

## **THRIVING NOT SURVIVING- SETTING YOURSELF UP FOR SUCCESS AT SEACSM**

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The purpose of this preconference tutorial is to engage new professional and student members in making the most of the SEACSM Annual Meeting and membership. Audience members will have an opportunity to meet current SEACSM Executive Board members and learn more about service and leadership opportunities for professionals and students. Discussion topics will include identification of key events and activities where valuable networking is available. This interactive session will include an opportunity for the audience to learn about techniques and resources to implement before, during and after the conference to maximize their experience. Time for questions and discussion will be included.

**PC1**

**PC2**

## **OVERVIEW AND SCOPE OF THE CERTIFIED EXERCISE PHYSIOLOGIST**

Greg Stanley. Carson-Newman University, Jefferson City, TN

Proposed mini-symposium session will provide a definition, description, focus, and overview of the scope of practice for the clinical exercise physiologist. A brief description of the educational and professional preparation required for the CEP profession will be provided. In conjunction with a concise outline of the chronic diseases served by CEPs. **LEARNING OBJECTIVE:** Attain general understanding of the CEP profession and how it is beneficial to the management of multiple chronic diseases.

No grant or external funding for presentation.

## **RAPID RESEARCH RACE**

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The Rapid Research Race (RRR) Preconference is a wonderful way to learn about the SEACSM research diversity within three minutes. **Methods:** This session will give the attendee the opportunity to hear well-known researchers, both PhD students and faculty, from different universities present a variety of quality projects. **Results:** Each speaker will present original research findings in two minutes. They will then have a one-minute question-and-answer session, following their presentation.

**Conclusions:** Come and network with these researchers and learn about all great research in a short span of time.

**PC3**

Confirmed presenters with research titles:

- Behavioral approaches to accumulating physical activity are associated with the sex steroids in mice; Robert (Bob) S. Bowen, Ph.D., Dean and Associate Professor, Truett McConnell University, Cleveland, GA;
- Examining Health Risk a Factors in Community-dwelling Older Adults; Trudy Moore-Harrison, Ph.D., Clinical Assistant Professor, University of North Carolina-Charlotte
- Exercise in All Chemotherapy: The ENACT Trial; Kathryn Schmitz, Ph.D., Professor, Penn State University, ACSM president
- High Intensity Functional Training - More than just Extreme; Yuri Feito, Ph.D., Associate Professor, Kennesaw State, Kennesaw, GA
- Relationship between self-reported training distress and protein expression in collegiate swimmers: A season long study; Amy Knab, Ph.D., Associate Professor, Queens University, Charlotte, NC
- Identifying the Critical Resistance for the Deadlift; Taylor Dinyer, Ph.D. Student, University of Kentucky
- Impact of acute exercise on ERP responses to addictive substances; Dr. Stephen P. Bailey, Professor, Elon University, Elon, North Carolina
- High intensity interval training for cardio-respiratory fitness among HIV+ women with neurocognitive impairment; Farah Ramirez-Marrero, Ph.D., University of Puerto Rico
- Genetic and cellular determinants of ischemic disease; Terence Ryan, Assistant Professor, University of Florida, Gainesville, FL
- Exercise Evaluation; Lauren Gover Killen, Assistant Professor, University of North Alabama, Florence, Alabama
- Is device-based physical activity related to Executive Function and Academic Skills among African-American Children with Behavior Disorders? Maria Santiago, Ph.D. student, University of Illinois, Chicago

## ENHANCING BODY COMPOSITION TECHNIQUES AND THE IMPACT OF HYDRATION AND SUBJECT PRESENTATION ON VARIOUS METHODS

J. R. Moon; ImpediMed, Inc., Carlsbad, CA; United States Sports Academy, Daphne, AL

Over the last several years there have been significant advances in body composition methods and techniques. Specifically, updated and simplified multi-compartment models, methods to detect fluid shifts in whole body and segmental tissue, and other new approaches have been investigated. Yet, many researchers and clinicians simply rely on single methods that haven't changed much in decades. Additionally, recent studies have shed light on the impact of different pre-testing guidelines (subject presentation) as well as the impact of hydration changes on various body composition techniques, such as the impact of creatine loading or glycogen depletion on a DXA scan. Attendees of this tutorial will develop a better understanding of current body composition methods and their recent enhancements and inherent limitations while learning ways to quantify variability and remove some measurement error using their current equipment and devices.

T1

## ACSM CLINICAL EXERCISE PHYSIOLOGIST CERTIFICATION® AND THE CEPA REGISTRY FOR CLINICAL EXERCISE PHYSIOLOGISTS

Trent A. Hargens, James Madison University, Harrisonburg, VA

In November of 2017, the American College of Sports Medicine (ACSM) Board of Trustees approved a motion by the Committee on Certification and Registry Boards (CCRB) to merge the two ACSM clinical certifications, the Registered Clinical Exercise Physiologist® (RCEP) and the Certified Clinical Exercise Physiologist®, into a single clinical certification. This new certification became the new ACSM Certified Clinical Exercise Physiologist® (ACSM-CEP®) in November of 2018. As a result, many current certified professionals expressed concerns about the status of their certifications moving forward. In response to the certification merger, and with the support of ACSM, the Clinical Exercise Physiology Association (CEPA), an affiliate society of ACSM, established a Registry for Clinical Exercise Physiologists, administered by CEPA and through the CEPA website. This registry is the only national registry promoting the profession of clinical exercise physiology and is a way to connect highly qualified clinical exercise physiologists with employers across the country. For employers, the registry offers a place to find individuals to lead and design exercise testing and training programs across a variety of clinical populations. This tutorial will: a) describe in detail the CEPA Registry for Clinical Exercise Physiologists, including the criteria for application, b) provide information on the ACSM-CEP® in its current form, c) provide information on how CEPA works to advance the profession of clinical exercise physiologists, and d) provide a broad overview on the profession of clinical exercise physiologist. This tutorial is targeted towards students, faculty, professionals, practitioners and employers interested in the field of clinical exercise physiology, obtaining and/or maintaining a clinical certification, and applying for the CEPA Registry for Clinical Exercise Physiologists

T2

## EXERCISE INTERVENTION IN CHRONIC PAIN: AN UPDATE OF EVIDENCE AND PRACTICE

B.J. Myers; Campbell University, Buies Creek, NC

Pain is a large driver of health seeking behavior throughout the world with most cases resolving independent of health care intervention or with targeted amelioration strategies. Persisting pain lasting >6 months is a growing health concern that now affects >20% of the population. Musculoskeletal disorders frequently respond well to exercise via endogenous analgesia in both acute and chronic states. However, whiplash associated disorders, fibromyalgia, and other conditions with central neurobiological changes may respond negatively to the initiation of physical activity. All medical pain conditions benefit from physical activity is an integral component of a multi-dimensional strategy. Improvement is likely in pain, sleep quality, depression, anxiety, mood, fear, social isolation and physical function. This session will provide guidance in addressing exercise interventions for persistent pain including: 1) appropriate screening for medical referral, 2) neurobiological changes in pain perception, 3) parameters for progression of cardiovascular and resistance training, and 4) collaboration with a multi-disciplinary health care team. LEARNING OBJECTIVES: 1. Describe the current state of evidence supporting exercise interventions in the presence of chronic pain. 2. Examine the importance of individual performance measures in relationship to exercise intervention in chronic pain. CHANGES IN COMPETENCE AND/OR PERFORMANCE: Attendees will be able to apply current evidence in the exercise management of individuals with chronic pain.

T3

## EFFECTS OF FAITH-BASED INITIATIVES IN IMPROVING AND SUSTAINING HEALTH AND WELLNESS

Walter R. Thompson, and L. Jerome Brandon. Georgia State University, Atlanta, GA

Health and wellness among Americans have declined in recent decades despite national, state and local efforts advanced to change the trend. The diversity of the American population complicates planning and programming for all segments of our population as existing research and practices have not produced the desired outcomes, as a recent World Health Organization report indicates. One area that has promise for segments of the population is faith-based initiatives particularly when combined with technology. Spiritual beliefs have been shown to enhance the commitment and discipline necessary to improve quality of life. Therefore, the purpose of this tutorial is to present results from research in the literature and data from our laboratory on the contribution of physical activity, weight management efforts and healthy lifestyle choices combined with technology to help individuals of faith become healthier. Four general topics will be discussed in this presentation: 1) life skills, physical activity, nutritional and stress management instructional bullets on improving overall quality of life; 2) community-based participatory research as a guiding framework among people of faith; 3) Combining technology, information and instructed participation with motivation sessions to encourage individuals to become healthier; 4) importance of culture and faith blended with other initiatives in motivating Americans to be healthier. The tutorial will end with a discussion to get input from the audience to assist the ACSM Presidential Task Force on Faith-Based Initiatives.

T4

## PHYSICAL ACTIVITY GUIDELINES: WHERE WE'VE BEEN AND WHERE WE'RE GOING

P.G. Davis, FACSM; The University of North Carolina at Greensboro, Greensboro, NC

T5

Over the past several decades, physical activity has become recognized as an effective means of delaying mortality and improving most aspects of health. While earlier physical activity recommendations focused primarily on structured exercise, guidelines over the past twenty-plus years have “loosened” to recognize the benefits from a larger range of physical activity that might not necessarily be “fitness”-based. This tutorial will review the chronology of physical activity guidelines over the years, discussing rationale and some of the accompanying controversies. The discussion will then segue into a review of the US Department of Health and Human Services’ “2018 Physical Activity Guidelines Advisory Committee Scientific Report”. The Review’s major findings since DHHS’s inaugural “2008 Physical Activity Guidelines for Americans” will be discussed and the tutorial will conclude with a brief discussion of the still currently “unknowns” regarding the relationship between physical activity and health.

