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# MARC-ACSM Annual Meeting

## Abstract Sessions



## Masters/Doctoral Research Award Sessions: Ash/Birch

Time	Speaker	Title of Presentation
1:00-1:15	Sara Mascone	Racial Differences in ROS Production and SOD Activity Following Induced Inflammation
1:15-1:30	Millissia Murro	Relationship between self-efficacy and physical activity in individuals with and without chronic hip pain
1:30-1:45	Cynthia Weiner	Carotid Artery Stiffness decreases in Older Women Following 6-Month Aerobic Exercise Intervention
1:45-2:00	Sydney Brackett	Bioelectrical Impedance Analysis: Insight into Subclinical Atherosclerosis
2:00-2:15	Andrew Heckel	Ambulatory Arterial Stiffness, Salivary Inflammation, and Physical Activity in Young Adults With and Without COVID-19
2:15-2:45	Break	
2:45-3:00	Candace Longoria	Regulator of G Protein Signaling 14 Disruption Affects the Gut Microbiota and Metabolome in Mice
3:00-3:15	Nathan Romberger	Inverse Salt Sensitivity in Normotensive Adults: Role of Demographic Factors
3:15-3:30	Nicole Sekel	Slow Wave Activity Sleep is Significantly Associated with Decision-Making During Simulated Military Operational Stress
3:30-3:45	Felix Proessel	Corticospinal Excitability and the Size of Motor Cortex Representations Reflect Distinct Aspects of Corticomotor Function
3:45-4:00	Justin Mehrer	The Effects of Elevated Sodium on Mitochondrial Function in Peripheral Blood Mononuclear Cells



## Undergraduate Research Award Session: Ash/Birch

<b>Time</b>	<b>Speaker</b>	<b>Title of Presentation</b>
9:00-9:15	Jordyn Parks	Differences in Tibialis Anterior Mitochondrial Capacity in Recreationally Active Younger and Middle-aged Adult
9:15-9:30	Samuel Zercher	Continuous and Interval Training Acutely Elevate Serum BDNF in Healthy College-age Males
9:30-9:45	Danika Swech	You are What (Time) You Eat: Investigating Chrono-nutrition and Body Mass Index in Free-Living Adult
9:45-10:00	Stephanie Resnick	The Effect Habitual Exercise on Older Adults Mental Health During the COVID-19 Pandemic
10:00-10:15	Lauren McDonald	Cesarean Section Delivery Does Not Impact Postpartum Weight Loss and Recovery
10:15-10:45	Break	

**Masters Poster Sessions: Ballroom C, D, E**

<b>Time</b>	<b>Speaker</b>	<b>Title of Presentation</b>
1:00-1:10	Kerry Callahan	Establishing Inter-Day Reliability of Neuromuscular Coordination of the Lower Extremity During a Drop-Jump Landing
1:10-1:20	Ryan Campbell	Hydration Does Not Influence Corticospinal Excitability
1:20-1:30	Alexa Glatfelter	Thrive: Impact of a Mind, Body and Soul Program on Anxiety Symptoms and Quality of Life
1:30-1:40	Ashley Heffelfinger	The Impact of VO <sub>2</sub> and Cardiovascular Drift on Submaximal Exercise utilizing ACSM's Cycle Metabolic Equation
1:40-1:50	Kristina Holmes	Time-Site differences in Cancer Survivors Ratings of Distress due to COVID-19 and Exercise Clinics Closure
1:50-2:00	Juliana Houghland	Little Variability in Active Motor Thresholds of Trunk and Leg Muscles Across Days
2:00-2:10	Deanna Huck	Effects of Repetitive Transcranial Magnetic Stimulation on Mood When Targeting Motor-Related Brain Region
2:10-2:20	Lynn Nguyen	Racial Disparities in Cardiac Rehabilitation Attendance After Percutaneous Coronary Intervention
2:20-2:30	Andrew Schlosser	Resistance and Endurance Training Improve Exercise Enjoyment and Happiness in Young Adult
2:30-2:40	Michael Shafer	Effects of Acute Aerobic and Resistance Exercise on Neuroplasticity-A Pilot Study
2:40-2:50	John Stauffer	Repetitive Brain Stimulation Does Not Influence Perceived Exertion During Maximal Cycle Ergometer Protocol
2:50-3:00	Alexis Trumbetti	Attitudes Surrounding Group vs. Individual Cycling During COVID-19

## Doctoral Poster Sessions: Ballroom C, D, E

Time	Speaker	Title of Presentation
3:00-3:10	Maria Canino	Perceived Muscle Soreness Does Not Modulate Corticospinal Excitability
3:10-3:20	Caitlin Cheruka	Oxygen Consumption and Heart Rate Responses Between Different Sequences of a Vinyasa Yoga Practice
3:20-3:30	William Evans	Acute Exercise-Induced Changes in Extracellular Vesicle Cargo in Adults with or Without Type 2 Diabetes
3:30-3:40	Caitlin Gallo	Hand Dominance and Head Impact Location in Collegiate Ice Hockey
3:40-3:50	James Heilman	Effects of Oxidative Stress versus Cytokine-dependent Inflammation on the release of Endothelial Microparticles
3:50-4:00	Megan Heintzelman	Perspectives on Participation in and Support for Youth Physical Activity Opportunities in Low-Income, African American Neighborhoods
4:00-4:10	Anthony Holmes	Associations of Workplace Design with Workday Sedentary Behaviour and Sit-to-Stand Transition
4:10-4:20	Yuan Liu	Estrogen Augments the Cardiac Functional Response to $\beta$ 2-Adrenergic Receptor Stimulation in Young Female Rat Hearts
4:20-4:30		Break
4:30-4:40	James Baker	Repetitive Transcranial Magnetic Stimulation Does not Improve Lower Extremity Anaerobic Physical Fatigue in Healthy Participants
4:40-4:50	David Donley	Physical Activity Patterns and Beliefs of Medical Fitness Facility Clients During COVID-19
4:50-5:00	Diana Gilleland	Capturing Client Feedback for the Reopening of a Medical Fitness Facility During the COVID-19 Pandemic
5:00-5:10	Jessica Klugh	Nutritional Knowledge and Body Dissatisfaction in NCAA Division II College Athletes
5:10-5:20	Brian Leary	Oral Health and Salivary IgA Responses in Division I Female Athletes
5:20-5:30	Ashley Lesniak	The Impact of Gender on Self-Reported RPE during a Graded Exercise Test
5:30-5:40	Tristan Ragland	Effect of Chronotype on Non-Exercise Physical Activity Patterns and Metabolic Insulin Sensitivity
5:40-5:50	Lori Sherlock	Work-Related Exercise Programming for Firefighters: A Mixed Method Design

## Clinical Case Studies: Pennsylvania Room

Time	Speaker	Title of Presentation
1:00-1:15	Robert Eberly	Chronic Anterior Hip Pain in a Track Athlete
1:15-1:30	Ashley Koontz	Poland Syndrome as a Risk Factor for a Common Diagnosis in a Baseball Pitcher
1:30-1:45	Sean Sussman	Trimming Hedges: An Unlikely Cause for Arm Pain in a Weightlifter
1:45-2:00	Sahel Uddin	Acute Visual Field Defect in a Division III Lacrosse Player
2:00-2:15	Jana Qiao	Shin Splints? Think Again!
2:15-2:30	Break	
2:30-2:45	McKensie Walker	Time is Testicle: A Case of Traumatic Testicular Rupture in a Collegiate Athlete
2:45-3:00	Ryan Meyer	An Accelerated Return to Sport Following Myocarditis in a Recreational Male Athlete
3:00-3:15	David Lee	Unilateral Lower Extremity Swelling In Recreational Golfer
3:15-3:30	Jeremy Palmer	Postop Patellar Tendon Rupture Repair Pain in a Weightlifting Athlete with EDS
3:30-3:45	Hannah Fanelli	Post COVID Neuralgic Amyotrophy
3:45-4:00	Break	

**Undergraduate Poster Sessions: Pennsylvania Room**

<b>Time</b>	<b>Speaker</b>	<b>Title of Presentation</b>
8:00-8:10	Katie Kelley	The Effects of a Novel Muscle Activation Technique on Performance Parameters in Collegiate Football Players
8:10-8:20	Brogan Loudon	NSAID Usage Patterns & Amount of Negative Side Effects in Shippensburg University Student Athletes
8:20-8:30	Victoria Maybruck	Effects of Wearing a Surgical Mask During Moderate Exercise on Muscle and Blood Oxygen Saturation
8:30-8:40	Samantha Mosey	The Relationship Between Sleep and Perception of Performance in College Athletes
8:40-8:50	Zachary Brodeur	Effects of Static and Dynamic Stretching on Muscle Oxygen Saturation in the Rectus Femoris
8:50-9:00	Lauren Roberts	Heart Rate Responses to Three Unweighted Conditions on anAlter-G® Treadmill
9:00-9:10	Lydia Sedijo	Effects of the COVID-19 Pandemic on Mood and Motivation in Division 2 Athletes
9:10-9:20	Macy Slack	Effects of a Multi-Strain Probiotic on Depression, Anxiety, and Stress in College-Aged Individuals
9:20-9:30	Emma Soliva	Do College Students View Walking as Physical Activity? Relationship between Walking and Physical Activity Perceptions
9:30-9:40	Kylie Thal	Ability to Reproduce RPE while Self-Selecting Treadmill Speed vs Incline
9:40-9:50	Ella Weinbeck	Acute Cardiovascular Responses in Cell Phone Usage in College Students
9:50-10:00	Kendell Zaleski	Sex Differences in Estimating Cardiac Autonomic Function Using Heart Rate Variability: Effects of Oral Capsaicin



**Undergraduate Poster Sessions: Ballroom C, D, E**

<b>Time</b>	<b>Speaker</b>	<b>Title of Presentation</b>
8:00-8:10	Kathryn Armstrong	The Influence of CYP1A2 and ADORA2A Polymorphisms and Caffeine Consumption under Anaerobic Conditions
8:10-8:20	Gabe Balascio	Effects of Cell Culture Conditions on Extracellular Vesicle Production in Human Embryonic Kidney Cell
8:20-8:30	Naimh Cashin	Galvanic Skin Response Increase Following Exercise and Correlates with Exercise Analgesia
8:30-8:40	Jillian Chan	Symptoms of COVID-19 May Cause Exercise Induced Autonomic Nervous System Dysfunction
8:40-8:50	Hannah Chenoweth	Anaerobic Power of Division-1 Competitive Dancers
8:50-9:00	Olivia Cunningham	The Effects of a Regular Yoga Practice on Mental Health in College Students during COVID-19
9:00-9:10	Gillian Gunn	Comparison of Self-Myofascial Release Methods on Ankle Range of Motion, Balance, and Patient Reported Comfort
9:10-9:20	Abena Gyampo	Do Racial Differences Exist in Blood Pressure and Vascular Stiffness in Otherwise Healthy Young Men?
9:20-9:30	Maxwell Heller	Thermal Strain During Endurance Running Events
9:30-9:40	Jacqueline Santaniello	Arterial Blood Pressure Responses Reflect Differences in Alter-G® Treadmill Chamber Pressure in College Age Participants
9:40-9:50	Dalton Jones	Inter-set Voluntary Hyperventilation-aided Recovery Does Not Improve Bench Press and Squat in Recreationally Trained Individuals
9:50-10:00	Diane Kalita	The Effects of a Resistance Training Program on Arterial Stiffness in Young, Healthy Females

**Research Free Communications: Chestnut/Dogwood**

<b>Time</b>	<b>Speaker</b>	<b>Title of Presentation</b>
1:00-1:15	Bailey Capra	Ultra-Processed Food is Associated with BMI, Sedentary Time, and Adverse Dietary Patterns in Young Adult
1:15-1:30	Rachel Cottle	Critical Environmental Limit Protocol: Validity and Reliability (PSU HEAT)
1:30-1:45	Daniel Gwon	Family History of Hypertension and Heart Rate Results from the Variable Height Step Test
1:45-2:00	Jessica Jones	The Interrelationship of Bisphenols-A and-S, Lipid Profiles, and Their Effect on Glucose Uptake
2:00-2:15	Natalie Turbett	Effects of a Six-Week Walking Intervention on Cardiometabolic Risk Factors and Mental Well Being
2:15-2:30	Craig Berry	Hydration is More Important than Exogenous Carbohydrate Intake during Push-to-the-Finish Cycling in the Heat
2:30-2:45	Matthew Bird	Sex-Differences in Counter Movement Jump Kinetics and Kinematics Following 10-week Marine Officer Candidates School
2:45-3:00	Emily Blake	Brachial Artery Low-Flow-Mediated Constriction (L-FMC) is Augmented in Older Women
3:00-3:15	Wonhee Cho	Effect of ketogenic diet on exercise efficiency and metabolic regulation during exercise in adults
3:15-3:30	Michele Dagata	Macrovascular Function Assessed by Flow-Mediated Dilation Does Not Change Across Menstrual Cycle Regardless of Race
3:30-3:45	Jacob Deblois	Mental Health and Central and Peripheral 24-Hour Blood Pressure in Emergency Responders
3:45-4:00	Theodore Deconne	The Influence of Sleep Duration on Cerebrovascular Reactivity
4:00-4:15	Gabrielle Dillon	Nitric Oxide-mediated Microvascular Function is not Altered in Healthy Adults Following SARS-CoV-2 Infection.
4:15-4:30	Kiara Garry	A Qualitative Analysis of Student-Athletes' Experiences During COVID-19: "It's hard to feel like an athlete"

**Research Free Communications: Elm/Fir**

<b>Time</b>	<b>Speaker</b>	<b>Title of Presentation</b>
1:00-1:15	Alaina Glasgow	Association of Muscular Strength with Pulse Pressure and Aortic Calcification in Older Adults
1:15-1:30	Camille Johnson	Forced Marching in Load Decreases Tibiofemoral Joint Space Compared to Running
1:30-1:45	Darrin Lenhart	The Impact of High Intensity Interval Training on Neurogenesis and Angiogenesis in the Dentate Gyrus
1:45-2:00	Mary-Margaret Remchak	Reduced Aortic Wave form Responses to Insulin in Late Chronotype with Metabolic Syndrome
2:00-2:15	Jared Rosenberg	Interactive Effects of Physical Activity and 1HGC on Type 2 Diabetes Risk
2:15-2:30	Faria Sanjana	Relation between middle cerebral artery pulsatility index and hippocampal tissue integrity in healthy adult
2:30-2:45	Kylie Shuler	Generation of Myotropic Extracellular Vesicles for Targeted Delivery of Therapeutics to Skeletal Muscle
2:45-3:00	Scott Dankel	Does Performing Resistance Exercise to Failure Homogenize the Stimulus?
3:00-3:15	Jaclyn Dosik	Light Physical Activity Relates to Insulin Sensitivity and Earlier Time of Day in Metabolic Syndrome
3:15-3:30	Kristen Koltun	Sex-differences in Bone Density, Geometry, and Estimated Strength Adaptations to 10-weeks of Military Officer Training
3:30-3:45	Davi Mazala	Peak satellite cell proliferation for regenerative myogenesis takes place 24-72h post injury in mouse muscles
3:45-4:00	Myong-won Seo	Is there an Optimal HIIT Protocol for Muscular Development of Adolescent Athletes?
4:00-4:15	William Pomilla	Association Between Meeting Physical Activity Guidelines with Ambulation, Quality of Life, and Inflammation in Claudication
4:15-4:30	Julia Santos	The Effect of Bisphenols A and S Exposure on Dyslipidemia, Oxidative stress, and Physical Fitness in Normal and Overweight/Obese Young Adult
4:30-4:45	Kory Stauffer	The Effect of Facial Coverings on Prediction of Aerobic Capacity During a Maximal Treadmill Test

## Clinical Case Studies: Pennsylvania Room

<b>Time</b>	<b>Speaker</b>	<b>Title of Presentation</b>
4:00-4:15	Shawn Sunu	A well-known Yet Rare Cause of Mono-Articular Arthritis
4:15-4:30	Megan McQuarrie	Not Too Late For This Lunate
4:30-4:45	Lynn Weaver	Dizziness in a Division I College Field Hockey Athlete

**Research Free Communications: Chestnut/Dogwood**

<b>Time</b>	<b>Speaker</b>	<b>Title of Presentation</b>
8:00-8:15	Keerthana Arjuna	Oral Health in Division I Female Athletes
8:15-8:30	Samuel Ellestad	Comparison of Muscle Activation Across Three Straight-Legged Hinge Exercises
8:30-8:45	Mohammed Elzokm	Assessment of Peripheral Versus Central Autonomic Control of Vascular Function in Healthy Subjects
8:45-9:00	Rhianna Gonzales	The Effect of Meditation on Heart Rate Variability
9:00-9:15	Alicia Hauser	Vascular Function and Physical Activity in Young and Middle-aged Adult
9:15-9:30	Stephanie Judkins	Eating Disorders Risk Within Division III Athletic East Conference Female Athletes
9:30-9:45	Amy Kwok	Dietary Protein Intake and Sarcopenia from the 2003-2004 National Health And Nutrition Examination Survey
9:45-10:00	Benjamin Lerch	Comparison of Glenohumeral and Scapulothoracic Kinematic Parameters During Baseball Pitching Between Fastballs and Curveballs
10:00-10:15	Ben McEldowney	The Effect of Vigorous Exercise on the Inter-Arm Difference in Systolic Blood Pressure

**Research Free Communications: Elm/Fir**

<b>Time</b>	<b>Speaker</b>	<b>Title of Presentation</b>
8:00-8:15	Lauren Naylor	Passive Arm Movement to Induce an Inter-Arm Difference in Systolic Blood Pressure
8:15-8:30	Juliana Schraer	The Relationship Between Sleep Quality and Quantity and Body Composition in a College Population
8:30-8:45	Anthony Smith	Effect of Late versus Early Chronotype on Fuel Metabolism During Exercise
8:45-9:00	Alyssa Watts	The Impact of the Cold Pressor Test on Inter-arm Differences in Blood Pressure
9:00-9:15	Ashlyn Whiteside	Correlations Between Remote Learning and Undergraduate Sleep and Exercise Habits



## Comparison of Muscle Activation Across Three Straight-Legged Hinge Exercises

Samuel H. Ellestad, Jesse E. Scheaffer, Noah C. Novak, Carol A. Weber, Michael E. Holmstrup, Jeremy R. Dicus. Slippery Rock University, Slippery Rock, PA

The 'hinge' movement pattern includes lower body resistance training exercises that prioritize hip flexion and extension, though there are few studies to characterize their application. Hinge exercises are critical to building a balanced resistance training program in concert with 'knee-dominant' (e.g., squat, lunge) exercises. Biomechanical differences between various straight-legged hinge (SLH; minimal knee flexion and extension) exercises may alter muscle activation. For example, a Romanian deadlift (RDL) is a closed-chain SLH, while a reverse hyperextension (RH) is open-chain. Likewise, the RDL offers resistance via gravity while the similar cable pull-through (CP) offers redirected-resistance through a pulley. A deeper understanding of the potential impact of the differences between these exercises may improve their application to specific goals. **PURPOSE:** To compare muscle activity in the RDL, RH, and CP in apparently healthy males. **METHODS:** Participants initially completed repetition-maximum (RM) testing on the RDL, RH, and CP. On a follow-up visit, surface electromyography (EMG) of the longissimus, multifidus, gluteus maximus, semitendinosus, and biceps femoris, muscles that contribute to lumbar/hip extension, was measured using standard procedures. After a standardized warm-up, participants completed maximal voluntary isometric contractions (MVICs) in the 5 muscles noted. They then completed 5 slow (2s concentric, 2s eccentric) repetitions of the RDL, RH, and CP at 50% of estimated 1RM. The order of testing was randomized. A one-way ANOVA was used to compare activation (%MVIC) of each muscle across the 3 exercises. **RESULTS:** Shifting from a gravity- (RDL) to a redirected-resistance (CP) SLH decreased activation in the longissimus (-11.0%), multifidus (-14.1%), biceps femoris (-13.1%), and semitendinosus (-6.8%). Alternately, changing from a closed- (RDL) to an open-chain (RH) SLH increased activation in the gluteus maximus (+19.5%), biceps femoris (+27.9%), and semitendinosus (+18.2). **CONCLUSION:** Simple alterations in the execution of a SLH can alter the activation of muscles that impact lumbar/hip extension. Careful application of these exercises may improve the outcomes of interventions ranging in application from performance enhancement to clinical rehabilitation.

## Oral Health in Division 1 Female Athletes

Keerthana Arjuna, Savannah Bryner, Megan Pycraft, Renee Engle, Brian K Leary, Miriam E Leary, Randy W Bryner. West Virginia University, Morgantown, WV

A direct correlation exists between overall health and oral health. Previous findings suggest significant oral health issues in athletes which, for Division 1 (D1) college athletes, could negatively impact their performance and overall wellbeing. **PURPOSE:** To assess if D1 athletes are at an increased risk of developing decay compared to non-athletes by evaluating dental practices, decay causing foods, and salivary protective factors. **METHODS:** Fifty-four female athletes [32 rowers (R) and 22 soccer players (S)] and 34 female college age-matched controls (C) participated. All subjects completed a Dental Health Questionnaire to assess current dental habits, history of orofacial trauma, and dietary patterns as well as the International Physical Activity Questionnaire (IPAQ) to assess physical activity levels. All subjects underwent a brief dental examination using the Dental Epidemiologic Study: Decay, Missing, Filled Surfaces Index (DMFS). Resting saliva samples were collected and analyzed for salivary IgA using standard ELISA kits. **RESULTS:** While C were shorter compared to athletes (C:  $166 \pm 1$  cm; R:  $169 \pm 1$  cm; S:  $169 \pm 1$  cm;  $p < 0.05$ ), there were no differences in weight (C:  $71 \pm 3$  kg; R:  $72 \pm 1$  kg; S:  $65 \pm 2$  kg;  $p > 0.05$ ). Controls had lower levels of physical activity compared with both the R and S groups (C:  $945 \pm 182$  MET/min/wk; R:  $3,246 \pm 968$  MET/min/wk; S:  $10,413 \pm 2,499$  MET/min/wk;  $p < 0.05$ ). Visits to the dentist in the last year were reported by 70% of C, 75% of R, and 81% of S groups. 68% of C, 64% of R, and 63% of S groups self-reported consuming  $< 3$  servings of sugar (CHO)/day. Rowers had lower DMFS (%Total Surface Area) compared with (C:  $6.2\% \pm 0.9\%$ , R:  $3.2\% \pm 0.6\%$ ;  $p < 0.05$ ); however, there were no differences between S and any other group (S:  $4.8\% \pm 0.9\%$ ) ( $p > 0.05$ ). Soccer players tended to have more decay than rowers (S:  $3.5 \pm 0.87$ ; R:  $1.4 \pm 0.33$ ;  $p = 0.07$ ) and had lower resting IgA levels versus C and R (C:  $105 \pm 13$  mg/dL; S:  $31 \pm 3.7$  mg/dL; R:  $77 \pm 11$  mg/dL;  $p < 0.05$ ). **CONCLUSION:** Despite similar dental practices, differences in dental health exist between cohorts of female collegiate athletes suggesting less elite athletes exhibit better dental health. In addition, elite soccer players had a reduced resting salivary IgA level, a known dental protective factor.



## **Assessment of Peripheral Versus Central Autonomic Control of Vascular Function in Healthy Subjects**

Mohamed Elzokm, Jack Philips, Dr. Andrew Gow, Emily Stevenson. Rutgers University, New Brunswick, NJ

Current measures of cardiovascular function do not consider the relative importance of autonomic central control of vascular tone with reference to local hypoxic mediated vasodilation. The central augmentation index (cAIX) is a measure of arterial stiffness, with a predominance of the response regulated by major arteries. Alternatively vascular responsiveness can be assessed by peripheral measures such as dichrotic notch height. Peripheral measures are often difficult to observe in the presence of changes in autonomic activity; this is especially difficult in healthy populations. The use of ambulatory blood pressure monitors allows for continuous assessment of both central and peripheral arterial waves, which allows one to assess both central autonomic control and peripheral hypoxia-mediated vasodilation. **PURPOSE:** To examine exercise as a method to evaluate the effect of the autonomic system on peripheral vascular response and improve cardiovascular assessment. We propose that a short-term hypoxic stimulation will lower vascular stiffness (cAIX) while maximal exercise will increase it. Further that these responses will be independent of changes in dichrotic notch height as a measure of peripheral relaxation. **METHODS:** Blood pressure and pulse wave data was collected from young (19-23), healthy subjects (11 M and 4 F) using an Oscar 2 Ambulatory Blood pressure monitor over 2 hrs. After 1 hr, a hyperemia response was elicited using a manual cuff on the forearm. After 2 hr, the subject performed a maximal exercise stress test as per the Bruce Protocol. Subsequently, another hyperemia response was elicited. **RESULTS:** In 15 healthy subjects we observed that cAIX in the presence of hyperemia was greater pre-exercise than post indicating that central sympathetic stimulus reduced increased vascular stiffness. However, height of the dichrotic notch, an indicator of peripheral vessel stiffness, was reduced by hyperemia and increased by exercise. **CONCLUSION:** These studies show that ambulatory blood pressure monitoring can be used to assess vascular responsiveness and have the capacity to monitor both central and peripheral control. Furthermore, we propose an algorithm that can be used to assess the vessel relaxation capacity of peripheral arteries.

## **The Effect of Meditation on Heart Rate Variability**

Rhianna M. Gonzales, Roise Hartman, Hannah K. Logan, Courtney S. Luckenbill, Spencer N. Cassel H. Scott Kieffer (FACSM). Messiah University, Mechanicsburg, PA

Heart rate variability (HRV) reflects the autonomic balance of the sympathetic (SNS) and parasympathetic (PNS) nervous systems. The frequency and time domains of an ECG are analyzed to determine the influence of PNS activity. HRV has been shown to be influenced by exercise training; however, meditation and guiding breathing techniques may also influence HRV. **PURPOSE:** To evaluate the effect of a short, guided meditation session on the measures of heart rate variability of inexperienced meditators. **METHODS:** 39 participants (18-21 years) volunteered and gave informed consent. During the experimental session, a Polar H10 heart rate monitor was fitted around the subject to record a 15-minute ECG. The breathing protocol consisted of sitting in a comfortable position and continuous 5-minute stages of spontaneous breathing (SP1), controlled breathing (CB), and returning to spontaneous breathing (SP2). During CB, a 6 breath/min guided protocol was followed using a commercially available App. A one-way ANOVA with repeated measures was conducted for each variable using SPSS,  $p > 0.05$ . **RESULTS:** CB produced a significant increase in heart rate from  $70.6 \pm 11.9$  bpm to  $72.9 \pm 10.4$  bpm ( $p < 0.005$ ) during CB, and then decreased to  $71.7 \pm 10.3$  bpm ( $p < 0.05$ ). Measures of the frequency domain included high frequency (HF) and low frequency (LF) power. HF significantly decreased from  $49.2 \pm 21.1$  nu during SP1, to  $16.6 \pm 9.9$  nu ( $p < 0.005$ ), and returned to  $34.6 \pm 18.3$  nu ( $p < 0.005$ ). For LF, SP1 was  $50.9 \pm 21.0$  nu, significantly increased to  $83.4 \pm 9.9$  nu ( $p < 0.005$ ), and returned to  $65.4 \pm 18.3$  nu ( $p < 0.005$ ). The measures of the time domain included rMSSD and SDNN. rMSSD at SP1 was  $60.9 \pm 33.8$ , significantly increased to  $74.2 \pm 36.6$  ( $p < 0.005$ ), and returned to  $56.0 \pm 33.1$  ( $p < 0.005$ ). The SP1 for SDNN was  $62.7 \pm 31.4$ , significantly increased to  $110.4 \pm 39.6$  ( $p < 0.005$ ), and returned to  $66.1 \pm 29.7$  ( $p < 0.005$ ). **CONCLUSION:** The direction and magnitude of change in frequency domain (HR, HF and LF) may initially suggest a dampening of the PNS. However, CB has been showed to initiate SNS activity which is represented in the frequency measures. In short-term HRV measures, rMSSD and SDNN are the more appropriate measures to consider for the PNS activity. Thus, the results of this study indicate that a short session of CB may stimulate a PNS response.



## **Eating Disorders Risk Within Division III Atlantic East Conference Female Athletes**

Stephanie L. Judkins, Dr. Anjali Gairola, Cabrini University, Radnor PA

Previous studies have shown that female athletes are at higher risk of developing eating disorders than their peers (Lichtenstein, M., 2018). **PURPOSE:** The purpose of this study was to investigate the eating disorder risk among NCAA Division three (DIII) female athletes. **METHODS:** A total of 162 NCAA Division III Atlantic East conference female athletes volunteered for this study. The athletes completed the EAT-26 survey. EAT-26 is not a diagnostic tool but can suggest the symptoms commonly associated with eating disorders. The total score can range from zero(min) to 78 (max). A score of higher than 20 on EAT-26 is indicative of a subclinical eating disorder (Garner,1982). **RESULTS:** The median ( $\pm$ MAD) EAT 26 score was 8( $\pm$ 5). The observed range for EAT 26 scores was zero (min) to 47 (max). Out of 162, 23 athletes (14.2%) had a score of above 20. **CONCLUSION:** This study shows that there is a susceptibility of developing eating disorders in DIII female athletes. This suggests the importance of nutritional staff in DIII athletic departments. Future studies may examine the effect of season, type of sport, Division, and nutritional education interventions on eating behaviors.

Statement of Disclosure: Pierce Fellowship



## Vascular Function and Physical Activity in Young and Middle-aged Adults

Alicia Hauser, Jordyn Parks, Nicolas D. Knuth, Hyunjeong Park, Rian Q. Landers-Ramos. Towson, University, Towson, MD

Cardiovascular risk increases with advancing age and can be attributed to changes in both central cardiovascular function and peripheral microvascular function. Remaining physically active through middle- and older-age may attenuate this risk. **PURPOSE:** Compare central cardiovascular function and peripheral microvascular reactivity between younger (Y) and middle-aged (MA) moderately active adults and determine if differences in physical activity (PA) modify these outcomes. **METHODS:** Twelve apparently healthy, moderately active individuals (n=6 younger) participated in the study. Central cardiovascular function was assessed using cuff-based applanation tonometry on the dominant arm and results were normalized to a heart rate of 75 bpm (AIx75). Microvascular reactivity of the tibialis anterior (TA) muscle was assessed using near-infrared spectroscopy. A cuff was placed on the lower leg distal to the tibiofemoral joint. Baseline data was collected for 2 minutes, after which the cuff was inflated to 250 mmHg for 5 minutes. Microvascular reactivity was calculated as the tissue oxygen saturation (StO<sub>2</sub>) reperfusion slope for 10s after cuff release. Sitting time, and time spent walking, and performing moderate or vigorous PA was collected through self-report. **RESULTS:** Analyses indicated no significant main effect of age on AIx75 ( $10.8 \pm 10.47$  vs.  $6.83 \pm 7.17\%$  in MA and Y, respectively;  $p=0.458$ ). Similarly, there was no significant main effect of age on the StO<sub>2</sub> reperfusion slope ( $1.59 \pm 0.34$  vs.  $1.45 \pm 0.39 \%^{-1}$  in MA vs. Y, respectively;  $p=0.524$ ). Time spent in moderate and vigorous PA was not significantly different between groups ( $p=0.896$  and  $p=0.346$ , respectively), but compared with MA, Y adults reported significantly more time walking ( $208 \pm 157$  vs.  $118 \pm 142$  min/day;  $p=0.044$ ) and less time sitting ( $5.16 \pm 2.2$  vs.  $7.25 \pm 2.5$  hrs/day;  $p=0.015$ ). Inclusion of walking and sitting time as covariates did not change the results of our microvascular outcomes, but covarying for min/day of walking resulted in significantly lower AIx75 in Y vs. MA adults ( $p=0.046$ ). **CONCLUSIONS:** Differences in microvascular function of the TA muscle are not evident between Y and MA adults who perform similar amounts of moderate and vigorous physical activity, but more time spent walking may contribute lower AIx75 values in younger adults.

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## **Comparison of Glenohumeral and Scapulothoracic Kinematic Parameters During Baseball Pitching Between Fastballs and Curveballs**

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Biomechanical analyses of baseball pitching possess limitations in accurately measuring dynamic scapular orientation and distinguishing between glenohumeral (GH) and scapulothoracic (ST) contributions to global shoulder motion. Past studies have compared the effects of fastballs and curveballs at the elbow, trunk, and lower extremities, but GH and ST joint kinematics between pitch types remain unknown. Decreased ST upward rotation, internal rotation, and posterior tilt, and increased GH elevation are linked with reduced subacromial space which may increase the risk for rotator cuff injuries during pitching. GH external rotation and horizontal abduction both impart strain on soft tissues surrounding the joint which can help to improve ball velocity but may also increase injury risk. **PURPOSE:** To examine GH and ST kinematic parameters related to injury risk and performance between pitch types.

**METHODS:** Trunk and upper extremity segment orientations of 14 collegiate pitchers were measured with motion capture during fastball and curveball pitches. An individualized linear model approach was used to estimate dynamic scapular orientation based on measurable humerothoracic orientation. ST and GH kinematics were calculated throughout each pitch and values at full arm cocking were compared between pitch types using paired t-tests with Bonferroni corrections. **RESULTS:** No significant differences were found between pitch types for any ST or GH variables at full arm cocking. The mean within-subject differences (fastball minus curveball) and variability ( $\pm 1SD$ ) were very small for each parameter: ST upward rotation ( $-0.4^{\circ} \pm 1.4^{\circ}$ ), internal rotation ( $1.5^{\circ} \pm 9.1^{\circ}$ ), and posterior tilt ( $-2.1^{\circ} \pm 9.4^{\circ}$ ), and GH elevation ( $-0.9^{\circ} \pm 2.1^{\circ}$ ), horizontal abduction ( $-3.3^{\circ} \pm 7.8^{\circ}$ ), and external rotation ( $2.3^{\circ} \pm 7.2^{\circ}$ ).

**CONCLUSION:** The results of this study demonstrate that GH and ST joint orientations at full arm cocking are similar between pitch types which provides evidence suggesting that injury risk at the shoulder may be similar between fastballs and curveballs.



