pm 5.3$  ml/kg/min) performed repeated 20-min cycle ergometer trials at a constant RPE of 13 (somewhat hard) on separate days to determine the reliability of total oxygen consumption ( $VO_2$ ) and mechanical work performed during self-regulated exercise. Using a double-blind, placebo controlled, crossover design, subjects performed two experimental RPE 13 trials 2.5 hours following ingestion of 140 ml of concentrated beetroot juice (12.9 mmol nitrate), or nitrate-depleted placebo. Following each experimental trial, subjects rode at 75W for an additional 5 min to determine the effect of beetroot juice on fixed work rate exercise. **RESULTS:** Coefficients of variation in total  $VO_2$  (L) and work performed (kJ) during the RPE 13 clamp trials were 8.2 and 9.5%, respectively. Consumption of beetroot juice did not affect total  $VO_2$  or work performed during RPE 13 exercise, but lowered resting systolic blood pressure by  $\sim 5$  mmHg ( $P=0.041$ ) and oxygen consumption at 75W by  $\sim 4\%$  ( $P=0.048$ ), relative to placebo. **CONCLUSIONS:** Since the effect of beetroot juice on oxygen consumption was small, and may be masked by daily variability during self-regulated exercise, it is unlikely to improve moderate-intensity training up to 20 min in duration.

Category A Mentor: AW Subudhi, PhD

### 39. THE RELATIONSHIP BETWEEN LINEAR RUNNING SPEED AND SELECTED MEASURES OF POWER AND STRENGTH AMONGST A SPECIAL WEAPONS AND TACTICS TEAM

J. Jay Dawes<sup>1</sup> JJ, Katie Krall<sup>1</sup>, Craig L. Elder<sup>1</sup>, Michael Stierli<sup>2</sup>

1. University of Colorado Colorado Springs - Department of Health Sciences, Colorado Springs Colorado
2. Sydney Police Centre, Sydney Australia

Email: [jdawes@uccs.edu](mailto:jdawes@uccs.edu)

Special Weapons and Tactics (SWAT) team officers that are able to express force rapidly are more likely to be successful in specific occupational job tasks, such as during a foot pursuit and finding cover. **PURPOSE:** The purpose of this study was to examine the relationship between selected measures of power, strength and sprint speed over 5m, 10m, and 20 m among Special Weapons and Tactics (SWAT) team members. **METHODS:** Archival data related vertical jump, isometric leg/back strength and sprinting performance for twenty-one ( $n=21$ , age  $36.05 \pm 4.06$  yrs.) male tactical officers belonging to a part-time SWAT team was provided to the investigators for analysis. VJ height, body mass, and body fat estimations via 3 site skinfold measurements were used to calculate absolute and relative power output via the Harman and Sayers Peak Power (PP) Equations. Power-to-weight (P:W) and strength-to-weight (S:W) ratios were then calculated by dividing absolute values by the officers total and lean body mass. **RESULTS:** A Pearson's correlation revealed significant ( $p \leq .001$ ) moderate ( $r = -.572$  to  $-.608$ ) relationships between speed (5m, 10m and 20m) and peak power in watts ( $r = .686$  to  $.959$ ,  $p \leq .05$ ) using the Sayers Peak Power Equation. Furthermore, significant ( $p \leq .01$ ) moderate ( $r = -.561$  to  $-.696$ ) relationships were discovered between speed and all estimations of relative power measured in watts. No significant relationships were discovered between speed and isometric leg/back strength in either absolute or relative terms. Power as measured by VJ was also significantly ( $p \leq .001$ ) correlated ( $r = -.572$  to  $-.602$ ) with forward linear speed. **CONCLUSIONS:** Conditioning measures that increase power performance, such as plyometrics and Olympic weightlifting, should improve a SWAT officer's ability to move forward and rapidly seek cover.

Category C

### 40. CONSUMPTION OF A TESTOSTERONE-BOOSTING SUPPLEMENT IS SAFE AND LOWERS ESTROGEN AND CORTISOL LEVELS

Falcone, PH, JM Joy, RM Vogel, MM Mosman, CM Hughes, JD Griffin, KJ Paulin, MP Kim, and JR Moon

Email: [jordan@musclepharm.com](mailto:jordan@musclepharm.com)