## DIETARY NITRATE SUPPLEMENTATION: WHAT IS IT GOOD FOR? AN ERGOGENIC AID OR EXERCISE THERAPEUTIC?

J.D. Allen. The University of Virginia

T6

Oral consumption of inorganic nitrate, abundant in green leafy vegetables, has been shown to increase plasma nitrite concentration, which can be converted to nitric oxide (NO) in low oxygen conditions. The associated physiological effects include a reduction in blood pressure, modification of platelet aggregation and increases in limb blood flow. There are numerous studies of nitrate supplementation in healthy populations; however, the ergogenic benefits are unclear due to small sample sizes, different dosing regimens, nitrate conversion rates, heterogeneity of initial fitness levels and types of exercise tests employed. In clinical populations, study results seem more promising, particularly in patients with cardiovascular diseases (CVD) who present with disruptions in the VO<sub>2</sub>-oxygen cascade and reduced exercise tolerance. Many disease-related, physiological maladaptation’s including, endothelial and mitochondrial dysfunction, increased reactive oxygen species and reduced tissue perfusion have been identified as potential targets for NO restorative effects. This tutorial will outline the evidence for inorganic nitrate supplementation as a ergogenic aid in healthy populations and as therapeutic intervention to restore exercise tolerance in patients with CVD. It will summarize the factors that appear to limit or maximize its effectiveness and present a case for why nitrate supplementation may be more effective in patients with CVD. Learning Objective: To understand the role of the nitrate/nitrite/nitric oxide pathway and its role in exercise performance in health and disease. Changes: Be able to make informed decisions related to the optimal administration (timing/dosage) of inorganic nitrate and which populations/conditions may illicit a larger benefit.

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## A ROLE FOR EXERCISE PHYSIOLOGISTS ON THE ONCOLOGY CARE TEAM

G. Stephen Morris, PT, PhD, FACSM; Wingate University; Wingate, NC

T7

Like most people in the general population, cancer survivors are poorly conditioned when they receive a cancer diagnosis and their conditioning status typically declines during treatment. Some, but not all, recover their pre-diagnosis status once treatment has been completed. Like most people in the general population, participation in an exercise training program results in cancer survivors experiencing positive physiological and psychological adaptations. The health status of post treatment cancer survivors can range from being as healthy as age matched healthy individuals to being severely compromised secondary to the presence of multiple comorbidities. Exercise physiologists (EP) increasingly play an important role in providing exercise training services to cancer survivors and do so in a number of settings. However, their training, license and experience prevents them from treating all cancer survivors. Understanding these limitations and providing focused training allows EPs to treat a broader population of cancer survivors and allows them to become integral components of the cancer health care team.

This symposium will provide the following:

A review of current literature of exercise training in the context of an oncology diagnosis; An introduction to the role of EPs in cancer rehabilitation stepped care; Programs that provide advanced training in oncology to EPs; Using cardiac rehabilitation programs as a model for oncology rehabilitation.

Attendees will learn about potential roles for EPs in the exercise training of cancer survivors. This knowledge will broaden attendees knowledge of new, potential clients for EPs and increase their employment opportunities.

## USING ACCELEROMETERS TO BETTER MANAGE TYPE 1 DIABETES MELLITUS: CAN IT HELP PREDICT THE FUTURE?

J.R. Jagers, K. Wintergerst. University of Louisville, Louisville, KY

T8

The importance of routine physical activity when it comes to maintaining health and longevity is just as important during adolescence as it is while aging and often sets the stage for lifelong healthy behaviors. With all children encouraged to accumulate at least 60 minutes of play for known health benefits, it is imperative that those with type 1 diabetes mellitus (T1DM) be able to participate with their peers free from fear of diabetes related complications. However many pediatricians treating children with T1DM lack the ability to monitor minute by minute activity, heart rate, and sleep data. Even if they do there has yet to be an easy way to integrate the data from other mobile devices being used as part of their regular care like continuous glucose monitors (CGM) and insulin pumps. Without knowing how to adequately anticipate a response many individuals put themselves at an increased risk of hyper- or hypoglycemia during exercise, and nocturnal hypoglycemia during sleep. This often leads to fear of exercise and competitive sport participation for those living with T1DM. Using patient-based care data collected from ongoing research at the Novak Center for Children’s Health this tutorial will discuss the importance of taking daily physical activity into consideration when managing diabetes and explore the use of data from real-time physical activity monitoring combined with patient CGM data to identify trends, relationships, and even prediction equations that are specific to each individual patient. Those in attendance will learn novel ways of incorporating physical activity monitoring with other mobile devices used in diabetes patient care.

Funded by Children’s Hospital Foundation, Christensen Family, Norton Children’s Hospital, and University of Louisville.

### WALK WITH US

WH. Weimar, CW. Wilburn, BE. Decoux, and JA. Roper. Auburn University, Auburn, AL

**T9**

While gait is a much studied movement, it is often investigated by considering only one component at a time. This approach has revealed considerable knowledge about gait; however, due to this myopic view, some of these findings have been identified as flawed. For example, the six determinants of gait proposed by Saunders et al., 1953 have strong mechanical backing, but limitations emerge when energetics are considered. In addition, a propensity of research is beginning to align and confirm that the ankle is main source of propulsion during gait. However, the literature has yet considered the role of the architecture of the foot, footwear, or even the surface on this finding. So, as gait is the primary locomotion of many beings, the multitude of things that influence it continues to make it a source of great interest. The purpose of this tutorial is to introduce the participant to how only four of these things influence each other and in turn, gait. Specifically, the items considered will be the foot architecture, footwear, surfaces and energetic cost. This tutorial will (a) provide a brief overview of how each of these components influence gait, and (b) indicate how each of these factors influence each other in the context of gait. This tutorial should have broad appeal to individuals with locomotion as an area of interest, particularly from a mechanical and energetic perspective.

### USING YOUR EXERCISE SCIENCE DEGREE TO IMPROVE YOUR FUTURE PHYSICAL OR OCCUPATIONAL THERAPY SCHOOL EXPERIENCE

A. Bosak. Liberty University, Lynchburg, VA

**T10**

With the requirement of obtaining the DPT degree for new physical therapists to practice their trade and the increase of various clinical graduate degree options (ie. Occupational Therapy, Chiropractic, Physician Assistant, etc.), there has been an increase in students who enter undergraduate and graduate exercise science degree programs in order to pursue future rehabilitation sciences (ie. clinical) training. The need to advise these specific students on how to utilize their exercise science degree to improve their chances of being admitted to these highly competitive clinical graduate programs has become exceedingly important. Ironically, there is a strong relationship between the content covered in an exercise science degree and the related material that students encounter at the clinical graduate school level. Hence, the purpose of this tutorial will be to suggest how students can maximize all aspects of their exercise science undergraduate and/or graduate degree in order to enhance their future overall clinical graduate school experience. Similarities between classes at the clinical graduate and undergraduate exercise science level, plus the completion of all relevant tasks, required to pursue clinical graduate degrees, will be discussed. An additional feature of this tutorial is that an exercise science professor and graduate director will give insight on how to prepare students for DPT, OT, and related rehabilitative sciences degrees. This presentation is intended for students seeking future clinical graduate degree options and advisors or new professors who assist students in preparing for their DPT or related degree future.

### HOW OUR THOUGHTS ON SKELETAL MUSCLE INJURY HAVE CHANGED OVER THE LAST THREE DECADES

G.L. Warren<sup>1</sup>, C.W. Baumann<sup>2</sup>. <sup>1</sup> Georgia State University, Atlanta, GA; <sup>2</sup> University of Minnesota, Minneapolis, MN

**T11**

In the early 1990's, several classic reviews on skeletal muscle injury were published, including one authored by one of the tutorial's speakers. These reviews shaped muscle injury research for years to come. A general theme of these reviews was that in muscle injury there is an initiating event that is followed by a secondary injury caused by loss of calcium homeostasis, production of reactive oxygen species, and inflammation. The reviews also purported that the loss of strength following injury is due exclusively to muscle fiber death and/or structural damage within the muscle. Finally, these reviews would generally have us believe that recovery from all muscle injuries is the same. In other words, muscle injury is muscle injury. The objective of this tutorial is to present data that demonstrate these beliefs are probably wrong. We will provide extensive evidence that the majority of strength loss following contraction-induced injury is due to a failure in the excitation-contraction process and depending on the conditions, this failure may be due to an inability to trigger calcium release from the sarcoplasmic reticulum or an inability of the fiber to generate and/or conduct action potentials. We will also provide convincing evidence for the lack of a secondary injury and that more inflammation, if anything, accelerates the recovery from injury. Finally, we will provide evidence that recovery from some injuries is rapid and complete and in others, the recovery is minimal.

### GRADUATED NOW WHAT? SUCCEEDING IN THE EXERCISE PROFESSION

Meir Magal<sup>1</sup>, Francis B. Neric<sup>2</sup>. <sup>1</sup>North Carolina Wesleyan College, Rocky Mount, NC; <sup>2</sup>American College of Sports Medicine, Indianapolis, IN

**T12**

Every "fresh" graduate must think about the next step. How can you shine above the rest upon graduation? It is not just cliché, it is reality. Becoming an ACSM certified professional may be the one thing that you can do to in order to stand out above the others in the field. With ACSM being a leader by providing the most highly accepted certifications in the industry, becoming a certified professional means that you are making a commitment to establish yourself as a respectable fitness professional. After all, this is your opportunity to lead and hold a Gold Standard credential. This tutorial will focus on providing information concerning why is it important to gain ACSM certification and what tools are available to you in your pursuit of a Gold Standard certification.