## **Dietary Protein Intake and Sarcopenia from the 2003-2004 National Health And Nutrition Examination Survey**

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Sarcopenia is characterized by the gradual loss of skeletal muscle size and strength. The prevalence of sarcopenia in the United States is between 9.9% and 40.4% among adults 65 years of age and older. Risk factors for sarcopenia include but are not limited to having a low body mass, living a physically inactive lifestyle and being malnourished. Protein synthesis, a factor germane to skeletal muscle size and strength, is influenced by consumption of essential amino acids and has been previously associated with body mass and bone mineral density. However, examination of the relationship between body mass and physical limitations in population-based cohorts is lacking. **Purpose.** To assess the relationship between dietary protein intake and sarcopenia in a large-scale population-based cohort from the (2003-2004) National Health Assessment and Nutrition Examination Survey (NHANES). **Methods.** Our population included 9,643 participants who provided written informed consent for an in-home interview and health examination at a mobile examination center. Twenty-four-hour dietary recalls were used to assess protein intake and Dual X-ray Absorptiometry was used to assess lean body mass. Protein intake was quantified by the total self-reported intake in grams and the percentage of total daily calories consumed. Lean body mass measurements including total lean mass, muscle mass index, appendicular lean mass, and percent lean body mass, were assessed with self-reported responses to a Physical Limitation Score (PLS). **Results.** Increased protein intake was significantly correlated with greater lean body mass. Total muscle mass was positively predicted by total and appendicular muscle mass index in males and females between 19 and 50 years ( $p < 0.05$ ), 51 and 70 years ( $p < 0.05$ ), and 71+ years ( $p < 0.05$ ). The PLS also inversely predicted ( $p < 0.10$ ) lean muscle mass; however, this finding neglected to reach statistical significance. **Conclusion.** Increased protein intake was associated with lower percentages of lean mass and physical function, indicating that adequate protein intake may be used as preventative and mitigative measures of sarcopenia. Our findings may provide insight for future experimental trials assessing the effects of dietary changes on outcomes of body composition and physical function in older adults.

## The Effect of Vigorous Exercise on the Inter-Arm Difference in Systolic Blood Pressure

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A large inter-arm difference (IAD+;  $\geq 10$ mmHg) in systolic blood pressure (BP) has been linked to poor cardiovascular health. Further, moderate-intensity exercise has been shown to induce an exercise-effect (eIAD) on this difference, unique to resting IAD status. The eIAD response to vigorous exercise is unknown. Finally, both hemodynamics and vascular biomarkers may help explain variability in vascular function, IAD status, and eIAD responses. **PURPOSE:** To determine the eIAD response to vigorous exercise, while considering the contributions of hemodynamics and vascular biomarkers. **METHODS:** BP was simultaneously measured using two automated, auscultatory monitors in apparently healthy individuals during a graded exercise test (GXT). Specifically, BP was measured at baseline, at the two-minute mark of each three-minute stage, immediately post-exercise, and during recovery. Continuous hemodynamic measurements were performed using non-invasive impedance cardiography. Finally, electrochemiluminescence assays were performed to determine the expression of markers of vascular injury from blood plasma drawn at rest and following the vigorous exercise bout. Descriptive and inferential statistics were generated. **RESULTS:** Nine individuals (31%) were IAD+ at rest. IAD- individuals (n=20, 69%;  $< 10$ mmHg at rest) demonstrated an augmented relative percentage change in IAD during, immediately following, and in recovery from vigorous exercise. Hemodynamic variables including stroke volume, cardiac output, and systemic vascular resistance did not differ by IAD status and followed expected patterns during exercise. C-reactive protein, intracellular adhesion molecule-1, and serum amyloid-A were not different based on resting IAD status or altered by vigorous exercise. However, an interaction was found where vascular adhesion molecule-1 (VCAM-1) was augmented in IAD+ and attenuated in IAD- individuals pre- to post-exercise. **CONCLUSION:** In apparently healthy individuals, vigorous exercise induced by a GXT altered eIAD in accordance to resting IAD status, similar to previous studies. Resting IAD and alterations in eIAD may be independent of hemodynamic changes and the influence of select vascular biomarkers, though the further examination of VCAM-1 may be warranted due to a potential link with eIAD.



## Cesarean Section Delivery Does Not Impact Postpartum Weight Loss and Recovery

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Inability to lose weight gained during pregnancy increases a woman's risk of becoming overweight or obese. Epidemiological studies have suggested that obesity is strongly associated with history of cesarean section (c-section) delivery. This association may be related to postpartum changes in physiological (e.g. physical activity) and behavioral (e.g. sleep) factors associated with weight loss. **PURPOSE:** To examine differences in postpartum body mass and factors related to weight loss between women who gave birth via c-section vs. vaginally. **METHODS:** Body mass was measured in 37 women (11 c-section [CD] and 26 vaginal [VD] delivery), at 3, 6, 9, and 12 months postpartum. Additionally, body composition (DXA), resting energy expenditure, physical activity, sleep quality, fatigue, depression, and body image were assessed at each time point. Self-reported pre-pregnancy weight and pregnancy weight gain were recorded and differences between CD and VD were assessed with student's t-tests. Differences between CD and VD postpartum factors were assessed using two-way ANOVA with repeated measures. **RESULTS:** There was no significant difference between CD and VD groups in pre-pregnancy BMI ( $26.5 \pm 5.9 \text{ kg/m}^2$  vs.  $25.4 \pm 5.4 \text{ kg/m}^2$ ,  $p=0.59$ , CD vs VD respectively), pregnancy weight gain ( $16.2 \pm 5.2 \text{ kg}$  vs.  $14.4 \pm 4.8 \text{ kg}$ ,  $p=0.32$ , CD vs VD respectively), and body mass at delivery ( $86.3 \pm 17.8 \text{ kg}$  vs.  $83.9 \pm 13.8 \text{ kg}$ ,  $p=0.67$ , CD vs VD respectively). At 12 months postpartum, similar weight loss occurred in both groups ( $14.3 \pm 6.1 \text{ kg}$  vs  $13.8 \pm 5.4 \text{ kg}$ ,  $p=0.77$ , CD vs VD respectively). ANOVA analysis of the changes in physiological and behavioral factors related to weight loss over the postpartum period revealed no significant difference between CD and VD women. **CONCLUSION:** Despite longer recovery time associated with c-section delivery, weight loss in the postpartum period was not impacted and therefore it does not appear to be a risk factor for obesity.



## **Passive Arm Movement to Induce an Inter-Arm Difference in Systolic Blood Pressure**

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Previous research in our lab has shown that both acute aerobic and isometric exercise can alter the inter-arm difference (IAD) in systolic blood pressure (BP). Further, based on initial resting systolic IAD status, differential responses have been reported. Physiological mechanisms behind these responses remain unclear, however. While the exercise pressor reflex is known to be mediated by contraction-dependent (i.e., mechanoreceptors, metaboreceptors) and contraction-independent (i.e., nitric oxide) factors, passive limb movement (PLM) may allow a partitioning of these mechanisms for deeper understanding.

**PURPOSE:** To determine if PLM in the upper extremities alters IAD. **METHODS:** BP was simultaneously measured using two automated, auscultatory BP monitors in apparently healthy individuals at rest, immediately following a series of three-minute active (i.e., unweighted) and passive (i.e., unweighted, arm moved by investigator) bicep curl sets. Sets were randomized by both arm and condition, and controlled by a metronome. A five-minute recovery period separated each condition. Descriptive statistics were generated and a 2x2 (IAD and Condition) repeated-measures ANOVA was performed. **RESULTS:** Twenty-five individuals completed all of the requirements of the study. Thirty-two percent (n=8) of the cohort was IAD+ (i.e., left/right BP difference  $\geq 10$ mmHg at rest). An overall difference in the PLM response was noted between IAD- (i.e., left/right BP difference  $< 10$ mmHg at rest) and IAD+ individuals ( $P < 0.05$ ). **CONCLUSION:** Both passive and active limb movement mediated IAD similarly, and the observed effect was consistent with previously reported exercise.

## **Differences in Tibialis Anterior Mitochondrial Capacity in Recreationally Active Younger and Middle-aged Adults**

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Mitochondrial capacity measures the efficiency of a muscle's ability to utilize oxygen, and this overall capacity is thought to decrease with age. Mitochondrial capacity deficits within a muscle in middle-age may indicate future risk of reduced physical function and poor quality of life (QOL). **PURPOSE:** To examine the differences in mitochondrial capacity of the tibialis anterior (TA) muscle and QOL in recreationally active younger and middle-aged individuals. **METHODS:** Apparently healthy participants (21-45 yrs; n=12) arrived for testing after refraining from physical activity, food, alcohol, and caffeine for 12 hrs. Participants consisted of younger (Y) (n=6) and middle-aged (MA) (n=6) recreationally active adults. Participants completed the SF-12 questionnaire to assess physical and mental QOL. A near infrared spectroscopy (NIRS) device was placed on the belly of the TA with electrodes placed proximally and distally to measure differences in oxygenated and deoxygenated hemoglobin (Hb diff). A cuff capable of rapid inflation was placed on the upper leg proximal to the tibiofemoral joint. Resting metabolism of the TA muscle was assessed as the downward slope in Hb diff during a 30s occlusion and the average of three trials was used. Mitochondrial capacity of the TA muscle of the dominant leg was assessed with NIRS using a 22-cuff recovery protocol following 30s of electrical stimulation. The protocol was repeated twice, and a physiological calibration was performed to correct for changes in blood volume. Recovery time constants (seconds) following stimulation were derived from analyses of Hb diff signals. **RESULTS:** Independent t-tests revealed no significant main effect of age on resting metabolism ( $p=0.155$ ). Mitochondrial capacity of the TA muscle was significantly greater in MA individuals compared with Y individuals ( $58.6 \pm 13.8$  s vs.  $39.1 \pm 7.1$  s vs.,  $p=0.012$ ). There were no age-related differences in physical ( $55.4 \pm 3.8$  vs.  $56.1 \pm 3.5$  AU in MA vs. Y, respectively) or mental ( $52.4 \pm 7.1$  vs.  $47.4 \pm 10.7$  AU, MA vs. Y, respectively) QOL scores. **CONCLUSION:** Preliminary results of this study demonstrated higher mitochondrial capacity in the TA of middle-aged compared with younger adults. These findings may suggest a shift in the TA to a more oxidative phenotype in middle-age in an effort to maintain QOL.

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## **The Effect Habitual Exercise on Older Adults Mental Health During the COVID-19 Pandemic.**

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The COVID-19 pandemic increased existing social isolation challenges in older adults due to quarantine and social distancing policies. Social isolation can be associated with an increase in mental health conditions such as anxiety and depression. Due to social isolation, many older adults had limited access to exercise opportunities. This is important because exercise can also affect mental health. **PURPOSE:** To consider the impact of exercise habits on older adults' mental health during the COVID-19 pandemic. **METHODS:** The data used were from the Health and Retirement Study, a longitudinal study interviewing a representative sample of older adults biennially about physical and mental health, employment, and daily activities. In 2020, additional questions were added relating to COVID-19 and distributed to a subset of participants. Participants completed a physical activity questionnaire, the Beck Anxiety Inventory (n=1920) and the Center for Epidemiological Studies Depression questionnaire (n=2909). We ran logistic regression models. Model one had anxiety as the outcome of interest, and model 2 depressive symptoms. The independent variable was engaging in moderate exercise at least twice a week. All analyses were adjusted for covariates including the number of chronic health conditions, race/ethnicity, financial hardship during the pandemic, education, and alcohol use. **RESULTS:** Approximately 47% of this sample reported exercising 1 or less times per week (mean age 70±11 years, 49% female) compared to 53% reporting that they exercise 2 or more times per week (mean age 67±11 years, 51% female). Compared to older adults who exercised 2 or more times a week, those who exercised 1 or fewer times per week were found to be at increased risk for having elevated anxiety (OR = 1.41, 95% CI= .695 -2.92) and depressive symptomology (OR =1.98,95% CI =1.51-2.59). **CONCLUSIONS:** Exercising one or fewer times a week during the COVID-19 pandemic was associated with higher odds of anxiety and depressive symptoms in older adults. Older individuals who exercise less may be at increased risk for mental health symptoms during times of high psychosocial stress. With the emergence of new variants and uncertainty of the pandemic, it is important that older adults are encouraged to exercise to reduce odds of poor mental health outcomes.



## **The Relationship Between Sleep Quality and Quantity and Body Composition in a College Population**

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The amount of sleep and the quality of that sleep can distress countless physiological components of the body. A deficiency in these two sleep dynamics may lead to a higher body composition. Specifically, due to the change of lifestyle of a typical college student would lead more into the assumption that sleep would affect their body composition. **PURPOSE:** This study aimed to analyze the relationship of sleep quality and quantity with the corresponding body composition parameters and resting metabolic rate (RMR) in a non-athletic college population. **METHODS:** Study participants included 27 East Stroudsburg University students aged 18-25 years (11 males and 16 females). Subjects were undergraduate/graduate students and non-NCAA athletes. Subjects were 8-10 hours fasted prior to testing. Testing took place between 6:30am - 9:30am. PARQ+ and physical activity forms were completed first followed by BODPOD and waist/hip circumference testing. Following lab testing, The Pittsburgh Quality Sleep Index (PQSI) was used to assess sleeping quality. Pearson's correlation coefficient was used to determine the relationship between variables. Significance was set at  $p=0.05$ . Data is presented as mean $\pm$ SD. **RESULTS:** Subjects were 21.11 $\pm$ 1.5 years old with a body weight of 156.59 $\pm$ 32.7lb. 15 subjects were physically active, and 12 subjects were inactive. Subjects presented with RMR of 1499.93 $\pm$ 321.1 kcal/day, body fat 22.09 $\pm$ 10.4%, and PQSI of 6.11 $\pm$ 2.8. Results showed no statistically significant relationship between PQSI score and body fat ( $R(27) = 0.24$ ,  $p=0.22$ ), waist circumference ( $R(27) = 0.22$ ,  $p=0.28$ ), or RMR ( $R(27) = 0.11$ ,  $p=0.59$ ). **CONCLUSION:** There is little to no correlation between sleep and body composition in this population. Possible reasonings could be the age of this population as the average age was 21.11 years old which may explain why body composition variables were not correlated with sleeping patterns.

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## **You are What (Time) You Eat: Investigating Chrono-nutrition and Body Mass Index in Free-Living Adults**

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While quality and quantity of food are important determinants of body weight and obesity status, there is increasing evidence that time of day when food is consumed (i.e. chrono-nutrition) is also an important contributor. For example, eating at times that do not align with circadian rhythms in nutrient metabolism (e.g. late at night) has been associated with poor cardiometabolic health outcomes (i.e. obesity). However, many studies are limited by the use of fully subjective diet assessments and data collection over short monitoring periods. **PURPOSE:** To characterize the timing of food intake in free-living adults via 14-days of photographic diet records, and to determine its association with body mass index (BMI). **METHODS:** Data for this study are being collected as part of an ongoing cross-sectional, micro-longitudinal study in adults aged 18-45 yrs. Participants have a BMI <35 kg/m<sup>2</sup>, do not have any chronic diseases, and do not engage in fasting. Height and weight were measured using a wall-mounted stadiometer and a calibrated scale, respectively, and used to calculate BMI. Participants completed 14 days of photographic diet records using a smartphone app ('Meallogger'). Data were entered into the Nutritional Data System of Research. Chrono-nutrition variables were then determined for each day (eating onset: clock time of first caloric consumption; eating offset: clock time of last caloric consumption; midpoint: halfway point between onset and offset; and duration: time elapsed between onset and offset). Associations between chrono-nutrition variables and BMI were examined using Pearson's correlations.  $P < 0.05$  was considered statistically significant. **RESULTS:** Thus far the study includes 13 participants (30±8 yrs, 7F/6M) and an average BMI of 23.9±2.8 kg/m<sup>2</sup>. The average time of eating onset was 8:18am, eating offset was 8:10pm, midpoint at 2:14pm, and duration of 12 hours. Both eating offset and eating midpoint were significantly positively correlated with BMI (offset:  $r=0.73$ ,  $p<0.01$ ; midpoint:  $r=0.70$ ,  $p<0.01$ ). **CONCLUSION:** Preliminary data supports prior evidence of an association between chrono-nutrition variables with BMI, suggesting benefits of consuming food earlier in the day. Timing of caloric intake may be an alternative strategy for reducing the risk of obesity and subsequent chronic diseases.

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## Effect of Late versus Early Chronotype on Fuel Metabolism During Exercise

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**PURPOSE:** Late chronotypes are characterized by low insulin sensitivity and metabolic inflexibility. However, it is unclear whether people classified as late chronotype have altered fuel selection during exercise. **METHODS:** Middle-aged adults with obesity and metabolic syndrome were classified as early (Morning-Eveningness Questionnaire (MEQ); MEQ = 63.4±0.9, n= 18 (15 F), 54.6±1.1 years, 3.5±0.1 ATP III criteria) or late (MEQ= 46.7±1.4, n= 22 (18 F), 54.9±1.8 years, 3.6±0.2 ATP III criteria) chronotype. Carbohydrate and fat utilization were measured using indirect calorimetry to determine respiratory gases (VO<sub>2</sub> and VCO<sub>2</sub>) at rest, 55% and 85% VO<sub>2max</sub>, along with heart rate and rating of perceived exertion (RPE), for 15-minute treadmill stages. Metabolic flexibility (MetFlex, ΔRQ) from rest to exercise during each stage was also calculated. Maximal aerobic capacity (VO<sub>2max</sub>), body composition (DXA), and insulin sensitivity (euglycemic hyperinsulinemic clamp, 40mU/m<sup>2</sup>/min, 90 mg/dl) were also determined. **RESULTS:** Age, BMI, body fat and ATP III criteria were similar between groups. However, late chronotype exhibited lower VO<sub>2max</sub> ( $P=0.01$ ) and insulin sensitivity ( $P=0.01$ ). Resting fat oxidation rates were also lower in late compared with early chronotype (1.23±0.11 vs. 1.88±0.24 mg/kg-LM/min,  $P=0.03$ ). Compared to rest, both groups relied on carbohydrate during exercise at 55% VO<sub>2max</sub>. At 85% VO<sub>2max</sub> though, late chronotype utilized more carbohydrate as a percent of energy expenditure (84.1±4.2 vs. 72.2±3.9 %,  $P=0.05$ ) despite similar heart rate and RPE. Interestingly, resting fat oxidation correlated with MetFlex at 55% ( $r=0.57$ ,  $P=0.005$ ) and 85% VO<sub>2max</sub> ( $r=0.68$ ,  $P=0.004$ ), as well as insulin sensitivity ( $r=0.47$ ,  $P=0.04$ ). **CONCLUSIONS:** People with late chronotype have reduced resting fat oxidation and capacity to switch towards carbohydrate during exercise in relation to insulin sensitivity. Whether these differences in fuel use promote chronic disease risk awaits further work.

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## **The Impact of the Cold Pressor Test on Inter-arm Differences in Blood Pressure**

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The presence of a large inter-arm difference (IAD+;  $\geq 10$ mmHg between arms at rest) in blood pressure (BP) at rest has been established as an early indicator of cardiovascular risk. As potential mechanisms for IAD at rest or during exercise are not well understood, unique physiological stimuli may provide useful insight towards better understanding for potential diagnostic and/or therapeutic interventions. It is well known that the cold pressor test (CPT) has a potent effect on BP and acts primarily through the sympathetic nervous system (SNS), specifically nociceptors. To date, the effects of SNS stimulation on IAD are not known. **PURPOSE:** To examine the effects of the CPT on IAD. **METHODS:** On an initial visit, participants were measured for anthropometrics and provided with pre-test instructions for a follow-up visit (i.e., 4h fast, 24h abstinence from exercise, caffeine, alcohol). On the second visit, BP was monitored simultaneously using two, automated, auscultatory monitors. Participants randomly completed two CPT tests (left and right hand), with each test including a 15-minute rest, three pre-test BP measurements (averaged), a three-minute water immersion (3°C; BP at :30s and 2:00), and a 10-minute passive recovery period. Descriptive statistics were calculated, and a repeated measures ANOVA test was used to compare the relative IAD response to the CPT between IAD+ and IAD- (<10mmHg IAD at rest) individuals at rest. **RESULTS:** An overall difference in the CPT response was noted between IAD- and IAD+ individuals ( $P < 0.05$ ), though pairwise comparisons yielded no specific differences. Observationally, a great deal of variance was noted in the percentage change in IAD (%) in the IAD- cohort, while the IAD+ response had very little variance. **CONCLUSION:** The CPT revealed a similar response in IAD as previously documented stimuli, specifically a greater increase in systolic IAD across arms in IAD- individuals. IAD+ individuals had a blunted response to the CPT, possibly indicating that suggested anatomical bases, and physiological responses derived by sympathetic means, deserve further investigation as potential mechanisms behind resting and exercise IAD.

## Correlations Between Remote Learning and Undergraduate Sleep and Exercise Habits

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The COVID-19 pandemic caused a pivot to primarily remote learning for students. Lack of travel to and from class, increased demands with online learning, and other lockdown-related challenges are likely to negatively influence behaviors such as physical activity (PA) and sleep quality (SQ) in college students – a population already at high-risk for insufficient PA and poor SQ. **PURPOSE:** To examine PA, SQ, and the relationship between these behaviors during a semester of remote learning in college students.

**METHODS:** Undergraduate students were invited to complete an online survey on demographics, as well as validated questionnaires on PA and SQ. The Global Physical Activity Questionnaire (GPAQ) was used to determine recreational moderate-to-vigorous PA (MVPA; min/week) in a typical week. The Pittsburgh Sleep Quality Index (PSQI) was used to determine SQ over the past month; scores range from 0-21 (higher scores=worse sleep), and a cut-point >5 is validated for distinguishing “poor” (vs. “good”) sleepers. All data was obtained during a remote semester (Fall 2020). **RESULTS:** 33 participants (19.2±1.1 years, 73% female, 46% freshmen) completed the surveys, with 79% and 21% classified as full-time remote and “hybrid,” respectively. Participants reported 52±86 min/week of MVPA and a mean PSQI score of 7.9±4.0, with 61% of participants classified as inactive (0 min/week MVPA) and 67% classified as poor sleepers. While there was no correlation between MVPA and PSQI score, PSQI score was significantly, positively correlated with grade level ( $r=0.40$ ,  $p=0.02$ ), such that a higher grade level was associated with poorer sleep quality. When stratified by activity level, associations between grade level and PSQI strengthened for those who were inactive ( $r=0.55$ ,  $p=0.01$ ) and were nonsignificant for those who engaged in MVPA ( $r=0.20$ ,  $p=0.58$ ). **CONCLUSIONS:** During a remote semester, poor SQ and physical inactivity are highly prevalent in college students. Future studies should examine if poor sleep and physical inactivity are exacerbated during remote vs. traditional semesters. Additionally, more research is needed to determine if increasing PA represents a means for ameliorating the apparent decline in SQ that is associated with increasing grade level, particularly for those engaging in primarily remote learning.

Authors have no conflicts of interest to report.



## Continuous and Interval Training Acutely Elevate Serum BDNF in Healthy College-age Males

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Research suggests both moderate and high-intensity aerobic exercise may improve brain health. Brain-derived Neurotrophic Factor (BDNF) is a protein responsible for neuroplasticity and aerobic exercise has been shown to elicit temporal increases in BDNF in blood serum. **PURPOSE:** The purpose of this study was to compare changes in serum BDNF following moderate-intensity continuous training (MICT) and high-intensity interval training (HIIT). **METHODS:** Ten healthy males subjects (age =  $20.10 \pm 0.99$  years, weight =  $78.18 \pm 7.82$  kg) volunteered and gave informed consent to participate in the study. Each subject performed  $VO_{2max}$  protocol on a cycle ergometer to determine the peak workload ( $W_{peak}$ ) to prescribe target loads for the MICT and HIIT sessions. A workload of 60%  $W_{peak}$  for the MICT and 75%  $W_{peak}$  for the HIIT were selected to reflect the range of intensities outlined in the ACSM guidelines for healthy adults. The MICT protocol consisted continuous exercise for 20 minutes whereas the HIIT consisted of 1-minute intervals of high/low intensity corresponding to 75%/40%  $W_{peak}$ . The two protocols were designed to match time and overall METS. Venous blood samples were drawn prior to each session, immediately after exercise and 15 minutes post exercise using a 21-gauge needle and a serum vacutainer. The samples were incubated at room temperature for 30 minutes followed by a 15-minute centrifuge at 1300g. Serum was pipetted into 2 ml cryovials and stored at  $-80^{\circ}$  C. Samples were thawed and serum BDNF was calculated, in duplicate, using a commercially available sandwich ELISA. A one-way ANOVA with repeated measures was conducted for each variable,  $p > 0.05$ . **RESULTS:** Serum BDNF levels significantly increased following exercise from baseline measures for each intensity of exercise. MICT elicited a 44% increase in serum BDNF following the exercise protocol,  $9.91 \pm 2.53$  ng/ml to  $14.31 \pm 5.57$  ng/ml, and HIIT demonstrated a 35.6% increase from baseline,  $10.66 \pm 3.44$  ng/ml to  $14.44 \pm 7.00$  ng/ml. 15-minute post showed a non-significant decrease in BDNF for MICT and HIIT,  $12.89 \pm 6.83$  ng/ml and  $11.57 \pm 5.67$  ng/ml, respectively. **CONCLUSION:** Both MICT and HIIT protocols elicited significant increases in serum BDNF; however, BDNF levels between the MICT and HIIT protocols did not differ from each other for matched time and overall METS.



## Effects of Cell Culture Conditions on Extracellular Vesicle Production in Human Embryonic Kidney Cells

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Extracellular vesicles (EVs) have potential as a novel drug delivery system and EV-based therapeutics are typically produced *in vitro*. Fetal bovine serum (FBS), a commonly used nutrient source for cells, is a well-known contaminant in the production of therapeutic EVs. These contaminants can reduce the efficacy and reproducibility of EV production. Establishing optimal *in vitro* culture conditions, including nutrient sources and seeding density, are essential for the advancement of the EV therapeutic field. **PURPOSE:** To determine if more extensive downstream processing of FBS reduces contaminants without the removal of beneficial nutrients. Additionally, we sought to determine the optimal cell seeding density and cell passage number for EV production. **METHODS:** Human embryonic kidney cells (HEK293 cells) were cultured to isolate EV enriched media. The cells were grown to confluency in regular FBS media, washed 2x with phosphate buffered saline (PBS), then placed in vesicle-free culture media for 48h. We tested a high seeding density (100k cells/cm<sup>2</sup>) and a low seeding density (20k cells/cm<sup>2</sup>). We hypothesized that a lower seeding density would produce a higher yield of EVs. In a subsequent experiment we tested 6 different cell culture supernatants. Ultracentrifuge (Vesicle-Free) and a proprietary blend FBS (Exo-Free). Both groups were then further processed with Polyethylene Glycol (PEG) and ultracentrifuge spin column (100 kDa). This gave us a total of 6 groups Exo-Free, Exo-Free-PEG, Exo-Free-100kda, Vesicle-Free, Vesicle-Free-PEG, and Vesicle-Free-100kda. Data was quantified using Nanoparticle tracking analysis (NTA), cell viability and cell count. **RESULTS:** Combining NTA and cell counting we found there was 3x more EVs ( $P < 0.0001$ ) in the lower seeding density group. The lower seeding density group also had significantly smaller EV ( $p = 0.0067$ ). We did not observe any differences between the various FBS formulations, cell viability or passage number. **CONCLUSION:** A lower seeding density yielded significantly more EVs. Various FBS formulations do not affect cell viability and passage number does not affect EVs.

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## **The Influence of CYP1A2 and ADORA2A Polymorphisms and Caffeine Consumption under Anaerobic Conditions**

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Caffeine (CAF) is the most commonly used psychoactive drug in the world, having implications for athletics and medicine. The metabolism, clearance, and reception of CAF varies significantly among individuals, primarily dictated by the liver enzyme CYP1A2 and the adenosine neuroreceptor ADORA2A. **PURPOSE:** The purpose was to determine the effect of CAF and potential genetic influences in anaerobic exercise. **METHODS:** 11 female college athletes completed two maximal 30-s Wingate anaerobic bike tests on a Velotron cycle ergometer after ingesting a capsule of CAF monohydrate ( $5\text{mg}\cdot\text{kg}^{-1}$  BW) or a placebo (maltodextrin). Anaerobic Power ( $\text{W}\cdot\text{kg}^{-1}$ ) (AP) and anaerobic capacity ( $\text{W}\cdot\text{kg}^{-1}$ ) (AC) were recorded during each trial. DNA from buccal cells were obtained via a 0.9% NaCl mouth rinse, isolated through cell lysis using proteinase k, and extracted using DNA spin columns. The allelic determinations of CYP1A2 (rs762551) and ADORA2A (rs5751876) were determined using TaqMan® SNP Assay, 40 thermocycles for amplification, and allele analysis with a One-Step qPCR. The data was analyzed using a 2 (condition) x 2 (CYP) x 2(ADORA) ANOVA with repeated measures,  $p < 0.05$ . **RESULTS:** The main effect of CAF showed no significant difference between the CAF or placebo trials for AP,  $9.4\pm 1.2$  to  $9.5\pm 1.1$ ,  $\text{W}\cdot\text{kg}^{-1}$  or for AC,  $7.5\pm 0.8$  to  $7.4\pm 0.01$ ,  $\text{W}\cdot\text{kg}^{-1}$ . The interaction of CAF x CYP showed no significant difference across the AA and AC/CC genotypes for PP,  $9.5\pm 1.5$  and  $9.4\pm 1.0$   $\text{W}\cdot\text{kg}^{-1}$ , respectively. The interaction effect of CAF x ADORA2A produced no significant difference between the TT and TC/CC genotype,  $10.0\pm 1.2$  and  $9.4\pm 1.3$   $\text{W}\cdot\text{kg}^{-1}$ , respectively. Additionally, the main effects and interaction effects for AC produced no significant differences at any level of analysis. The interaction effect of CAF x CYP x ADORA did not produce significant changes in PP; however the allelic combinations of CYP:ADORA did show a reduction in PP for AA:TT (-3.4%), AA:CC/TC (-2.1%) and AC:TT (-6.5%) whereas the AC/CC:TC/CC produced a 4.6% increase. **CONCLUSION:** CAF did not produce any significant changes in power nor did a specific or combination of genotypes. However, future study should continue to focus on the percent changes in power for different genotypes.



## Symptoms of COVID-19 May Causes Exercise Induced Autonomic Nervous System Dysfunction

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As the number of COVID-19 cases begin to diminish it is important to turn our attention to any long-term issues that may be associated with a prior infection. Further, identifying if differences exist between COVID-19 infected individuals who had symptoms (symptomatic) or did not have symptoms (asymptomatic) has only scarcely been examined. **PURPOSE:** To examine if there is a difference in autonomic nervous system (ANS) function during submaximal treadmill exercise (EX) between control (never infected), asymptomatic and symptomatic college students who were previously infected with COVID-19. **METHODS:** Subjects ( $n=12$ ) filled out a questionnaire before performing EX to determine if they were asymptomatic (AS) or symptomatic and if symptomatic what symptoms they experienced. Subjects next performed a 5-minute warm-up followed by 25 minutes of treadmill EX (5-6 METS). During EX, blood pressure (BP) was recorded on the brachial artery every 5 minutes and electrocardiography was measured continuously. Heart rate variability (HRV) was analyzed in the time-domain using the standard deviation of the inter beat intervals of normal sinus beats (SDNN). Blood pressure variability (BPV) was computed as the average of the absolute differences between consecutive mean arterial pressure (MAP) measurements. A one-way ANOVA with a Tukey's post hoc was used to determine statistical differences between groups. Data are shown as mean $\pm$  SEM. Significance was set to  $p<0.05$ . **RESULTS:** There were no differences ( $p>0.05$ ) between HR (HR; Con =  $104\pm 4$  BPM vs. AS= $118\pm 6$  BPM vs. S= $111\pm 3$  BPM ) or MAP (MAP; Con =  $108\pm 4$  mmHg vs. AS= $105\pm 13$  mmHg vs. S= $108\pm 7$  mmHg) between groups. However, HRV (HRV; Con= 139 vs. AS = $156\pm 6$ ms vs. S= $77.7\pm 11$ ms;  $p<0.05$ ) and BPV (BPV; Con=  $139\pm 13$  vs. AS= $13\pm 1.1$  mmHg vs. S= $5\pm 1.0$ mmHg;  $p<0.05$ ) were different. **CONCLUSION:** Previously symptomatic subjects had altered HRV and BPV and thus indicates that experiencing symptoms associated with COVID-19 may impact the ANS.



## Galvanic Skin Response Increase Following Exercise and Correlates with Exercise Analgesia

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Galvanic skin response (GSR) can be used to measure sweat gland activity which is tied to changes in emotion and the autonomic nervous system. There is evidence that GSR has a relationship to dopamine release and transmission and therefore can be used to indirectly measure a dopamine response. Exercise (EX) is known to release dopamine and create an analgesic effect. If there is a relationship between GSR and EX induced analgesia we may be able to use GSR as a means to determine the dopaminergic effect of EX. **PURPOSE:** To determine if 1) GSR increases following a bout of EX and 2) if there is a relationship between GSR and EX analgesia. **METHODS:** GSR was measured with sensors placed on the fingers and recorded through Neulog software. Measurements were conducted right before moderate intensity (5-6 METS) treadmill EX lasting for 25 minutes and immediately following EX. GSR was measured for 2 minutes each time (20 samples per second) and the area under the curve (AUC) was quantified. The change in AUC between pre and post EX was examined. EX analgesia was assessed by finding the minimal pain threshold (MPT) before and following EX using a pain algometer on the extensor carpi radialis and was measured in Newtons (N). Pre vs. Post AUC was quantified using a Student's T-Test. A Pearson's correlation was used to evaluate the relationship between change in AUC and change in MPT. Data is shown as mean  $\pm$  SEM. Significance was set to  $p < 0.05$  **RESULTS:** AUC of GSR was significantly increased following EX (Pre =  $937 \pm 141$  vs. Post =  $1808 \pm 90.22$ ;  $p < 0.05$ ). Further, there was a correlation between the change in MPT and the change in GSR (0.71;  $p < 0.05$ ). **CONCLUSION:** GSR appears to be sensitive to the effects of EX. GSR also correlates to exercise analgesia as measured by MPT which may be indicative of the activation of the dopaminergic system.