MusclePharm Sports Science Institute, Denver, CO

Increasing testosterone and lowering estrogen can lead to performance benefits and possible health benefits in some men. Testosterone-boosting supplements (TB) may exert these effects; however, it is still unclear whether many TB are safe or effective when consumed chronically. **PURPOSE:** To determine the efficacy and safety of a TB ingested for 8 weeks. **METHODS:** Eighteen trained men (age: 25.8 +/- 4.3 years; height: 176.7 +/- 4.97 cm; weight: 80.35 +/- 11.99 kg) completed a double-blind, placebo-controlled study. First, blood was sampled for safety panels, estrogen, and cortisol. For 8 weeks, the TB group (n = 10) consumed a TB twice daily, and the placebo (PLA) group (n = 8) consumed a visually identical placebo in the same manner. After the 8 weeks, subjects returned to the testing facility to provide another blood sample. **RESULTS:** Regarding safety, no statistically significant changes were measured in hematology other than chloride (TB: PRE, 102 +/- 2.12 mmol/L to POST: 103 +/- 1.83 mmol/L; PLA: PRE, 103 +/- 1.13 mmol/L to POST: 102 +/- 1.89 mmol/L; p = 0.025) and the change in chloride was not clinically significant (clinical range: 97-108 mmol/L). Liver enzymes aspartate aminotransferase (TB: PRE, 24.1 +/- 9.05 IU/L to POST: 24.6 +/- 7.49 IU/L; PLA: PRE, 26.0 +/- 13.9 IU/L to POST: 28.5 +/- 14.7 IU/L) and alanine aminotransferase (TB: PRE, 28.9 +/- 7.19 IU/L to POST: 26.7 +/- 10.2 IU/L; PLA: PRE, 22.8 +/- 11.8 IU/L to POST: 23.8 +/- 12.4 IU/L) demonstrated no statistical differences. Estrogen (TB: PRE, 124 +/- 35.9 pg/ml; POST: 97.9 +/- 25.3 pg/ml; p = 0.0166) and cortisol (PRE: 20.5 +/- 3.96 ug/dl; POST: 16.6 +/- 3.93 ug/ml; p = 0.0160) decreased significantly in TB, while no changes were observed in PLA. **CONCLUSION:** A TB supplement is safe and effective at decreasing estrogen and cortisol levels in the blood.

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#### 41. PERFORMANCE EFFECTS OF 10 WEEKS SUPPLEMENTATION WITH A PURPORTED TESTOSTERONE-BOOSTING SUPPLEMENT

Joy, JM, Falcone, PH, Vogel, RM, Mosman, MM, Hughes, CM, Griffin, JD, Paulin, KJ, Kim, MP and Moon, JR

MusclePharm Sports Science Institute, Denver, CO

4721 Ironton St.

Bldg A

Denver, CO, 80239

jordan.joy@musclepharm.com

Anabolic hormones are recognized as the premier compound to facilitate improvements in exercise performance. As an alternative to hormone use, testosterone-boosting supplements (TB) may be consumed to increase testosterone for performance enhancement. While these supplements may fail to augment testosterone in eugonadal men, they may still exert an ergogenic effect.

**PURPOSE:** To determine the performance enhancing capabilities of a TB.

**METHODS:** Eighteen trained men (25.8 ± 4.3y; 176.7 ± 5.0cm; 80.4 ± 12.0kg) completed a double-blind, placebo-controlled study consisting of 10 total weeks resistance training. The TB group supplemented daily with 2 doses of a multi-ingredient TB, and the placebo (PLA) group supplemented with an equal volume, visually identical placebo in the same manner. The first 8 weeks consisted of daily undulating periodized resistance training 3 days per week, focusing on either muscular hypertrophy, power, or strength. The final 2 weeks featured an overreach and taper phase. Tests consisted of 1RM strength of the bench press and leg press, a 30s Wingate, bench press peak power and velocity, and vertical jump height, peak power, and peak velocity.

**RESULTS:** No differences existed between groups at baseline. Independent T-tests revealed a significant (p<0.05) difference in delta values from week 8 to 9 for bench press peak power. Wherein, PLA decreased (-29.4 W) and TB remained the same (+2.1 W). This corresponded with a significant (p<0.05) difference in bench press peak velocity for the same time period. However, the changes were divergent in this case (TB: +0.06 m/s; PLA: -0.05 m/s). A significant (p<0.05) difference was found for leg press 1RM from week 4 to 9 (TB: +31.7 kg; PLA +13.1 kg), and trends were observed from week 4 to 10 (p=0.054; TB: +40.2 kg; PLA: +21.9 kg) and from week 8 to 9 (p=0.093; TB: +10.6 kg; PLA: -0.3 kg). A significant (p<0.05) effect was observed for bench press 1RM from week 0 to 4 (TB: +5.5 kg; PLA: +1.7 kg), which seemed to reverse from week 4 to week 8 (p=0.07; TB +1.8 kg; PLA +4.0 kg). No other significant interactions were observed.



**CONCLUSION:** A TB supplement may be efficacious for increasing maximal strength and preventing the performance decrements associated with overreaching.