### **RISKY PLAY: IS THE RISK GREATER THAN THE REWARD?**

D.P. Coe<sup>1</sup>, T.J. Kybartas<sup>1</sup>, and M.E. Chaney<sup>2</sup>. <sup>1</sup>The University of Tennessee, Knoxville, TN and <sup>2</sup> Wauhatchie School, Chattanooga, TN

**T13**

Risky play is described as active experiences for children that involve thrill and also the potential for injury. Sandseter has written extensively on children's risky play, providing operational definitions, affordances for risky play experiences, and the benefits of risky play. Risky play can take place either indoors or outdoors, with much of Sandseter's work focuses on outdoor play. Although Sandseter has provided definitions and examples of risky play, each individual may have a unique connotation of risky play that has developed from their own experiences. Adult perceptions of risky play may differ based on the age, sex, and skill level of the child, and perceptions may be different among caregivers (teachers and parents). Paradoxically, in society we primarily focus on reducing risk in most situations. The physical activity recommendations for young children address the safety of the indoor and outdoor environment prior to children engaging in activity. Additionally, most playgrounds have specific regulations and certifications to ensure a safe environment. These factors and children's physical safety may cause apprehension in caregivers' tolerance to allowing children to engage in risky play. The overall objective of this tutorial is to educate researchers, practitioners, and caregivers on the multifaceted nature of risky play. The benefits of risky play will be addressed. We will provide evidence regarding how physical activity levels vary during risky play compared to typical play. We will also discuss results from a qualitative study that investigated parents' and teachers' perceptions of toddler's risky play. Finally, we will explore the potential of creating a continuum of activities based on risk level in order to provide the audience with a better understanding of risky play and what activities would be appropriate for young children.

### **GRADUATE STUDENTS' AND A PROGRAM DIRECTOR'S PERSPECTIVE ON ACHIEVING ACADEMIC AND PROFESSIONAL GOALS**

R. Lowell, H. Nelson, M. Phillips, B. Ziebell, & A. Bosak. Liberty University, Lynchburg, VA

**T14**

It is rather apparent that many students are apprehensive about their academic and vocational future. Often, students will seek advice from their academic advisor, research mentor, and/or other professionals in order to gain knowledge and insight on what they should do with their future and how they should compete for graduate school or a future career. However, it can be very valuable for students to discuss their fears and concerns with other students who have experienced similar feelings and/or situations. Hence, this tutorial's purpose is to allow session attendees to hear various graduate students' perspectives on progressing from an undergraduate degree to graduate school and/or careers. A distinct feature of this presentation is insight and viewpoints from four current second-year graduate assistants with diverse educational backgrounds and individual future professional goals. The students will be sharing their academic paths, guidance they have received, and recommendations they have for students in similar situations. This session will also include remarks and insight from a Professor and Director of a graduate program. This presentation will 1) outline various tasks that students should accomplish in order to be prepared for graduate school or related career and 2) serve as a "help-session" by sharing tips and suggestions that have aided other students in acquiring their desired graduate assistantship or job. This session will also discuss professional development areas (i.e. research/scholarship, professional service, internships, etc.) that students should focus on to enhance their portfolios. This presentation is intended for undergraduate students seeking graduate degrees, graduate students who desire to continue their education, new assistant professors seeking ways to advise their current students for future graduate degrees or careers, or recently graduated young professionals who are looking for ways to be competitive in today's job market.

### **CONVERGENCE OF PHYSICAL ACTIVITY & HEALTH: PROMISING CAREER PATHS FOR THE FUTURE**

M Stoutenberg<sup>1</sup>, DB Bornstein<sup>2</sup>, AG Bell<sup>3</sup>; <sup>1</sup> University of Tennessee at Chattanooga, Chattanooga, TN; <sup>2</sup> The Citadel, Charleston, SC; <sup>3</sup> Mid-Atlantic Affiliate of the American Heart Association, Morrisville, NC

**T15**

Through decades of rigorous research by exercise scientists and leaders in sports medicine, the numerous health benefits of physical activity are undeniable. With the increasing incidence of chronic disease and dangerously high levels of physical inactivity, both in the United States and globally, we must shift our understanding of how to translate our scientific findings regarding the benefits of physical activity into achieving sustainable improvements in the health of our communities. Now more than ever we must understand how to optimally implement physical activity interventions as an integrated part of population health. This session will expose attendees to the growing role and importance of physical activity in public health, and how to better translate science into action. Through an active learning process, attendees will learn about key guidelines and organizations working to promote physical activity in public health. Attendees will also learn about the important role they can play in increasing population-levels of physical activity in order to prevent disease, whether as a clinician, researcher, or practitioner. The overall goal of this program is to expose attendees to the field of public health and the professional pathways available to them in impacting the health of their communities. At the conclusion of this presentation, attendees will be able to: 1) summarize key physical activity concepts, guidelines, and organizations in the field of public health, 2) understand what role they can play in being a solution to the physical inactivity pandemic, and 3) identify potential career paths in the field of public health for students with training in exercise science.

### **ENDURANCE TRAINING WITH LOW CARBOHYDRATE AVAILABILITY: CURRENT EVIDENCE AND CONTROVERSIES**

M.J. Saunders, FACSM. James Madison University, Harrisonburg, VA

**T16**

Endurance exercise conducted with low-carbohydrate reserves ('training low') has been a topic of considerable investigation and controversy in recent years. Numerous studies have reported that 'training low' results in enhanced fat utilization, and increased markers of mitochondrial biogenesis, compared to when training is completed with high carbohydrate availability. Although these adaptations are seemingly advantageous for endurance athletes, most of these studies have reported that performance gains from 'training low' are similar to performance improvements when training is completed with high carbohydrate availability. In addition, 'training low' has been associated with negative consequences, including increased perceived effort during exercise, impaired training capacity, and elevated risks for overtraining. Current evidence suggests that strategically-timed 'training low' strategies may be beneficial under specific circumstances, but this approach may not be desirable for most athletes as a regular training diet, or during sustained periods of heavy training. This tutorial will: a) examine evidence regarding the effects of 'training low' on adaptations to exercise, and endurance performance, b) discuss how different 'training low' strategies influence the efficacy of this approach, and c) discuss practical considerations when considering the utilization of these strategies for athletes. The tutorial is targeted to students, professionals and practitioners who have an interest in effects of nutritional modifications on metabolic responses and performance in endurance athletes.

### THE ROLE OF BIOGENIC AMINES IN MOVEMENT

KA Neely, MS Kamath, & JA Roper. Auburn University, Auburn, AL

The role and importance of neurotransmitters in movement is often overlooked in behavioral studies. In particular, it is not standard practice to obtain a medical history and a list of current medications from healthy participants. Importantly, however, it is well known that neurotransmitters such as dopamine and serotonin influence the brain systems supporting movement. There has been a 64% increase in the number of people taking antidepressants between 1999 and 2014, such that 12.7% of the U.S. population (over age 12) report taking antidepressant medication in the last month (Pratt et al., 2017). Therefore, it would be prudent for movement scientists to consider whether “healthy” participants are taking medications for psychiatric or neurologic conditions. In addition, the effect of medications should be considered when interpreting differences between clinical groups (e.g., ADHD) and non-clinical groups. This tutorial will discuss how movement may be influenced by the biogenic amines: dopamine, serotonin, histamine, epinephrine, and norepinephrine. We will discuss key studies in the literature, as well as present new data on the use of medications in young adults with and without ADHD. We will suggest best practices for the consideration of medication in human movement research. This tutorial should appeal to a broad audience with interests in physiology, biomechanics, and motor control and learning.

**T17**

### CONSIDERATIONS FOR QUALITATIVE AND QUANTITATIVE ANALYSIS OF WEARABLE TECHNOLOGY

J.A. Bunn<sup>1</sup> and L.C. Eschbach<sup>2</sup>; <sup>1</sup> Campbell University, Buies Creek, NC; <sup>2</sup> Valencell Inc., Raleigh, NC

DESCRIPTION: Validity, reliability, and accuracy of physical activity monitors is a growing area of research in the field of exercise science, but there is large variation in methods employed for statistical assessment. These discrepancies confound the research creating equivocal results within devices, thereby confusing researchers and consumers. This session will discuss evaluating devices for steps and heart rate related to: 1) the use of appropriate benchmarks for comparison, 2) practical methods used for qualitative assessment, and 3) best practices for quantitative assessment using statistical procedures. Discussion about qualitative assessment includes the importance of examining reference device data, data alignment, methods for addressing error distribution, and data dropout from devices. Discussion regarding quantitative assessment includes using equivalence testing versus tests of differences, correlation procedures, and statistical violations. This session will be led by a wearable technology industry expert and an academic researcher with publications assessing the accuracy of activity monitors. LEARNING OBJECTIVE: Understand and apply appropriate methods for evaluating the validity, reliability, and accuracy of physical activity monitors for steps and heart rate. CHANGES IN COMPETENCE AND/OR PERFORMANCE: Attendees will be able to apply the methods presented in this session to their own data collection and research in wearable technology, as well as becoming a more meticulous consumer of research on wearables.