## **The Effects of a Regular Yoga Practice on Mental Health in College Students during COVID-19**

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College students often experience stress and anxiety, with many reporting increased stress and anxiety due to the COVID-19 pandemic. A regular yoga practice has been shown to reduce anxiety in this population prior to COVID-19 pandemic. **PURPOSE:** The purpose of this study was to determine if a 12 week regular yoga practice taught over Zoom would improve measures of mental health in college students during the COVID-19 pandemic. **METHODS:** Students taking Yoga 1 classes were recruited to participate in this study at the start of the semester. Students not enrolled in a yoga class were also recruited via email from various professors at the University. 32 yoga participants (Y: 23F; 20.9±1.4yrs) and 24 non-yoga participants (C: 21F; 21.0±0.7yrs) completed the entire study. At week 1, all participants responded to an online survey regarding their level of physical activity (IPAQ short form), perceived daily stress (1=low; 5=high, often difficult to handle), and state and trait anxiety (STAI forms Y1 and Y2). During the next 12 weeks, students in the yoga class participated in 150minutes/week of a regular beginner's yoga practice over Zoom. Students not enrolled in Yoga participated in their classes as usual and were asked not to make any major changes to their fitness routine. At the completion of Week 12, participants completed the follow up survey identical to baseline. Due to the small sample size and violation of normality in some variables, all variables were compared via Mann Whitney Rank Sum tests. **RESULTS:** There were no differences between groups in total MET minutes per week (MEAN±SEM: Y 4229±523 vs C 4068±645min, p=0.681), ratings of daily stress (Y 2.9±0.2 vs C 2.9±0.2, p=0.958), and STAI Y1 (Y 43.6±1.9 vs C 44.8±2.2, p=0.817) or Y2 surveys (Y 44.8±1.8 vs C 44.9±2.6, p=0.685) at baseline. There was also no difference between groups in total MET minutes per week (Y 3610±469 vs C 4155±755, p=0.714), daily stress (Y 2.7±0.2 vs C 2.8±0.2, p=0.914) STAI Y1 (Y 41.3±1.5 vs C 42.6±2.4, p=0.881) or Y2 (Y 42.7±1.7 vs C 45.4±2.3 p=0.446) surveys after 12 weeks. **CONCLUSION:** 12 weeks of a regular yoga practice taught over Zoom did not improve measures of mental health in college students during the COVID-19 pandemic. These results are not consistent with previous work that suggested the beneficial effects of regular Yoga practice on mental health.



## Anaerobic Power of Division-1 Competitive Dancers

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Competitive dance routines are short (<3 min) duration and high-intensity involving repeated jumps and turns which require high-power outputs. Currently, data characterizing the anaerobic power profile of competitive dancers is lacking. **PURPOSE:** To characterize the anaerobic power capabilities of D1 collegiate competitive dancers. **METHODS:** Anaerobic power was determined in 24 D1 competitive dancers. Testing occurred over two visits separated by >48 hours to determine power output (PO) through a variety of performance tests. Day 1: Subjects were assessed for height (cm), body mass (kg), resting heart rate (bpm), and blood pressure (mmHg). Following a standardized warm-up, subjects performed a 30s Wingate Anaerobic Test (resistance: 7.5% of body mass) to measure anaerobic PO. Day 2: Following a standardized warm-up subjects performed 3 maximal countermovement vertical jumps followed by a 3-min all-out cycling test (resistance: 3.5% of body mass) to determine critical power (CP) and anaerobic work capacity (W'). CP was estimated by the mean power of the last 30 secs of the 3-min all-out cycling test, while W' was estimated using the following equation  $W' = 150s (P_{150} - CP)$ , where  $P_{150}$  is the mean power during the first 150secs of the all-out test. Peak PO during vertical jump testing was calculated based on published equations. All data are reported as Mean  $\pm$  SE. **RESULTS:** Height ( $162.5 \pm 0.98$  cm), body mass ( $61.88 \pm 1.63$  kg), resting systolic and diastolic blood pressure ( $118 \pm 2$  mmHg and  $72 \pm 2$  mmHg, respectively), and resting heart rate ( $73 \pm 3$  bpm) were within normal ranges of college-age females. Dancers had a vertical jump height of  $33.97 \pm 0.83$  cm; peak PO calculated from jump height was  $2824.1 \pm 128.6$  W and relative peak PO was  $45.7 \pm 78.9$  W/kg. Absolute peak PO during the Wingate Anaerobic Test was  $629.04 \pm 18.08$  W and relative peak PO was  $10.19 \pm 0.20$  W/kg, with an average absolute PO of  $507.58 \pm 14.21$  W and average relative PO of  $8.21 \pm 0.12$  W/kg. Critical power of the dancers occurred at an absolute PO of  $202.45 \pm 6.87$  W and relative PO of  $3.25 \pm 0.07$  W/kg with a W' of  $4101.3 \pm 524.2$  kJ. **CONCLUSIONS:** Competitive dancing requires high-power outputs and anaerobic capacity over short durations. Data presented in this study may provide coaches and practitioners valuable information on the anaerobic power characteristics of competitive dancers.



## Comparison of Self-Myofascial Release Methods on Ankle Range of Motion, Balance, and Patient Reported Comfort

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Exercise has been shown to elicit an inflammatory reaction in response to both acute and chronic exposures. The impact of this inflammation, if not treated, can be detrimental to function, training ability, and performance. These negative effects have been frequently treated through a variety of therapeutic interventions, including self-myofascial release (SMR). In SMR, the patient combines his/her weight with an external device, i.e., a foam roller, band, or massage stick, and movement to mobilize soft tissue restrictions. While SMR methods appear to be beneficial, the efficacy of various tools and their effect on balance, range of motion, and patient comfort are not fully known. **PURPOSE:** The purposes of this project were to examine the acute effects of the CTM Band (CTMB) or foam roller (FR) on ankle dorsiflexion (DF) range of motion, ankle stability, and patient-related comfort. **METHODS:** Subjects completed the Physical Activity Readiness Questionnaire (PAR-Q) prior to participation. After completion of a standardized stationary bike warm up, ankle range of motion was measured using the weight bearing lunge test (WBLT). Visual analog scale (VAS) for patient comfort was assessed during and 5 minutes post-treatments. Balance was assessed using the anterior reach portion of the Y-balance test (YBT) due to its relationship with ankle instability. **RESULTS:** Fourteen female subjects (n=14, 18-21 years old) participated. No significant changes in ankle range of motion (WBLT) or balance (YBT) after treatment with the CTMB ( $29.43 \pm 3.76$ ,  $30.57 \pm 3.72$ ,  $p=0.56$ ;  $62.57 \pm 6.12$ ,  $62.72 \pm 6.11$ ,  $p=0.087$ ) or FR ( $31.71 \pm 3.26$ ,  $31.21 \pm 4.09$ ,  $p=0.22$ ;  $60.72 \pm 5.66$ ,  $61.73 \pm 5.68$ ,  $p=0.80$ ) were found. There were significant differences in the VAS scale during-treatment ( $t=-9.33$ ,  $p<0.001$ ) and post-treatment ( $t=-3.05$ ,  $p=0.009$ ). **CONCLUSION:** A single treatment with a FR or CTMB was not enough to increase ankle DF, but did not negatively affect ankle stability. Patient comfort should be considered when choosing SMR tools or techniques.

## Do Racial Differences Exist in Blood Pressure and Vascular Stiffness in Otherwise Healthy Young Men?

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Cardiovascular disease (CVD) is the leading cause of morbidity and mortality in the United States but is most pervasive among non-Hispanic Black/African American individuals. Central blood pressure (BP) and vascular stiffness are relatively novel functional indicators of vascular health and function and are highly indicative of CVD risk, but few studies have explored whether racial differences exist in these parameters, and if heart rate variability (HRV), a non-invasive index of cardiac autonomic nervous activity, is explanatory. **PURPOSE:** The purpose of this study was to determine possible racial differences in central and peripheral BP and vascular stiffness between young healthy African American (AA) and Caucasian American (CA) men, and whether if such differences might be explained in part, by HRV. **METHODS:** 17 college age males (AA: n=8, age=19 ± 1yrs. vs. CA: n=9, age=21 ± 2yrs.) were assessed for peripheral systolic (SBP) and diastolic (DBP) blood pressure using an automated oscillometric sphygmomanometer following 10 mins supine quiet rest. Central systolic (cSys) and diastolic (cDia) pressures were derived from peripheral waveforms using a generalized transfer function. Pulse wave analysis determined augmentation index (AIx) normalized to 75 beats/min (AIx@75), and pulse wave velocity (PWV). Time-domain indices of HRV, root mean square of successive differences (RMSSD) and standard deviation of n-n intervals (SDNN) were obtained via an HR monitor. **RESULTS:** AA men and CA men presented no significant disparities in vascular function marked by systolic (AA:129 ± 14 vs. CA:120 ± 8 mmHg, p=0.14, d=0.76), diastolic (AA:73 ± 6 vs. CA:74 ± 6 mmHg, p=0.79, d=-0.13), cSys (AA:118 ± 13 vs. CA 111 ± 10 mmHg p=0.23, d=0.61) and cDia (AA:74 ± 7 vs. CA:75 ± 6 mmHg, p=0.67, d=-0.21) BP, AIx@75 (AA:13 ± 10 vs. CA: 4 ± 12%, p=0.14, d=0.77), and PWV (AA:5.28 ± 0.37 vs. CA:5.18 ± 0.43m/s, p=0.61, d=0.26). RMSSD (AA: 78.91 ± 48.53 vs. CA: 66.68 ± 53.16, p=0.749, d=0.158) and SDNN (AA: 76.3 ± 35.56 vs. 67.98 ± 37.81, p=0.728, d=0.172) were not different between AA and CA. **CONCLUSION:** Central and peripheral BP, vascular stiffness, and HRV were not different between young healthy AA and CA men, though moderate effect sizes in central and peripheral systolic blood pressure were noted.



## Arterial Blood Pressure Responses Reflect Differences in Alter-G® Treadmill Chamber Pressure in College Age Participants

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Lower body positive pressure (LBPP) treadmills utilize an inflatable chamber to provide a range of unweighted conditions for meeting specific rehabilitation or training purposes. Positive pressure is achieved by pumping air into the chamber, which results in a lower body lift or unweighted condition. Creating an unweighted condition for the user reduces the physiological strain on the lower body during treadmill exercise. Yet, little is known about internal chamber air pressure changes during unweighted conditions and its effect on arterial blood pressure (BP) during a resting state. **PURPOSE:** To study changes in chamber air pressure (CAP) and arterial BP across three unweighted conditions at rest. **METHODS:** Apparently healthy participants ( $N = 38$ ;  $BMI = 25.48 \pm 4.27$ ) stood in the LBPP treadmill chamber under positive pressures of 70%, 35%, and 90% unweighted conditions, respectively. CAP was measured using a portable weather station barometer inside the chamber and arterial BP was measured with an automatic BP cuff. Measurements were recorded at the beginning and end of a 3-minute stage for each condition. A 3x2 within repeated measures ANOVA with Bonferroni pairwise comparisons ( $p < 0.05$ ) determined significant differences between the three conditions and time. If sphericity was violated, Greenhouse-Geisser correction was used. **RESULTS:** CAP was statistically ( $ps < 0.001$ ) highest at 35%, lowest at 90%, with 70% in between ( $760.6 \pm 8.8$ ,  $737.7 \pm 10.9$ ,  $744.8 \pm 7.6$  mmHg, respectively). Systolic BP (SBP) was lower at 90% compared to 70% and 35% ( $127 \pm 12$ ,  $134 \pm 11$ ,  $133 \pm 10$  mmHg, respectively;  $ps < 0.001$ ). Diastolic BP (DBP) at 90% was lower than 70% ( $p = 0.031$ ), but no different from 35% ( $78 \pm 7$ ,  $80 \pm 7$ ,  $79 \pm 8$  mmHg, respectively). SBP and DBP decreased over time ( $p = 0.04$  &  $0.001$ , respectively) for all conditions. An interaction for pressure\*time ( $p = 0.022$ ) indicated that CAP decreased over time at 35% ( $p = 0.031$ ), but remained stable at 90% and 70% ( $ps = 1.0$ ). **CONCLUSION:** As expected, chamber air pressure is significantly different between 70%, 35%, and 90%. SBP at 90% is consistently lower than that at 70% and 35%. This suggests that the decrease in CAP resulted in a lower arterial BP. These findings are the first to demonstrate internal chamber air pressure across different unweighted conditions in a resting state.



## Thermal Strain During Endurance Running Events

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It is widely accepted that the human capacity to perform prolonged exercise is impaired in warm environments. **PURPOSE:** The aim of this study was to investigate the potential impact of thermal strain during endurance running events in male athletes. **METHODS:** Data from six running events were obtained from publicly available online sources. Weather data [air temperature, dew point, wind speed, cloud coverage, and Wet-Bulb Globe Temperature (WBGT)] corresponding to the time of each race (marathon, 50km race-walk, 20km race-walk, 10,000m, 5,000m and 3,000m-steeplechase) were obtained from the free-available online database. Data of body mass and height were collected for the top five international men athletes of each event and Body Mass Index and Body Surface Area were calculated. Thereafter, the clothing insulation was calculated by finding the sum from a list of clothing, and the metabolic rate was calculated using previous methodology of regression equation between running velocity and oxygen uptake. In turn, computer-based simulations using the FAME Lab Predicted Heat Strain software were conducted to calculate the heat strain of elite runners performing in the most frequent cool and warm weather conditions. **RESULTS:** Simulated data showed that athletes running in warm conditions (ranged between 20°C and 27°C), experience on average  $0.87 \pm 0.26$  °C higher core temperature,  $2.29 \pm 1.02$  °C higher skin temperature, and  $24.67 \pm 3.33$  higher bpm predicted heart rate compared to the same athletes running in cooler environmental conditions (ranged between 5°C and 16°C). **CONCLUSION:** Concluding, male athletes may experience a greater heat strain with potential impacts on performance and health running in warmer conditions. Athletes and coaches must be educated about these risks and prepare for the heat by employing heat mitigation strategies where possible.

## The Effects of a Resistance Training Program on Arterial Stiffness in Young, Healthy Females

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Arterial stiffness is a leading risk factor for cardiovascular disease and early detection is crucial in seeking appropriate treatment interventions. Current research studies have reported findings in positive correlations with chronic resistance while others did not find any correlations. **PURPOSE:** To examine the inconsistencies from previous investigations utilizing two resistance training models in female participants. **METHODS:** Subject characteristics included 24 female, untrained college students aged 18-22 years that were randomized into one of three groups: control (CON) group (n = 8), high-intensity resistance exercise (HI) group (n = 8), and high-volume resistance exercise (HV) group (n = 8). Subjects randomized to resistance training groups were required to perform strength training exercises three to five days a week for 11 weeks. The exercise regimen consisted of 2-3 sets of 3-8 repetitions (80-90% of 1-repetition maximum (1 RM)) for the HI group and 3-4 sets of 10-15 repetitions (50%-70% of 1 RM) for the HV group. All subjects were instructed to continue their normal diet and avoid cardiovascular exercise during the study. **RESULTS:** Following the intervention, there was a significant increase in carotid femoral pulse wave velocity (C-F PWV) ( $6.39 \pm 0.73$  to  $8.4 \pm 2.31$ ;  $P < 0.05$ ) and carotid radial (C-R) PWV ( $9.77 \pm 1.74$  to  $12.58 \pm 2.09$ ;  $P < 0.05$ ) in the CON group only. Both CON and HI groups significantly decreased central pulse pressure (cPP) ( $-15.3 \pm 12.4$  vs.  $-13.11 \pm 12.0$  percent change;  $P < 0.05$ ), respectively. Both the HI and HV groups increased their maximum squat ( $36.6 \pm 7.9$  vs.  $41.3 \pm 31.8$  percent change;  $P < 0.05$ ), bench press ( $34.4 \pm 12.6$  vs.  $23.4 \pm 11.1$  percent change;  $P < 0.05$ ), and seated row ( $22.0 \pm 12.6$  vs.  $21.9 \pm 12.5$  percent change;  $P < 0.05$ ), respectively. **CONCLUSION:** Our findings support the use of resistance training exercise without undue impact on vascular compliance in otherwise healthy, young female populations.



## **Inter-set Voluntary Hyperventilation-aided Recovery Does Not Improve Bench Press and Squat in Recreationally Trained Individuals**

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Inter-set voluntary hyperventilation (VH) aided recovery has recently been shown to improve reps to failure of bench press and leg press at 80% of 1RM in advanced athletes. It is unknown if VH would be ergogenic at other relative intensities using recreationally trained individuals. **PURPOSE:** To examine the effects of VH between sets of bench press (BP) and squat (SQ) at 70 and 90% 1RM on repetitions to failure, power, bar velocity, blood lactate, session RPE (sRPE), and muscle oxygen saturation (SmO<sub>2</sub>). **METHODS:** Fifteen recreationally trained ( $2.92 \pm 2.18$  yrs. of resistance training experience,  $97.27 \pm 20.69$  kg 1RM BP,  $131.06 \pm 22.69$  kg 1RM SQ) college-aged males ( $20.27 \pm 1.39$  yrs.,  $182.40 \pm 7.42$  cm,  $82.23 \pm 10.84$  kg) participated in a randomized crossover trial in which they performed 3 sets of BP and SQ to failure at 70 and 90% 1RM on separate days with normal breathing (CON) or 30 sec of VH (60 breaths/min) during inter-set rest periods. Statistical significance was set *a priori* at  $p \leq 0.05$ . **RESULTS:** There were no significant differences between conditions for repetitions, power, velocity and sRPE ( $p$ 's  $> 0.05$ ) at either intensity of BP or SQ. VH resulted in a slight, but significant, attenuation of blood lactate increase from sets 2 and 3 of SQ at both intensities (+0.56 vs. +1.08 mmol at 70%, +0.25 vs. +1.16 mmol at 90%,  $p = 0.037$ ) compared to CON. There was a significant condition and intensity interaction for SmO<sub>2</sub> of the pectoralis ( $p = 0.034$ ) with VH producing a higher SmO<sub>2</sub> at 90% 1RM ( $78.26 \pm 12.02$  vs.  $71.30 \pm 13.03$ ) and a lower SmO<sub>2</sub> at 70% 1RM ( $72.32 \pm 14.63$  vs.  $76.11 \pm 10.21$ ) than the CON. **CONCLUSION:** Voluntary hyperventilation did not produce an ergogenic effect in recreationally trained individuals which, when considering current evidence, suggests other factors including training experience may influence the effectiveness of VH.



## **The Effects of a Novel Muscle Activation Technique on Performance Parameters in Collegiate Football Players**

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Self-administered neuromuscular activation techniques (NMAT) implemented during athletic warm-up routines is a novel concept proposed to improve athletic performance, such as flexibility, agility, strength, power, and speed. At present, a paucity of research exists to support such claims. **PURPOSE:** To analyze the impact of NMAT on athletic performance measures when used in addition to a standardized dynamic warm-up. **METHODS:** Fourteen Division III male collegiate football players (age  $19.4 \pm 1.0$  years, mass  $93.9 \pm 24.6$  kg.) completed a randomized crossover study consisting of three performance testing sessions following a control condition (dynamic warm-up + 5-minute brisk walk at a 4.8 km/hr. pace (CON)), and two experimental conditions including a dynamic warm-up + NMAT (NMAT) and dynamic warm-up + sham (SHAM). Performance testing consisted of sit & reach, pro-shuttle, handgrip strength, vertical jump, and 40-yard dash. **RESULTS:** There were no significant differences between the CON, NMAT and SHAM for the sit & reach ( $23.0 \pm 7.7$ ,  $24.0 \pm 9.0$ ,  $24.3 \pm 8.6$  cm;  $p = 0.310$ ), pro-shuttle ( $4.87 \pm 0.27$ ,  $4.89 \pm 0.31$ ,  $4.84 \pm 0.31$  sec;  $p = 0.821$ ), right handgrip ( $53.93 \pm 8.20$ ,  $54.71 \pm 8.84$ ,  $55.29 \pm 9.19$  kg;  $p = 0.504$ ), left handgrip ( $52.43 \pm 8.62$ ,  $51.29 \pm 8.95$ ,  $53.21 \pm 9.67$  kg;  $p = 0.239$ ), vertical jump ( $48.9 \pm 6.3$ ,  $49.2 \pm 6.2$ ,  $49.7 \pm 5.8$  cm;  $p = 0.508$ ), and 40-yard dash ( $5.41 \pm 0.29$ ,  $5.44 \pm 0.33$ ,  $5.40 \pm 0.30$  sec;  $p = 0.500$ ). **CONCLUSION:** NMAT appears to be a technique that is easy to learn, safe and quick to administer, however, there were no acute benefits of adding NMAT to a standard dynamic warm-up for the purposes of enhancing acute flexibility, speed, agility, strength, and power. Many questions remain concerning NMAT (e.g., appropriate dosing, timing, and sequencing, etc.) and further research is needed to draw stronger conclusions regarding potential benefits.

## **Impact of COVID-19 on Perceptions of Health, Well-Being, and College Experience in Division III Student-Athletes**

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College athletics is a part of the college experience that cannot be converted into a virtual experience. Thus, this study explored the direct implications of the COVID-19 pandemic which altered educational and athletic experiences in Division III student-athletes. **PURPOSE:** Determine the impact of COVID-19 on the student-athletes collegiate experience, health, well-being, sport related training, and physical fitness during the COVID-19 pandemic compared to before the pandemic. **METHODS:** Division III student-athletes over the age of 18 years who were enrolled at Pennsylvania State University were emailed a link of the 43-question survey which was deployed using Qualtrics Survey Software during the COVID-19 pandemic in the Fall 2020 semester. The survey asked questions about collegiate experience, health, well-being, sport related training, and physical fitness before and during the pandemic. **RESULTS:** There were 238 student-athletes (ages 18-24 years; 46.2% males, 53.8% females) surveys included in analysis. Approximately 94% of participants reported that COVID-19 slightly (49.6%) or significantly (44.1%) worsened their college experience. About 52% of participants believed that COVID-19 had a slight (40.8%) or significant (11.3%) negative impact on their health, and 59.2% of participants believed that COVID-19 had a slight (44.5%) or significant (14.7%) negative impact on their well-being. Nearly 79% of student-athletes reported that their sport-related training slightly (35.3%) or significantly (43.3%) decreased during the pandemic. Over half of participants believed that their physical fitness (62.6%), physical endurance (67.2%), and physical strength (53.8%) decreased during the COVID-19 pandemic. **CONCLUSION:** The implications of the COVID-19 pandemic on Division III collegiate student-athletes include a worsened college experience as well as worsened health and well-being. Over half of student-athletes reported reductions in their physical fitness, endurance, and strength over the COVID-19 pandemic. The impact of COVID-19 related reductions in sport-related training and physical fitness remains unclear, but it may contribute to worsened performance in competition, increased injury risk, and/or reduced self-efficacy in student-athletes.



## **NSAID Usage Patterns & Amount of Negative Side Effects in Shippensburg University Student Athletes**

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The usage of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) by college student-athletes could cause negative side effects if not used properly. While NSAIDs have been shown to relieve/block pain and help athletes' bodies heal and recover at a faster rate, overuse, misuse, and constant use over time can have unfavorable lasting impacts relating to GI distress, or even heart and liver damage. **PURPOSE:** To determine how student athletes at a NCAA Division II school use, perceive, procure and understand NSAIDs and possible adverse effects. This information could help inform and assist both athletic and medical professionals by allowing them to better educate and care for their athletes and patients. **METHODS:** 70 intercollegiate athletes (52 female; M age 19.70±1.29 yrs) participated in this study. After consent was received from all individuals, they were given a demographic questionnaire and a questionnaire pertaining to knowledge of NSAIDs, usage patterns, and potential negative side effects. **RESULTS:** No significant correlation was found between class year and NSAID consumption ( $p>.05$ ). However, weight was significantly correlated with the greatest amount of pills consumed in one dose ( $r=.361, p<.01$ ) and the greatest number of pills consumed in a day ( $r=.307, p<.05$ ). In regard to NSAID usage in the anticipation of pain, 38.5% indicated they used NSAIDs for that purpose. When athletes were asked if they thought NSAIDs could negatively impact healing, 48.6% did not believe they could and 21.4% were unsure. Regarding side effects, 12.9% did not think NSAIDs were capable of causing tumor growth and 47.1% were unsure. Finally, 30% of athletes admitted to taking more than the daily recommended NSAID values. **CONCLUSION:** Over one-third of athletes used NSAIDs in anticipation of pain rather than alleviating pain, and well over half were unaware of harmful side effects. Moderately-strong correlations between the highest number of pills in one dose and highest number of pills in one day were evident with weight and other variables, which will be discussed. While NSAIDs can be beneficial for short term pain management, this survey demonstrates that many student-athletes are unaware of the side effects of overuse or prolonged use of NSAIDs.



## Effects of Wearing a Surgical Mask During Moderate Exercise on Muscle and Blood Oxygen Saturation

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The rise in use of surgical masks to prevent COVID-19 infections has led to questions concerning their impact on performance during sport and exercise. Currently, there is a paucity of literature on the effects of mask-wearing on oxygen levels in the body during exercise, which are critical for optimal aerobic exercise performance. Moreover, no studies to date have addressed the implications of mask-wearing during moderate intensity exercise in a field setting in a fit, college-age population. **PURPOSE:** To determine if mask-wearing during moderate intensity aerobic exercise affects blood oxygen and muscle oxygen saturation levels compared to equal activity when not wearing a surgical face mask in college athletes. **METHODS:** Six subjects (3 males and 3 females;  $20 \pm 2$  yrs) were randomized to perform a moderate-intensity 1-mile run either with a mask (M) or unmasked (U) on an outdoor track. Subjects performed a guided warm-up, then began run with instructions to remain within maximum heart rate (HR) range of 64-76%. Blood oxygen saturation ( $SpO_2$ , measured with pulse oximeter), muscle oxygen saturation ( $SmO_2$ , measured with near-infrared spectroscopy), and HR (measured with heart rate monitor) were assessed at 3 separate times during the exercise protocol – after donning monitors, after warm-up, and after run. Maximal oxygen consumption ( $\dot{V}O_2$  max) was estimated using prediction equation described by George et al. Results were analyzed using a one-way ANOVA with repeat measures. **RESULTS:** No differences were seen for  $SmO_2$  ( $M=62 \pm 17.6$ ,  $U=66.0 \pm 2.8$ ;  $p>0.05$ ),  $SpO_2$  ( $M=98.3 \pm 0.6$ ,  $U=98.3 \pm 0.6$ ;  $p>0.05$ ) or HR ( $M=160.7 \pm 16.0$ ,  $U=128.0 \pm 19.0$ ;  $p>0.05$ ) between the groups at the end of the exercise protocol. Additionally, no differences were seen in predicted  $\dot{V}O_2$  max ( $M=37.7 \pm 1.9$ ,  $U=48.0 \pm 5.9$ ;  $p>0.05$ ) between groups. **CONCLUSION:** Wearing a surgical mask during moderate exercise had no detrimental effects on blood or muscle oxygenation in college-age participants in a real-world setting.

## **The Relationship Between Sleep and Perception of Performance in College Athletes**

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Sleep is a natural recurring process that is crucial for healthy lifestyle. Among college athletes, however, sleep deprivation is a common occurrence possibly affecting cognitive function and physical performance. **PURPOSE:** To examine the relationship between sleep behaviors (e.g. sleep quality and duration) in collegiate athletes and mental and physical perceived performance. **METHODS:** Ninety-four NCAA collegiate athletes (30 male, 64 female), between the ages of 18-24 years (mean age = 20 years), were enrolled to participate in the study. At the time of enrollment, participants varied in sports and in time of season (e.g. in-season and off-season). Each participant completed the following questionnaires: Pittsburgh Sleep Quality Index (PSQI), Functional Outcomes of Sleep Questionnaire (FOSQ), and Positive and Negative affect Schedule (PANAS). The answer choices of these questionnaires were converted to rating scale system using the Qualtrics<sup>XM</sup>. Pearson moment product correlation was used to examine the relationships between different measures of sleep behaviors and their mood state, perceptions of cognitive function and physical performance. **RESULTS:** Majority of the study participants reported to sleep between 5-7 hours each night ( $5.86 \pm 0.9$ ) and rarely felt worried in bed ( $2.53 \pm 0.8$ ). Quality of sleep has found to be significantly correlated with the performance confidence ( $r=0.41$ ,  $p<0.05$ ). Further, a weak but a significant positive relationship was shown between quality of sleep and perception of concentration ( $r=0.26$ ,  $p<0.05$ ). Likewise, there was a significant positive relationship between hours of sleep and alertness ( $r=0.33$ ,  $p<0.05$ ). However, no significant relationship was found between hours of sleep and performance confidence ( $r=-0.01$ ;  $p>0.05$ ) or concentration ( $r=0.13$ ;  $p>0.05$ ). **CONCLUSION:** Quality of sleep is important for both physical and mental perceived performance in athletes, although hours of sleep showed weak correlation with perceived performances.



## Effects of Static and Dynamic Stretching on Muscle Oxygen Saturation in the Rectus Femoris

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Warm-ups commonly include static stretching (SS) though it may hinder performance and increase injury, while dynamic stretching (DS) increases range of motion while improving athletic performance. One minimally researched explanation for this difference is muscle oxygenation saturation ( $SmO_2$ ). **PURPOSE:** To determine if DS would yield higher  $SmO_2$  post-stretch versus SS. A secondary aim was to observe  $SmO_2$  trends post stretch to determine optimal stretch timing. **METHODS:** Twenty-three students (13 males, 10 females, ages 18-24) who exercised regularly were recruited and completed two separate stretching sessions at least a day apart, utilizing a cross-over design with simple randomization. SS protocol involved performing a static quadriceps stretch, while DS involved a walking quadriceps stretch; both protocols had an equivalent stretching dose. Muscle oxygen of the rectus femoris was measured with a monitor using near-infrared spectroscopy. Paired t-tests compared  $SmO_2$  at the end of the stretching protocols and effect sizes were calculated using Cohen's *d*. **RESULTS:** Muscle oxygen saturation was significantly higher ( $p < 0.05$ ) for DS ( $62.8\% \pm 12.6\%$ ) than SS ( $55.1\% \pm 17.8\%$ ) immediately after stretching ended, with a large effect size observed ( $d = 2.21$ ). In both protocols,  $SmO_2$  levels began decreasing as soon as the stretching ended.  $SmO_2$  levels in the DS group did not return to baseline levels until 2 minutes. **CONCLUSION:** DS significantly elevated  $SmO_2$ , which would likely increase baseline muscle oxygen consumption. A large effect size was observed, suggesting this could augment aerobic endurance performance. Additionally,  $SmO_2$  levels dropped quickly after stretching further supporting the notion that changes seen contribute to performance enhancement.



## Heart Rate Responses to Three Unweighted Conditions on an Alter-G® Treadmill

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A lower body positive pressure treadmill (LBPP) uses forced air into an inflatable chamber to produce pressure. This pressure produces a lift, or body weight support, over a range of unweighted conditions, which can assist in facilitating rehabilitation or training purposes. Most studies using a LBPP examine heart rate responses during bouts of exercise. Yet, little is known about internal chamber air pressure (CAP) changes during unweighted conditions and its effect on heart rate (HR) responses during standing rest. **PURPOSE:** To measure the effects of changes in CAP on standing heart rate (HR) at different unweighted conditions over time. **METHODS:** Thirty-eight apparently healthy participants ( $N = 38$ ;  $BMI = 25.48 \pm 4.27$ ) participants (17 female, 21 male) stood in a LBPP treadmill chamber under pressures of 70%, 35%, and 90% unweighted conditions. HR was measured using a smart watch at minute one- and three of a three-minute stage. A 3x2 within repeated measures ANOVA with Bonferroni pairwise comparisons ( $p < 0.05$ ) determined significant differences in HR between the three pressures used and over time. **RESULTS:** HRs at the two time points for each of the three unweighted conditions: 70% ( $76 \pm 12$ ;  $77 \pm 12$  bpm) 35% ( $77 \pm 11$ ;  $74 \pm 12$  bpm), and 90% ( $79 \pm 12$ ;  $81 \pm 12$  bpm). A significant interaction was noted for pressure\*time ( $p < 0.001$ ). HR in the 35% condition decreased over time ( $p = 0.002$ ) compared to the other conditions where HR remained stable ( $p = 1.00$ ;  $p = 0.973$ ). Upon completing the 35% condition ( $74 \pm 12$  bpm), HR significantly increased at the first minute of the 90% condition ( $79 \pm 12$  bpm). HR in the 90% continued to increase above the first time point of 35% ( $81 \pm 12$  vs.  $77 \pm 11$  bpm, respectively). **CONCLUSION:** This suggests the most unweighted condition puts the most pressure on the body to assist with venous return. The quick release of pressure (35% to 90%) possible decreased stroke volume to an extent causing HR to increase.