Category C

## 42. THE SAFETY OF PRE-WORKOUT SUPPLEMENTATION IN RECREATIONALLY ACTIVE ADULT FEMALES FOR 28 DAYS

R.M. Vogel, J.M. Joy, P.H. Falcone, M.M. Mosman, M.P. Kim, and J.R. Moon

MusclePharm Sports Science Institute, 4721 Ironton St., Bldg A, Denver, CO, 80239

Email: roxanne.vogel@musclepharm.com

Pre-workout supplements (PWS) have increased in popularity among athletic populations for their purported ergogenic benefits. Currently, little research exists on the safety and potential side effects of chronic consumption of PWS, particularly among females. **PURPOSE:** To examine the clinical safety of consuming a PWS daily in healthy adult females for 28 days. **METHODS:** 34 recreationally active adult females ( $27.1 \pm 5.4$  years,  $165.2 \pm 5.7$  cm,  $68.2 \pm 16.0$  kg) participated in this study. Participants were randomly assigned to consume either 1 (G1) or 2 (G2) servings daily of a commercially available PWS, or remain unsupplemented (CRL) for a period of 28 days. Fasting blood samples, as well as resting blood pressure and heart rate, were taken before and after the supplementation period. Blood samples were analyzed for CBC, CMP and lipid panels. **RESULTS:** Significant ( $p < 0.05$ ) group by time interactions were present for absolute monocytes, MCH, creatinine, eGFR, and total cholesterol. There were no significant interactions for any other variables. Means  $\pm$  SD for significant interactions are presented in Table 1. **CONCLUSION:** This study confirms our hypothesis that a PWS containing caffeine, beta-alanine, and nitrate will not cause abnormal changes in hematological markers or resting vital signs among adult females. Although there were statistically significant ( $p < 0.05$ ) group by time interactions for absolute monocytes, MCH, creatinine, eGFR, and total cholesterol, all values remained well within accepted physiological ranges and were not clinically significant. In sum, daily supplementation with up to 2 servings of a PWS, over a 28 day period, is apparently safe for consumption among active adult females.

Variable	Group	PRE	POST	Delta	Reference Interval
Monocytes (Absolute) (x10E3/uL)	CRL	0.56 $\pm$ 0.16	0.46 $\pm$ 0.14 <sup>††</sup>	-0.10 $\pm$ 0.10	0.1 - 0.9
	G1	0.44 $\pm$ 0.08	0.47 $\pm$ 0.14	0.03 $\pm$ 0.13	
	G2	0.48 $\pm$ 0.29	0.49 $\pm$ 0.31	0.01 $\pm$ 0.12	
MCH (pg)	CRL	30.66 $\pm$ 1.08	30.53 $\pm$ 1.03	-0.13 $\pm$ 0.46	26.6 - 33.0
	G1	30.18 $\pm$ 1.92	30.54 $\pm$ 1.61 <sup>*‡</sup>	0.36 $\pm$ 0.52	
	G2	30.46 $\pm$ 1.41	30.28 $\pm$ 1.16	-0.19 $\pm$ 0.39	
Creatinine (mg/dL)	CRL	0.90 $\pm$ 0.10	0.90 $\pm$ 0.11	0.00 $\pm$ 0.05	0.57 - 1.00
	G1	0.96 $\pm$ 0.30	0.90 $\pm$ 0.25	-0.06 $\pm$ 0.13	
	G2	0.91 $\pm$ 0.17	0.77 $\pm$ 0.12 <sup>*</sup>	-0.14 $\pm$ 0.08	
eGFR (mL/min/1.73)	CRL	90.93 $\pm$ 13.79	90.14 $\pm$ 14.27	-0.69 $\pm$ 5.97	> 59
	G1	89.80 $\pm$ 27.23	95.90 $\pm$ 22.95	6.10 $\pm$ 15.89	
	G2	88.25 $\pm$ 18.84	102.88 $\pm$ 14.02 <sup>*</sup>	14.63 $\pm$ 7.11	
Total Cholesterol (mg/dL)	CRL	160.75 $\pm$ 27.81	158.31 $\pm$ 24.39	-2.44 $\pm$ 13.63	100 - 189
	G1	155.10 $\pm$ 9.00	169.50 $\pm$ 24.37 <sup>*‡</sup>	14.40 $\pm$ 27.32	
	G2	165.75 $\pm$ 21.86	155.38 $\pm$ 21.55	-10.38 $\pm$ 15.39	

**Table 1. Significant Interactions**

CRL = Control (n=16); G1 = Group 1 (n=10); G2 = Group 2 (n=8); All data are reported as means  $\pm$  SD.

\*Different from CRL( $p < 0.05$ ), †Different from G1 ( $p < 0.05$ ), ‡Different from G2 ( $p < 0.05$ )

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