**T19**

### CREATING AN EFFECTIVE AND PROFESSIONAL SOCIAL MEDIA STRATEGY

B. Parr<sup>1</sup>, Y. Feito<sup>2</sup>, A. Schwartz<sup>3</sup>; <sup>1</sup>University of South Carolina Aiken, Aiken, SC; <sup>2</sup>Kennesaw State University, Kennesaw, GA; <sup>3</sup>University of Tennessee, Knoxville, TN

Social media, blogs, and other online platforms have become a primary means of sharing research and communicating for professionals and students. However, many students and professionals have not embraced these essential communication tools. This can limit the visibility of research and other professional activity to the media and others in the field. Students may miss opportunities to communicate with potential employers, graduate programs, and other professionals. The purpose of this tutorial is to explain the benefits of using social media to showcase research and other professional activities, promote professional development, and enhance student engagement. This tutorial will share strategies for students and professionals getting started using social media, provide examples of using social media for professional networking, and explain how to integrate social media platforms to make it easy to share your work with a wider audience. The target audience for this tutorial is researchers, educators, and students who want to get started using social media as well as those want to take their social media use to the next level. Time for questions and discussion will be included.

**T18**

## RUNNING THROUGH THE AGES

David Hryvniak, Robert Wilder, Siobhan Statuta; University of Virginia, Charlottesville, VA

The running athlete is a unique challenge for clinicians as they commonly present with vague concerns which require knowledge about the anatomy as well as biomechanics. Adding to this challenge is the distinction in approaches to medical care between differing age group and sexes. This session will explore the current literature and guidelines regarding the medical management of special populations of runners including children, females, and the aging runner.

**S1** Clinicians, especially those not specialized in sports medicine, commonly take a similar, generalized approach to advice and treatment of their running patient population. However, there exist unique and imperative considerations when managing care related to children, females, and the aging runner.

It is important to educate clinicians as to the specifics for each of these distinctive populations, thus keeping these patients safely exercising. The complexity stems from each athlete being unique, but also due to shifting guidelines regarding safety of running for children, female athletes (especially related to female athlete triad and relative energy deficiency in sport), and well as cardiac concerns, osteoarthritis, and long term health in the aging runner.

## BLOOD FLOW RESTRICTION: IMPORTANT UPDATES AND APPLICATIONS

MB Jessee<sup>1</sup>, JG Mouser<sup>2</sup>, SL Buckner<sup>3</sup>; <sup>1</sup>University of Southern Mississippi, Hattiesburg, MS; <sup>2</sup>Troy University, Troy, AL; <sup>3</sup>University of South Florida, Tampa, FL

Background: Blood flow restriction (BFR), by itself or combined with low-load resistance training, has been shown to elicit both skeletal muscle and cardiovascular adaptations. Using pneumatic cuffs, elastic wraps, or other devices applied at the most proximal portion of the limbs BFR decreases arterial flow and limits venous return. As BFR training has become more popular in general, athletic, and clinical populations, literature has placed a greater focus on standardizing BFR methodology. Specifically, efforts have been made to understand variables affecting the amount of pressure applied and how that pressure influences muscular and cardiovascular responses. In addition, the understanding of the mechanisms involved in how BFR works is evolving. Scope: Given the greater implementation of BFR in a range of populations, this symposium will: 1) discuss important considerations and current best practices in the application of BFR, 2) discuss the cardiovascular adaptations observed following low-load resistance training combined with BFR, and 3) discuss muscular adaptations observed following low-load resistance training combined with BFR. Learning Objectives: Researchers and practitioners will leave with an understanding of the latest recommendations for application of BFR, an understanding of how BFR works, and what adaptations can be expected following a program that includes BFR. Researchers and practitioners may change how they apply restrictive pressure and will be able to better design protocols to elicit the desired adaptation.

**S2**

## TACTICAL PERFORMANCE RESILIENCY: AN INTERDISCIPLINARY APPROACH TO FITNESS AND PERFORMANCE IN MILITARY AND PARAMILITARY POPULATIONS

D.B. Bornstein, C.J. Sole, R.S. Sacko, A. Macdonald, B. Hickey, L. Townes, S. L. Crews; The Citadel, The Military College of South Carolina, Charleston, South Carolina

Attendees of this session will enhance their understanding of: cutting-edge methods for measuring fitness and performance in military and paramilitary populations; unique interventions for improving mental and spiritual resiliency in tactical athletes; and methods for working with military and paramilitary officials in redefining and improving fitness and performance of tactical personnel. Improving and monitoring readiness of military and paramilitary personnel requires comprehensive approaches, theories, and methods used by the U.S. military and other paramilitary organizations. This session will include a review of methods and results from a series of studies and policy efforts aimed at improving the physical, mental, social, and/or spiritual resiliency of tactical athletes in military and/or paramilitary environments. Experts from the fields of motor control, motor learning, tactical strength and conditioning, military psychology, and policy and environmental change will present ideas and evidence-based recommendations for improving what the U.S. Armed Forces calls "Total Force Fitness." Topics presented will include: novel approaches to the assessment of readiness for military and paramilitary training; defining, intervening upon, and assessing mental and spiritual resiliency in military and paramilitary populations; assessing sleep quality and quantity in a paramilitary setting; and achieving policy buy-in for implementing changes to traditional military physical training.

Some of the research presented was funded by The Citadel Foundation

**S3**

## FROM YOUNG ATHLETES TO THE ELDERLY: PROTEIN NEEDS THROUGHOUT THE LIFESPAN

M.A. Spano, Atlanta, GA

Protein has a powerful impact on health and disease prevention. This macronutrient is important throughout the lifespan and affects athletic performance, body composition and the progression of chronic diseases. A person's need for protein changes depending on their health status, age, training, calorie intake and more. When choosing protein, the total amount consumed in a sitting isn't the only factor to consider. Foods rich in protein often contain a package of nutrients including micronutrients and other compounds. The unique food matrix can affect acute muscle protein synthesis and also contribute to overall health. Yet cooking and food processing impact the bioavailability of amino acids.

This session will uncover the latest science behind protein needs, timing and type of protein for a wide range of individuals, plant versus animal proteins and how supplemental protein fits into the mix.

Supported by The Dairy Alliance

**S4**

### DEVELOPING AND IMPLEMENTING A STRENGTH AND CONDITIONING AND WELLNESS PROGRAM FOR FIREFIGHTERS

G.A. Ryan & B.F. Melton; Georgia Southern University, Statesboro, GA

S5

Working with and training of tactical athletes (law enforcement, military, firefighters, etc.) is of increasing interest to practitioners and researchers. The need for development of physical, emotional, mental, and nutritional health programs is vital to improve the overall health and well-being of this population. However, gaining access, facilities, and funding can sometimes be a barrier to working with tactical populations. The aim of this presentation is to discuss the development and implementation of a strength and conditioning, mental, and nutritional wellness program with firefighters in rural Southeast Georgia. We will discuss the history of the collaborative relationship we have with the local government and how this research serves to aid firefighters and other tactical athletes. The presentation will describe the procedures for establishing, developing, and implementing a strength and conditioning and overall wellness program for this population. The presenters will also discuss how data from this population has been processed, analyzed, and used to inform decision making on future strength and conditioning, mental, and nutritional testing and programming. In addition, normative data, as well as data from current and previous testing with these firefighters will be presented to facilitate discussion regarding how this research can be best used as a service to a tactical population.

### EXERCISE AND DIETARY ENERGY AVAILABILITY: EFFECTS ON CARDIOVASCULAR, PULMONARY AND METABOLIC DISEASE RISK

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S6

Physical inactivity and high calorie diets are leading contributors to the development of cardiovascular, pulmonary, and metabolic disease in the United States. While there is clear evidence that prescribing exercise lowers risk of disease and/or progression, the mechanism by which dietary manipulation interacts with exercise to optimize health is unclear in clinical populations. As a result, there is a strong need to determine if proximal energy availability (i.e. deficit/surplus) and/or macronutrient intake impacts acute and chronic exercise-induced adaptation in individuals at risk for chronic disease. Herein, we present evidence that improvements in endothelial function and insulin sensitivity are key cardio-metabolic factors impacted by diet and exercise therapy independent of fitness and weight loss. We also discuss the relevance of energy availability and high fat feeding surrounding exercise on systemic and airway inflammation as well as lung function in young and old adults. We further propose that under calorie restricted conditions, exercise promotes unique changes within adipose tissue energy metabolism that is central in “cross-talk” with whole-body and skeletal muscle glucose homeostasis in a dose-dependent manner. Taken together, we provide evidence-based recommendations on energy intake around exercise with the ultimate goal of prevention or treatment of cardiovascular, pulmonary and metabolic disease across the lifespan.

### NOVEL TECHNIQUES TO ASSESS PERIPHERAL VASCULAR FUNCTION AND BLOOD FLOW REGULATION IN HEALTH AND DISEASE

RS Garten, DL Kirkman, P Rodriguez-Miguel. Virginia Commonwealth University, Richmond, VA

S7

The presence of vascular dysfunction and/or exercise intolerance is evident in numerous disease states as well as in individuals at high risk for cardiovascular disease. The loss of vascular reactivity is well established as precursor for atherosclerosis development highlighting the importance of identifying and reversing this dysfunction. Furthermore, the potential mismatch of oxygen supply to oxygen demand in the working skeletal muscle can result in exercise intolerance, a characteristic highly related to overall mortality. Currently, numerous techniques exist that can examine large and small artery function at rest and during exercise. This symposium will focus on the current strategies and techniques employed when assessing peripheral vascular function and blood flow regulation in healthy and diseased populations. Specifically, Dr. Kirkman will discuss the use of laser Doppler to assess microvascular function in chronic kidney disease patients, Dr. Rodriguez-Miguel will discuss the use of the flow mediated dilation technique in individuals with COPD and cystic fibrosis, and Dr. Garten will discuss the use of passive limb movement and small muscle mass exercise in the evaluation of vascular function and blood flow regulation in healthy individuals and patients with heart failure. The goals of this symposium are to 1) highlight the numerous novel techniques utilized in the field of vascular physiology, 2) discuss relevant research in healthy and diseased populations utilizing these techniques, and 3) identify the important limitations and considerations when employing these techniques.