## Effects of the COVID-19 Pandemic on Mood and Motivation in Division 2 Athletes

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**PURPOSE:** The purpose of the present study is to identify the effects of the COVID-19 Pandemic on mood and motivation in division two collegiate athletes. **METHODS:** Forty division two collegiate athletes were surveyed in this study. Of the four hundred athletes on campus, participants were surveyed if their sport team was either in season or training during the spring 2021 academic semester. From this sample, forty athletes responded. Of those forty participants, three participants did not complete the full survey. The final data includes responses from thirty-seven study participants. Participants were asked to respond to twelve questions related to alterations in mood and motivation during the COVID-19 pandemic using either a Likert scale or yes/no response. All responses were in reference to the previous three months. Participants selected one of five possible responses to each question; never, rarely, sometimes, very often, and always. Likert scale answers were coded 1-5, respectively. Yes/no answers were coded 1-2, respectively. **RESULTS:** Participant mood was most affected by the stress of being a student athlete during the pandemic ( $3.43 \pm 1.09$ ). Participants reported “rarely” experiencing increased stress due to lack of resources ( $2.56 \pm 1.06$ ) or fear of becoming out of shape due to lack of resources ( $2.29 \pm 1.12$ ). Participant sport motivation was mostly affected by the feeling of being overwhelmed ( $3.13 \pm 1.33$ ). 24 out of 37 participating collegiate athletes reported an inconsistent schedule led to decreased sport motivation. Participants also reported a lack of sport motivation due to isolation ( $2.75 \pm 1.36$ ). **CONCLUSION:** The COVID-19 Pandemic forced student-athletes to isolate, limit training time, and shift classroom learning online. These factors combine to increase stress in the lives of division two collegiate athletes. Future research should follow-up with this population to monitor mental health and sport motivation over the coming sport seasons. Specifically, questions related to diagnosis of mental health conditions need to be answered, and perhaps followed up with counseling and general wellness coaching.



## **Effects of a Multi-Strain Probiotic on Depression, Anxiety, and Stress in College-Aged Individuals**

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Intestinal microbiota is a variety of bacterial species important in preventing pathogenic factors into the body. Microbiota impact the use of ingested nutrients and affect the development and performance of the immune system. Probiotics are a live bacterial diet supplementation that when ingested settle amongst microbiota and carryout similar activities and functions. Research studies have shown that probiotic supplementation can improve immune, digestive, and respiratory functions. Studies have even found that probiotic supplementation improves neural function due to the bidirectional communication between the intestinal tract and central nervous system. However, there is little research on the neurological effects of an acute ingestion of a multi-strain probiotic (PRO). **PURPOSE:** To assess how a multi-strain PRO supplement effected symptoms of depression, anxiety, and stress in college-aged individuals. **METHODS:** 32 subjects (PRO=16, placebo [PLA]=16, age 20.4±1.2 yrs, weight 101.5±57.2 kg) ingested either a multi-strain PRO or PLA supplement two times a day for six-weeks. A single PRO dose consisted of 2 grams (containing  $2.5 \times 10^9$  colony-forming units) of bacteria per gram and was composed of the main bacterial strains Bifidobacterium, Lactobacillus, and Lactococcus lactis. The PLA included 2 grams of freeze-dried maize starch and maltodextrin. At baseline, three weeks, and six weeks subjects completed the depression, anxiety, and stress test. **RESULTS:** There was a main effect of time ( $P < .05$ ) for symptoms of depression, anxiety, and stress. Symptoms of depression significantly ( $P < .05$ ) improved from baseline (9.9±1.5), three weeks (5.2±1.2), and six weeks (4.1±1.0) of taking a supplement. Symptoms of anxiety significantly ( $P < .05$ ) improved from baseline (11.5±1.2), three weeks (6.8±1.2), and six weeks (5.3±.98) of taking a supplement. Symptoms of stress significantly ( $P < .05$ ) improved from baseline (17.2±1.5), three weeks (10.5±1.1), and six weeks (9.7±1.1) of taking a supplement. There was no significant difference ( $P > .05$ ) in symptoms of depression, anxiety, or stress between ingestion of PRO or PLA supplement. **CONCLUSION:** Acute ingestion of a PRO supplement did not improve symptoms of depression, anxiety, and stress in college-aged individuals.

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## **Do College Students View Walking as Physical Activity? Relationship between Walking and Physical Activity Perceptions**

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Adults are recommended to complete 150-300 minutes of moderate-to-vigorous intensity physical activity (PA) for substantial health benefits; however, 1 in 4 adults do not fulfill the PA recommendations globally. Walking is the most common mode of PA participation; however, it is unclear if college students view this mode of movement as physical activity. Brisk walking as a form of PA may help college students to overcome common barriers to PA participation. Common perceived barriers include lack of time, interference with work or school, motivation, and tiredness. **PURPOSE:** To examine the association between self-reported walking (indoor or outdoor for transportation or exercise) and perceptions of PA in a sample of college students. **METHODS:** College students completed a one-time online questionnaire regarding demographics, total walking per week, and perceptions of PA (barriers, benefits, and views). Students were eligible to participate if they were 18-24 years old and registered for classes. **RESULTS:** Seventy-eight participants provided informed consent and completed the questionnaire. Participants were 18-24 years old, female (79.7%), and reported engaging in an average of  $332 \pm 233$  minutes per week of brisk walking, the most common form of PA. While the mean self-reported brisk walking exceeded the minimum PA recommendations, 16.67% of the sample did not report engaging in a minimum of 150 of moderate intensity activity each week. The relationship between self-reported walking and perceptions of PA were examined. Participation in brisk walking was associated with the following perceptions: I consider myself physically active ( $r = -0.267$ ,  $p = 0.018$ ), PA is uncomfortable ( $r = 0.227$ ,  $p = 0.045$ ), and I do enough PA to keep me healthy ( $r = -0.245$ ,  $p = 0.030$ ). **CONCLUSIONS:** While most participants in this study reported high levels of brisk walking each week; self-reported walking was negatively associated with perceptions of being a physically active individual and engaging in enough PA to be healthy. These results highlight a need to disseminate additional information on PA recommendations among individuals in this age group and identify strategies for addressing perceptions of walking as a form of PA.



## Ability to Reproduce RPE while Self-Selecting Treadmill Speed vs Incline

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Ratings of perceived exertion (RPE) are commonly used to self-regulate exercise intensity. **PURPOSE:** To investigate if subjects can reproduce a prescribed RPE by adjusting either the incline or speed alone on a treadmill. **METHODS:** Six men (age:  $21.7 \pm 0.8$  yr; height:  $172.6 \pm 5.3$ cm; mass:  $86.5 \pm 8.4$ kg; body fat:  $22.6 \pm 7.1\%$ ;  $VO_2\text{max}$ :  $53.0 \pm 7.2$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) and six women (age:  $20.8 \pm 0.4$ yr; height:  $162.3 \pm 5.5$ cm; mass:  $66.9 \pm 18.5$ kg; body fat:  $27.1 \pm 11.5\%$ ;  $VO_2\text{max}$ :  $44.9 \pm 5.6$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) completed a maximal oxygen consumption ( $VO_2\text{max}$ ) and two RPE reproduction trials on a treadmill. During session one, subjects completed a graded exercise test to volitional fatigue using the modified Bruce protocol. Subjects received standardized instructions on Borg RPE scaling procedures. Oxygen consumption ( $VO_2$ ), heart rate (HR), minute ventilation (VE), respiratory rate (RR), tidal volume (TV), and RPE (overall = RPE-O; peripheral = RPE-P;) were collected every minute. During the two 15-minute reproduction trials, the subjects were asked to adjust only treadmill speed or incline, in a counterbalanced order, to reproduce a RPE-O of 13 or 14 (somewhat hard). An average value from the minute before and after reaching the target RPE-O was used for statistical analysis. Dependent t-tests were used to determine differences between the  $VO_2\text{max}$  test and RPE reproduction trials. **RESULTS:** When comparing the speed (S) and  $VO_2\text{max}$  (V) trials at the prescribed RPE-O, there was no significant difference in relative  $VO_2$  (S:  $34.9 \pm 9.5$  ml·kg<sup>-1</sup>·min<sup>-1</sup>; V:  $37.9 \pm 6.5$  ml·kg<sup>-1</sup>·min<sup>-1</sup>,  $p = .158$ ), HR (S:  $174.0 \pm 13.1$  b·min<sup>-1</sup>; V:  $173.9 \pm 13.8$  b·min<sup>-1</sup>,  $p = .992$ ), or VE (S:  $70.5 \pm 17.7$  l·min<sup>-1</sup>; V:  $73.5 \pm 17.7$  l·min<sup>-1</sup>,  $p = .630$ ). There was a significant difference in RR (S:  $38.6 \pm 6.6$ ; V:  $33.6 \pm 8.5$  b·min<sup>-1</sup>,  $p = .047$ ), TV (S:  $1.9 \pm 0.5$  L; V:  $2.3 \pm 0.6$  L,  $p < .001$ ), and RPE-P (S:  $15.0 \pm 1.3$ ; V:  $13.7 \pm 0.8$ ,  $p = .002$ ). When comparing the incline (I) and V trials at the prescribed RPE-O, there was a significant difference in relative  $VO_2$  (I:  $29.0 \pm 6.3$ ,  $p < .001$ ), HR (I:  $158.9 \pm 12.0$ ,  $p = .010$ ), VE (I:  $53.1 \pm 8.7$ ,  $p = .002$ ), RR (I:  $30.0 \pm 6.5$ ,  $p = .022$ ), TV (I:  $1.9 \pm 0.6$ ;  $p = .001$ ), and RPE-P (I:  $14.8 \pm 1.6$ ,  $p = .019$ ). **CONCLUSION:** The subjects more accurately reproduced the prescribed RPE exercise intensity when self-controlling treadmill speed rather than incline.

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## Sex Differences in Estimating Cardiac Autonomic Function Using Heart Rate Variability: Effects of Oral Capsaicin

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Heart rate variability (HRV) estimates autonomic nervous system (ANS) influence on the heart and is sex-specific. Sensory afferents exhibit sex-specificity; although, there is a paucity of data on the potential effects of Capsaicin, an agonist for transient receptor potential vanilloid channel-1 (TRPV<sub>1</sub>), on cardiac ANS activity and if the effect is sex-dependent. **PURPOSE:** Therefore, this study sought to determine the sex-specificity in the effect of capsaicin on cardiac autonomic function estimated through HRV.

**METHODS:** HRV was measured in 38 young males (M: n=25) and females (F: n=13), and, in a blinded crossover design, after acute ingestion of placebo or capsaicin capsules. Resting measurements of HR, RR interval, root mean square of successive differences (RMSSD), natural log-transformed RMSSD (LnRMSSD), standard deviation of n-n intervals (SDNN), number of pairs of successive n-n intervals that differ by more than 50 msec (NN50), and percent NN50 to total n-n intervals (PNN50) were obtained.

**RESULTS:** Under placebo, males had significantly lower minimum HR (M: 49±9.7 vs. F: 58±16 beats/min, p=0.038, d=-0.738) and significantly higher NN50 (M: 141±118 vs. F: 33±23, p=0.003, d=0.129) than females. There was a main effect of sex on HR (M: 59±9.3 vs. F: 65±12 beats/min, p=0.036,  $\eta^2=0.098$ ), minimum HR (M: 47±8.3 vs. F: 56±12 beats/min, p=0.014,  $\eta^2=0.124$ ), and NN50 (M: 177±143 vs. F: 29±17, p<0.001,  $\eta^2=0.249$ ). There was a significant interaction of sex and treatment (p=0.02,  $\eta^2=0.027$ ) for RMSSD, where males increased (Placebo: 78±55 vs. Capsaicin: 91±64 ms), and females decreased (Placebo: 105±83 vs. Capsaicin 76±43 ms). **CONCLUSION:** This study recapitulates previously documented sex differences in HR and HRV. Acute ingestion of capsaicin increased RMSSD in men, but decreased RMSSD in women, suggesting a sexual dimorphism in parasympathetic response, perhaps due to differences in TRPV<sub>1</sub>-sensitive afferents or sensitivity.



## **Bioelectrical Impedance Analysis: Insight into Subclinical Atherosclerosis**

Sydney E. Brackett, Tiago V. Barreira, Jacob P. DeBlois, Joon Young Kim, Kevin S. Heffernan. Syracuse University, Syracuse, NY, USA

Visceral fat may hasten the atherosclerotic process manifesting as increases in aortic stiffness, which is highly correlated with cardiovascular disease (CVD) risk. Standard tools to measure visceral fat, such as Magnetic Resonance Imaging and Dual-Energy X-Ray Absorptiometry, are expensive and not accessible to all patients, clinicians, and researchers in resource-constrained environments. Visceral fat can also be estimated with bioelectrical impedance analysis (BIA), which is cost-effective and applicable to large-scale observational studies. Whether the visceral fat index from BIA is associated with subclinical CVD risk is unknown. **PURPOSE:** To examine the association of BIA-measured visceral fat index with subclinical CVD risk. **METHODS:** Aortic stiffness was used as a measure of subclinical CVD risk and measured as carotid-femoral pulse wave velocity (cfPWV) in 71 adults (49 females, mean age  $21 \pm 3$  years; body mass index [BMI] of  $25 \pm 3$  kg/m<sup>2</sup>). A BIA scale was used to assess visceral fat index by measuring impedance at different frequencies (eg 5 kHz and 200 kHz) and then applying predictive equations. Systemic body fat was assessed using air-displacement plethysmography. The association between BIA visceral fat index and cfPWV were compared using blockwise linear regression. Covariates included age, sex, race/ethnicity, mean arterial pressure, body fat percentage, and BMI. **RESULTS:** BIA visceral fat index was significantly associated with cfPWV ( $r = 0.51$ ,  $p = 0.001$ ). Associations remained after fully adjusting for aforementioned covariates (standardized Beta = 0.72,  $p = 0.006$ ). Aforementioned covariates explained 23.5% of the variance in cfPWV (sig. F change = 0.001) with BIA visceral fat index explaining an additional 8% of the variance in cfPWV (sig. F change = 0.006). Results were similar in a model that replaced air displacement plethysmography body fat percentage with BIA body fat percentage (standardized Beta = 0.81,  $p = 0.008$ , R-squared change = 0.07). **CONCLUSION:** BIA visceral fat index was associated with aortic stiffness independent of several confounders including BMI and other measures of systemic body fat. Visceral fat index from BIA may be a safe and cost-effective means to provide insight into subclinical CVD risk.

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## Family History of Hypertension and Heart Rate Results from the Variable Height Step Test

Daniel Gwon, Fiona M. Horvat, Robert R. Horn, David A. Phillips, Evan L. Matthews. Montclair State University, Montclair, NJ

Adults with a family history of hypertension (+FHH) have been shown to exhibit exaggerated sympathetic and heart rate (HR) responses to static exercise and decreased resting baroreflex control of HR. Less is known about exercise responses to dynamic exercise in +FHH adults. Additionally, this may have implications for submaximal cardiorespiratory fitness tests that rely on HR. **PURPOSE:** To examine dynamic exercise HR responses to the variable height step test (VHST) between +FHH and negative family history of hypertension (-FHH) adults. **METHODS:** 40 healthy participants (+FHH: n = 15, 22 ± 4 yrs; M 8, W 7; -FHH: n = 25, 25 ± 5 yrs; M 8, W 17) self-reported family history of hypertension status and self-palpated 60s HR at rest and post VHST from three step test trials performed on different days. **RESULTS:** Repeated measures ANOVA results across all three trials found significant differences between groups for  $\Delta$ HR values (post VHST HR – resting HR) (+FHH mean: 39 ± 19; -FHH mean: 30 ± 12  $\Delta$ BPM; group p = 0.031,  $\eta^2$  = 0.199; trial p = 0.463,  $\eta^2$  = 0.009; interaction p = 0.364,  $\eta^2$  = 0.010), but not absolute HR values (+FHH mean: 106 ± 26; -FHH mean: 98 ± 18 BPM; group p = 0.179,  $\eta^2$  = 0.101; trial p = 0.325,  $\eta^2$  = 0.007; interaction p = 0.821,  $\eta^2$  = 0.001). **CONCLUSIONS:** These preliminary findings suggest that a positive family history of hypertension status increases heart rate responses to dynamic exercise, but likely has minimal impact on heart rate-based cardiorespiratory fitness tests such as the variable height step test.



## Critical Environmental Limit Protocol: Validity and Reliability (PSU HEAT)

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An incremental heat stress protocol used to establish critical environmental limits for human heat exchange, i.e., those combinations of ambient temperature and humidity above which heat stress becomes uncompensable and, therefore, unsafe. However, no studies have rigorously investigated the reliability and validity of this experimental paradigm. **PURPOSE:** Here, we assessed the (1) between-visit repeatability and (2) validity of an experimental paradigm that either holds ambient vapor pressure ( $P_a$ ) constant and incrementally increases dry-bulb temperature ( $T_{db}$ ) or vice versa. **METHODS:** Twelve subjects (5M/7W;  $25 \pm 4$  yr) completed a progressive heat stress protocol during which they walked on a treadmill (2.2 mph, 3% gradient) in a controllable environmental chamber. After an equilibration period, the progressive heat stress protocol involved increasing  $T_{db}$  every 5 min while  $P_a$  was held constant ( $T_{crit}$  experiments), or increasing  $P_a$  ( $P_{crit}$  experiments) every 5 min while  $T_{db}$  was held constant ( $P_{crit}$  experiments), until an upward inflection in gastrointestinal temperature ( $T_{gi}$ ) was observed. For repeatability experiments, 11 subjects returned to the lab to repeat the same protocol as their first visit. For validity experiments, 10 subjects returned to the lab for a progressive heat stress trial in which  $T_{db}$  or  $P_a$  was held constant at the  $T_{crit}$  or  $P_{crit}$  value from their first visit. **RESULTS:** The between-visit repeatability for critical environmental limits was excellent (ICC = 0.98). Similarly, there was excellent agreement between original and validity trials for  $T_{db}$  (ICC = 0.95) and  $P_a$  (ICC = 0.96). Furthermore, the wet-bulb temperature at the  $T_{gi}$  inflection point was not different during reliability ( $p = 0.78$ ) or validity ( $p = 0.32$ ) trials compared to original trials. **CONCLUSION:** These findings suggest that this experimental paradigm is highly repeatable and valid for the determination of critical environmental limits delineating compensable from uncompensable heat stress.

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## **Ambulatory Arterial Stiffness, Salivary Inflammation, and Physical Activity in Young Adults With and Without COVID-19**

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COVID-19 illness may cause a dysregulated systemic inflammatory response, leading to cardiovascular damage and an increased risk for cardiovascular disease (CVD). Physical activity (PA) is inversely associated with systemic inflammation and CVD risk and may be a cardioprotective lifestyle factor for individuals recovering from COVID-19. **PURPOSE:** 1) To compare CVD risk, assessed as arterial stiffness and systemic inflammatory levels, between young adults recovering from COVID-19 and uninfected controls, and 2) to explore PA as a mediator for the relationship of COVID-19 infection history with arterial stiffness and systemic inflammation. **METHODS:** Analyses were performed on 23 COVID-19 (15 females, 25.0±8.9 years, 24.1±3.5 kg/m<sup>2</sup>) and 32 control participants (18 females, 24.4±6.5 years, 25.1±3.5 kg/m<sup>2</sup>). Arterial stiffness was estimated as pulse wave velocity (PWV) during 24-hour ambulatory blood pressure monitoring with an oscillometric blood pressure device. Systemic inflammation was assessed as salivary C-reactive protein (CRP) levels using the passive drool method. PA was objectively measured via accelerometry and assessed as moderate-to-vigorous PA (MVPA). An independent samples *t*-test was used to compare measures of arterial stiffness and systemic inflammation between the COVID-19 and control groups. Mediation analysis was used to determine whether there was a significant indirect effect of COVID-19 infection history through MVPA on arterial stiffness and CRP levels. **RESULTS:** There were no significant differences ( $p > 0.05$ ) between the SARS-CoV-2 and control groups in PWV (5.0±0.5 m/s vs. 5.1±0.5 m/s) or CRP levels (765.4±672.9 pg/mL vs. 526.3±674.8 pg/mL). Mediation analysis did not reveal a significant indirect effect of COVID-19 infection history through MVPA on arterial stiffness (estimate = 0.02, 95% CI = -0.05 – 0.24) or CRP levels (estimate = 0.03, 95% CI = -0.07 – 0.16). **CONCLUSION:** These results suggest there are no differences in arterial stiffness and systemic inflammation between young adults recovering from COVID-19 and uninfected controls, and that MVPA may not significantly mediate the relationship for COVID-19 infection history with arterial stiffness and systemic inflammation. Young adults recovering from COVID-19 may not have a heightened CVD risk compared to controls.



## The Interrelationship of Bisphenols-A and -S, Lipid Profiles, and Their Effect on Glucose Uptake

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Bisphenol-A (BPA), a chemical used in food packaging, and its replacement, bisphenol-S (BPS), are established obesogens and have been closely associated with a risk of insulin resistance, dyslipidemia, and furthermore T2D. Physical exercise has been shown to attenuate these conditions. **PURPOSE:** To investigate the relationship between lipid profiles, levels of urinary BPA and BPS, and their influence on glucose uptake induced by insulin and aerobic exercise. **METHODS:** Eighteen healthy subjects (ages  $23.28 \pm 2.61$  yrs; BMI  $29.41 \pm 8.28$  kg/m<sup>2</sup>) participated in two, separate testing days. Participants fasted (only water) for 3-hours prior to each session. Before testing began, a urine sample was collected, and basal blood glucose, lipid profile, and body fat were also assessed. Participants then consumed a mixture of 8 ounces of water and 50 g of Maltodextrin. In the following 30-, 60-, and 75-minutes, the subjects' blood glucose was measured. On the "Exercise" testing day, subjects ran for 30-minutes on a treadmill, while on the "Rest" testing day, they remained seated. Urinary BPA and BPS were measured by an assay kit. **RESULTS:** The "Exercise" condition produced a significant decrease in blood glucose measures from 30- to 60-minutes ( $132.9 \pm 17.1$  vs  $80.9 \pm 19.5$  mg/dL;  $p = 000000000018$ ), returning to basal measures ( $81.8 \pm 8.9$  vs  $80.9 \pm 19.5$  mg/dL;  $p = 0.83$ ). The results of the correlation analyses yielded a significance between levels of BPS and triglycerides (TG) ( $r = 0.49$ ) and correspondingly TG/HDL ( $r = 0.50$ ). Correlation analyses also yielded a significance between body fat % and the glucose uptake measures in the "Exercise" ( $r = -0.51$ ) and "Rest" ( $r = -0.52$ ) protocols. There were no correlations between levels of BPA or any of the parameters assessed. **CONCLUSION:** The hypotheses that BPA would correlate with glucose uptake, lipid profile, BMI and percentage of fat were rejected. BPS was correlated with increased levels of triglycerides (TG) and the correspondingly the TG/HDL ratio, potentially lending support that BPS promotes obesogenic effects via a different pathway than BPA. This study produced strong evidence of a positive exercise effect on a hyperglycemic state as well as demonstrating that body fat % plays an essential role in influencing health risk.

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## Racial Differences in ROS Production and SOD Activity Following Induced Inflammation

Sara E. Mascone, Katherine I. Kim, Steven J. Prior, and Sushant M. Ranadive. University of Maryland, College Park, MD.

Greater hypertension incidence in African Americans (AA) may be due to subclinical vascular dysfunction caused by inflammation and heightened levels of reactive oxygen species (ROS). At rest, AA and Caucasian Americans (CA) exhibit divergent inflammation, ROS production, and ROS clearance both *in vivo* and *in vitro*. However, racial differences in ROS production and clearance following induced inflammation are not fully elucidated. **PURPOSE:** To evaluate racial differences in ROS production and superoxide dismutase (SOD) activity, a major contributor to ROS clearance, in AA and CA human umbilical vein endothelial cells (HUVECs) following induced inflammation. **METHODS:** Following triplicate, parallel experiments with inflammation induced in eight HUVEC cell lines (n=4/group) using tumor necrosis factor-alpha (TNF- $\alpha$ , 50ng/ml), cell lysate samples from Control and TNF- $\alpha$  treatment were collected at 4 (4H) and 24 hours (24H) post-stimulus. Fluorescence detection was used to quantify ROS production and viable cells alive at 4H and 24H post-stimulus. Control and TNF- $\alpha$  cell lysate were subsequently assayed for SOD activity and protein concentration. **RESULTS:** TNF- $\alpha$  treatment significantly increased ROS production per living cell in all HUVECs at 24H compared with Control (CellROX/Hoechst ratio- 24H TNF- $\alpha$ :  $1.44 \pm 0.20$ , 24H Control:  $1.37 \pm 0.21$ ,  $p=0.004$ ). Notably, AA HUVECs did not exhibit a significant higher ROS production at 24H compared with 4H of TNF- $\alpha$  treatment (4H:  $1.23 \pm 0.20$ , 24H:  $1.40 \pm 0.25$ ,  $p=0.08$ ). However, CA HUVECs exhibited significantly greater ROS production at 24H compared with 4H of TNF- $\alpha$  treatment (4H:  $1.29 \pm 0.13$ , 24H:  $1.49 \pm 0.15$ ,  $p=0.003$ ). Further, AA HUVECs SOD Activity was similar between conditions and time points, yet CA HUVECs SOD Activity was significantly greater at 24H as compared to 4H in the Control condition with a similar trend in the TNF- $\alpha$  condition (SOD Activity (U/mg)- Control 4H:  $0.240 \pm 0.12$ , Control 24H:  $0.622 \pm 0.17$ ,  $p=0.003$ ; TNF- $\alpha$  4H:  $0.220 \pm 0.09$ , TNF- $\alpha$  24H:  $0.480 \pm 0.17$ ,  $p=0.07$ ). **CONCLUSION:** AA and CA exhibit divergent ROS production and SOD Activity following induced inflammation (*in vitro* model), suggesting higher ROS production in CA and a better ability to buffer ROS production in AA.

Funded by UMD Tier 1 Grant (UMD seed grant for Sushant Ranadive)



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Funded by UMD Tier 1 Grant (UMD seed grant for Sushant Ranadive)

## Effects of a Six-Week Walking Intervention on Cardiometabolic Risk Factors and Mental Well Being

Natalie R. Turbett, Shawn N. Munford, Chad A. Witmer, Emily J. Sauers, FACSM, East Stroudsburg University of Pennsylvania, East Stroudsburg, PA

Less than half of the U.S. adults meet exercise recommendations for cardiorespiratory exercise. Exercise has been shown to positively impact cardiometabolic risk factors (CRF) and mental well-being in adults. However, there is currently limited research on the impacts of a walking intervention on CRF and mental wellbeing. **PURPOSE:** The aim of this study was to investigate the effects of six-week moderate-intensity walking intervention on CRF and mental wellbeing. **METHODS:** 10 subjects ( $24.78 \pm 3.0$  yrs) participated in a six-week walking intervention, at individual moderate heart rate intensities, five times a week for 30 minutes. Three lab sessions were completed to test body mass (BM), Body Fat Percentage (BF%), Body Mass Index (BMI), Waist Circumference (WC), Hip Circumference (HC), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Resting Heart Rate (RHR), Total Cholesterol (TC), Triglycerides (TG), High Density Lipoprotein (HDL), Low-Density Lipoprotein (LDL), and Blood Glucose (BG). Additionally, the Generalized Anxiety Disorder (GAD), Perceived Stress Scale (PSS), Dresden Body Image Questionnaire (DBIQ), and General Self-Efficacy Scale (GSE) were used to assess mental wellbeing. Data is presented as mean $\pm$ SD. **RESULTS:** There were no significant changes in BM ( $-0.12 \pm 1.0$  kg,  $p=.83$ ), BF% ( $-0.46 \pm 3.5\%$ ,  $p=.98$ ), BMI ( $0.01 \pm 0.4$  kg/m<sup>2</sup>,  $p=.86$ ), WC ( $-3.66 \pm 4.5$  cm,  $p=.75$ ), and HC ( $-1.97 \pm 4.5$  cm,  $p=.75$ ) over the six weeks. There were no significant changes in SBP ( $-2.88 \pm 13.0$  mmHg,  $p=.99$ ), DBP ( $1.38 \pm 8.9$  mmHg,  $p=.53$ ), and RHR ( $4.75 \pm 10.2$  bpm,  $p=.51$ ) throughout the duration of the intervention. No significant changes were observed over the six weeks for TC ( $13.37 \pm 39.8$  mg/l,  $p=.71$ ), TG ( $-9.38 \pm 44.0$  mg/dl,  $p=.17$ ), HDL ( $1.13 \pm 16.9$  mg/dl,  $p=.99$ ), LDL ( $9.63 \pm 36.6$  mg/dl,  $p=.53$ ), and BG ( $-3.1 \pm 11.8$  mg/dL,  $p=.19$ ). There were no significant findings for GAD ( $-0.75 \pm 3.4$ ,  $p=.95$ ), PSS ( $-0.88 \pm 9.8$ ,  $p=.90$ ), DBIQ ( $15.5 \pm 23.5$ ,  $p=.49$ ), and GSE ( $0.50 \pm 2.6$ ,  $p=.94$ ). **CONCLUSION:** None of the measured variables significantly impacted CRF or mental wellbeing. However, these results should not undermine the positive benefits found in other studies regarding the benefits of low-moderate intensity exercise on CRF and mental wellbeing.

Supported by Faculty Development and Research Mini Grant at East Stroudsburg University #000532



## Relationship between self-efficacy and physical activity in individuals with and without chronic hip pain

Millissia A. Murro, Kate N. Jochimsen. West Virginia University, Morgantown, WV

Chronic hip pain affects 18.2 million adults annually. Individuals with chronic hip pain partake in less physical activity than individuals without, despite evidence that physical activity reduces chronic musculoskeletal pain. Physical activity self-efficacy has not been measured in patients with chronic hip pain, though it may provide valuable insight into effective treatment modalities. Interventions like goal setting, improve low self-efficacy and may be an effective addition to treatments to help increase physical activity levels. **PURPOSE:** To examine the relationship between physical activity [moderate to vigorous physical activity (MVPA) and step count] and physical activity self-efficacy and whether differences exist between individuals with chronic hip pain (HIP) and those without (NON). **METHODS:** 13 individuals with chronic hip pain (2M/11F; 40.2 ± 16.9 years; 27.2 ± 6.9 kg/m<sup>2</sup>), and 15 individuals without (5M/10F; 24.3 ± 8.3 years; 23.8 ± 6.2 kg/m<sup>2</sup>) participated in this study. Following informed consent, participants completed a demographics survey and the Self-Efficacy for Physical Activity Scale. An accelerometer (60Hz) was worn over their symptomatic (HIP) or dominant (NON) hip for seven continuous days, except to shower and sleep. The middle five days of wear time were evaluated. After Shapiro-Wilk test for normality, Pearson product-moment correlations were used to examine the relationship between physical activity and self-efficacy, and Mann-Whitney U or independent T-tests were used to compare physical activity and self-efficacy between groups. Statistical significance was set at p<.05. **RESULTS:** Groups did not differ in terms of age, sex, BMI, or self-efficacy (p>.10). Total MVPA and self-efficacy were related (r=.381, p=.04). The HIP group had lower total MVPA (HIP: 28.9 ± 16.0 min/hr; NON: 48.9 ± 24.7 min/hr; p=.02) and lower peak MVPA (HIP: 53.4 ± 29.3 min/hr; NON: 85.9 ± 36.2 min/hr; p=.01) than the NON group. **CONCLUSION:** Individuals with chronic hip pain have lower measures of physical activity than those without hip pain. Regardless of hip pain status total, MVPA was related to physical activity self-efficacy.

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## **Carotid Artery Stiffness decreases in Older Women Following 6-Month Aerobic Exercise Intervention**

Cynthia M. Weiner, Sara E. Mascone, Lauren E. Eagan, Emily F. Blake, Daniel D. Callow, Gabriel S. Pena, Junyeon Won, Yash Kommula, Naomi A. Arnold-Nedimala, J. Carson Smith, Sushant M. Ranadive. University of Maryland, College Park, MD

Aging causes functional and structural arterial changes in both sexes. However, aerobic exercise shows beneficial effects on arterial function and structure in older men, whereas older women show limited to no effect on arterial function after aerobic exercise. Currently, little is known about effects of longer aerobic exercise intervention on arterial structure as well as function in older women. **PURPOSE:** To elucidate the effect of a 6-month moderate intensity aerobic exercise intervention on arterial structure and function in older women. **METHODS:** Carotid artery beta-stiffness and compliance (arterial structure) as well as flow-mediated dilation (%FMD) of brachial artery (arterial function) were measured in eleven older women ( $75 \pm 9$  y) at baseline and after a 6-month moderate exercise (3-4x/week) intervention. Furthermore, central arterial stiffness was assessed by carotid-femoral pulse wave velocity (PWV). **RESULTS:** There were no significant differences pre and post intervention in %FMD ( $2.93 \pm 2.03$  vs.  $3.49 \pm 2.77$ ,  $p=0.49$ ), PWV ( $9.36 \pm 1.14$  vs.  $9.12$ ,  $p=0.09$ ,  $n=9$ ), and arterial compliance ( $0.48 \pm 0.18$  vs.  $0.58 \pm 0.24$ ,  $p=0.07$ ). A significant decrease in beta stiffness ( $13.85 \pm 5.1$  vs.  $11.27 \pm 5.70$ ,  $p=0.03$ ) was seen compared to baseline. **CONCLUSION:** Moderate intensity aerobic exercise intervention improves the carotid artery stiffness in older women despite a lack of improvement in overall arterial responsiveness to increased flow.

Funding – NIH R01AG0557552 (Smith)



## **Bioelectrical Impedance Analysis: Insight into Subclinical Atherosclerosis**

Sydney E. Brackett, Tiago V. Barreira, Jacob P. DeBlois, Joon Young Kim, Kevin S. Heffernan. Syracuse University, Syracuse, NY, USA

Visceral fat may hasten the atherosclerotic process manifesting as increases in aortic stiffness, which is highly correlated with cardiovascular disease (CVD) risk. Standard tools to measure visceral fat, such as Magnetic Resonance Imaging and Dual-Energy X-Ray Absorptiometry, are expensive and not accessible to all patients, clinicians, and researchers in resource-constrained environments. Visceral fat can also be estimated with bioelectrical impedance analysis (BIA), which is cost-effective and applicable to large-scale observational studies. Whether the visceral fat index from BIA is associated with subclinical CVD risk is unknown. **PURPOSE:** To examine the association of BIA-measured visceral fat index with subclinical CVD risk. **METHODS:** Aortic stiffness was used as a measure of subclinical CVD risk and measured as carotid-femoral pulse wave velocity (cfPWV) in 71 adults (49 females, mean age  $21 \pm 3$  years; body mass index [BMI] of  $25 \pm 3$  kg/m<sup>2</sup>). A BIA scale was used to assess visceral fat index by measuring impedance at different frequencies (eg 5 kHz and 200 kHz) and then applying predictive equations. Systemic body fat was assessed using air-displacement plethysmography. The association between BIA visceral fat index and cfPWV were compared using blockwise linear regression. Covariates included age, sex, race/ethnicity, mean arterial pressure, body fat percentage, and BMI. **RESULTS:** BIA visceral fat index was significantly associated with cfPWV ( $r = 0.51$ ,  $p = 0.001$ ). Associations remained after fully adjusting for aforementioned covariates (standardized Beta = 0.72,  $p = 0.006$ ). Aforementioned covariates explained 23.5% of the variance in cfPWV (sig. F change = 0.001) with BIA visceral fat index explaining an additional 8% of the variance in cfPWV (sig. F change = 0.006). Results were similar in a model that replaced air displacement plethysmography body fat percentage with BIA body fat percentage (standardized Beta = 0.81,  $p = 0.008$ , R-squared change = 0.07). **CONCLUSION:** BIA visceral fat index was associated with aortic stiffness independent of several confounders including BMI and other measures of systemic body fat. Visceral fat index from BIA may be a safe and cost-effective means to provide insight into subclinical CVD risk.

Supported by NIH Grant 1R03MD011306-01A1

## **Establishing Inter-Day Reliability of Neuromuscular Coordination of the Lower Extremity During a Drop-Jump Landing**

Kerry N. Callaghan, Abigail L. Daly-Smith, Bailey T. Capra, David A. Phillips. Montclair State University, Montclair, NJ

Prior studies have indicated that females have increased quadriceps activation compared to males, which may contribute to the increased rate of anterior cruciate ligament (ACL) injuries in females. Research examining muscle activation timing with a focus on the timing of initial peak activation is limited.

**PURPOSE:** To determine the minimum number of trials necessary to establish a stable mean for initial peak activation, the reliability of time to initial peak muscle activation across days, the standard error of measure (SEM), the smallest detectable difference (SDD), and compare the algorithm identifying initial peak to manual visual inspection. **METHODS:** Nine healthy adults with no history of lower extremity injury were recruited. Participants completed 10 drop jumps onto two force plates during two data collection sessions. Muscle activation was tracked using five electrodes on the gluteus maximus, gluteus medius, biceps femoris (BF), vastus medialis (VM), and gastrocnemius. Intraclass correlation coefficient (ICC) was used to determine reliability of time to initial peak muscle activation between both sessions. The sequential estimation method was used to establish a stable mean. **RESULTS:** 175 trials were viable. To ensure a stable mean is established 97.5% of the time, it was determined nine trials are necessary. Data were good and moderately reliable for time to initial peak for the vastus medialis and biceps femoris with  $ICC(3,1) = 0.79$  and  $ICC(3,1) = 0.68$  respectively. The algorithm agreed with visual inspection for VM (96%) and BF (97.7%) of the time respectively. The SEM and SDD were 9.8 ms and 27.3 ms for VM, and 11.5 ms and 32.0 ms for BF. **CONCLUSIONS:** These findings suggest muscle activation timing during a drop jump landing is good to moderately reliable across two data collection sessions.



## Hydration Does Not Influence Corticospinal Excitability

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Euhydration is essential for the maintenance of central nervous system function and human performance. Transcranial magnetic stimulation (TMS), a non-invasive brain stimulation technique, can be used to assess corticospinal excitability and subtle changes in motor system input-output properties. While it is known that hydration influences motor performance, little is known about the affect of hydration on corticospinal excitability. **PURPOSE:** To determine if hydration status influences corticospinal excitability. **METHODS:** On four distinct visits (D1-D4), hydration was assessed in 16 participants (3W, age:  $26.3 \pm 5.4$ yr; height:  $173.5 \pm 10.2$ ; body mass:  $73.1 \pm 13.7$ kg) based on refractometry urine specific gravity (USG; range: 1.001-1.029 USG). Corticospinal excitability was determined based on active motor thresholds (AMT) during sustained isometric abdominal flexion (RA) or knee extension (VL) at 15% maximum voluntary isometric contraction force. AMT's were determined with the parameter estimation by sequential testing technique. Each visit ranked by hydration status, with the corresponding AMT's for the RA and VL across visits. **RESULTS:** Hydration status varied among visits (Day1:  $1.008 \pm 0.006$ , Day2:  $1.011 \pm 0.007$ , Day3:  $1.016 \pm 0.007$ , Day4:  $1.019 \pm 0.007$ ,  $F_{1,7,25,8} = 43.9$ ,  $p < 0.001$ ), yet AMT's in the RA (Day1:  $59.8 \pm 7.5$ , Day2:  $58.9 \pm 8.6$ , Day3:  $59.8 \pm 8.7$ , Day4:  $59.8 \pm 8.8$ ,  $F_{3,45} = 0.8$ ,  $p = 0.50$ ) and VL (Day1:  $57.9 \pm 8.6$ , Day2:  $57.2 \pm 9.0$ , Day3:  $57.3 \pm 8.7$ , Day4:  $57.1 \pm 9.4$ ,  $F_{3,45} = 0.5$ ,  $p < 0.70$ ) did not differ across visits. **CONCLUSION:** As determined by urine specific gravity, hydration status (within a normal range) does not appear to influence corticospinal excitability. Future studies should explore a wider range of hydration levels, including dehydrated states.

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**Thrive: Impact of a Mind, Body, Soul Program on Anxiety Symptoms and Quality of Life**

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Research supports a link between exercise and physical, mental, and spiritual health. Supporting holistic wellness is an important emphasis for individuals and within healthcare systems. Various studies with individuals with Generalized Anxiety Disorder (GAD) have suggested improvements in anxiety symptoms and quality of life from involvement in mindfulness and physical exercise. **PURPOSE:** The six-session Thrive program was designed to help students and employees at Messiah University improve quality of life and decrease symptoms of anxiety through physical exercise, mindfulness practices, and spiritual disciplines. **METHODS:** In this mixed methods study, program effectiveness was evaluated with adherence rates, pre and post-program completion of the Burns Anxiety Inventory, written session feedback, and a focus group at conclusion of the class. Data was triangulated from the various evaluation sources. **RESULTS:** The study included 21 participants with an overall adherence rate of 81%. The Burns Anxiety Inventory pre-program ( $M = 28.0$ ,  $SD = 16.1$ ) and post-program assessment ( $M = 18.6$ ,  $SD = 12.7$ ) indicated decreased anxiety symptoms among participants ( $p < 0.001$ ). Thematic analysis from the focus group and session feedback forms showed that participants benefitted and learned from Thrive, identified ways that Thrive could be improved for the future, and experienced positive effects on personal anxiety and quality of life. **CONCLUSION:** As a mind, body, and soul program, Thrive was a feasible option for students and employees, who reported decreased symptoms of anxiety after completion.



## **The Impact of VO<sub>2</sub> and Cardiovascular Drift on Submaximal Exercise utilizing ACSM's Cycle Metabolic Equation**

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Clinical exercise physiologists frequently utilize the American College of Sports Medicine's (ACSM) metabolic equations to prescribe exercise intensity for clinical (e.g. cardiac, pulmonary, etc.) populations. Oxygen uptake (VO<sub>2</sub>) drift and cardiovascular drift have been demonstrated to be significant across fitness levels as exercise duration increases. **PURPOSE:** The purpose of the present study was to evaluate the impact of VO<sub>2</sub> drift and cardiovascular drift on sustained, submaximal exercise workloads based on VO<sub>2</sub> as predicted by ACSM's cycle equation.

**METHODS:** The study consisted of 10 male and female subjects ages 23–58 who participated in sustained, submaximal cycle exercise for 20 min at an intensity equivalent to 60% of predicted VO<sub>2MAX</sub>. Heart rate (HR) and VO<sub>2</sub> were monitored and recorded during the exercise sessions.

**RESULTS:** Mean measured VO<sub>2</sub> at min 5 was  $19.8 \pm 1.2$  mL · kg · min<sup>-1</sup>, and mean measured VO<sub>2</sub> at min 20 was  $20.6 \pm 1.3$  mL · kg · min<sup>-1</sup>. Mean predicted VO<sub>2</sub> at min 20 was  $21.8 \pm 1.1$  mL · kg · min<sup>-1</sup>. There was a statistically significant difference between measured VO<sub>2</sub> at min 5 and measured VO<sub>2</sub> at min 20 ( $p < 0.001$ ). There was a statistically significant difference between measured VO<sub>2</sub> at min 20 and predicted VO<sub>2</sub> at min 20 ( $p = 0.004$ ) with predicted VO<sub>2</sub> lower compared to measured VO<sub>2</sub>. Mean measured HR at min 5 was  $138 \pm 4$  bpm and mean measured HR at min 20 was  $149 \pm 4$  bpm with a statistically significant difference ( $p < 0.001$ ).

**CONCLUSION:** Although oxygen drift was demonstrated for the subjects in the current study, the mean measured VO<sub>2</sub> at min 20 was lower than the predicted VO<sub>2</sub> at min 20. The ACSM prediction equation for cycle ergometry may still be an appropriate tool for use in the clinical population; however, HR and oxygen drift should be regularly monitored during exercise in this population.

## **Time-Site differences in Cancer Survivors Ratings of Distress due to COVID-19 and Exercise Clinics Closure**

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**PURPOSE:** To determine differences and 6-month changes in Cancer survivor reported levels of distress relating to COVID-19 pandemic and closure of Cancer Exercise Rehabilitation Clinics at three sites: Pacific Island site (S 1, n=50), Urban (S 2, n=102) and Rural (S3, n=14).

**METHODS:** Cancer Survivors (n=166; 89% female, 87% white, 46% Breast Cancer) who participated in structured exercise prior to the pandemic completed a modified NCCN Distress Thermometer in March 2020 (T1) and September 2020 (T2). COVID-19 and Exercise Clinic Concern categories were added to existing categories. Distress Ratings, identification of Problem Concerns, changes and correlations were determined. **RESULTS:** Sites S2 (4.38) S3 (4.77) met mean clinical distress levels ( $\geq 4$ ) while S1 did not (3.64). All ratings decreased slightly T1 (N=50) to T2 (N=115) with no significant site or time differences. Emotional (46%) and Exercise Clinic Closure (48%) were most frequently identified Problem Concerns. 2 X 2 ANOVA identified Site (F=3.086 P=.048, df=2) and Time (F=7.521 P=.007, df=1) differences in Physical Concerns, with Post-Hoc Tukey HSD differences in sites 1 vs 2, and 1 vs 3. Site differences (F=6.987 P=.001, df=2) in Exercise Concerns were noted with Post-Hoc Tukey HSD (2 vs 3) . Time (F=9.044 P=.003 df=1,) differences in COVID-19 Concerns with no Post-hoc differences. A trend in Family Concerns (F =2.267, P=.107, df=2) noted Post-Hoc differences sites 1 vs 2. Multiple Significant Site, Time correlations were noted with Distress. Exercise Concerns had no time, site Distress Correlations while COVID-19 Concerns had 2 site and 2-time correlations. Emotional Category Correlations occurred at all sites, most times and with all other categories. **CONCLUSION:** Overall Rural (S3) survivors had higher ratings of distress (4.77) identified more concerns (avg 34%) vs Urban S2 (4.38; 26%) and Pacific Islanders S1 (22%) who also had the lowest distress rating (3.64), and warrants more investigation. Multi-factorial Contributions to Clinical levels of distress was confirmed with Emotional Concerns the primary contributor. Exercise Concern lack of Distress correlation suggests it contributes less to distress than expected. However, Emotion-Exercise associations suggests Exercise does contribute to well-being.



## Little Variability in Active Motor Thresholds of Trunk and Leg Muscles Across Days

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Transcranial magnetic stimulation (TMS) is a non-invasive technique that is used to assess the functional properties of the corticospinal system. TMS assessments often target the intrinsic hand muscles because of their large corticomotor representations and low motor thresholds. Given their roles in activities of daily living and susceptibility to various neurological disorders, there is growing interest in the assessment of postural and lower extremity corticospinal circuits. Nevertheless, less is known about the reliability, consistency, and variability of corticospinal excitability estimates from axial and lower extremity muscles. **PURPOSE:** To determine the reliability, consistency, and variability of active motor thresholds (AMT) in the rectus abdominis (RA) and vastus lateralis (VL). **METHODS:** 25 right-handed and -footed participants (8W, age:  $26.5 \pm 5.5$ yr, height:  $174.2 \pm 9.2$ cm, weight:  $72.7 \pm 13.0$ kg) completed AMT testing for the RA and VL on four visits separated by  $9.2 \pm 8.4$ d. Biphasic single pulse TMS was delivered with a 96mm curved coil and individualized structural neuronavigation. Hotspots for each muscle were determined as the scalp location that consistently produced the largest peak-to-peak motor evoked potential (MEP) from 15-65ms post-stimulus. Next, participants performed isometric contractions of the RA or VL at 15% of maximum voluntary isometric contraction force. During contractions, TMS was delivered to the respective hotspot at 0.1-0.2Hz and the AMT was determined with parameter estimation by sequential testing. For each muscle, AMT consistency and reliability were determined based on intraclass correlation coefficient (ICC), coefficient of variation (CV), and standard error of measurement (SEM) across days. Absolute agreement was evaluated via Bland-Altman plots. **RESULTS:** For the RA and VL, consistency and reliability were excellent (RA: ICC=1.0 CV=4%, SEM=1.3%, AMT range=37-73; VL: ICC=1.0, CV=3%, SEM=1.1%, AMT range=36-75). Absolute disagreement across days was less than one percent for either muscle (RA: mean bias=0.83%; VL: mean bias=0.19%). **CONCLUSION:** Trunk and leg muscle AMTs are consistent and reliable across four days; future studies can explore corticospinal excitability in these muscles.

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## Effects of Repetitive Transcranial Magnetic Stimulation on Mood When Targeting Motor-Related Brain Regions

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Repetitive transcranial magnetic stimulation (rTMS) is often used as a therapeutic modality to treat psychiatric and neurological disorders by modulating cortical activity. Through functional connections to subcortical areas, stimulation of the primary motor cortex (M1) can modulate the perception of pain. Recent work also confirms that M1 is active during emotional processing, but it is not clear if the modulation of activity in M1 can alter mood. **PURPOSE:** To determine whether acute intermittent theta burst stimulation (iTBS) or continuous theta burst stimulation (cTBS) of M1 influences mood. **METHODS:** 21 participants (8W age:  $25.8 \pm 5.4$  yr, height:  $172.5 \pm 8.3$  cm, weight:  $70.8 \pm 13.0$  kg) were randomly assigned to an iTBS (N=11) or cTBS (N=10) intervention. During three counterbalanced visits, each group received 600 pulses of rTMS at an intensity equal to 80% of active motor threshold over the supplementary motor area (SMA), M1 leg, or M1 trunk representation. Targeting accuracy and precision was confirmed with individual structural neuronavigation. Total mood disturbance (TMD) and six subdomains of mood (vigor, tension, fatigue, anger, confusion, depression) were assessed before and after rTMS using the Profile of Mood States short form (POMS). TMD and each subdomain were compared before and after rTMS, between target locations, and among stimulation protocols using a mixed model ANOVA. **RESULTS:** No changes in TMD were detected from pre to post rTMS ( $F_{1,19}=0.4$ ,  $p=0.5$ ) independent of protocol ( $F_{1,19}=2.8$ ,  $p=0.1$ ) or target location ( $F_{2,38}=0.6$ ,  $p=0.5$ ; mean diff iTBS SMA:  $-1.1 \pm 2.3$ , Leg:  $0.5 \pm 2.2$ , Trunk:  $-0.2 \pm 2.2$ ; cTBS SMA:  $0 \pm 4.6$ , Leg:  $1.7 \pm 4.0$ , Trunk:  $0.6 \pm 4.0$ ). Similarly, no subdomain differed over time between targets or protocols (all  $p > 0.05$ ). **CONCLUSION:** Our results suggest that when applied to the corticomotor system, a single session of subthreshold patterned rTMS does exert acute modulatory effects on affective state. Future studies may explore the effects of repeated rTMS visits as well as other stimulation parameters such as intensity and duration.

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## **Racial Disparities in Cardiac Rehabilitation Attendance After Percutaneous Coronary Intervention**

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Cardiac rehabilitation (CR) is a program designed to improve a patient's cardiovascular health through exercise, nutrition and education. Although there are many benefits to CR, it is an underutilized service. Furthermore, there has been evidence of racial disparities in referrals to and enrollment in CR programs. This leads to a significantly lower rate of initiation and participation in CR in minority patients.

**PURPOSE** The current study aims to compare demographic data of those patients who are referred to CR after a percutaneous coronary intervention (PCI) at a local hospital from 1/1/2017-1/31/2021 with the demographic data of those patients who engaged in at least one session of CR within the same timeframe.

**METHODS** Data regarding gender, age, race, medical insurance, cardiac diagnosis and CR attendance were provided by the hospital. The information obtained was limited to patients referred to CR after a percutaneous coronary intervention (PCI) procedure between January 1, 2017-January 31, 2021. A Chi-square test of independence was used to determine any associations of characteristics between participants and non-participants of CR. Participants were grouped into white (W) vs non-white (NW), males vs females, attended vs not attended, referred vs not referred, types of insurance (none, one type, more than one type), and pre-COVID (1/1/2017-2/29/2020) vs post-COVID (3/1/2020 – 1/31/2021).

**RESULTS** There was no effect of race on those referred to CR. Of those that attended CR, race was found to be a significant factor with W comprising 91.9% of those attending vs. 8.1% of NW ( $p < 0.001$ ). Those who possessed either 1 (49.5%) or more (50.3%) types of insurance were significantly more likely to attend than those who had no insurance (0.02%) ( $p < 0.001$ ). Also, W participants were more likely to have more than one type of insurance (49.2%) compared to NW participants (38.8%) ( $p = 0.003$ ). There was more CR attendance pre-COVID (55.9%) compared to post-COVID attendance (48.0%;  $p = 0.025$ ). There was no effect of gender on attendance ( $p = 0.379$ ). **CONCLUSION** More whites than non-whites attend CR after a PCI at this particular hospital, which may, in part, be due to differences in insurance.

## **Resistance and Endurance Training Improve Exercise Enjoyment and Happiness in Young Adults**

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An abundant number of studies have investigated the relationship between exercise and levels of anxiety, stress, enjoyment, and happiness. **PURPOSE:** This study compared the anxiety, stress, enjoyment, and happiness levels of young adults that engage in three forms of regular exercise: aerobic training, resistance training, and yoga training. **METHODS:** Participants (N = 110, 25% male, 75% female,  $M_{age} = 21.6$ ,  $SD = 2.1$ ) answered a 12-item survey that prompted them to report on preferred type of exercise, and levels of stress, anxiety, happiness, and overall enjoyment associated with their exercise. **RESULTS:** Only 3 of the participants reported engaging in Yoga therefore the following results are reflective of resistance and endurance training. Most of the participants selected resistance training as their preferred type of exercise (64%). Descriptive analysis indicated that 44% of the participants that preferred resistance training enjoyed it 'a great deal.' Only 20% of preferred endurance participants enjoyed their exercise 'a great deal.' About 81% of resistance participants felt increased happiness after a workout, while 60% of endurance participants felt increased happiness after their workouts. Around 31% of resistance participants experienced feelings of stress and anxiety 'often.' About 87% of this group reported being less anxious and stressed after completing a resistance workout. Similarly, 35% of endurance participants felt stress and anxiety 'often,' while 85% of this group felt less anxious and stressed after endurance training. Exercise enjoyment and happiness were significantly associated with preferred types of exercise ( $p = .047$ ;  $p = .03$ ). Stress and anxiety levels were not significantly associated with preferred types of exercise ( $p = .321$ ;  $p = .471$ ). **CONCLUSION:** In young adults, endurance training and particularly resistance training improve exercise enjoyment and overall happiness after exercise completion.



## Effects of Acute Aerobic and Resistance Exercise on Neuroplasticity- A Pilot Study

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Neuroplasticity takes place when acquiring new skills, after damage to the nervous system, and as a result of sensory deprivation. It can also take place due to exercise. Few studies exist that look at the effects of anaerobic/resistance training and its effects on neuroplasticity in humans, as the majority of existing research delves into how resistance training can help at the subcortical and spinal level of the body, not in the brain. **PURPOSE:** The aim of this study was to determine whether resistance training is as effective as aerobic training at improving neuroplasticity. **METHODS:** Five competitive weightlifters (3 females, 2 males, age  $34 \pm 9$  yrs) were recruited to complete a control (20 minutes of quiet sitting), aerobic (5 minute warm up followed by 15 minutes of cycling at 60% age predicted heart rate max), and resistance protocol (10 minute warm up followed by 10 minutes of resistance intervals) on three separate occasions. Participants completed the Trail Making Test (TMT) before and immediately after the cessation of each 20-minute protocol separated by multiple days. **RESULTS:** A repeated measures ANOVA for part A revealed a significant effect of time ( $p=0.004$ ) and condition ( $p=0.004$ ), but there was not a statistically significant interaction between timepoint and condition ( $PRE_{Control}$ :  $19.3 \pm 1.0s$ ,  $PRE_{Aerobic}$ :  $17.3 \pm 1.4s$ ,  $PRE_{Resistance}$ :  $16.2 \pm 1.5s$  versus  $POST_{Control}$ :  $17.7 \pm 1.0s$ ,  $POST_{Aerobic}$ :  $15.2 \pm 1.4s$ ,  $POST_{Resistance}$ :  $12.9 \pm 2.8s$ ,  $p=0.429$ ). A separate ANOVA revealed a significant effect of time ( $p=0.033$ ) but not condition ( $p=0.054$ ) for part B, but there was not a statistically significant interaction between timepoint and condition ( $PRE_{Control}$ :  $43.4 \pm 2.9s$ ,  $PRE_{Aerobic}$ :  $39.6 \pm 1.7s$ ,  $PRE_{Resistance}$ :  $36.5 \pm 3.4s$  versus  $POST_{Control}$ :  $34.7 \pm 2.2s$ ,  $POST_{Aerobic}$ :  $34.2 \pm 3.6s$ ,  $POST_{Resistance}$ :  $28.6 \pm 3.4s$ ,  $p=0.164$ ). The percent change from pre to post test was not different between conditions for TMT part A or part B (A: Control,  $-7.5 \pm 6.6\%$ , Aerobic,  $-11.8 \pm 1.9\%$ , Resistance,  $-20.3 \pm 2.3\%$ ,  $p=0.141$ . B: Control,  $-7.9 \pm 3.5\%$ , Aerobic,  $-3.3 \pm 6.4\%$ , Resistance,  $-16.8 \pm 1.9\%$ ,  $p=0.055$ ). **CONCLUSION:** Our results suggest that resistance exercise may be as beneficial as aerobic exercise for enhancing neuroplasticity.

## **Repetitive Brain Stimulation Does Not Influence Perceived Exertion During Maximal Cycle Ergometer Protocol**

John W. Stauffer, Felix S. Proessl, Maria C. Canino, James M. Baker, Juliana R. Hougland, Deanna R. Huck, Ryan J. Campbell, Christopher Connaboy, Bradley C. Nindl, FACSM, and Shawn D. Flanagan. University of Pittsburgh, Pittsburgh, PA.

Repetitive transcranial magnetic stimulation (rTMS) is a non-invasive brain stimulation technique that has been used to improve exercise performance by modulating activity in homotopic areas of the primary motor cortex (M1). However, the optimal stimulation parameters and targets have yet to be determined. Additionally, objective measures of physical exertion are consistent with subjective measures (e.g., perceived exertion) but it is unknown if rTMS can influence perceived exertion when applied to M1.

**PURPOSE:** To examine the effects of two rTMS protocols and three stimulation targets on perceived exertion after maximal anaerobic lower extremity exercise. **METHODS:** On three separate visits, 22 participants (6W, age:  $26.3 \pm 5.3$  yr, wt:  $80.4 \pm 35.2$  kg, ht:  $173.3 \pm 9.3$  cm) were randomized to receive continuous theta burst stimulation (N=10) or intermittent theta burst stimulation (N=12) over the SMA, M1 trunk (M1<sub>RA</sub>) or leg (M1<sub>LEG</sub>). Following 600 pulses of TBS at 80% of motor threshold, participants performed two 30s maximal sprints on a cycle ergometer while pedaling against 7.5% of their body weight with two min of rest between sprints. Participants were provided with a 2min warmup, followed by a 15s standardized lead-in at 125W and 100RPM. Perceived exertion was assessed immediately after each sprint using the Borg Ratings of Perceived Exertion scale (RPE). Mean Difference (MD) RPE were compared among targets and stimulation protocols using a mixed-model ANOVA. **RESULTS:** RPE increased from sprint one to two (S1 RPE average=  $16.4 \pm 0.4$ , S2 RPE Average=  $18.1 \pm 0.3$ , Grand Average=  $17.3 \pm 0.35$ , MD:  $1.7 \pm 0.3$ ,  $F_{1,20} = 49.3$ ,  $p < 0.01$ ,  $\eta^2 p = 0.71$ ). However, RPE did not differ between stimulation protocols (MD:  $0.1 \pm 0.7$   $F=0.6$ ;  $p=0.5$ ) nor stimulation target (MD: M1<sub>RA</sub> to M1<sub>LEG</sub>:  $0.2 \pm 0.2$ ;  $p > 0.05$ , M1<sub>RA</sub> to SMA:  $0.4 \pm 0.2$ ;  $p=0.6$ , M1<sub>LEG</sub> to SMA:  $0.4 \pm 0.2$ ;  $p=0.6$ ,  $F=1.4$ ;  $p=0.3$ ). **CONCLUSION:** Neither protocol nor target altered perceptual responses to this fatiguing exercise protocol. As expected, perceived exertion increased from the first to second Wingate in response to physical fatigue. Future studies should examine other cognitive brain and exercise program variables to determine if rTMS can be used to modulate perceptual responses to exercise.

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## Attitudes Surrounding Group vs. Individual Cycling During COVID-19

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Group exercise settings can offer a team-like environment that can enhance social bonding as well as increase perceived physical ability and perhaps higher enjoyment of the activity. Due to the COVID-19 pandemic, individuals who engage in group exercise were suddenly unable to attend their conventional exercise classes. To combat the isolation of the pandemic, a local spin studio allowed its members to rent a spin bike and follow along to rides broadcasted and recorded by instructors. Although the at home spin routine would be similar to the workouts performed in the studio, the attitudes of participants could vary greatly as the group atmosphere would be missing from the at home experience. **PURPOSE:** The purpose of this exploratory study was to survey members' remote cycling experiences during the COVID-19 pandemic. **METHODS:** Seventeen adult cyclists (16 females, 1 male,  $M_{age} = 37.1 \pm 12.0$  yrs) responded to a survey including 5 Likert scale (scored 1-5, 1= not true at all, 5= very true) and 6 open ended questions. Mean and standard deviation were calculated for each of the Likert scale questions. Qualitative response questions were analyzed by means of thematic content analyses to determine dominant themes in participants' replies. **RESULTS:** The results revealed that participants were less motivated, less engaged, and felt less confident while spinning remotely from home ( $1.63 \pm 0.89$  for "I feel more motivated to spin at home as opposed to spinning in the studio",  $1.27 \pm 0.46$  for "I feel more engaged when I spin at home as opposed to spinning in the studio", and  $1.71 \pm 1.14$  for "I feel better about my ability to cycle when I spin at home as opposed to spinning in the studio". Members also reported missing the community component the most (N=14), but some members did enjoy the flexibility in the schedule (N=6). **CONCLUSION:** Cyclists favored cycling in the group exercise studio as opposed to cycling individually at home. This may be due to the community environment and resultant increased motivation inherent to group exercise settings.

## Hydration is More Important than Exogenous Carbohydrate Intake during Push-to-the-Finish Cycling in the Heat

Craig W. Berry, S. Tony Wolf, Rachel M. Cottle, W. Larry Kenney. The Pennsylvania State University, University Park, PA

Dehydration  $\geq 2\%$  loss of body mass is associated with reductions in performance capacity and carbohydrate-electrolyte solutions are often recommended to prevent dehydration and provide a source of exogenous carbohydrate during competitive exercise. It is also well established that performance capacity in the heat is diminished compared to cooler conditions, a response primarily attributable to greater cardiovascular strain caused by high skin and core temperatures. **PURPOSE:** Because hydration status, environmental conditions, and carbohydrate availability interact to influence performance capacity, we sought to determine how these factors affect push-to-the-finish cycling performance. **METHODS:** Ten trained cyclists (6 men, 4 women; aged 21-38 yrs) exercised at a moderate intensity ( $2.5 \text{ W}\cdot\text{kg}^{-1}$ ) in a hot-dry condition ( $40^\circ\text{C}$ , 20% RH) until they lost 2% body mass. Subjects then consumed either no fluid (NF) or enough fluid (water, WAT; Gatorade®, GAT; or GoodSport™, GS) to replace 75% of their body mass deficit over 30 min. After a 30-min light-intensity warm-up ( $1.5 \text{ W}\cdot\text{kg}^{-1}$ ) in a  $35^\circ\text{C}$ , 20% RH environment, subjects then completed a 120-kJ time trial (TT). A subset of four subjects returned to the laboratory to repeat the WAT, GAT, and GS treatments to determine if between-beverage differences in time-trial performance were evident with a longer TT in thermoneutral conditions ( $21^\circ\text{C}$  and 20% RH; 250-kJ TT). **RESULTS:** In the heat trials, TT time-to-completion was significantly improved with consumption of WAT ( $535 \pm 214 \text{ sec}$ ), GAT ( $539 \pm 226 \text{ sec}$ ), and GS ( $534 \pm 238 \text{ sec}$ ) compared to NF ( $631 \pm 310 \text{ sec}$ ; all  $p < 0.01$ ) with no differences among fluid types. In the longer TT in thermoneutral conditions, all four subjects improved TT performance in the GS ( $919 \pm 353 \text{ sec}$ ) trial compared to WAT ( $960 \pm 376 \text{ sec}$ ) and three subjects improved TT performance in the GAT ( $946 \pm 365 \text{ sec}$ ) trial compared to WAT. **CONCLUSION:** These findings suggest that hydration is more important than carbohydrate availability during a sprint-to-the-finish cycle exercise in the heat, while carbohydrate availability becomes more important during this type of task in cooler conditions.

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## Sex-Differences in Counter Movement Jump Kinetics and Kinematics Following 10-week Marine Officer Candidates School

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The Counter Movement Jump (CMJ) is a field expedient test to evaluate kinetics and kinematics relating to readiness, and injury risk. There is a greater incidence of injuries in women during military training and understanding key measures within the CMJ between sexes may be useful in determining injury/performance differences. **PURPOSE:** To evaluate sex differences in kinetics and kinematics during the loading phase of the CMJ in Marine Officer Candidates (MOC) pre and post Officer Candidates School (OCS). **METHODS:** 375 MOCs (women n=72, 25±3 y, 65.9±7.1 kg, 164.9±5.7 cm; men n=303, 25±3 y, 81.3±9.4 kg, 177.5±6.9 cm) performed three maximal CMJs, 15 second rest between CMJs, on Hawk Dynamics force plate (FP) and DARI marker less motion capture (mMoCap) pre and post 10-weeks of OCS, a rigorous graded physical, leadership and academic training pipeline for incoming Marine Officers. Three CMJs were averaged to one jump, and right and left limbs were averaged for mMoCAP. Separate 2-way mixed measures ANOVAs (Time\*Sex) were conducted on each CMJ dependent variable 1) FP: avg. propulsive force (APF), avg. braking force (ABF), jump height (JH) 2) mMoCap: loading hip flexion (LHF), loading knee flexion (LKF), loading ankle flexion (LAF). **RESULTS:** There was a significant interaction effect on JH ( $p < .001$ ,  $\eta_p^2 = .04$ ) and APF ( $p < .001$ ,  $\eta_p^2 = .07$ ). Simple main effects of time showed that JH declined differently between women (.29±.05 to .28±.04 m,  $p < .001$ ,  $\eta_p^2 = .16$ ) and men (.40±.06 to .37±.06 m,  $p < .001$ ,  $\eta_p^2 = .04$ ), and APF improved in women (1053±144 to 1063±140 N,  $p = .242$ ,  $\eta_p^2 = .02$ ) but declined in men (1404±201 to 1361±177 N,  $p < .001$ ,  $\eta_p^2 = .22$ ). ABF displayed a significant decline over time ( $p < .001$ ,  $\eta_p^2 = .04$ ) and men performed better than women ( $p < .001$ ,  $\eta_p^2 = .25$ ). There were no significant interactions or main effect of sex for mMoCap, but LHF ( $p < .001$ ,  $\eta_p^2 = .12$ ), LKF ( $p < .001$ ,  $\eta_p^2 = .12$ ) and LAF ( $p < .001$ ,  $\eta_p^2 = .03$ ) decreased significantly over time. **CONCLUSION:** Kinematics decreased for men and women, while kinetics were less consistent from this trend in women. Although stiffer CMJ loading flexions in all joints, JH and ABF declined for both men and women, women slightly gained propulsive force, thus contributing to efficiencies in the CMJ protected and improved after OCS for women.