### IT JUST MAKES GOOD “CENTS”. COST BENEFITS OF PHYSICAL ACTIVITY

KL Peyer, K Hahn, GW Heath. University of Tennessee at Chattanooga, Chattanooga, TN

S8

**PURPOSE AND METHODS:** Changes to infrastructure and the built environment which are designed to increase active transport and recreation have been shown to support increased levels of physical activity. This improvement in activity levels can result in potential savings associated with the cost of selected chronic diseases. This symposium will describe the use of the CDC Chronic Disease Calculator that has been developed to estimate the cost burden of chronic diseases. When combined with the estimated increase in physical activity levels and concomitant decrease in physical inactivity due to improved pedestrian and bicycle infrastructure, the calculator allows for estimation of cost-benefit of these environmental supports. Specifically, the symposium will discuss 1) the cost calculator and its associated data sources, 2) sensitivity and specificity issues related to physical activity behaviors and prevalence of physical activity-related chronic diseases, 3) planning for infrastructure projects that support physical activity, and 4) evaluation of these projects. By the end of the session, learners should be able to describe the benefits to project justification that can be provided through the use of such calculators. Learners should also be able to incorporate cost-benefit approaches into their future studies related to the built environment, physical activity, and chronic disease outcomes.

### **MOVE MORE, MOVE TOGETHER: PROMOTING ACTIVE FAMILIES**

KD DuBose & D Dlugonski, East Carolina University, Greenville, NC

Parents are important facilitators of a child's growth and development. Parents help shape children's lifestyle and behavior choices, such as physical activity participation. Unfortunately, many parents and children are not engaging in regular physical activity. Using the family environment may be one method for increasing physical activity participation among parents and children. Therefore, this symposium will focus on the role families have on increasing physical activity in adults and young children. This symposium will: 1) provide an overview of the current literature regarding family-based physical activity; 2) discuss research-based strategies to help families increase their physical activity levels; and 3) present opportunities and challenges of working with families as a method to increase physical activity levels. By the end of the session, attendees will be able to articulate how family-based physical activity can help promote physical activity in adults and young children. Those attending the session will be able to shift their perspective on how to help families become more physically active and will be able to develop strategies for teaching families to be active together.

Funding: Research/Creative Activity Award East Carolina University

S9

### **SPORTS INJURY SURVEILLANCE: STATE OF THE SCIENCE AND APPLICATIONS TO INJURY PREVENTION**

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Sports injury surveillance has played a critical role in identifying patterns related to the incidence and outcomes of injuries across multiple levels of competition. In particular, injury surveillance has made considerable contributions to extending the sports medicine community's understanding of sports-related concussions (SRCs). As surveillance methodology evolves, new challenges arise in regards to analyzing surveillance data and interpreting associated findings. As such, there exists a need to examine the current state of sports injury surveillance and reconsider the analytical frameworks employed in this context. This will facilitate the utilization of surveillance data in developing nuanced hypotheses related to injury etiology, and support the process of developing evidence-based injury prevention programs. Accordingly, this symposium aims to present the current state of sports injury surveillance- particularly as it relates to SRCs, posit strategies for handling the unique analytical challenges posed by the evolving sophistication of surveillance methodology, and discuss the role of injury surveillance in the context of injury prevention. Attendees will be equipped with tools to be more refined consumers of epidemiological findings, and will be able to better apply such findings in informing their own sports injury-related research. The symposium will be broken down as follows: i. (0-10 mins): Introduction and general overview of sports injury surveillance, with emphasis on SRC-related findings; ii. (10-20 mins): Presentation and interpretation of sports injury surveillance data with emphasis on descriptive analysis as well as predictive modeling of injury outcomes; iii. (20-30 mins): The value of sports injury surveillance in the evaluation of injury prevention interventions; iv. (30-40 mins): Strengths and limitations of sports injury surveillance with particular attention paid to the capacity of surveillance in extending the understanding of injury etiology; v. (40-50 mins): Questions and Answers.

S10

### **SITTING IS THE NEW SMOKING: ACUTE SITTING AND CHRONIC WHOLE-BODY CARDIOVASCULAR ASSAULT**

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There has been great interest in the relationship between sedentary behavior, such as sitting, and whole-body cardiovascular risk. However, it is unclear how repeated exposure to acute bouts of prolonged sitting leads to cardiovascular risks. Further, most of our current understanding pertains to vascular dysfunction in the legs; little is known about the contributing mechanisms, as well as the acute effects of prolonged sitting on the central- and cerebro-vasculature. This knowledge is required to guide public health policy. This symposium will be broken down as follows: presentation 1 (0-10 min): a general overview, including a summary of what is known about the effects of prolonged sitting on the peripheral vasculature; presentation 2 (11-20 min): potential mechanisms leading to cardiovascular disease; presentation 3 (21-30 min): potential mechanisms leading to cerebrovascular impairments; presentation 4 (31-40 min): importance of repeated sedentary behavior to public health, and remaining gaps in the literature. Following the four presentations 10 minutes will be allotted for Q&A.

Grant Funding: American Heart Association

S11

### **EXERCISE IS MEDICINE-ON CAMPUS: GOING FOR GOLD; LESSONS LEARNED FROM SMALL, MEDIUM AND LARGE CAMPUSES**

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Exercise is Medicine®-On Campus (EIM-OC) calls faculty, staff and students to work together toward improving health and well-being by making movement a part of the daily campus culture, and assessing physical activity at every student health visit. Recognizing that each academic institution is unique, there is flexibility as to how campuses realize the aims of EIM-OC. This tutorial will highlight how three institutions of different sizes (small: Maryville College [~1200 students], medium: University of Tennessee-Chattanooga [~10,000 students] and large: University of Tennessee-Knoxville [~22,000 students]) in the state of TN approached establishing EIM-OC. Despite their significant difference in size, setting, and resources, all three programs were able to achieve Gold Level status after one year of implementing EIM-OC. Each school will share their approach for "going for gold", which will facilitate a discussion of a variety of programming successes, challenges, similarities and differences. All three programs are still in their infancy and are committed to the institutionalization of EIM-OC to insure program sustainability. This tutorial will provide concrete examples of how the goals of EIM-OC can be carried out across diverse campus communities, and share programming ideas and strategies that have been successfully implemented to contribute to Gold Level recognition.

Funding: Maryville College Gibson Fund

S12

### ELECTROMYOGRAPHY ACTIVATION PATTERNS DURING THE SOFTBALL SWING AMONG COLLEGIATE SOFTBALL PLAYERS

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Minimal research exists examining electromyography (EMG) in softball hitting. Upper extremity activation patterns have been established; however, no study has examined the musculature of the lumbopelvic-hip complex (LPHC) in these athletes. Purpose: The purpose of this study was to investigate muscle activation patterns of the LPHC during the softball swing in female, collegiate softball players. Methods: Nine NCAA Division I female softball players (19.9 ± 1.9 yrs; 159.6 ± 34.5 cm; 69.4 ± 9.9 kg) volunteered to participate. Surface EMG electrodes were placed on the following LPHC musculature: bilateral gluteus medius, bilateral gluteus maximus, and bilateral latissimus dorsi. Manual muscle testing was performed following electrode placement to determine baseline maximum voluntary isometric contraction (MVIC). Participants executed three maximal effort swings from a stationary tee placed mid-way between the knee and the hip and in the middle 'strike zone' location. All data were recorded at five swing events (stance, load, foot contact, ball contact, and follow-through) and expressed as a percentage of MVIC. Results: Stride leg gluteus medius yielded the greatest activation throughout the swing with 89.5%MVIC at foot contact, 82.8%MVIC at ball contact, and 102.4%MVIC at follow-through. Conclusions: Greatest activation of the stride leg gluteus medius is not surprising, as the need for maintaining the movement plane during pelvic transverse rotation is essential in generating power from foot contact to ball contact. However, it is interesting to note the discrepancy in gluteus medius activation of the load leg, specifically at the load event in which the athlete's center of mass has shifted towards the load leg. At this event of loading, it is postulated that the athlete should be activating the load side gluteus medius to maintain pelvic position prior to executing transverse rotation towards the ball.

TP1

### ASSESSMENT OF ANKLE MUSCLE ACTIVITY DURING UNEXPECTED AND EXPECTED INVERSION PERTURBATIONS

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PURPOSE: Anticipatory responses to ankle inversion perturbations can confound biomechanical data and prohibit an accurate assessment of lateral ankle sprain (LAS) injury mechanisms. Therefore, the purpose of this study was to assess neuromuscular control during unexpected and expected inversion perturbations using a novel experimental protocol. METHODS: Physically active participants with no LAS history (n=21) completed unexpected and expected 30 cm single-leg landings on a tilted platform rotated 25° in the frontal plane. Normalized mean muscle activity of the tibialis anterior (TA), medial gastrocnemius (MG), peroneus longus (PL) and peroneus brevis (PB) was computed for the 200 ms pre-landing and 200 ms post-landing using surface electromyography and compared using a dependent samples t-test (p < 0.05). RESULTS: Significantly less pre-landing TA activity (p = 0.031) and significantly greater post-landing PL activity (p = 0.017) was observed during the unexpected landing condition. CONCLUSIONS: Knowledge of the inversion perturbation elicited different motor control strategies to stabilize the foot and ankle when landing on the inverted surface. Future investigations should implement protocols that control for anticipatory responses to more accurately identify factors that contribute to LAS injuries.