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## **Brachial Artery Low-Flow-Mediated Constriction (L-FMC) is Augmented in Older Women**

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Endothelial dysfunction is a key component of vascular aging and increases the risk for cardiovascular disease (CVD). Women experience significant attenuations in vascular function as they age, which is exacerbated following menopause. Vasoconstrictor responses to low-flow conditions such as forearm ischemia may provide novel insights into vascular function that complement the vasodilatory responses assessed via flow-mediated dilation (FMD). However, little is known about the effects of aging on vasoconstrictor reactivity during an ischemic stimulus and the relationship between constrictor/dilator reserve, especially in women. **PURPOSE:** To compare vasoconstrictive responses to forearm ischemia between young and older women in addition to the traditional FMD. **METHODS:** Vascular responses to 5-min forearm ischemia were assessed in a convenience sample of 18 young ( $22 \pm 3$  y) and 18 older women ( $69 \pm 6$  y) via brachial artery low-flow-mediated constriction (%L-FMC), defined as  $[(\text{nadir diameter during last 30 s of occlusion} - \text{baseline diameter})/\text{baseline diameter}] * 100$ , %FMD, defined as  $[(\text{peak post-occlusion diameter} - \text{baseline diameter})/\text{baseline diameter}] * 100$ , and total vasoreactivity via modified FMD (%mFMD), defined as  $[(\text{peak post-occlusion diameter} - \text{nadir diameter during last 30 s of occlusion})/\text{nadir diameter during last 30 s of occlusion}] * 100$ . **RESULTS:** Older women had significantly augmented %L-FMC ( $-2.97\% \pm 3.01$  vs.  $-0.76\% \pm 1.29$ ,  $p = 0.0072$ ) as compared to young women. %FMD and %mFMD were significantly higher in young women ( $9.32\% \pm 3.37$  vs.  $3.34\% \pm 3.20$ ,  $p = <0.0001$  and  $10.18\% \pm 3.63$  vs.  $6.41\% \pm 4.30$ ,  $p = 0.0075$ , respectively) as compared to older women. **CONCLUSION:** Older women experience increased vasoconstrictor responses to low-flow conditions as compared to young women, which may further contribute to age-related attenuations in vasodilatory response.

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## Effect of ketogenic diet on exercise efficiency and metabolic regulation during exercise in adults

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A ketogenic diet (KD) has suggested to enhance metabolic health in individuals with obesity, metabolic syndrome, and diabetes. However, it is unknown if short-term KD is beneficial for exercise efficiency and metabolic adjustment during exercise. **PURPOSE:** To examine the effects of 3 days of KD on exercise efficiency and hormonal response during and after the graded exercise testing (GXT). **METHODS:** Fourteen adults (age 26.3±3.1 [SD] years; BMI 23.6±4.2 kg/m<sup>2</sup>) completed 3 days of mixed diet (MD; 15% fat, 25% protein, 60% carbohydrate) followed by 3 days of wash-out period and another 3 days of KD (75% fat, 20% protein, and 5% carbohydrate). After 3 days of each diet arm, GXT on treadmill was performed with: low- (LIE; 40% of VO<sub>2</sub>max), moderate- (MIE; 55%), and high-intensity exercise (HIE; 70%). Exercise efficiency was calculated as power output (kcal/min) / exercise energy expenditure (EEE; kcal/min) (Amati, *J Appl Physiol*, 2008). Repeated measures ANOVA with Bonferroni's post-hoc tests was used to examine changes in outcome measures over the GXT by each diet arm, with significance set at p<0.05. **RESULTS:** All participants complied with MD and KD regimens. Weight loss (2.2±0.6 kg, p<0.01) with no reduction in total body fat mass was observed after KD. Fat oxidation at recovery period was higher in KD vs. MD (1.1±0.2 vs. 0.6±0.3 kcal/min, p<0.01). In response to the same workload during HIE, KD vs. MD showed higher EEE (10.2±2.7 vs. 9.1±3.0 kcal/min, p<0.01), leading 11% lower exercise efficiency (18.4±0.7 vs. 20.7±0.3 %, p<0.01). After KD, free fatty acid (FFA) was higher at MIE and recovery vs. resting (1221.0±95.1, 1606.7±93.8 vs. 682.7±40.6 mg/dL, respectively, p<0.01), and beta-hydroxybutyrate (BOHB) was lower at HIE vs. resting (252.2±47.5 vs. 546.6±114.1 mg/dL, p<0.01). Cortisol level after KD was higher in recovery vs. resting (17.0±9.0 vs. 13.7±8.4 ug/dL, p=0.02), with no significant changes during GXT after MD. **CONCLUSION:** Our data suggest that short-term KD is favorable to fat metabolism leading increased circulation of FFA and BOHB during LIE to MIE. However, it is notable that KD may cause (1) exercise inefficiency manifested by increased EEE and (2) elevated exercise stress during HIE and recovery period evidenced by high cortisol levels. Combined effects of KD + exercise on metabolic adaptation should be uncovered.

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## **Macrovascular Function Assessed by Flow-Mediated Dilatation Does Not Change Across Menstrual Cycle Regardless of Race**

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Extending the debate on whether vascular function in premenopausal women is influenced by fluctuations in sex hormone concentrations across the natural menstrual cycle is the consideration of an effect of race. To the best of our knowledge, no previous study assessing macrovascular function across the menstrual cycle has reported the racial characteristics of their participants despite increasing evidence of racial differences in vascular function and potentially sex hormone concentrations. **PURPOSE:** To assess macrovascular function across the menstrual cycle in a racially diverse group of young, normotensive, non-obese, naturally cycling women using brachial artery flow-mediated dilatation (FMD). **METHODS:** Participants self-identified as either white (WHW), black (BLW), or Hispanic (HW). FMD was performed during three menstrual phases: early follicular (EF; first 1-5 days of menstruation), ovulation (OV; determined by an at-home ovulation test, 1-3 days surrounding the luteinizing hormone surge), and mid-luteal (ML; 7-to-10 days post ovulation, depending on cycle length). Arterial diameter and blood velocity were assessed using Doppler ultrasound. A one-way repeated measures ANOVA was used to compare participant characteristics between racial groups. A two-way repeated measures ANOVA was used to compare FMD between racial groups across menstrual phases. Data are presented as mean  $\pm$  standard deviation. **RESULTS:** The present study included 19 WHW (25 $\pm$ 5 years), 12 BLW (24 $\pm$ 5 years), and 8 HW (23 $\pm$ 4 years). Groups had similar cycle lengths (WHW 30 $\pm$ 2; BLW 30 $\pm$ 4; HW 31 $\pm$ 5 days) and testing was conducted on similar days during each phase (data not shown, all  $p > 0.05$ ). Baseline brachial artery diameters were not different between races ( $p = 0.54$ ) or across phases ( $p = 0.39$ ). The vasodilatory response to FMD (FMD%) was not influenced by race ( $p = 0.67$ ) or phase ( $p = 0.68$ ) nor was there a significant interaction between race and phase ( $p = 0.41$ ) (WHW: EF 8.2 $\pm$ 1.7, OV 7.8 $\pm$ 2.8, ML 8.1 $\pm$ 1.9%; BLW: EF 6.8 $\pm$ 2.5, OV 6.9 $\pm$ 2.3, ML 8.6 $\pm$ 3.0%; HW: EF 8.0 $\pm$ 2.4, OV 8.1 $\pm$ 4.2, ML 7.5 $\pm$ 2.3%). **CONCLUSION:** These preliminary findings indicate that macrovascular function assessed by FMD% does not change across the menstrual cycle, regardless of race. These data also suggest FMD% is a stable measure of macrovascular function in premenopausal women.



## **Mental Health and Central and Peripheral 24-Hour Blood Pressure in Emergency Responders**

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**INTRODUCTION:** Police officers, firefighters, emergency medical technicians, and military service members, collectively referred to as “emergency responders” (ER), have high rates of hypertension. Furthermore, ER have a higher prevalence of anxiety, depression, and post-traumatic stress disorder (PTSD) compared with the general public. These mental health disorders impact blood pressure (BP) and might contribute to the pervasiveness of hypertension in ER. Assessment of 24-hour BP correlates more closely with cardiovascular outcomes than traditional office BP. Moreover, some BP monitors now allow for estimation of central aortic BP, which may offer additional insight into cardiovascular disease risk beyond traditional peripheral brachial BP. **PURPOSE:** Compare mental health and 24-hour central and peripheral BP in ER with an age- and sex-matched non-ER control group. **METHODS:** 20 ER ( $n=2$  women; age,  $34\pm 8$  yrs, body mass index,  $26.1\pm 3.8$   $\text{kg}\cdot\text{m}^{-2}$ ) and 18 non-ER ( $n=2$  women; age,  $32\pm 6$  yrs; body mass index,  $24.7\pm 4.5$   $\text{kg}\cdot\text{m}^{-2}$ ) wore a BP monitor for 24 hours with measures obtained every 20 min from 0700-2200h and every 30 min from 2200-0700h. Concomitantly, participants completed questionnaires to assess symptomology of anxiety, depression, and PTSD. Nine days of accelerometry provided measures of moderate-to-vigorous physical activity (MVPA), and sleep and wake times which were used to calculate nocturnal BP dipping and the morning BP surge. **RESULTS:** Anxiety symptomology was similar between ER and non-ER ( $6\pm 6$  vs  $3\pm 3$ ,  $p=0.09$ ), but ER had greater depressive ( $14\pm 9$  vs  $8\pm 6$ ,  $p=0.02$ ) and PTSD symptomology ( $2\pm 2$  vs  $0\pm 1$ ,  $p=0.001$ ). MVPA did not differ between ER and non-ER ( $265\pm 143$  vs  $240\pm 143$   $\text{min}\cdot\text{wk}^{-1}$ ,  $p=0.62$ ). There was no difference in 24-hour central ( $112\pm 6 / 79\pm 7$  vs  $108\pm 8 / 76\pm 6$  mmHg,  $p\geq 0.16$ ) or peripheral BP ( $122\pm 6 / 78\pm 7$  vs  $119\pm 9 / 75\pm 6$  mmHg,  $p\geq 0.17$ ) in ER and non-ER, respectively. Central and peripheral BP dipping ( $p\geq 0.29$ ) and the morning BP surge ( $p\geq 0.25$ ) were also similar between groups. **CONCLUSIONS:** This group of young ER did not exhibit elevated central or peripheral BP profiles despite a greater prevalence of mental health disorder symptomology. These results may differ in an older group of ER and during occupational duties. Further investigation of 24-hour BP is warranted in this occupational group.

## **Nitric Oxide-mediated Microvascular Function is not Altered in Healthy Adults Following SARS-CoV-2 Infection.**

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Cardiovascular complications are part of the clinical sequela following SARS-CoV-2 infection. Vascular dysfunction, one of the earliest indicators of cardiovascular disease (CVD), has been reported in adults who have recovered from COVID-19. To date, no studies have investigated the underlying mechanisms of persistent COVID-19-associated vascular dysfunction. Additionally, physical activity (PA) status has not been accounted for when examining vascular function in COVID-19 recovered (CR) adults.

**PURPOSE:** to quantify nitric oxide (NO)-mediated vasodilation in healthy adults who have recovered from SARS-CoV-2 infection. Using the skin as a model circulation, we hypothesized that CR adults would have impaired NO-mediated vasodilation compared to adults who have not had COVID-19, and greater PA will be associated with enhanced microvascular function in CR. **METHODS:** We performed a cross-sectional study including: 9 (4M/5W, 24 ± 4yrs) healthy control (HC) unvaccinated for COVID-19 adults, 9 (4M/5W, 26 ± 6yrs) healthy vaccinated (HV) adults, and 8 (3M/5W, 23 ± 3yrs) CR (13 ± 5wks) adults. COVID-19 symptoms severity (survey) and PA (accelerometer) for 7 days prior to the experimental visit were assessed. A standardized 39°C local heating protocol was used to assess NO-dependent vasodilation, confirmed by the perfusion (intradermal microdialysis) of 15 mM NG-nitro-L-arginine methyl ester during the plateau of the heating response. Red blood cell flux was measured (laser-Doppler flowmetry) and cutaneous vascular conductance (CVC = flux/mmHg) was expressed as a percentage of max (28mM sodium nitroprusside + 43°C). **RESULTS:** The local heating plateau (HC: 57 ± 24%, HV: 60 ± 20%, CR: 64 ± 20%, p=0.89) and NO-dependent vasodilation (HC: 47 ± 16%, HV: 43 ± 16%, CR: 42 ± 14%, p=0.80) were not different among groups. Neither symptom severity (26 ± 15 AU) nor time since diagnosis correlated with the NO-dependent vasodilation ( $R^2=0.1$ , p=0.59 and  $R^2=0.7$ , p=0.54, respectively). PA was not different among groups (HC: 28 ± 5%, HV: 27 ± 2%, CR: 27 ± 11%, p=0.42). PA did not correlate with the NO-dependent vasodilation in CR ( $R^2=0.6$ , p=0.08).

**CONCLUSION:** Healthy adults who have had COVID-19 do not have altered NO-mediated microvascular function. Additionally, PA is not related to microvascular function in CR adults.

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## The Influence of Sleep Duration on Cerebrovascular Reactivity

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The impaired ability of the cerebrovasculature to dilate in response to a vasoactive stimulus (i.e., cerebrovascular reactivity, CVR) is associated with increased risk of cognitive impairment. In otherwise healthy adults, poor sleep quality, including sleep deprivation impairs peripheral vascular function, but its effect on CVR has largely been unexplored. Aberrant CVR has been reported in various populations with poor sleep quality such as obstructive sleep apnea; however, the impact of sleep quality on CVR in generally healthy adults without sleep apnea is unknown. **PURPOSE:** To assess the relation between subjective sleep quality and CVR in healthy adults. Because the relation between sleep duration and physiologic function is an inverted U-shape, we hypothesized that CVR would be lower in adults who slept longer than or shorter than the recommended 7-8 hours of sleep. **METHODS:** Data from thirty-five adults across the lifespan (21 males / 14 females, age:  $44 \pm 17$  years; BMI:  $26.8 \pm 4.8$  kg/m<sup>2</sup>; blood pressure, BP:  $114 \pm 12$  /  $71 \pm 10$  mmHg; heart rate, HR:  $62 \pm 8$  bpm) were included in this analysis. CVR was assessed by measuring the change in middle cerebral artery blood flow velocity (MCAv) at baseline and following a 3-minute hypercapnic stimulus (+9 mmHg increase in the end-tidal partial pressure of CO<sub>2</sub>) using transcranial Doppler ultrasound. MCAv was normalized to beat-to-beat BP (MCA<sub>CVC</sub>), and CVR was calculated as the percentage change in MCA<sub>CVC</sub> and normalized to the absolute change in end-tidal CO<sub>2</sub>. **RESULTS:** Sleep duration was negatively associated with lower CVR (R= -0.41, P=0.014). A correlation matrix was performed to determine if any variables other than sleep duration (e.g., age, sex, etc) might also impact CVR. Age (P=0.53), BMI (P=0.93), systolic BP (P=0.22), diastolic BP (P=0.84), HR (P=0.071), and mean arterial pressure (P=0.57) were not associated with CVR. Only sex was significantly associated with CVR (P=0.036); and did not influence the association between CVR and sleep duration (model adjusted for sex: R= -0.42, P=0.013). **CONCLUSION:** Longer sleep duration was independently associated with lower CVR in healthy adults. Future studies should include more individuals with shorter sleep duration to test the possibility of an inverted U-shaped association with CVR.

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## **A Qualitative Analysis of Student-Athletes' Experiences During COVID-19: "It's hard to feel like an athlete"**

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The COVID-19 pandemic has impacted the behavioral health of student-athletes on several fronts. Key elements of the student-athlete experience such as social connectedness and competitive sporting events have been altered or eliminated. While the impact of the pandemic on behavioral health has been reported within the general population, less is known about the lived experience of high-level athletes.

**PURPOSE:** We sought to use qualitative methodologies to explore the impact of COVID-19 on student-athlete identity. **METHODS:** An online survey was sent to 884 Division 1 athletes. A free response question asked participants to "tell the story of their COVID-19 experience" including the impact on their sense of self-identity as a student-athlete. Qualitative responses were analyzed in NVIVO software by inductive coding, following a grounded theory approach with iteration and constant comparison.

Responses were dual coded in sets of 10, with reconciliation and iteration of the codebook until thematic saturation was reached. **RESULTS:** 47 participants provided a free-response answer (5% response rate). Qualitative analysis revealed 5 primary domains pertaining to the impact of COVID-19 on athletes' experiences: 1) Behavioral, 2) Emotional, 3) Cognitive, 4) Social, and 5) Identity. 29 underlying themes including Motivation, Disorientation, Isolation, Frustration, Impact on Mental Health, Motivation, Perspective, Identity Loss, and Identity Conflict were identified. The most prevalent themes included the behavioral and emotional impacts of the pandemic on athletes' sense of self. **CONCLUSION:** COVID-19 had a significant impact on student-athlete identity. In this cohort of Division 1 collegiate athletes, their experiences and narratives revealed common domains that could be used to help student-athletes cope with uncertainties related to the pandemic and return to high level performance.

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## Association of Muscular Strength with Pulse Pressure and Aortic Calcification in Older Adults

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Age is a well-known risk factor for the development of atherosclerotic cardiovascular disease (CVD). Pulse pressure (PP) and abdominal aortic calcification (AAC) increase with advancing age and are markers of subclinical atherosclerotic CVD. Muscular strength is an important measure of overall physical fitness and functional status that is associated with lower CVD risk. Older women tend to have lower levels of muscular strength and increased CVD mortality than men, but the relationship between muscular strength and CVD risk in older women is still unclear. **PURPOSE:** To examine the sex-specific association of muscular strength with PP and AAC in a nationally representative sample of older men and women. **METHODS:** Data from the 2013-2014 National Health and Nutrition Examination Survey (NHANES) – nationally representative data of the civilian, noninstitutionalized US population – were assessed in 942 older men and women (women: n=511) ages 68.4±0.2 years. PP was calculated as the difference between mean systolic and mean diastolic blood pressure measured manually via stethoscope and mercury sphygmomanometer. AAC was derived from DXA thoraco-lumbar spine images (L1-L4) and scored AAC relative to each vertebral height for the anterior and posterior aortic walls. Handgrip strength was assessed using a dynamometer and recorded as the maximal reading summed from each hand in kilograms. Sample weighted linear regression models analyzed the association between PP and AAC with handgrip strength, and were stratified by sex and adjusted for body mass index, smoking, high cholesterol/use of lipid medication, diabetes/use of diabetes medication, hypertension/use of anti-hypertensive medication, family history of myocardial infarction, and self-reported physical activity. **RESULTS:** Multivariable linear regression models showed 1) an inverse association between handgrip strength and extent of AAC in men ( $\beta=-0.05$ ,  $p<0.02$ ) and women ( $\beta=-0.06$ ,  $p<0.04$ ); and 2) an inverse association between handgrip strength and PP in men ( $\beta=-0.16$ ,  $p<0.02$ ) and women ( $\beta=-0.33$ ,  $p<0.007$ ). **CONCLUSION:** Higher muscular strength was associated with lower PP and AAC in older men and women. These findings provide novel insight into the cardio-protective role of greater muscular strength with lower atherosclerotic CVD risk in older adults.

## Forced Marching with Load Decreases Tibiofemoral Joint Space Compared to Running

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Knee osteoarthritis (OA) is prevalent among military servicemembers and has been linked to occupational load carriage. Lower extremity injury risk is two times higher in female recruits. Effects of load and ambulation strategy (walk vs. run) on knee kinematics are known, however effects on arthrokinematics during high-velocity walking (force march) is unknown. Analyzing knee biomechanics during a loaded march is essential to understand potentially injurious motion and OA progression. **PUPOSE:** To identify effects of load carriage magnitude and ambulation strategy on knee arthrokinematics in recruit-aged women. **METHODS:** 12 recruit-aged women (age:  $24.5 \pm 2.4$  years) ran and force marched on a treadmill while carrying no load (bodyweight [BW]) and while loaded with +25%BW and +45%BW (average:  $14.3 \pm 2.0$  kg,  $25.6 \pm 3.5$  kg). Synchronized biplane radiographs of the right knee were collected (150 images/s, 1s). Computed tomography scans were segmented to construct subject-specific femur and tibia models. Joint coordinate systems were created and a validated model-based tracking system determined in vivo bone motion (accuracy:  $0.9^\circ$ , 0.7mm). Six degree-of-freedom knee arthrokinematics were calculated. Two-way repeated measures analysis of variance examined effects of load (BW, +25%BW, +45%BW) during each movement (run [RN], force march [FM]) on kinematics, joint space, and contact center location (CCL) at four time points (foot strike (0%), 10%, 20%, 30% stance,  $\alpha=0.05$ ). **RESULTS:** Treadmill velocity was  $2.0 \pm 0.2$  m/s. Knees were  $7.5^\circ$  more extended and  $0.6^\circ$  more abducted during FM vs. RN at 10-30% (all  $p \leq 0.004$ ) and  $2.4^\circ$  more internally rotated (IR) with +45%BW at 20-30% (all  $p < 0.033$ ). IR decreased  $1.8^\circ$  during FM vs. RN at 20-30% (all  $p < 0.048$ ). Anterior translation increased 0.6mm with +25%BW ( $p=0.045$ ) at 0%. Medial translation increased 0.2mm at 20% ( $p=0.039$ ). Joint space decreased 1mm at 0% during FM vs. RN (Med/Lat:  $p=0.001$ ). Medial CCL was more medial during FM vs. RN at 10-30% (all  $p < 0.030$ ). CCL was more anterior during FM vs. RN at 10-30% (Med: all  $p < 0.001$ ; Lat: all  $p \leq 0.002$ ). **CONCLUSION:** Loaded forced marching affects knee arthrokinematics in recruit-aged women. Prolonged load carriage could increase risk of degenerative injury in this population.

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## **The Impact of High Intensity Interval Training on Neurogenesis and Angiogenesis in the Dentate Gyrus**

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Exercise is associated with improved neuronal health and longevity, synaptic plasticity, cerebral blood volume, overall brain volume, and neurogenesis which collectively may have the power to forestall neurodegenerative disease. **PURPOSE:** This study aims to explore the impact of high intensity interval training on individuals with mild cognitive impairment using a range of cognitive, physiological, and biomechanical measures. Specifically, this study seeks to assess the impact of high intensity interval training on neurogenesis and angiogenesis in the dentate gyrus of individuals with mild cognitive impairment versus healthy age-matched controls, as assessed by urinalysis of BDNF levels, performance on the Rey Auditory Verbal Learning Test, and postural sway as measured by observing sway variability using force plates. **METHODS:** The indices of neurogenesis and angiogenesis were assessed using the surrogate measures of maximal oxygen uptake ( $VO_{2max}$ ), cognitive function as assessed by the Rey auditory verbal learning test (RAVLT), urinalysis of brain-derived neurotrophic factor (BDNF), and medio-lateral sway jerk taken just prior to and just after a six-week training protocol. Fourteen adult males were randomized into either high intensity interval training group (HIIT) or a control group and were compared over the course of a six-week supervised training study. **RESULTS:** Significant post-protocol changes were observed among experimental (e) versus control (c) group participants in  $VO_2$  ( $e=3.16$ ,  $c=-1.16$ ;  $p=0.008$ ), cognitive function as assessed by the RAVLT ( $e=2.29$ ,  $c=.14$ ,  $p<.001$ ) and postural control ( $e=-.35$ ,  $c=6.5$ ;  $p<.001$ ). Findings reflect a positive association between increased  $VO_2$  and increased cognitive function ( $r=0.61$   $p=0.02$ ), and negative associations between postural control and cognitive function ( $r=-.785$ ,  $p=.001$ ), and between postural control and  $VO_2$  ( $r=-.58$ ,  $p=.031$ ). **CONCLUSION:** High intensity interval training up-regulates neurogenesis and angiogenesis in the dentate gyrus. Therefore, high intensity interval training protocols, like the one used in this study, could forestall the onset of symptoms of neurodegenerative diseases that target the dentate gyrus.

## The Effects of Elevated Sodium on Mitochondrial Function in Peripheral Blood Mononuclear Cells

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Sodium has been shown to accumulate in the interstitium as a result of high salt diets. Exposure of macrophages to excess interstitial sodium alters mitochondrial function and has been shown to contribute to alterations in inflammation. However, it is unclear if exposure to elevated sodium also alters circulating peripheral blood mononuclear cells (PBMC) mitochondrial function. **PURPOSE:** To test the hypothesis that PBMCs incubated in medium with elevated sodium have lower mitochondrial respiration than those incubated in isotonic medium. **METHODS:** PBMCs were separated from whole blood of six (5 men/1 women) healthy subjects (18-30 yrs.; blood pressure,  $\leq 130/80$ mmHg; BMI  $< 30$  kg/m<sup>2</sup>). PBMCs were then counted via trypan-blue staining and seeded at  $2 \times 10^5$  cells/well in 8-well Poly-D-lysine treated cell culture plates. Plated cells were incubated for 24-hr in RPMI 1640 medium with 10% FBS at 140 mM sodium (normal sodium, NS) or 180 mM sodium (high sodium, HS). Basal and maximal oxygen consumption rate (OCR) were assessed post-incubation by respirometry via Seahorse XFp analyzer (Agilent). Spare respiratory capacity (SRC) was calculated as the difference between maximal and basal OCR. Data were analyzed using two-tailed paired T-tests. **RESULTS:** Basal OCR was reduced in HS compared to NS ( $35.4 \pm 8.5$  vs.  $47.7 \pm 7.5$  pmol/min,  $p = 0.01$ ), as was maximal OCR ( $121.2 \pm 39.3$  vs.  $169.2 \pm 46.0$  pmol/min,  $p = 0.04$ ). SRC in HS was also reduced compared to NS ( $85.9 \pm 31.4$  vs.  $121.4 \pm 38.9$  pmol/min,  $p = 0.03$ ). **CONCLUSION:** Diminished basal and maximal OCR and SRC provide evidence for reduced mitochondrial function in PBMCs exposed to elevated sodium. These findings warrant further investigation into the specific cell types affected, and the potential systemic effects of sodium induced immune cell mitochondrial dysfunction.

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## Regulator of G Protein Signaling 14 Disruption Affects the Gut Microbiota and Metabolome in Mice

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The gut microbiota is linked to brown adipose tissue (BAT), but the mechanisms and microbes facilitating BAT production or function are unknown. A novel mouse model containing a gene knock-out of regulator of G protein signaling 14 (RGS14KO) has increased BAT. Our early studies found a unique microbiota in RGS14KO mice and BAT-specific metabolites. **PURPOSE:** To identify key gut microbial species and uncover BAT-specific metabolites in RGS14KO mice. Further, we aim to identify and associate metabolites produced in specific tissue samples with these key gut microbes. **METHODS:** Twenty-two mice (N=13 RGS14KO, N=9 Wild type (WT)) were used to identify predominant microbes and metabolites. Gut microbiota profiles were obtained by sequencing bacterial ribosomal operons. Metabolomics used UHPLC to evaluate positive and negative untargeted metabolites in fecal, cecal, brain, and BAT samples. Microbiome analysis used Kulczynski distance to compare WT to RGS14KO reads in two-dimensional non-metric multidimensional scaling (NMDS) plots. Two-tailed t-tests were used to compare WT and RGS14KO metabolite means ( $p < 0.05$ ). MetaboAnalyst 5.0 was used to identify significant metabolite pathways in tissue samples and generate pathway plots. **RESULTS:** Approximately 500k rRNA reads post QA/QC ((84% identify; >1000 bp alignment) were obtained from all samples by MegaBlast. NMDS plots showed significant bacterial community differences (Genus:  $p=0.035$ ; species:  $p=0.028$ ; strain:  $p=0.037$ ) between WT and RGS14KO mice. Specifically, RGS14KO mice housed two unique strains of *Akkermansia muciniphila* (*A. muciniphila* BIOML-A22 and *A. muciniphila* AN78) while WT animals contained *A. muciniphila* EB-AMDK-1. Untargeted metabolomics identified 82 significantly different ( $p < 0.05$ ) unique metabolites were between RGS14 KO and WT mice in one of the four samples. Specifically, RGS14KO animals had significantly higher levels of G6P, glycyl-l-proline, glycerophosphocholine, isoleucine, pipercolic acid, thymidine, UDP-D-glucose, malate, leucic acid, NADP<sup>+</sup>, and guanosine in BAT compared to WT animals. **CONCLUSION:** The gut microbiome differs between RGS14KO and WT mice from genus to strain level. Unique metabolites found in RGS14KO BAT may be linked to BAT function.

## **Corticospinal Excitability and the Size of Motor Cortex Representations Reflect Distinct Aspects of Corticomotor Function**

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Corticospinal excitability (CSE) and the size of motor cortex (M1) representations are often used as markers of use-dependent plasticity. Frequently used muscles present with greater CSE and enlarged M1 representations, but the direct interplay between motor map size and CSE and is unknown. **PURPOSE:** To examine the association between CSE and the size of M1<sub>HAND</sub>, M1<sub>LEG</sub> and M1<sub>TRUNK</sub> representations. **METHODS:** Sixteen healthy young adults (7 women, age: 26±5yrs, BMI: 23.0±2.5kg/m<sup>2</sup>) completed one experimental visit, in which transcranial magnetic stimulation was used to elicit motor-evoked potentials (MEP) in the active (15% maximum voluntary contraction) first dorsal interosseus (FDI), vastus lateralis (VL) and rectus abdominis (RA). CSE was determined based on the plateau (MEP<sub>MAX</sub>) and midpoint of the rising phase (V50) of stimulus-response-curves, which express MEPs as a function of stimulator output (range 5-100%). M1 size was quantified as motor map surface area (SA) based on the delivery of 120 biphasic pulses at 0.2-0.5Hz and 120% of active motor threshold at pseudorandom locations within a 6x6cm grid placed around each hotspot. MEPs at each stimulation location were fitted to neuronavigation-derived coordinates. CSE and SA were compared across muscles using a repeated measures ANOVA. Within-muscle relations between CSE and M1 SA were examined with Pearson correlations. **RESULTS:** CSE was highest in the FDI and similar between the VL and RA (MEP<sub>MAX</sub> FDI: 3.7±2.2mV, VL: 0.9±0.5mV, RA: 0.7±0.5mV,  $F_{2,45}=27.1$ ,  $p<0.01$ ; V50 FDI: 48.2±13.4%, VL: 65.7±10.6%, RA: 74.8±11.0%,  $F_{2,45}=21.2$   $p<0.01$ ). Correspondingly, SA was greatest in M1<sub>HAND</sub> but similar in M1<sub>LEG</sub> and M1<sub>TRUNK</sub> (SA FDI: 2.3±2.2cm<sup>2</sup>, VL: 1.1±0.7cm<sup>2</sup>, RA: 0.9±0.7cm<sup>2</sup>;  $F_{2,45}=4.3$ ,  $p=0.02$ ). Interestingly, within muscle, M1 CSE was not related to SA ( $r$  range: 0.07-0.17,  $p$  range: 0.54-0.79). **CONCLUSION:** CSE is greater in muscles with larger motor cortex representations but is not the result of such enlargement. Thus, CSE and M1 size appear to reflect shared but distinct aspects of corticomotor function.

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## Reduced Aortic Waveform Responses to Insulin in Late Chronotype with Metabolic Syndrome

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**PURPOSE:** Late chronotype (i.e. evening people) is linked to metabolic insulin resistance and cardiovascular disease. However, it is unknown if insulin reduces aortic waveforms and inflammation in late chronotype (LC) compared with early chronotype (EC; i.e. morning people). **METHODS:** Thirty-nine sedentary adults (54.9±1.1 y; VO<sub>2MAX</sub> 22.2±0.7 ml/kg/min) with metabolic syndrome (MetS) (3.5±0.1 ATP-III score) & obesity (DXA body fat: 45.2±0.9%) were classified as either LC (n=19 (16F)) or EC (n=20 (16F)) using the Morning-Eveningness Questionnaire (MEQ). A 120 min euglycemic hyperinsulinemic clamp (40mU/m<sup>2</sup>/min, 90 mg/dl) was performed to determine metabolic insulin sensitivity (glucose infusion rate (GIR)). Measurements were taken before & after the clamp to assess substrate oxidation, pulse waveform, and inflammation. Carbohydrate (CHO<sub>OX</sub>) & fat oxidation (F<sub>OX</sub>), with non-oxidative glucose disposal (NOGD) were measured by indirect calorimetry while aortic waveform and blood pressure were characterized via applanation tonometry including: augmentation index (AIx75); augmentation pressure (AP); central (CPP) and brachial (BPP) pulse pressure; mean arterial pressure (MAP); forward (Pf) & backward (Pb) pulse wave. **RESULTS:** Age, fat mass, and ATP III score were similar between LC (MEQ=45.5±1.3) & EC (MEQ=63.5±1.2). However, LC had higher FFM (*P*=0.04) and lower VO<sub>2MAX</sub> (*P*=0.05), GIR (*P*<0.01), and NOGD (*P*<0.01), as well as blunted suppression of F<sub>OX</sub> during insulin infusion (*P*=0.03). Although fasted aortic waveforms were comparable, LC had higher insulin-stimulated BPP (*P*<0.001) & AP (*P*<0.01). Additionally, LC had greater reductions in AP (*P*<0.01) & AIx75 (*P*=0.09), but attenuated responses in Pf (*P*<0.01) & MAP (*P*=0.08) with the clamp. Further, LC had elevated insulin-stimulated TNF-α (*P*=0.04) & blunted insulin-mediated reductions in VCAM (*P*<0.01) versus EC. VO<sub>2MAX</sub> correlated with insulin-mediated reductions in AIx75 (*r*=-0.56, *P*<0.01) & AP (*r*=-0.49, *P*<0.01) while NOGD correlated with insulin-mediated reductions in AP (*r*=-0.44, *P*= 0.03) & Pf (*r*=-0.43, *P*=0.04). Insulin-mediated changes in VCAM also correlated with reductions in MAP during the clamp (*r*=0.41, *P*=0.03). **CONCLUSIONS:** Late chronotype was characterized by blunted aortic waveform and inflammatory responses to insulin in people with MetS.

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## Interactive Effects of Physical Activity and 1HGC on Type 2 Diabetes Risk

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One-hour glucose concentration (1HGC) during an oral glucose tolerance test (OGTT) heralds biomarkers of type 2 diabetes (T2D) risk in adults. 1HGC of 155 mg/dL was identified as an optimal cutoff for predicting future T2D (Abdul-Ghani, *Diabetes Care*, 2007). Adults with 1HGC  $\geq 155$ mg/dL (above155) compared with 1HGC  $< 155$ mg/dL (below155) exhibited worse insulin sensitivity and  $\beta$ -cell dysfunction, attesting a high risk for T2D. Although physical activity (PA) is considered a first-line treatment/prevention of T2D in adults, it is unknown if PA can enhance the relationship between 1HGC and T2D pathophysiological risk factors. **PURPOSE:** To examine the interactive effects between PA and 1HGC on insulin sensitivity and  $\beta$ -cell function as measured by OGTT-derived indices. **METHODS:** A total of 455 Latino adults (age  $37.5 \pm 9.9$  [SD] years; 289F/166M; body mass index:  $30.2 \pm 5.8$  kg/m<sup>2</sup>) underwent a 2-hr OGTT (75g dextrose), and venous blood samples were obtained at -15, 0, 30, 60, 90, and 120 minutes for the measurement of glucose and insulin concentrations. Participants who completed a PA screener (to assess whether they engaged in regular PA; “yes”; n=251 vs. “no”; n=204) were divided into two groups based on 1HGC (above155 vs. below155). Matsuda index was calculated as  $10,000/\sqrt{(\text{fasting glucose} \times \text{fasting insulin}) \times (\text{mean OGTT glucose} \times \text{mean OGTT insulin})}$ , and insulinogenic index (IGI) as  $(\Delta \text{Ins}_{0-30})/(\Delta \text{Glu}_{0-30})$ . Two-way ANOVA was used to examine the effects of 1HGC (above155 vs. below155) and PA (yes vs. no) on Matsuda index and IGI, with significance set at  $p < 0.05$ . **RESULTS:** The below155 showed higher IGI than the above155 ( $1.6 \pm 1.2$  vs.  $1.0 \pm 0.8$ ,  $p < 0.01$ ), while there was no difference in IGI between the PA “yes” vs. “no” ( $1.3 \pm 1.0$  vs.  $1.3 \pm 1.1$ ,  $p = 0.3$ ). When 1HGC and PA were examined as interactive terms, PA significantly moderated the relationship between 1HGC and IGI (interaction  $p = 0.041$ ). The magnitude of decrease in IGI from below155 to above155 was greater in those with PA “no” (47%) vs. “yes” (21%) responders. No significant interactive effects on Matsuda index was observed. **CONCLUSION:** Our data suggest that PA can moderate the relationship between 1HGC and  $\beta$ -cell function, potentially reducing the T2D risk. Studies with objectively measured PA should be warranted to confirm whether those relationships can be enhanced by PA.

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## **Inverse Salt Sensitivity in Normotensive Adults: Role of Demographic Factors**

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Inverse salt sensitivity, a sodium induced reduction in blood pressure (BP), has recently been associated with increased incidence of hypertension. However, there is a paucity of data regarding the prevalence of inverse salt sensitivity (ISS). **PURPOSE:** The purpose of this retrospective analysis was to determine the prevalence of ISS in a cohort of normotensive adults and to determine if ISS is associated with any demographic characteristic(s). **METHODS:** Subjects included healthy, normotensive, and non-obese adults (n=111; age=37±13yr) who participated in a controlled feeding study, consuming a low-sodium (LS, 20 mmol Na/d) and high-sodium (HS, 300 mmol Na/d) diet for 7 days each in a randomized order; diet compliance was assessed with 24-hr urinary sodium excretion (LS=29.0±23.6 mmol/d, HS=240.5±92.0 mmol/d, p<0.0001). On the final day of each diet, 24-hr ambulatory BP was assessed. Subjects were grouped based on change in 24-hr mean arterial pressure (MAP) from the LS to HS diet. ISS was defined as a reduction in MAP >5mmHg, salt sensitive (SS) as an increase in MAP >5mmHg, and salt resistant (SR) as a change in MAP between -5 and 5mmHg. Group differences in sex, race, age, and BMI were evaluated using Chi Square or Fisher's exact tests. Group differences in mean age and BMI were assessed with a one-way ANOVA (mean±SD). **RESULTS:** Overall, 12.6% (n=14) were ISS, 72.1% (n=80) SR, and 15.3% (n=17) SS. Prevalence of ISS was not different with respect to sex (male [n=57]: 15.8% (9), female [n=54]: 9.3% (5), p=0.30), race (white [n=84]: 14.3% (12), black [n=16]: 6.3% (1), Asian [n=11]: 9.1% (1), p=0.88), or age (21-40 y.o. [n=64]: 15.6% (10), 41-60 y.o. [n=47]: 8.5% (4), p=0.26). However, prevalence of ISS tended to be higher in those with lower BMI (BMI < 25 [n=71]: 16.9% (12), BMI ≥ 25 [n=40]: 5.0% (2), p=0.07). There were no group differences with respect to mean age (ISS=34±13yr, SR=37±12yr, SS=41±14yr, p=0.29), but SS had a significantly higher BMI than ISS and SR (ISS=22.9±2.8 kg/m<sup>2</sup>, SR=24.3±2.6 kg/m<sup>2</sup>, SS=26.7±3.6 kg/m<sup>2</sup>, p=0.0009). **CONCLUSION:** In a normotensive cohort, we found that 12.6% of subjects were ISS. Furthermore, prevalence of ISS was not different with regards to sex, race, and age, but ISS may be associated with lower BMI. Future research is needed to further understand the ISS phenotype.

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## Relation between middle cerebral artery pulsatility index and hippocampal tissue integrity in healthy adults

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Increasing evidence suggests that peripheral vascular dysfunction, including stiffening of large elastic arteries, contributes to age-related cognitive decline. Transmission of highly pulsatile pressure waves from the peripheral vasculature to the low-resistance cerebrovasculature is hypothesized to promote structural damage to the brain. In this regard, changes to neuronal tissue microstructural integrity of the hippocampus (HC), a brain structure essential for memory encoding, may reflect the impact of increased pulsatile blood flow through the middle cerebral artery (MCA). **PURPOSE:** To examine whether increased pulsatile blood flow within the MCA, assessed using Gosling's pulsatility index (PI) is associated with HC tissue integrity in adults across the lifespan. **METHODS:** Transcranial doppler ultrasound was used to measure basal MCA blood flow velocity (MCAv) in 25 healthy participants (16M/9F, mean age: 44±16 y; age range: 22-69 y; mean BMI: 27±5 kg/m<sup>2</sup>; mean BP: 115±11/71±10 mmHg). PI was calculated as the difference between maximum MCAv and minimum MCAv (MCAv pulse amplitude) normalized to the mean MCAv. Tissue integrity was determined through the viscoelastic properties of the HC measured using magnetic resonance elastography (MRE). MRE data were acquired using a Siemens 3T Prisma MRI scanner to image shear waves generated via a pneumatic actuator (Resoundant, Rochester, MN) at 50 Hz. Bilateral HC stiffness ( $\mu$ ) was estimated from MRE displacement data using a nonlinear inversion algorithm. Associations between HC  $\mu$  and cerebrovascular parameters, including PI and MCAv (mean and pulse amplitude), were assessed using linear regression correcting for age. **RESULTS:** PI was negatively associated with HC  $\mu$  ( $R^2=0.31$ ,  $P=0.004$ ). There was no association between MCAv pulse amplitude and HC  $\mu$  ( $R^2=0.002$ ,  $P=0.84$ ), though there was a trend towards a positive association of HC  $\mu$  with mean MCAv ( $R^2=0.10$ ,  $P=0.10$ ). **CONCLUSION:** Greater pulsatility of cerebral blood flow is associated with lower HC tissue integrity, possibly reflecting damage to tissue that has to withstand pulsatile blood flow in the cerebrovasculature, which may result in late-life loss of cognitive function.

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## Slow Wave Activity Sleep is Significantly Associated with Decision-Making During Simulated Military Operational Stress

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Modern warfare exposes Service members (SMs) to volatile and complex environments. Adaptability in responding to these challenges and maintaining resiliency for sustained optimal cognitive and physical functionality is essential to operational readiness. Therefore, associations between neurocognitive measures, heart rate variability, physical fitness, and slow wave activity during sleep, may provide valuable information for operational success. **PURPOSE:** To determine if performance in a laboratory-based, militarily relevant decision-making assessment called the Soldier Performance and Effective, Adaptable Response (SPEAR) task is influenced by physiological, neurocognitive, sleep, and aerobic fitness batteries during simulated military operational stress. **METHODS:** Thirty-six male (n=30) and female (n=6) SMs (age: 26 ±5.3 years) participated in a 5 day/night protocol, including familiarization day (D0), baseline testing (D1), and two days of sleep and caloric restriction (D2 and D3), with D3 considered the peak stress period. Baseline testing included a treadmill VO<sub>2peak</sub> test. Neurocognitive test known as MATCH and the SPEAR task were performed on D1 and D3. Respiratory sinus arrhythmia (RSA) were acquired concurrently just prior to the SPEAR task. Sleep was monitored each night with baseline absolute slow wave activity (SWA) as the outcome of interest. Multiple linear regression was used to predict change in SPEAR performance from D1 to D3 using the following predictors: baseline RSA, baseline MATCH score, VO<sub>2peak</sub> test score, and SWA. **RESULTS:** On average, SPEAR score decreased -1.22 ± 8.64 from D1 to D3 with change scores demonstrating variability among SMs. Overall, the model predicted 27% of the variation in performance from D1 to D3,  $F(4,35)=2.88, p=.039, R^2=.271$ . Only SWA had a significant slope coefficient ( $p=.034$ ) such that higher baseline SWA, which may reflect greater sleep propensity, while all other independent variables are held constant, predicted decreased SPEAR performance from D1 to D3 ( $\beta = -15.94$ ). **CONCLUSION:** Only baseline SWA was a significant contributing factor to the predictive model, suggesting that higher SWA, in the context of physiological, neurocognitive, and aerobic fitness testing batteries, may influence change in military-specific adaptive decision making.

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## Generation of Myotropic Extracellular Vesicles for Targeted Delivery of Therapeutics to Skeletal Muscle

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Current treatment modalities for neuromuscular diseases are non-specific to the diseased muscle, reducing efficacy and causing off-target effects in patients. Thus, a muscle-targeted delivery system is needed to shuttle therapeutics to the diseased muscle cells to improve efficacy and limit off-target effects. **PURPOSE:** The purpose of this investigation is to establish the feasibility of engineering biological lipid nanoparticles, extracellular vesicles (EVs), with myotropic properties. **METHODS:** Human Embryonic Kidney (HEK) cells were transfected to over-express one or a combination of various myotropic protein candidates: MyoMaker (MYMK), MyoMixer (MYMX), or M-Cadherin (M-Cad), each containing a green fluorescent protein (GFP) tag for detection. EVs were isolated from each group following transfection. EVs from non-transfected HEK cells were used as controls. Nanoparticle tracking analysis (NTA) was used to measure concentration and size of the EVs. Flow cytometry was used to analyze the incorporation of the proteins into EVs following transfection by measuring the associated GFP signal. The myotropic properties of the EVs were assessed by fluorescently-labeling the EV protein cargo followed by incubation in the culture media of C2C12 myotubes. Delivery of protein cargo into myotubes was quantified using confocal microscopy followed by computational analysis. One-Way ANOVA with multiple comparisons was used to determine statistical significance. **RESULTS:** NTA revealed a ~40% decline in total EVs produced in the MYMK group relative to control ( $p = 0.0217$ ). No significant differences in size were detected between any groups ( $p = 0.1885$ ). Flow cytometric analysis demonstrated the greatest GFP signal in the MYMK-EVs relative to control ( $p = 0.0055$ ), indicating higher incorporation of MYMK into EVs than the other candidates. Imaging and analysis of myotubes following incubation with EVs from each group demonstrated MYMK-EVs deliver ~125% more fluorescently-labeled protein cargo than control ( $p = 0.0005$ ). No other group displayed a significant difference in delivery of protein into myotubes. **CONCLUSION:** MYMK-EVs display enhanced myotropism and have the potential to be used as a muscle-targeted delivery system for therapeutics in the treatment of neuromuscular pathologies.

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## Oxygen Consumption and Heart Rate Responses Between Different Sequences of a Vinyasa Yoga Practice

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Vinyasa yoga (VY) has been previously established to meet criteria of moderate-intensity physical activity. VY features several sequences that link poses together: integration, sun salutations, crescent lunge series, balancing, standing, back bending, and restorative. However, it is unclear whether the poses in a sequence during a VY practice produce different oxygen ( $\text{VO}_2$ ) consumption and heart rate (HR) responses. **PURPOSE:** To evaluate potential differences in  $\text{VO}_2$  and HR responses across sequences of a standardized 60-minute VY session. **METHODS:** Data were collected on 40 healthy adults with self-reported yoga experience (20 females; body mass index=24.6±3.2 kg/m<sup>2</sup>; age=30.9±8.8 y). The VY sequence implemented was based on the *Journey into Power Sequence* from Baron Baptiste.  $\text{VO}_2$  (ml/kg/min) was measured using portable indirect calorimetry (Oxycon Mobile). HR (bpm) was measured using a Polar heart rate monitor (Kempele, Finland). One-way repeated measures ANOVA were utilized to examine the differences in  $\text{VO}_2$  and HR among sequences. Post-hoc analyses (with Bonferroni correction) for multiple pairwise comparisons between each sequence. **RESULTS:**  $\text{VO}_2$  and HR differed significantly across different sequences of the VY session ( $\text{VO}_2$ :  $F(3.3,116.5) = 450.2$ ,  $p < 0.001$ ; HR:  $F(2.9,104.0) = 51.3$ ,  $p < 0.001$ ). Post-hoc analyses indicated that  $\text{VO}_2$  for the integration, sun salutations, crescent lunge series, balancing, standing, back bending, and restorative (7.5±1.5, 14.8±2.2, 15.5±2.5, 14.0±2.4, 12.5±2.2, 13.7±2.4, and 9.0±1.6 ml/kg/min, respectively) was significantly different from each other ( $p < 0.001$ ) except for balancing and back bending being similar. HR during the integration and restorative were similar (91±2 and 94±2 bpm, respectively) and significantly lower compared to sun salutation, crescent lunge series, balancing, standing and back bending (110±4, 119±4, 118±4, 115±3, 118±3 bpm, respectively). The highest  $\text{VO}_2$  and HR were in the crescent lunge series; the lowest  $\text{VO}_2$  and HR were during integration. **CONCLUSION:**  $\text{VO}_2$  and HR differ significantly across different sequences of a standardized 60-minute VY practice. This data could inform an individualized prescriptive yoga series based off current fitness levels to maintain or improve cardiorespiratory fitness and warrants further investigation.

## Perceived Muscle Soreness Does Not Modulate Corticospinal Excitability

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Soreness due to exercise-induced muscle damage temporarily impairs motor performance. Transcranial magnetic stimulation (TMS) is often used to assess subtle changes in corticospinal excitability (CSE) and motor system input-output properties and demonstrates sensitivity to chronic pain. Nevertheless, the acute effects of muscle soreness on TMS-based measures of corticospinal excitability require further investigation. **PURPOSE:** To examine the relationship between perceived muscle soreness and CSE of postural and lower-extremity muscles. **METHODS:** 12 healthy adults (3W, age: 27.2±5.4 yr, ht: 175.6±11.0 cm, wt: 72.6±13.4 kg) completed three visits with maximal anaerobic lower extremity exercise. At the start of each visit, participants confirmed they abstained from any physical activity 24hr prior, and rated their overall residual muscle soreness using a 100mm visual analog scale. Visits were ranked based on muscle soreness with the highest and lowest soreness visits retained for analysis. To assess CSE, electromyographic motor-evoked potentials (MEPs) were recorded from the right rectus abdominis (RA) and vastus lateralis (VL). Active motor thresholds (AMT) were determined for each muscle during 15% of maximal voluntary isometric force using a biphasic stimulator and 96mm curved double coil. To determine CSE, ten TMS pulses were applied to each M1 hotspot at 120% AMT with the resultant MEPs averaged based on peak-to-peak amplitude from 15-65ms post-stimulus. Paired-samples t-test were used to assess mean differences in soreness, AMT, and MEP amplitudes. **RESULTS:** As expected, muscle soreness differed between visits (mean difference: 25.3 mm,  $t=5.08$ ,  $p<0.01$ ). Similar motor-thresholds were observed for the RA (mean difference: 0.3%,  $t=0.26$ ,  $p=0.80$ ) and VL (mean difference: 0.5%,  $t=0.45$ ,  $p=0.66$ ). MEP amplitudes were also similar for the RA (mean difference: 0.13 mV,  $t=1.74$ ,  $p=0.12$ ) and VL (mean difference: 0.01 mV,  $t=0.30$ ,  $p=0.77$ ). **CONCLUSION:** Day-to-day variation in CSE during lower extremity and axial contractions is not explained by differences in muscle soreness. Future work should examine CSE at multiple timepoints after acute exercise and use various submaximal intensities to further clarify whether CSE is responsive to muscle soreness.

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## Acute Exercise-Induced Changes in Extracellular Vesicle Cargo in Adults with or Without Type 2 Diabetes

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Circulating factors partially mediate the effects of exercise and type 2 diabetes mellitus (T2DM) on cardiometabolic outcomes. Extracellular vesicles (EVs) are lipid bilayer enclosed cargo carriers responsible for intercellular communication, yet EVs are understudied circulating factors in exercise and cardiometabolic disease. **PURPOSE:** To determine whether older adults with T2DM or normal glucose tolerance (NGT) have different circulating EV cargo before and after a bout of aerobic exercise. **METHODS:** Seventeen men (n=10) and women (n=7) 55-72 years of age completed a 30-minute bout of treadmill exercise at 60% of  $VO_{2max}$  and blood was drawn before (0 min) and immediately after (30 min) exercise. Plasma samples were collected and frozen at -80°C. EVs were isolated and processed for bottom-up proteomics. Peptide spectra were searched against a database (uniprot.org) and proteins were quantified using label-free quantitation. Data were normalized and the effects of condition and time were compared. Data are expressed as log<sub>2</sub>-fold change (FC). **RESULTS:** Three hundred seventy-six proteins were identified. Nine proteins were differently expressed between conditions at baseline including insulin-like growth factor-binding protein complex (IGFBP) (FC=1.3, p<0.05; NGT v. T2DM). Immediately after exercise (30 min), 30 proteins in NGT and 35 in T2DM were significantly different. Fourteen proteins, including clusterin-4, carbonic anhydrase, cholinesterase and several platelet and blood exosomal proteins, were different after exercise in both groups. Changes in 11 proteins were unique to NGT and changes in 16 proteins were unique to T2DM. In T2DM, downregulated proteins of interest at 30 min included IGFBP (30 min:0 min, FC=-0.7 p<0.03) and complement components (C8; FC=-0.736 p=0.036 and C3; FC= -0.436 p<0.01). In NGT, upregulated proteins at 30 min included neural cell adhesion molecule L1-like protein (NCHL1) (FC= 0.316 p= 0.02) and retinol binding protein (RBP) (FC=0.470 p<0.005). **CONCLUSION:** Acute aerobic exercise affects circulating EV cargo, with differential effects on specific proteins related to insulin sensitivity and inflammation in older adults with T2DM vs. NGT. These findings support a potential role of EV-derived mechanisms mediating the cardiometabolic effects of exercise and T2DM.

## Hand Dominance and Head Impact Location in Collegiate Ice Hockey

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Ice hockey is a unique, high velocity sport whereby the boards are a part of the playing arena and head impacts with the boards are commonplace. As shot dominance, or handedness, often dictates player position (e.g., right hand shot dominant plays right wing), this could be associated with elevated head impacts to one side of the head since their non-dominant side would be closer to the boards. **PURPOSE:** The purpose of this study was to determine if handedness affects head impact location in collegiate ice hockey players. **METHODS:** 65 NCAA Division III male (36) and female (29) ice hockey players were assessed during the regular ice hockey 2017-2018 and 2019-2020 seasons. Head impact monitoring occurred during each practice and game using G-Force Tracker sensors attached to back of the helmet. Impacts were quantified and classified based on location (Right, Left, Crown, Back) and were confirmed by video analysis. The primary outcome measures were the percentage of the handedness side of the head with two different approaches: 1) handedness side as a percentage of left and right impacts (e.g., right/ (right + left)), and 2) handedness as a percentage of all impacts (e.g., right/ (left + right + front + crown + back)). Linear regressions were performed to determine if handedness predicts the percentage of impacts sustained for each of the outcome measures while controlling for participant gender. **RESULTS:** Participants experienced  $90.8 \pm 104.7$  head impacts per season (Range: 2 – 567). Men experienced significant more head impacts than women (Men:  $133.6 \pm 122.9$  and Women:  $37.8 \pm 29.5$ ,  $p < 0.001$ ,  $d = 1.07$ ). For side head impacts only (right, left), handedness was a significant predictor (48.5% to the non-dominant side,  $p = 0.012$ ,  $R^2 = 0.069$ ). Handedness was not a significant predictor of impacts to the dominant side (25.2% to the non-dominant side,  $p = 0.178$ ,  $R^2 = 0.034$ ) amongst impacts to the five potential locations. **CONCLUSION:** Amongst side to side (Right and Left) impacts, players received more impacts on their non-dominant side as opposed to their dominant side. However, shot preference or handedness does not predict location of head impacts on right versus left location, or all five head impact location possibilities (Right, Left, Front, Crown, Back).



## Effects of Oxidative Stress versus Cytokine-dependent Inflammation on the release of Endothelial Microparticles

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Endothelial microparticles (EMPs) are released by endothelial cells in response to apoptosis and/or endothelial cell activation. As such, EMPs are considered markers of endothelial dysfunction and atherosclerosis that may be detected before clinical manifestation of vascular diseases. Even though certain mechanisms of EMP release are fairly well-known, EMP release following common stressors such as inflammation and oxidative stress remains less clear. **PURPOSE:** Determine the effects of lipopolysaccharide-induced cytokine-dependent inflammation (LPS) and hydrogen peroxide-induced oxidative stress (H<sub>2</sub>O<sub>2</sub>) on activated and apoptotic EMP release in cultured endothelial cells. **METHODS:** Three lots of passage 4-5 human umbilical vein endothelial cells (HUVECs) were incubated with either 1 µg/mL LPS for 24h or 400 µM H<sub>2</sub>O<sub>2</sub> for 1 hour in endothelial growth medium 2 (EGM2). Each condition was performed in each cell lot and processed in duplicate. After 1 hour of H<sub>2</sub>O<sub>2</sub> incubation, old medium was removed and new EGM2 was added to the cells, then collected after 24 hours. This was done because H<sub>2</sub>O<sub>2</sub> incubation for long periods will kill the cells and degrade EMPs. Endothelial microparticles were isolated from the medium of each condition and stained with fluorescent conjugated antibodies for flow cytometry to quantify CD31<sup>+</sup>42b<sup>-</sup> (apoptosis) and CD62E<sup>+</sup> (endothelial cell activation) EMPs. Analysis of variance was used to test for differences among H<sub>2</sub>O<sub>2</sub>, LPS, and control conditions. **RESULTS:** There was a significant increase in the amount of CD31<sup>+</sup>42b<sup>-</sup> EMPs per µL of media following the H<sub>2</sub>O<sub>2</sub> condition compared with the LPS condition (5.00 ± 1.84 vs. 1.31 ± 0.64, P < 0.01); however, there were no statistically significant differences between conditions and control. **CONCLUSION:** Microparticle release occurs in quiescent and stimulated endothelial cells. H<sub>2</sub>O<sub>2</sub>-induced oxidative stress enhances generation of apoptotic EMPs compared with cytokine-dependent LPS inflammation. As such, oxidative stress may be a more potent, specialized stimulus for endothelial cell dysfunction at the onset of chronic vascular disease compared to a cytokine-dependent stimulus, which instead works primarily through endothelial cell activation.

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## **Perspectives on Participation in and Support for Youth Physical Activity Opportunities in Low-Income, African American Neighborhoods**

Megan P. Heintzelman, Richard R. Suminski, Shannon M. Robson, Gregory R. Dominick, University of Delaware, Newark, DE

Low-income, African American youth lack accessible, high quality youth physical activity opportunities (YPAO) which undoubtedly contributes to their low levels of physical activity. **PURPOSE:** To identify and describe factors related to low-income, African American youth's participation in neighborhood youth physical activity opportunities (YPAO). **METHODS:** Nine, 60-90 min focus groups were conducted with 55 individuals (parents/guardians of youth, YPAO providers, small business representatives) from low-income, African American neighborhoods. The questions posed to the focus groups were related to awareness of YPAOs, benefits and barriers to providing YPAOs, ways to increase youth participants in YPAOs, and mechanisms (e.g., funding) for creating, improving, and sustaining YPAOs. Focus group recordings were transcribed, and thematic analysis was performed to identify themes related to increasing youth participation in YPAOs. **RESULTS:** Participants across community sectors identified seven major themes: exposure or having access to YPAOs, parent buy-in/accountability (e.g., personal values and trust with YPAOs), technology as a promotor (e.g., Wii Sports) or barrier (e.g., TV) to youth participation in YPAOs, increasing a sense of community, need for cost-effective YPAOs, finding resources to support YPAOs, and how to best use resources available to YPAOs. **CONCLUSION:** Developing strategies to incorporate effective community partnerships, creative program ideas with advertising, and active, multisector involvement including small businesses into practice has the potential to increase participation of low-income, African American youth in YPAOs.

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## **Estrogen Augments the Cardiac Functional Response to $\beta$ 2-Adrenergic Receptor Stimulation in Young Female Rat Hearts**

Yuan Liu, Sushant Ranadive, & Sarah Kuzmiak-Glancy. University of Maryland, College Park, MD

Sexual dimorphism exists throughout the cardiovascular system and is likely to play a role in the lower risk of hypertension, heart failure, and cardiovascular disease in pre-menopausal women compared to age-matched men. Alterations in  $\beta$ -adrenergic receptor ( $\beta$ -AR) signaling have been implicated in the development of heart failure, with aging associated with blunted cardiac  $\beta$ -adrenergic responsiveness. Previous studies report blunted increases in heart rate and contractility upon  $\beta$ -AR stimulation in female compared to male hearts. **PUPPOSE:** Therefore, the purpose of this study is to evaluate the role of estrogen on the responsiveness of male and female rat hearts to  $\beta$ 2-adrenergic stimulation. **METHODS:** Young (<8 months) and aging (>20 months) male and female rats were anesthetized, hearts were excised, and Langendorff-perfused. First, in young male and female rat hearts, dose-response curves were generated for either 17- $\beta$ -estradiol or the  $\beta$ 2-AR agonist, albuterol. Then, the estradiol dose which consistently resulted in maximal vasodilation was used to evaluate the interaction between estrogen receptor and  $\beta$ 2-adrenergic receptor signaling. 20  $\mu$ M 17- $\beta$ -estradiol was added to the perfusate, and after steady state function was established in the presence of estrogen, dose-response curves for albuterol were again generated in young and aging rats. **RESULTS:** Increases in heart rate upon addition of albuterol were blunted in young female compared to young male rat hearts (from  $244 \pm 12$  to  $298 \pm 11$  beats/min in males, and from  $236 \pm 10$  to  $252 \pm 25$  beats/min in females). When estradiol was added to the perfusate prior to albuterol, functional responses were rescued in the young female rat hearts (from  $225 \pm 8$  to  $278 \pm 8$  beats/min in males, and from  $225 \pm 9$  to  $271 \pm 10$  beats/min in females). Aging male and females demonstrated similar increases in HR in response to albuterol (from  $207 \pm 8$  to  $253 \pm 5$  beats/min in males, and from  $210 \pm 9$  to  $267 \pm 6$  beats/min in females). **CONCLUSION:** Cardiac responses to  $\beta$ -adrenergic stimulation were blunted in young female compared to young male hearts; however, the presence of estrogen rescued the response such that it matched that of male hearts. The findings in this study indicate that the presence of estrogen may play an important role in stimulation of cardiac function via  $\beta$ -AR signaling in female hearts.

## **Associations of Workplace Design with Workday Sedentary Behaviour and Sit-to-Stand Transitions**

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**PURPOSE:** Sedentary behaviour (SB) is common in desk-based work and recent research has highlighted associations between prolonged periods of SB and negative health outcomes. This study intended to explore associations between social and physical aspects of interior office design with SB during working hours in desk-based workers. **METHODS:** This study was a secondary analysis of baseline data from the RESET BP clinical trial. RESET BP is currently testing the effects of a SB intervention to reduce blood pressure and cardiovascular risk among inactive, desk-based workers (n=194, mean age: 45.01 ± 11.92 years, BMI: 30.21 ± 6.91 kg/m<sup>2</sup>, 62.37% women). At baseline, participants completed the Office Environment and Sitting Scale (OFFESS), a validated instrument that measured office design elements in physical environment (local connectivity, proximity of co-workers) and social environment (visibility of co-workers, overall connectedness) subscales. Workday SB was objectively measured using an activPAL and a time-use diary for 7 days. Workday SB was operationalized as total time and time spent in prolonged bouts of ≥30 minutes (SB30) and ≥60 minutes (SB60). Linear regression analysis assessed relationships between the OFFESS subscales and SB, SB30, SB60 and sit-to-stand transitions. Each analysis was adjusted by age, gender, BMI and work wear time. **RESULTS:** Participants accumulated SB, SB30, and SB60 that accounted for 76.7 ± 12.6%, 45 ± 19.5%, and 22.8 ± 17.2% of the working day, respectively. Participants averaged 26.6 ± 11.1 sit-to-stand transitions per working day. Regarding physical environment, a higher subscale score in local connectivity and in proximity of coworkers was significantly associated with lower SB30 and SB60 (ranging from -28.0 to -25.8 minutes/day, all p<0.05) and greater sit-to-stand transitions (+2.2 to 2.8, p=0.04). Regarding social environment, higher overall connectedness score was associated with reduced time spent in SB60 (-3.5 minutes/day, p=0.04), but was not associated with total SB, SB30, or sit-to-stand transitions. Visibility of co-workers was not associated with any SB (all p>0.05). **CONCLUSION:** Increasing physical and social connectedness and proximity of coworkers is a potential workplace design strategy to improve workday SB patterns in desk workers.



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Yuan Liu, Sushant Ranadive, & Sarah Kuzmiak-Glancy. University of Maryland, College Park, MD

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## Does Performing Resistance Exercise to Failure Homogenize the Stimulus?

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Resistance exercise commonly involves performing a set number of repetitions at a given relative load which accounts for individual differences in strength but not local muscle endurance. As such, it has been suggested that performing resistance exercise to volitional task failure may create a more homogeneous training stimulus by accounting for differences in local muscle endurance, but this hypothesis has not been experimentally tested. **PURPOSE:** To test if performing resistance exercise to volitional failure creates a more homogenous stimulus across individuals. **METHODS:** Individuals completed 2 testing sessions to compare repetitions, ratings of perceived exertion (RPE), muscle swelling assessed via ultrasound, and muscle fatigue assessed via decrements in isometric strength, between arbitrary repetition and failure protocols. The first testing session compared 3 sets of 8 repetitions (60%-SET) and 3 sets to failure (60%-FAIL) with a 60% load, while the second testing session compared 3 sets of 20 repetitions (30%-SET) with 3 sets to failure (30%-FAIL) with a 30% load. Differences in correlated variances between protocols were examined. **RESULTS:** Forty-six individuals (25 females and 21 males) completed the study. There was more variability in the number of repetitions completed during the failure protocols when compared to the arbitrary repetition protocols for both the 60% (average variance: 60%-SET=0.01, 60%-FAIL=16;  $p<0.001$ ) and 30% (average variance: 30%-SET=0.36, 30%-FAIL=139;  $p<0.001$ ) trials. Performing the 60% 1RM trial to failure appeared to reduce the variability in muscle swelling (average variance: 60%-SET=.034, 60%-FAIL=.023;  $p=0.017$ ) and RPE (average variance: 60%-SET=4.0, 60%-FAIL=2.5;  $p=0.002$ ), but did not alter the variability in muscle fatigue. No differences in variability were present between the SET-30% and FAIL-30% protocols for any of the dependent variables. **CONCLUSION:** Performing resistance exercise to failure may result in a more homogenous stimulus across individuals, particularly when using moderate to high exercise loads. From a practical standpoint this can ensure health professionals are prescribing an adequate training stimulus for all clients, while researchers may benefit by reducing the magnitude of error and increasing statistical power.



## Sex-differences in Bone Density, Geometry, and Estimated Strength Adaptations to 10-weeks of Military Officer Training

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Mechanical loading (e.g. physical activity) is associated with changes in bone density and structure; however, few investigations have examined the adaptive bone response to arduous military training in men and women. **PURPOSE** Investigate the effects of military training on volumetric bone density (vBMD), geometry, and strength in men and women who complete Marine Corps Officer Candidates School (OCS). **METHODS** Male and female candidates (n=266) completed a tibial peripheral quantitative computed tomography (pQCT) scan before and after a 10-week physically intensive military training course. Three-dimensional vBMD, geometry, and estimated bone strength were assessed at the 4%, 38%, and 66% sites. Wilcoxon signed-rank tests assessed changes across training. Data are mean±SEM,  $\alpha=0.05$ . **RESULTS** Subjects were aged 19-35 yrs- (25.3±0.2) with a BMI 25.5±0.1kg/m<sup>2</sup>. At the distal (4%) tibia, increases in total vBMD (pre: 354.5±2.7, post: 356.3±2.7 mg/cm<sup>3</sup>), trabecular vBMD (294.3±2.2, 295.6±2.2 mg/cm<sup>3</sup>), and estimated compression strength (BSI; 154.7±2.2, 156.2±2.1 mg<sup>2</sup>/mm<sup>4</sup>) were observed in men (n=222, p<0.001). In women (n=39), total vBMD (324.2±5.1, 326.5±5.2 mg/cm<sup>3</sup> p=0.03), trabecular vBMD (262.7±4.8, 264.4±2.9 mg/cm<sup>3</sup> p=0.01), and BSI (105.9±3.3, 107.4±3.4 mm<sup>3</sup> p<0.01) also increased. At the midshaft (38%) tibia, total vBMD (938.1±3.7, 938.9±3.7 mg/cm<sup>3</sup> p=0.03), cortical thickness (6.8±0.1, 6.8±0.1 mm, p<0.01), periosteal circumference (77.0±0.3, 77.1±0.3 mm p<0.01) and estimated bending strength (SSI; 2182.7±25.9, 2193.8±25.1 mm<sup>3</sup> p=0.02) increased in men (n=208). In women (n=40), only periosteal circumference increased (70.0±0.6, 70.1±0.6 mm p=0.05). At the proximal (66%) tibia, no significant changes (p>0.05) were observed in men (n=200). In women (n=38), total vBMD decreased (735.9±9.0, 732.7±8.8 mg/cm<sup>3</sup> p=0.04) and periosteal circumference increased (82.5±0.9, 82.8±0.9 mm p<0.01) following training. **CONCLUSION** Bone adaptations in response to 10 weeks of military training are slight (≤1.5%), but statistically significant and may be sufficient to improve estimates of bone strength. Changes are further dependent on biological sex and anatomical location.