TP2

### THE ROLE OF SINGLE LEG SQUATS IN PREDICTING PAIN AMONG YOUTH SOFTBALL PLAYERS

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Movement screens are designed to identify mechanical deficiencies and subsequently predict and prevent injury. In order for movement screens to be effective, population specific screens should be identified and/or developed. Use of proper screenings in youth softball players could reduce injury risk through the identification of pathomechanics. Purpose: To determine if the single leg squat (SLS) is an effective movement screen for youth softball players, by assessing pain history, sacrum depth, and knee valgus. Methods: Fifty-nine youth softball players (12.5 ± 2.16 yrs., 158.55 ± 9.74 cm, 61.53 ± 16.53 kg, 4.82 ± 2.23 yrs. of competitive play) performed the SLS bilaterally. Participants were instructed to "go down as far as you can" without the raised leg contacting the ground or stance leg. Kinematic data were collected at 100 Hz using an electromagnetic tracking system. SLS data were event marked at 45-degrees knee flexion on the decent (E1), maximal knee flexion (E2), and 45-degrees knee flexion on the ascent (E3). A Spearman's rank-order correlation was used to identify correlations between reported pain and sacrum depth/knee valgus at and between each event of the SLS. Results: Significant positive correlations were found between reported pain and significant change in degree of knee valgus from E1 to E2 in both the right (rs = 0.293, p = 0.024) and left (rs = 0.336, p = 0.009) SLS. Reported pain was also significantly correlated with sacrum depth at E2 (rs = 0.260, p = 0.047). Conclusion: These results indicate that the greater the degree of valgus deviation during the decent (E1 to E2) of the SLS is related to the occurrence of reported pain. Likewise, those who reached a greater depth at E2 in the right SLS were more likely to report pain. More research must be done in order to determine if the SLS has a role as a diagnostic tool in youth softball athletes. Thus, future research should aim at comparing more SLS variables to pain and developing a composite score for SLS performance.

TP3

### EFFECT OF ARCH TYPES ON CENTER OF MASS DISPLACEMENT AND KINETICS DURING LATERAL HOPPING

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Recent anecdotal suggestions have proposed that compromised foot architecture demonstrate alternative biomechanical characteristics beneficial to certain locomotive tasks. PURPOSE: This study examined the influence arch types have on stance phase kinematics and kinetics during a lateral hopping task. METHODS: A total of 27 collegiate male athletes (12 neutral arches (NA), 15 flat arches (LA)) were recruited to participate in this study. The Arch Height Index Measurement System was utilized to obtain foot anthropometric measurements for arch height classification. Following these measurements, participants performed three complete trials of lateral hopping (one-leg ski jumping; LJ) at a self-selected speed. A ten camera VICON optical motion capture system (200 Hz) and AMTI force platform (1000 Hz) were used to capture kinematic and kinetic data during the stance phase of each trial. Computations were then carried out in Visual 3D to extract the estimated frontal plane center of mass displacement (eCOM) and normalized mediolateral ground reaction forces (mGRF). RESULTS: A one-way MANOVA displayed significant differences in eCOM (F (3, 23) = 5.492, p = .005, η<sup>2</sup> = .417) but, lacked significance in mGRF. Post hoc tests revealed that LA (0.1047 ± 0.042 m) exhibited less eCOM when compared to NA (0.1559 ± 0.034 m; p = .002). CONCLUSIONS: The findings of this project suggest that different arch types produce distinctive eCOM deviations during directionally specific tasks. Future research should investigate how such alterations in eCOM can provide biomechanical benefits in various forms of locomotion.

TP4

### SAGITTAL PLANE KINEMATIC STABILIZATION AND VARIABILITY DURING A 30 MINUTE RUN

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Shoes are currently tested with a presumption that shoe behavior is stabilized and individuals respond within the same time frame. Previous studies reported sagittal plane kinematic stabilization within 20 minutes (min) of running; however, there is limited research regarding the variability of stabilization over a prolonged run. Purpose: To assess the sagittal plane kinematic stabilization and variability between beginning, middle, and end of a prolonged run. Methods: 9 recreational runners ( $26.5 \pm 9.2$  years) ran in non-habitual maximalist shoes on a treadmill for 30 minutes. 3D kinematics were captured every 5 minutes for 10 seconds. Kinematic data for mins 1, 15 and 30 were run through Visual 3D to calculate the maximum (max) angle for the hip, knee, and ankle for each stride. The average of each stride's max angle and standard deviation were calculated. Repeated measures ANOVAs with post hoc paired t-tests were run to assess differences between min 1, 15 and 30. Results: There were significant differences between max hip extension angle between min 1 and 30 ( $p=.004$ ), and max knee extension standard deviations between min 15 and 30 ( $p=.034$ ). Conclusion: When introduced to new shoes most sagittal plane angles were stabilized within the first 15 mins. Although max knee extension angle was stable, an increase in variability to maintain the stable angle may be present in the second half of the run.

TP5

### MINIMALIST STYLE MILITARY BOOT DOES NOT IMPROVE WALKING ECONOMY UNDER LOAD IN TRAINED MALES

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Footwear may be a simple external factor to improve rucking economy (RE) for soldiers that must carry heavy external loads, but it is also possible that with no flight phase, RE may not be enhanced by footwear style. This study compared RE with an ~500 g minimalist style boot (MIN) versus an ~800 g traditional style boot (TRD) while wearing a 16 kg external load consisting of a 7.5 kg weighted compression vest and ruck sack with 8.5 kg of weight. Male participants ( $n = 14$ ) completed two testing sessions for this study. In session 1 participants completed a VO<sub>2</sub> peak test ( $46.6 \pm 7.3$  ml/kg/min) under load while wearing their normal athletic shoes. The second session consisted of two 5-min walking treadmill sessions under load. Treadmill speed was based on the highest speed stage that allowed the participant to walk for the full stage during the VO<sub>2</sub> peak test. RE was evaluated using indirect calorimetry (TrueOne2400, Parvo Medics Inc. Provo, Utah) and calculated by averaging the 60-s average values of minutes 3-4 and 4-5. Steady state was confirmed by a difference  $< 0.1$  L/min between minutes 4 and 5. MIN and TRD were worn in a counter-balanced crossover order. There was a 10-min rest period between rucking bouts. RER did not differ between treatments (MIN =  $0.86 \pm 0.48$ ; TRD =  $0.86 \pm 0.51$ ;  $p = 0.96$ ). Although MIN ( $1.79 \pm 0.23$  L/min) tended ( $p = 0.13$ ) to improve RE versus TRD ( $1.85 \pm 0.30$  L/min), breathing RPE was the only measure that reached significance ( $p = 0.045$ ) between MIN ( $2.0 \pm 0.9$ ) versus TRD ( $2.4 \pm 1.2$ ). Altering boot type does not improve RE.

TP6

### EFFECT OF DEPTH JUMP HEIGHT ON LOWER EXTREMITY MUSCLE ACTIVATION

C.D. Addie, E.E. Grammer, M.K. Straughn, G.C. Ramos, T.J. Neltner, J.D. Simpson, L. Cosio-Lima, E.K. Greska, and L.E. Brown, University of West Florida, Pensacola, FL

Depth jumps (DJ) are commonly implemented in plyometric training programs in an attempt to enhance lower extremity power and jumping performance. However, it is unknown how different starting heights affect lower extremity muscle activation. PURPOSE: The purpose of this study was to assess lower extremity muscle activation during DJs from various heights. METHODS: College students who engage in plyometric training ( $m = 11$ ,  $f = 3$ ) (age:  $22.00 \pm 1.4$  y, height:  $166.52 \pm 48.88$  cm, mass:  $82.39 \pm 12.68$  kg) performed DJs from 30 cm (DJ30), 45 cm (DJ45), 60 cm (DJ60), 76 cm (DJ76), and 91 cm (DJ91). Surface electromyography (EMG) was used to record peak muscle activity from the lower extremity (vastus lateralis, gluteus medius, gluteus maximus) during the eccentric and concentric phases of the DJs. Dependent measures were compared using a repeated measures ANOVA. RESULTS: A significant main effect for box height was found for the eccentric phase where gluteus medius, DJ91 ( $1.414 \pm 0.429$  mV), DJ76 ( $1.361 \pm 0.451$  mV), and DJ60 ( $1.122 \pm 0.338$  mV) were greater than DJ45 ( $0.872 \pm 0.298$  mV). No other values were different. CONCLUSIONS: Increasing DJ height at and beyond 60cm augmented muscle activation of the gluteus medius during the eccentric phase of a DJ. Practitioners designing plyometric training programs that implement DJs may benefit from these findings when attempting to enhance lower extremity power and jumping performance.