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## Light Physical Activity Relates to Insulin Sensitivity and Earlier Time of Day in Metabolic Syndrome

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**PURPOSE:** Low insulin sensitivity is linked to metabolic syndrome (MetS). However, it is unclear whether the time of day when light physical activity (LPA) occurs affects insulin sensitivity. We tested the relationship between LPA time of day and insulin sensitivity in MetS. **METHODS:** Thirty adults with MetS were classified as morning (n=11, 9F), midday (n=9, 6F), or afternoon (n=10, 6F) by active LPA time using 7-d tri-axial hip-worn accelerometry (Actigraph). Time of day was defined by which part of the day had the highest percentage (>50%) of LPA. Peripheral insulin sensitivity was measured using a 2-hr hyperinsulinemic-euglycemic clamp (40mU/m<sup>2</sup>/min, 90 mg/dl), while hepatic (HOMA-IR), and adipose (Adipose-IR) insulin resistance were estimated from fasting glucose, FFA, and insulin, respectively. Aerobic fitness (VO<sub>2</sub>max) and anthropometrics (BMI, waist circumference) were also examined. **RESULTS:** There were no differences amongst groups in age (53.7±2.1 vs. 53.8±1.9 vs. 51.3±6y, *P*=0.60), ATP III criteria (3.6±0.2 vs. 3.6±0.2 vs. 3.5±0.3, *P*=0.91), or VO<sub>2</sub>max (22.8±1.1 vs. 22.2±1.5 vs. 21.5±1.3 ml/kg/min, *P*=0.76). While there were no differences in time in sedentary (73.8±1.8 vs. 74.2±1.7 vs. 77.4±2.8%, *P*=0.44) or moderate-to-vigorous activity (4.9±0.7 vs. 4.7±0.8 vs. 4.1±0.6%, *P*=0.66) amongst groups, the morning and midday groups had increased time in LPA compared to afternoon (21.3±1.7 vs. 21.1±1.3 vs. 16.5±1.2%, *P*=0.04). Further, energy expenditure was higher in the morning versus afternoon (33.2±3.2 vs. 32.9±5.6 kcal/hr, *P*=0.01), which coincided with morning having a lower BMI (33.1±1 vs. 41±2 kg/m<sup>2</sup>, *P*=0.004) and waist circumference (107.9±1.8 vs. 123.1±5.4 cm, *P*=0.02). Although clamp-derived insulin sensitivity (2.8±0.5 vs. 2.5±0.5 vs. 1.9±0.3 mg/kg/min, *P*=0.43), HOMA-IR (3.0±0.9 vs. 5±1 vs. 3.9±0.9 a.u., *P*=0.3), and adipose-IR (9.2±3.1 vs. 11.5±2.1 vs. 11.0±2.4 a.u., *P*=0.81) were similar across groups, higher LPA (%) related to increased peripheral insulin sensitivity (*r*=0.33, *P*=0.04) and lower adipose-IR (*r*=-0.36, *P*=0.02). **CONCLUSION:** Time spent in LPA relates to insulin sensitivity and earlier times of day. Future work should look at whether time of day influences appetite and cardiovascular health to optimize disease prevention/treatment.

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## Is there an Optimal HIIT Protocol for Muscular Development of Adolescent Athletes?

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Muscular development via high-intensity interval training (HIIT) can be varied by training protocols such as different work-to-rest ratios. **PURPOSE:** This study examined the effects of different HIIT protocols on muscle function and fatigue resistance in adolescent Taekwondo athletes. **METHODS:** Forty-seven adolescent Taekwondo athletes (age:  $16.7 \pm 0.8$  [SD] years, height:  $175.2 \pm 6.0$  cm, weight:  $66.2 \pm 10.5$  kg, body mass index:  $21.5 \pm 2.5$  kg/m<sup>2</sup>, training experience:  $53.4 \pm 10.6$  months) were randomly assigned to the control group (n=12) vs. 3 HIIT groups by work-to-rest ratios: 1) 1:2 [30s:60s] (n=12), 2) 1:4 [30s:120s] (n=12), and 3) 1:8 [30s:240s] (n=12). The intensity of HIIT was achieved at 90-100% of participants' maximal heart rate. All HIIT groups completed 10 sessions over 4 weeks while the control group maintained their regular Taekwondo training. The muscular function was assessed by isokinetic muscle strength ( $60^\circ\text{s}^{-1}$ ) and endurance ( $180^\circ\text{s}^{-1}$ ) of the knee extensor and flexor. Fatigue resistance was measured with an isokinetic dynamometer. The participants performed 3 sets of 20 maximal extensions and flexion contraction at  $120^\circ\text{s}^{-1}$  with 1 min interval between each set. The data were normalized with each participant's body weight and calculated as total work done for extensor ([Nm]/[kg]). Total work done was calculated as the sum of work done during each set. Repeated measures ANOVA (4 groups  $\times$  2 measurement time-points) was used to assess changes in muscle function and fatigue resistance, with significance set at  $p < 0.05$ . **RESULTS:** No significant interaction effects were observed for the group by time on isokinetic muscle strength/endurance. However, a positive effect on improving muscle fatigue resistance was observed at the first set of assessment in the HIIT with 1:4 (Pre:  $4719.2 \pm 577.3$  vs. Post:  $5166.0 \pm 534.7$  Nm/kg,  $\Delta 10.2\%$ ,  $p < 0.05$ ) and 1:8 groups ( $4845.6 \pm 384.1$  vs.  $5271.0 \pm 725.2$  Nm/kg,  $\Delta 8.6\%$ ,  $p < 0.05$ ). In addition, 1:4 group exhibited fatigue improvement in the second set ( $4259.1 \pm 390.2$  vs.  $4574.8 \pm 385.5$  Nm/kg,  $\Delta 7.7\%$ ,  $p < 0.01$ ), while other groups did not show any improvement. **Conclusion:** The HIIT 1:4 group (30s all-out with 120s rest) lasting over a brief 4-week period showed improvement in fatigue resistance. Our data may provide practical guidelines for muscle development by HIIT in adolescent athletes.

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## Peak satellite cell proliferation for regenerative myogenesis takes place 24-72h post injury in mouse muscles

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Skeletal muscle regeneration is accomplished by muscle resident satellite cells (SC). While the majority of studies evaluating the myogenic potential of SC has been performed *in vitro*, not many studies have assessed the function of these cells *in vivo* - proper muscle regeneration depends on the interaction between different cell types and their secreted factors. Also, our previous work showed that genetic modifiers can influence muscle regeneration in mouse models of Duchenne muscular dystrophy with genetic backgrounds. **PURPOSE:** our purpose was 2-fold: 1) determine the rate of SC proliferation and fusion during the subsequent days post-injury *in vivo*; 2) evaluate whether regenerative myogenesis differs in mice with different genetic backgrounds - C57BL/10ScSnJ (B10-WT) and DBA/2J (D2-WT) mice. **METHODS:** 24d old B10-WT and D2-WT mice were anesthetized with isoflurane prior to receiving intramuscular injections of the myotoxin notexin. Following injury, we administered 5'-bromo-2'-deoxyuridine (BrdU), a thymidine analog, in the drinking water at different time-intervals to label proliferating cells: either 24-48h (day 1 BrdU), 48-72h (day 2 BrdU), 72-96h (day 3 BrdU), and 96-120h (day 4 BrdU). Mice were euthanized and tissues harvested at 3 days post cessation of BrdU administration, and muscles were subsequently sectioned on slides for immunostaining with specific antibodies. To evaluate fusion of myogenic cells, we counted the number of BrdU+ centrally nucleated fibers (CNFs) and expressed it as a percentage of total myofibers throughout muscle sections. **RESULTS:** In B10-WT muscles, our findings demonstrate that both day 1 and 2 have a similar pattern of SC proliferation, which is shown by the %BrdU+ CNFs (day 1: 49.3% BrdU+ CNFs; day 2: 45.1% CNFs). By day 3 and 4, the rate of proliferation already decreased by 10-fold, as shown by only 4.2% and 3.0% myofibers with BrdU+ CNFs, respectively. Lastly, we found that regenerative myogenesis was severely comprised in muscles from D2-WT mice compared to B10-WT mice (%BrdU+ CNFs - day 1: 4.9%, day 2: 6.9%, day 3: 1.8% day 4: 0.9% BrdU+ CNFs). **CONCLUSION:** our data demonstrates that peak SC proliferation happens within 72h after muscle injury, and that genetic modifiers, which potentially alter the muscle niche, influence the function of SC in the D2-WT genetic background.

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## **The Effect of Bisphenols A and S Exposure on Dyslipidemia, Oxidative stress, and Physical Fitness in Normal and Overweight/Obese Young Adults**

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**PURPOSE:** Bisphenol A and S (BPA and BPS) are chemical compounds commonly found in a variety of food packaging products. Exposure to these chemicals has been closely associated with metabolic diseases such as type 2 diabetes. The mechanism by which BPA and BPS disturb homeostasis in humans is still unidentified; therefore, this study aimed to investigate the relationship between levels of urinary BPA, BPS, and oxidative stress and their effect on lipid profile and physical fitness in normal and overweight/obese subjects. **METHODS:** Urine sample of normal weight ( $BMI \leq 25$ ,  $n=11$ ) and overweight/obese ( $BMI \geq 25$ ,  $n=12$ ) was collected prior to the performance of 30 minutes of aerobic exercise (70% max HR). Urinary BPA, BPS and 8-isoprostane (a marker of oxidative stress) were assessed by ELISA assay and normalized by creatinine levels. In addition, triglycerides (TG), high-density lipoprotein (HDL) and low-density lipoprotein (LDL) were also assessed. Distance run was used to determine physical fitness.

**RESULTS:** No differences between groups, normal weight and overweight/obese were observed in urinary BPA, BPS, and oxidative stress. Levels of BPA and BPS were positively associated with oxidative stress ( $r=0.62$  and  $0.82$ , respectively,  $p < .05$ ). BPA and oxidative stress were negatively associated with physical fitness ( $r=-0.45$  and  $-0.50$ , respectively,  $p < .05$ ). BPS and oxidative stress were positively to TG levels ( $r=0.50$  and  $0.51$  respectively,  $p < .05$ ).

**CONCLUSION:** Bisphenols levels increase oxidative stress, which could affect physical fitness and lipid metabolism. Minimizing bisphenol exposure might be effective in controlling the development of metabolic diseases.

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## **Association Between Meeting Physical Activity Guidelines with Ambulation, Quality of Life, and Inflammation in Claudication**

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There is limited information available on how many patients with peripheral artery disease and claudication meet the physical activity time-intensity guidelines, and whether doing so is associated with better ambulation, health-related quality of life (HRQoL), and vascular outcomes. Additionally, it is not clear how many daily steps are necessary for patients with claudication to meet the physical activity time-intensity guidelines. **PURPOSE:** To determine if meeting the 2018 physical activity guidelines was associated with better ambulatory function, HRQoL, vascular function, and inflammation than failing to meet the guidelines in patients with claudication. Secondly, we determined the optimal number of total daily steps and the optimal number of daily steps taken at a moderate cadence that are needed to meet the physical activity guidelines in peripheral artery disease patients with claudication. **METHODS:** Five hundred seventy-two patients were assessed on their daily ambulatory activity for one week with a step activity monitor, and were grouped according to whether they achieved less than 150 minutes of moderate intensity physical activity per week (Group 1=Do Not Meet Guidelines; n=397), or whether they were above this threshold (Group 2=Meet Guidelines; n=175). **RESULTS:** Treadmill peak walking time (mean±SD) was significantly higher ( $p<0.001$ ) in Group 2 (709±359 sec) than in Group 1 (427±281 sec). Physical function HRQoL score was significantly higher ( $p<0.001$ ) in Group 2 (61±22%) than in Group 1 (44±21%). High-sensitivity C-reactive protein was significantly lower ( $p<0.001$ ) in Group 2 (3.6±4.5 mg/L) than in Group 1 (5.9±6.1 mg/L). Finally,  $\geq 7,675$  total daily steps and 1,660 steps taken at a moderate cadence were the optimal thresholds associated with meeting the physical activity guidelines. **CONCLUSIONS:** Patients with claudication who meet the 2018 physical activity guidelines for US adults had better ambulation, HRQoL, and vascular outcomes than those who failed to meet the guidelines. From a practical standpoint, patients with claudication best achieved the physical activity guidelines by taking at least 7,675 total daily steps, and at least 1,660 daily steps at a moderate cadence.

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## **The Effect of Facial Coverings on Prediction of Aerobic Capacity During a Maximal Treadmill Test**

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During the global COVID-19 pandemic, over 220 million people have been infected with over 4.5 million deaths reported worldwide. The effects of this virus have led to the development of several public health related mandates throughout the world. In the United States, this has included the requirement of wearing a facial mask while indoors while exercising. This has raised several concerns as to how it may influence exercise performance. **PURPOSE:** The purpose of this research study was to determine the effect that facial coverings had on estimated oxygen consumption during a maximal treadmill exercise test. **METHODS:** Twenty-nine individuals between 18-25 years of age (13 females, 16 males) were recruited for the study. Each subject underwent body composition assessment via Bod Pod. Body weight, fat mass, and fat-free mass were also measured during the Bod Pod assessment. Each subject performed 3 separate maximal Bruce protocol treadmill tests (1 test measuring VO<sub>2</sub> max using a metabolic cart, 1 test predicting VO<sub>2</sub> max wearing a facial covering and 1 test predicting VO<sub>2</sub> max without a facial covering. Heart rate and Rating of Perceived Exertion (RPE) were also collected during the treadmill test. **RESULTS:** Wearing a mask significantly decreased predicted VO<sub>2</sub> max in the mask wearing group compared to the standardized metabolic cart group ( $42.13 \pm 6.9$  vs.  $46.88 \pm 7.2$ ,  $p < 0.04$ ). Furthermore, when we evaluate women vs. men, we find that this effect persists in men ( $40.6 \pm 6.5$  vs.  $47.8 \pm 6.1$   $p < 0.001$ ) though there is no difference in females. **CONCLUSION:** Facial coverings contributed to a decrease in predicted aerobic capacity in men when performing a maximal effort treadmill test.

## Repetitive Transcranial Magnetic Stimulation Does not Improve Lower Extremity Anaerobic Physical Fatigue in Healthy Participants

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The ability to maintain anaerobic performance is important for physical activities that involve periodic segments of high-intensity actions. Intermittent theta burst stimulation (iTBS), a form of repetitive transcranial magnetic brain stimulation (rTMS), may improve anaerobic power, but its effects on anaerobic performance during fatigue have yet to be determined. In addition, despite growing evidence that stimulation parameters can influence the efficacy of rTMS protocols, little is known about the effects of continuous theta burst stimulation (cTBS). **PURPOSE:** To examine the effects of iTBS and cTBS over the supplementary motor area (SMA) and primary motor cortex (M1) trunk and leg representations on anaerobic performance under fatiguing conditions. **METHODS:** On three separate visits, 19 participants (5W, age:  $25.8 \pm 5.0$ yr, weight:  $71.8 \pm 12.7$ kg, height:  $172.9 \pm 9.9$ cm) performed two consecutive Wingate Anaerobic Tests (WAnT) on a cycle ergometer after receiving TBS over the SMA, M1<sub>TRUNK</sub>, or M1<sub>LEG</sub> representations. A subset of the participants received cTBS (n=8), while others (n=11) received iTBS. Participants were provided a 2min warm up followed by a 15s lead-in at 125W and 100RPM. Each participant was familiarized to the protocol and 2min rest was given between trials. Mean and peak power (normalized to body weight) as well as the rate of decline in power (fatigue index) were compared among target locations and between stimulation protocols using a mixed-model ANOVA. **RESULTS:** WAnT performance decreased from trial 1 (T1) to 2 (T2) (T2-T1 Peak power:  $-0.46 \pm 0.08$  W/kg,  $F_{1,17} = 30.5$ ,  $p < 0.01$ ,  $\eta^2_p = 0.64$ ; Mean power:  $-1.10 \pm 0.12$  W/kg,  $F_{1,17} = 81.2$ ,  $p < 0.01$ ,  $\eta^2_p = 0.83$ ; Fatigue index:  $1.52 \pm 0.023$  W/s,  $F_{1,17} = 42.9$ ,  $p < 0.01$ ,  $\eta^2_p = 0.71$ ) but did not differ between cTBS and iTBS ( $F = 1.1-2.7$ ;  $p = 0.12-0.30$ ) or target location ( $F = 0.6-1.4$ ;  $p = 0.25-0.56$ ). **CONCLUSIONS:** Lower extremity Wingate performance decreased from T1 to T2 but did not differ among TBS protocols or SMA, M1<sub>TRUNK</sub>, or M1<sub>LEG</sub> stimulation targets. Thus, our preliminary evidence does not suggest that two promising forms of non-invasive brain stimulation mitigate lower extremity anaerobic fatigue when targeted at M1 representations of primary task agonists, axial synergists, or the supplementary motor area. Supported by the Department of Defense W81XWH1810452



## **Physical Activity Patterns and Beliefs of Medical Fitness Facility Clients During COVID-19**

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The COVID-19 pandemic introduced many barriers to maintaining a physically active lifestyle, especially among those that exercised in a supervised medical fitness facility. Data characterizing the physical activity (PA) patterns and beliefs of those who continued to exercise with these facilities during COVID-19 is lacking, but could inform practitioners seeking to help others return. **PURPOSE:** To compare the PA patterns and beliefs of medical fitness facility clients who continued exercising with the facility against those who stopped utilizing services during the pandemic. **METHODS:** All active members of the facility were invited to complete a phone interview with questions pertaining to their PA patterns and beliefs. Those who responded were grouped into EX (those who continued exercising with the facility) and NOEX (those who stopped exercising with the facility) during the pandemic. The percentage of respondents for all interview questions was compared between groups using chi squared test. **RESULTS:** Of the 81 clients that participated, 32% (n=26) were EX and 68% (n=54) were NOEX. There was no difference between groups in those who reported exercising at least 0-3 times/week or for 150 minutes/week prior the pandemic (EX 88% vs NOEX 74%,  $p>0.05$ ). However, more in the EX group used cardio (EX 69% vs NOEX 30%,  $p<0.001$ ) and resistance training machines or equipment (EX 69% vs NOEX 19%,  $p<0.01$ ). Most in both groups felt their PA levels decreased (EX 85% vs NOEX 80%,  $p>0.05$ ) and that gym facility closures affected their ability to exercise regularly (EX 85% vs NOEX 69%,  $p>0.05$ ). For both groups, regular exercise is as important to them now as it was before the pandemic (EX 92% vs NOEX 83%,  $p>0.05$ ) and lack of motivation was the second highest barrier to exercise (EX 50% vs NOEX 57%,  $p>0.05$ ). **CONCLUSION:** The PA patterns and beliefs of clients who continued to exercise with a medical fitness facility during the pandemic did not differ compared with clients who did not, but they were more likely to use cardio and resistance training machines before the pandemic which may have encouraged an earlier return to supervised exercise. Data presented may provide practitioners valuable information in facilitating a return to supervised exercise for facility members.

## **Capturing Client Feedback for the Reopening of a Medical Fitness Facility During the COVID-19 Pandemic**

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Medical fitness facilities provide professional exercise and wellness expertise and programming for clinical patients and those with multiple health risks. The COVID-19 pandemic necessitated the immediate closure of these facilities for the safety of their vulnerable clients. However, data characterizing clients' preferences and concerns of reopening during the COVID-19 pandemic are lacking. **PURPOSE:** Feedback, including preferences and concerns, regarding reopening was captured from clients of a teaching medical fitness facility with the goal of informing reopening practices during the COVID-19 pandemic. **METHODS:** Clients of a medical fitness facility were invited to complete a COVID feedback survey. These data were retrospectively reviewed as a mixed-methods (quantitative and qualitative) study. **RESULTS:** Of 166 clients, 104 (63%) completed the survey. Almost all clients (96%) considered exercise to be important to them during the pandemic, citing benefits for physical and mental health and to avoid being sedentary. Physical activity levels decreased during the pandemic in 79% of participants due in part to COVID limitations, facility closures, and lack of motivation. Most (65%) were concerned about contracting COVID-19 while exercising in a facility and 38% were hesitant to exercise with student interns due to the spread of COVID-19 on campus. More than half (58%) wanted to exercise with a mask on in a fitness facility that strictly followed CDC guidelines to reduce the spread of COVID-19. The main policies that would make them feel safer upon return were cleaning procedures (30%), reduced people in the facility (26%), and mask requirements (26%), with many adding vaccinations and individual appointment times. During the 3-phase reopening plan 45% (74 of 166) of clients returned for 125 one-on-one appointments by January 2021 with a 336% increase (542 appointments) by August 2021. **CONCLUSION:** Incorporating client feedback, along with ACSM recommendations, supported the reopening of a medical fitness facility and reintroduction of exercise training for clinical populations. Data presented in this study may provide practitioners valuable information on reopening similar facilities.



## **Nutritional Knowledge and Body Dissatisfaction in NCAA Division II College Athletes**

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**PURPOSE:** To assess the nutritional knowledge of Division II athletes and evaluate the extent of their body dissatisfaction. **METHODS:** The Sports Nutritional Knowledge Survey and the Body Dissatisfaction Scale were placed on the secure web-based survey platform, Survey Monkey. Participants were sent the link to the survey via their school e-mail address and completed it at their leisure. **RESULTS:** There was data representation across 18 of the 21 athletic teams, 7 male sports and 7 female sports. The total number of participants was 153, 67 male and 86 female. The majority of the participants answered 70% of the questions correctly, 93% had “Somewhat” confidence in their correct responses and 7% were “Not very” confident in their correct responses. The majority of participants answered 30% of the questions incorrectly, 16% were either “Not Very”, “Somewhat”, or “Very” confident that they answered their incorrect responses correctly; while 50% were “Not at all” confident in their incorrect responses. Body dissatisfaction was expressed in both males and females. The majority of males desired body types 4 through 6 and the majority of females desired body types 3 through 5. **CONCLUSION:** The majority of the athletic population is somewhat confident in their nutritional knowledge and has some element of body dissatisfaction.

## Oral Health and Salivary IgA Responses in Division 1 Female Athletes

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Poor oral health is common in athletic populations. Salivary IgA has been reported to be decreased following bouts of intense exercise, but this may be influenced in part by oral health status as IgA plays an important role in mucosal homeostasis. **PURPOSE:** Examine oral health and salivary IgA responses to intense exercise in elite college athletes. **METHODS:** Twenty-Division I collegiate female soccer players underwent a brief dental examination using the dental epidemiologic study: Decay, Missing, Filled Surfaces Index (DMFS). Subjects were separated into two groups based on DMFS score; High DMFS (>5) and Low DMFS (DMFS ≤ 5). Subjects participated in an inter-squad scrimmage designed to simulate high-intensity competitive exercise. Salivary samples were collected prior to and immediately after the scrimmage, and immediately placed on ice until frozen at minus 80<sup>0</sup> C. Salivary IgA (sIgA) levels were determined in duplicate using standard ELISA kits. Exercise stress was assessed by determining average and maximal heart rate (HR), total distance covered, and training stress (TS, session RPE x Time) during the scrimmage. **RESULTS:** Athletes with high DMFS had higher levels of total decay ( $6.3 \pm 1.3$  vs  $0.70 \pm 0.47$ ), fillings ( $4.5 \pm 4.2$  vs  $1.6 \pm 0.62$ ), and DMFS index ( $11 \pm 1.3$  vs  $2.3 \pm 0.6$ ) compared with Low DMFS ( $p < 0.05$ ). There was a positive relationship between DMFS index and resting sIgA ( $r^2 = 0.26$ ,  $p < 0.05$ ). Whole group analysis revealed a significant decrease in sIgA pre ( $31.3 \pm 3.7$  mg/dL) vs post ( $22.6 \pm 2.5$  mg/dL) scrimmage ( $p < 0.05$ ). Furthermore, sIgA was reduced pre ( $35.6 \pm 6.0$  mg/dL) vs post ( $22.5 \pm 2.8$  mg/dL) in the High DMFS group ( $p < 0.05$ ), while there was no difference in the Low DMFS group (Pre:  $27.0 \pm 4.2$  mg/dL Post:  $22.7 \pm 4.3$  mg/dL) ( $p > 0.05$ ). There was no difference between groups in markers of exercise stress including average HR ( $154 \pm 8$  vs  $156 \pm 5$  bpm), maximal HR ( $208 \pm 5$  vs  $210 \pm 4.3$  bpm), distance covered ( $10 \pm 0.87$  vs  $9.8 \pm 0.75$  km), or TS ( $540 \pm 46$  vs  $549 \pm 47$ ) ( $p > 0.05$ ). **CONCLUSION:** Poorer dental health status may be associated with higher levels of resting salivary IgA concentrations. Athletes with poor dental health may be at risk for reduced salivary IgA following intense exercise, independent of specific exercise stress variables.



## The Impact of Gender on Self-Reported RPE during a Graded Exercise Test

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Ratings of perceived exertion (RPE) are commonly used to both assess and prescribe exercise intensity. **PURPOSE:** To determine if gender impacts how accurately subjects can assess exercise intensity using RPE during a  $\text{VO}_2\text{max}$  test. **METHODS:** Six men (age:  $21.7 \pm 0.8$  yr; height:  $172.6 \pm 5.3$  cm; mass:  $86.5 \pm 8.4$  kg; body fat:  $22.6 \pm 7.1\%$ ;  $\text{VO}_2\text{max}$ :  $53.0 \pm 7.2$   $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ) and six women (age:  $20.8 \pm 0.4$  yr; height:  $162.3 \pm 5.5$  cm; mass:  $66.9 \pm 18.5$  kg; body fat:  $27.1 \pm 11.5\%$ ;  $\text{VO}_2\text{max}$ :  $44.9 \pm 5.6$   $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ) participated in the study. Subjects completed the modified Bruce Protocol on the treadmill to volitional fatigue. Prior to testing, subjects received standardized instructions on Borg RPE scaling procedures. Overall RPE was collected every minute and oxygen consumption ( $\text{VO}_2$ ) was continually assessed.  $\text{VO}_2$  was averaged during the stages that the subject was in the defined RPE intensity zones for analysis. Independent Samples T-tests were used to compare subjects'  $\% \text{VO}_2\text{max}$  between genders at very light (RPE <9; <37%  $\text{VO}_2\text{max}$ ), light (RPE 9-11; 37-45%  $\text{VO}_2\text{max}$ ), moderate (RPE 12-13; 46-63%  $\text{VO}_2\text{max}$ ), vigorous (RPE 14-17; 64-90%  $\text{VO}_2\text{max}$ ), and maximal (RPE >18;  $\geq 91\%$   $\text{VO}_2\text{max}$ ) intensity zones, based on their reported RPE. **RESULTS:** There were no significant differences in  $\% \text{VO}_2\text{max}$  between genders at self-reported RPE equating to very light (men:  $34.4 \pm 9.1$ ; women:  $37.7 \pm 7.0\%$ ;  $p = .388$ ), light (men:  $56.6 \pm 14.0$ ; women:  $59.1 \pm 10.2\%$ ;  $p = .750$ ), moderate (men:  $62.5 \pm 16.3$ ; women:  $78.5 \pm 14.6\%$ ;  $p = .106$ ), vigorous (men:  $84.6 \pm 9.2$ ; women:  $90.1 \pm 9.0\%$ ;  $p = .321$ ), or maximal (men:  $97.0 \pm 2.1$ ; women:  $100.0 \pm 0.0\%$ ;  $p = .149$ ) exercise intensities. **CONCLUSION:** There was no difference in self-reported RPE between the men and women at any intensity level. However, both genders underreported RPE at the light intensity, while the women also underreported at the moderate and vigorous workloads.

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## Effect of Chronotype on Non-Exercise Physical Activity Patterns and Metabolic Insulin Sensitivity

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Late chronotype is associated with insulin resistance, obesity and metabolic syndrome (MetS). While people are encouraged to engage in physical activity (PA), it is unclear if late chronotypes with MetS are more sedentary and/or engage in less PA than early chronotypes. **PURPOSE:** To determine if adults classified as late chronotype differ in PA and sedentary behavior compared with early chronotype in relation to insulin sensitivity. **METHODS:** In this cross-sectional study, participants completed a Morning-Evening Questionnaire (MEQ) to determine early (n=14, 13F, MEQ=63.4±4.8, age=53.6±4.2y, BMI=36.8±5.7kg/m<sup>2</sup>) or late (n=14, 11F, MEQ=46.4±5.3, age=54.8±8.9y, BMI=37.3±5.5kg/m<sup>2</sup>) chronotype classification. Sedentary behavior, % light PA (LPA), and % moderate-to-vigorous (MVPA) were determined by 7-d tri-axial hip-worn accelerometry. A 2-hr hyperinsulinemic-euglycemic clamp (40mU/m<sup>2</sup>/min, 90 mg/dl) with indirect calorimetry was used to assess metabolic insulin sensitivity (glucose infusion rate) and substrate metabolism, respectively. Blood lactate (non-oxidative carbohydrate metabolism), VO<sub>2peak</sub> (aerobic fitness) and body mass index (BMI) were also measured. **RESULTS:** There was no difference in age (53.6±4.2 vs. 54.8±8.9y, *P*=0.67), BMI (36.8±5.7 vs. 37.3±5.5 kg/m<sup>2</sup>, *P*=0.84), ATP III score (3.4±.2 vs. 3.6±.2 a.u., *P*=0.46), or VO<sub>2peak</sub> (22.1±3.3 vs. 20.7±3.5 ml/kg/min, *P*=0.29) between groups. However, early chronotype had lower fasting lactate levels (0.71±0.06 vs. 0.87±0.05 mM, *P*<0.05) as well as higher metabolic insulin sensitivity (3.1±0.4 vs. 2.1±0.3 mg/kg/min, *P*=0.06). Sedentary time (74.1±0.02 vs. 74.7±0.02% *P*=0.82), LPA (21.1±0.01 vs. 19.6±0.01%, *P*=0.45), and MVPA (4.9±0.01 vs. 4.2±0.01%, *P*=0.39) were similar across the day between groups. Interestingly, early chronotypes performed more LPA in the morning than late chronotypes (6–10am: 73±0.03 vs. 62.9±0.04%, *P*<0.05), with no differences noted in the afternoon (3–7 pm: 19.9±0.01 vs 18.5±0.02%, *P*=0.44). **CONCLUSIONS:** Early chronotypes perform more LPA in the morning and have favorable metabolic health compared with late chronotype. Additional work is warranted to understand how to improve PA patterns for maximizing well-being in late chronotypes.

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## **Work-Related Exercise Programming for Firefighters: A Mixed Method Design**

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Work-related fitness programs can improve overall health and fitness in firefighters. **PURPOSE:** This mixed-method analyses paired quantitative clinical and performance outcomes with firefighters' qualitative feedback of a work-related exercise training program. **METHODS:** A 14-week work-related exercise training program with assessments conducted pre- and post-training was completed with a group of local Firefighters. Clinical outcomes included weight, body mass index (BMI), body fat percent, resting heart rate, systolic blood pressure (SBP), and diastolic blood pressure (DBP). Performance outcomes included the Sharpened Romberg Balance Test, 1-RM leg press and bench press, graded exercise test (estimated  $VO_{2max}$ ), knee range of motion (ROM), and shoulder and hamstring flexibility. Self-administered surveys (Short Form-36, International Physical Activity Questionnaire, Barriers Self-Efficacy Scale, and Barriers to Being Active Quiz) were completed. Three groups of 3-4 participants examined firefighters experience in the training program and their health behaviors. **RESULTS:** Twenty training sessions were completed by 14 male ( $36.4 \pm 2.6$  years old) firefighters. There were no significant changes to weight, BMI, body fat percent, SBP, estimated  $VO_{2max}$ , balance, knee ROM, or hamstring flexibility. A significant decrease in DBP ( $p < 0.05$ ) and increase in shoulder flexibility ( $p < 0.001$ ) and leg press 1-RM volume ( $p < 0.05$ ) was noted. Improvements in physical and mental health, team building, and health behaviors were reported by the participants. **CONCLUSIONS:** Fourteen weeks of work-related exercise training in firefighters elicited improvements in clinical, performance, and self-reported physical activity and mental health outcomes.

## **Perceptions of Monitoring Techniques for Fatigue Used by Strength Coaches on NCAA Women's Soccer Players**

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NCAA Division II women soccer athletes may experience high levels of fatigue which can have a negative impact on their performance during competition. Although coaches agree that monitoring fatigue is an important element in program design, there is not one widely accepted fatigue measure used to monitor women's soccer training. **PURPOSE:** To provide an investigation on the preferred mode of action by strength and conditioning coaches to reduce fatigue and increase performance of NCAA Division II women's soccer players. **METHODS:** Eight (n=8) head strength and conditioning coaches, two (n=2) women's soccer coaches, and eighteen (n=18) women's soccer players from the NCAA Division II PSAC participated in this retrospective qualitative case study from the fall 2019 semester. Strength and conditioning coaches and head women's soccer coaches participated in a semi-structured interview while women's soccer players completed an open-ended survey to share their insights to examine the current fatigue monitoring techniques utilized at the NCAA Division II level with all information subsequently analyzed thematically to code the data. **RESULTS:** All strength and conditioning coaches interviewed believed monitoring fatigue is important (100%) yet only a select number of coaches are currently implementing such fatigue monitoring techniques (38%). Of the fatigue techniques currently being implemented, the women's soccer players believed the programs did help reduce fatigue (72%) and increase performance (78%). Thematic analysis of the barriers that strength and conditioning coaches face to implement a fatigue monitoring program were also identified which include limited staff, budget, and facilities at the NCAA Division II level. **CONCLUSION:** With the wide range of fatigue monitoring techniques available, selection and implementation of the most appropriate test based on the various factors at each specific university can provide an effective and productive system to garner the most out of each athlete during training and competition.