TP7

### ELICITING MODERATE-TO-VIGOROUS PHYSICAL ACTIVITY IN PRESCHOOLERS: A COMPARISON OF INTERVENTION STRATEGIES

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PURPOSE: Approximately 50% of preschoolers do not meet physical activity recommendations and spend over 80% of their day sedentary. Although multiple interventions have targeted preschoolers, literature is unclear which types of interventions are effective eliciting physical activity for all preschoolers over time. The aim of this study was to determine which type of intervention elicits moderate-to-vigorous physical activity (MVPA) over time in preschool aged children. METHODS: 98 children (M age = 4.48 years) from one subsidized preschool participated in a physical activity intervention two days per week for 7 weeks (14 sessions). Participants were randomly assigned by class to one of four groups: control (unplanned free play), fundamental motor skill (FMS) focus, fitness focus, and both FMS and fitness focus. An Actigraph accelerometer placed on the hip measured percentage of time spent in MVPA during each session for all seven weeks. Stepwise linear regression determined which factors (sex, age or group) predicted physical activity at the end of the intervention. RESULTS: At baseline, males ( $p = .012$ ) and older children ( $p = .028$ ) participated in significantly more MVPA. The control group showed significantly lower levels of MVPA at baseline ( $p = .001$ ). The regression analysis showed more both boys and girls of all ages benefited from the intervention that targeted both FMS and Fitness ( $p = .041$ ). After controlling for baseline MVPA, age and sex in all three intervention groups participated in more physical activity than the control group ( $p = .002$ ) at week 7. CONCLUSIONS: Physical play environments that include a mix of both fundamental motor skills and fitness elicit higher level of MVPA for all preschoolers. Interventions that incorporate both FMS and fitness may decrease physical activity disparities within preschoolers.

TP8

#### **INCREASING NON-EXERCISE PHYSICAL ACTIVITY WITH AEROBIC TRAINING REDUCES CHANCE OF NON-RESPONSE TO EXERCISE**

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Evidence of cardiorespiratory fitness (CRF) non-response is emerging in both clinical and exercise training studies (~31.5%). **PURPOSE:** To determine if increases in non-exercise physical activity (NEPA) with aerobic training reduces CRF non-response among sedentary, overweight/obese adults. **METHODS:** Thirty-six adults (age: 54.19±7.14 years; BMI: 35.83±4.66 kg/m<sup>2</sup>; 77.8% female) were assessed from a 6-month exercise study (>70% adherence to training) with an aerobic training group (50-75% VO<sub>2</sub> max) and an aerobic training with increases in NEPA group (+3,000 steps/day from baseline). Non-response was determined via delta values (follow-up minus baseline values) for absolute VO<sub>2</sub> max (L/min). Non-responders were categorized via technical error (TE) (delta<0.71 L/min) and traditional measures (delta<0 L/min). Pearson chi-square test was conducted for categorical variables (i.e. responders vs. non-responders) in TE and traditional non-responders, separately. **RESULTS:** An increase in NEPA with training was significantly more likely to increase CRF in TE analysis (58.3%), X<sup>2</sup> (2, N=36) =10.99, p=.004, compared to training alone (30.0%). The traditional analysis showed no significant relationship among either group, X<sup>2</sup> (2, N=36) =2.77, p=.251. Binary multivariable logistic regression revealed age (p<.05) was a significant predictor of TE non-response, while BMI (p<.05) was a significant predictor for traditional non-response. **CONCLUSION:** Increasing non-exercise physical activity concurrent with aerobic training may improve likelihood of increasing CRF, which may promote reduced risk of cardiovascular disease.

Supported by a grant from the American Heart Association (13SDG17140091).

TP9

#### **EFFECTS OF REST INTERVALS ON REPETITIONS TO FATIGUE AND BLOOD LACTATE DURING BENCH PRESS EXERCISE**

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Rest interval (RI) and blood lactate (BL) concentration impacts performance during workouts.

**PURPOSE:** To examine effects that different RI (1, 3, and 5-minutes) have on repetitions to fatigue (RF) and BL following the bench press exercise, and to determine optimal RI between sets. **METHODS:** In a crossover and repeated measures design, 14 recreationally resistance trained men and women performed 5 sets of 5 repetitions at 75% one repetition maximum (1RM) with a randomly chosen RI between each set. BL was taken pre-warm up (BL0), 30 seconds post set (BL1), 30 seconds prior the next set (BL2), and 10 minutes post exercise (BL3). **RESULTS:** There was no main effect between sets and repetitions completed (p=0.081) and no interaction effect between repetitions completed and RI (p=0.058). RI has no effect on BL concentration taken at BL1 and BL2 (p=0.098, p=0.167 respectively). There was a main effect for BL2 (p=0.003) with BL increasing with each set. **CONCLUSIONS:** 1-minute RI is enough time to rest between sets for a five sets of five workout at 75% 1RM resistance training program. However, RI may fluctuate due to change in training goal or percentage of 1RM being used. More research is needed to investigate how BL concentration effects resistance training since most research on BL deals with aerobic exercises.

Supported by a grant from Undergraduate Research Advisory Committee and Meredith College Nutrition, Health and Human Performance Department.

TP10

#### **VALIDITY AND RELIABILITY OF THE YMCA SUBMAXIMAL CYCLE TEST USING AN ELECTRICALLY-BRAKED ERGOMETER**

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**Purpose:** Electrically-braked ergometers allow a consistent power output regardless of variances in pedaling cadence. To test the effect of using an electrically braked ergometer on the validity and reliability of the YMCA submaximal cycle test. **Methods:** 22 male and 13 female subjects (19 - 31 y) completed one maximal treadmill test and four submaximal cycle tests (using the YMCA protocol) to measure and estimate VO<sub>2</sub>max, respectively. The submaximal trials consisted of two tests performed using a friction-braked ergometer (Monark) and two using an electrically-braked ergometer (Viasprint). All measured and estimated VO<sub>2</sub>max values were compared using repeated measures ANOVA and post-hoc tests using paired t-tests. Paired t-tests were also used to determine potential differences between repeated submaximal trials using the same ergometer. Pearson correlation coefficients were used to determine validity and reliability coefficients. **Results:** The treadmill VO<sub>2</sub>max protocol yielded markedly higher (P < 0.05) values (50.3 ± 7.7 mL/kg/min) than the YMCA submax protocol using the friction-braked (40.8 ± 5.5 mL/kg/min) and electrically-braked ergometer (38.8 ± 4.5 mL/kg/min). Furthermore, estimated VO<sub>2</sub>max using the friction-braked ergometer was higher (P < 0.05) than that observed using the electrically-braked ergometer. There were similar reliability coefficients for the friction-braked (R = 0.63) and electrically-braked (R = 0.52) ergometers. Lastly, a moderately strong (R = 0.74) relationship was observed between actual VO<sub>2</sub>max and prediction error (VO<sub>2</sub>max - estimated VO<sub>2</sub>max). **Conclusion:** Both Monark and Viasprint ergometers underestimated VO<sub>2</sub>max in a sample of fit, young individuals. The magnitude of underestimation was greater in individuals with higher VO<sub>2</sub>max values. Using an electrically-braked ergometer did not improve either validity or reliability of VO<sub>2</sub>max estimates from the YMCA protocol.

TP11

TP12

### THERMONEUTRAL HOUSING EFFECTS ON ENERGY METABOLISM IN MICE

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Housing temperatures within the thermoneutral (TN) zone (30°C) produce mean energy expenditure (EE) rates in mice that are ~1.8 times higher than RMR, approaching values observed in humans. These findings question the validity of standard housing temperatures (22-23°C) for physiological and metabolic studies where EE rates are over 3 times higher than RMR. Inconsistencies in the literature and emerging evidence indicate that additional exploration of physiological and metabolic responses are required before adoption of TN housing in mice. Purpose: Explore effects of TN housing (30°C) vs. standard housing (22°C) on energy metabolism in mice. Methods: Sixteen 10-wk old male C57BL/6J mice were randomized to one of two groups (n = 8 per group): 1) TN (30°C) and 2) Standard (23°C) for 8 weeks. Energy intake and body weight were measured daily while body composition was measured during the final week of the study by Quantitative Magnetic Resonance (QMR). Resting (REE) and total energy expenditure (TEE) was measured by indirect calorimetry. Independent t-tests were used to examine differences among groups and values are reported as means  $\pm$  SD,  $\alpha < 0.05$ ). Results: Mice at TN had lower average energy intake compared to standard housing ( $7.5 \pm 0.3$  vs.  $10.0 \pm 0.2$  kcal/d,  $P < 0.001$ ). TEE was matched to energy intake with standard housing ( $10.0 \pm 0.2$  vs.  $9.9 \pm 0.5$  kcal/d,  $P < 0.001$ ), but energy intake was higher than TEE at TN ( $7.5 \pm 0.3$  vs.  $6.9 \pm 0.3$  kcal/d,  $P = 0.002$ ). Body weight in the TN group was 12.7% higher than standard housing ( $29.2 \pm 1.6$  vs.  $25.9 \pm 1.6$  g,  $P = 0.001$ ) and fat mass was 62.5% greater ( $7.8 \pm 1.3$  vs.  $4.8 \pm 0.7$  g,  $P < 0.001$ ). Blood glucose concentrations were not different between groups, but insulin responses in TN were higher than standard housing ( $1069.0 \pm 433.9$  vs.  $383.3 \pm 168.4$  pg/mL,  $P = 0.001$ ). Conclusions: The results of this study recapitulate well-known effects of TN housing on components of energy balance, but provide further evidence that additional studies will be required before large-scale adoption of TN housing conditions are applied to mouse studies.

TP13

### BODY COMPOSITION CHARACTERISTICS AND KNEE INJURY PREVALENCE OF NCAA DIVISION I WOMEN'S SOCCER AND LACROSSE

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Purpose: The purpose of this study was to characterize pre-season body composition differences and injury rates of female Division I soccer and lacrosse players using dual-energy x-ray absorptiometry (DEXA). Methods: Sixty Division I Women's Soccer (n=27) and Lacrosse (n=33) athletes (Mean  $\pm$  SD: Age: 19.8  $\pm$  1.4 yrs) participated in a whole body DEXA scan to determine fat mass (FM), percent body fat (%fat), lean mass (LM), segmental lean mass [right leg lean mass (RLM); left leg lean mass (LLM)], and bone mineral content (BMC). History of lower extremity injury (ACL and other knee injuries) throughout a career was self-reported. Measurements were taken pre-season (August 2018). Results: Between soccer and lacrosse, there were significant differences in %fat and segmental LM (LLM and RLM). Lacrosse athletes had higher %fat compared to soccer athletes: mean difference (MD): 2.5  $\pm$  2.3%;  $p=0.034$ . Segmental LM (LLM, RLM) was higher in both legs of soccer athletes (LLM MD: 0.80  $\pm$  0.54kg;  $p=0.004$ ; RLM MD: 0.89  $\pm$  0.52kg;  $p=0.001$ ). Total body LM, FM, and BMC were not different between sports ( $p>0.05$ ). When evaluating injured vs. not injured athletes in both sports combined, 45% of athletes reported a knee injury; %fat was significantly higher for athletes with no injury history (MD: 2.5  $\pm$  2.4%;  $p=0.046$ ). Conclusions: These findings illustrate body composition differences between Division I soccer and lacrosse athletes, specifically %fat and segmental LM (LLM and RLM). Identifying body composition characteristics between Division I soccer and lacrosse athletes may have implications for sport specific return to play and may be beneficial to off-season nutrition and strength training planning.

TP14

### COMPARISON OF VARIOUS BODY COMPOSITION MEASURES FOR DIVISION-I COLLEGIATE MALE ATHLETES

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Laboratory and field measures derive body composition values from algorithms based upon general populations and may provide varying estimates for athletic populations. PURPOSE: The purpose was to compare various field and laboratory measures of body composition in division-I male athletes against a criterion of air displacement plethysmography (ADP). METHODS: Sixty-nine Division-I collegiate male athletes, from various sports, performed five body composition measures (i.e., bioelectrical impedance spectroscopy (BIS), hand-to-foot bioelectrical impedance analysis (HF-BIA), foot-to-foot bioelectrical impedance analysis (FF-BIA), three site skinfold (SF), and ADP). Each participant performed all measures on the same visit to the laboratory. RESULTS: When compared to the criterion of ADP (12.2 $\pm$ 1.1%), results indicated a significant difference with BIS (18.1 $\pm$ 6.8%;  $p < 0.01$ ), and HF-BIA (18.5 $\pm$ 6.0%;  $p < 0.01$ ). There were no differences between ADP and FF-BIA (12.1 $\pm$ 6.5%;  $p=1.0$ ) or ADP and SF (13.2 $\pm$ 8.6%;  $p=1.0$ ). CONCLUSIONS: Results indicate that body composition estimates for field measures (i.e., FF-BIA and SF) may provide body composition estimates similar to a criterion measure, such as ADP. Additionally, laboratory measures may need alterations to body fat percentage algorithms for athletes.

TP15

### DIFFERENCES IN CHARACTERISTICS AND BEHAVIORS OF COLLEGE STUDENTS ATTEMPTING TO LOSE OR GAIN WEIGHT

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College students characteristics and behaviors may differ based on their weight management goals. Purpose: This study was conducted to determine how the behaviors and characteristics of college students differed depending on whether they reported trying to gain or lose weight. Methods: Using an online survey, students (n=105) reported gender, anthropometrics, weight goals, athlete status, sleep habits, physical activity (International Physical Activity Questionnaire [IPAQ]) and fruit/vegetable (F/V) consumption (NCI F/V screener). Independent samples t-tests compared continuous variables: age, body mass index (BMI), IPAQ score, F/V consumption, and sleep between the two groups. Chi-Squared tests compared categorical variables: gender, athlete status, and activity and healthy eating category between students who reported wanting to gain or lose weight. Results: Approximately 70% of students reported trying to lose weight, with average desired weight loss of 26.4 $\pm$ 22.2 lb. Those that wanted to gain weight, desired to gain 8.9 $\pm$ 11.3 lb, and had a significantly lower BMI (24.7 $\pm$ 6.1 kg·m<sup>-2</sup> vs 28.7 $\pm$ 3.8 kg·m<sup>-2</sup>,  $p=0.001$ ), higher IPAQ score (5300 $\pm$ 3315 met·min·m<sup>-1</sup> vs 3632 $\pm$ 2786 met·min·m<sup>-1</sup>,  $p=0.01$ ), were more likely to be male (81% vs 26%,  $p<0.001$ ), college athletes (63% vs 30%,  $p=0.002$ ), and report being very active (69% vs 37%,  $p=0.01$ ) compared to those wanting to lose weight, respectively. There were no significant differences in age (21 years), sleep (6.4 hours·day<sup>-1</sup>), likelihood of reporting eating a somewhat healthy diet (68%), and total amount of F/V consumed (3.8 F/V·day<sup>-1</sup>) between the two groups. Conclusion: Male athletes with a normal BMI may be more inclined to gain weight with exercise and a healthy diet, while female non-athletes in the overweight BMI range with lower activity levels may be more inclined to lose weight. Neither group prioritized getting enough sleep, but both groups ate the same amount of F/V.

TP16

Funding Source: Get Fruved Project, University of Tennessee

### **BODY COMPOSITION ASSESSMENTS AND CARDIOMETABOLIC RISKS IN AFRICAN AMERICAN ADOLESCENTS**

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Obesity is a major adolescent health challenge as the obesogenic culture has resulted in more children and adolescents experiencing health related obesity challenges. A disproportionate number of those experiencing related health challenges are minorities. Since body composition is different for different races, does the assessment procedure used to determine body composition and subsequently obesity influence the cardiometabolic risk (CMR) experienced by adolescents? Purpose: The purpose of this study was to evaluate the relationship between different measures of body composition and CMR in African American (AA) adolescents. Methods: A descriptive research design was used as 244 adolescents participated in this study. Cardio metabolic (CMO) measurements included systolic (SBP) and diastolic blood pressure, total cholesterol, high density cholesterol, and glucose. Body composition measurements included waist and hip circumference, body mass index, body fat percent (BF%) and fat mass. Descriptive statistics, t-tests and correlations were used to determine the body composition variables that were most associated with CMO, and whether or not the associations change with age in adolescents. Results: Adolescents were 10 to 16 years of age with a mean age of 12.5 years, and teenagers were heavier than preteens. Three-minute heart rate responses indicated that fitness levels, based on age (mean 172.6 ± 20.0 bpm) and sex (mean 172.5 ± 20.0 bpm), were not different. Mean arterial pressure and SBP were the only none body composition CMO variables that differed ( $p < 0.05$ ) based on age. Fat mass and BF% were not different based on age, but were different based on sex. No other CMO variables were related to body composition variables. Discussion: These data indicate that CMO variables and the relationship among these variables changes little during adolescence in AA's. Conclusion: BP and body composition are two variables that AA's struggle with, and some AA adolescents share these health challenges.

TP17

### **BODY COMPOSITION CHANGES ASSOCIATED WITH A STRUCTURED EXERCISE PROGRAM AMONG CHILDREN AND ADOLESCENTS**

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Children and adolescents in the U.S. fail to meet physical activity guidelines and health consequences associated with inactivity, such as high body fat composition, continue to impact children. Targeting children for physical activity and fitness interventions have the potential to improve body composition; however, little is known on body composition changes during a fitness-based intervention. PURPOSE: Therefore, the purpose of this study was to determine changes in body composition for children participating in a fitness-based intervention. METHODS: 21 children (M age = 9.38 ± 3.82, M BMI = 21.0, M body fat percentage = 30.90) participated in an 8-week, structured fitness intervention consisting of 1 hour weekly sessions. Weekly sessions provided fitness opportunities in a fun, non-competitive environment with the purpose to elicit moderate-to-vigorous physical activity. Pre and Post testing using the iDXA was conducted to detail changes in body composition. RESULTS: Results from a paired samples t-test showed significant increases in the following body composition measures: Left Leg Lean Mass ( $t = -2.366$ ,  $p = .028$ ), Right Leg Lean Mass ( $t = -3.914$ ,  $p = .001$ ), Lean Mass Truck ( $t = -2.766$ ,  $p = .012$ ), Lean Mass Total ( $t = -4.575$ ,  $p < .001$ ), Right Leg Bone Mass ( $t = -2.500$ ,  $p = .021$ ) and Bone Mass Total ( $t = -3.826$ ,  $p = .004$ ). CONCLUSIONS: Participation in an 8-week fitness intervention showed positive body composition changes for children. These changes occurred with minimal intervention (1 hour per week). Future studies should determine the duration of the effect.

TP18

### **EXAMINING THE IMPACT OF OBESITY ON VENTILATORY RESPONSES DURING ACUTE EXERCISE IN PATIENTS WITH HFPEF**

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PURPOSE: Heart Failure (HF) is a major cause of morbidity and mortality worldwide. Ventilatory responses during acute exercise have important prognostic value in HF patients. This study examined baseline ventilatory measures to determine if obesity further impacts ventilatory responses in normal subjects and heart failure patients with preserved ejection fraction (HFpEF). Methods: All participants performed a cardiopulmonary exercise test to maximal effort to quantify ventilatory responses (tidal volume (TV), breathing frequency (Bf), and minute ventilation (VE)) at submaximal (25 watts) and peak exercise. Ventilation efficiency was determined by assessing VE/VCO<sub>2</sub> at submax and the VE/VCO<sub>2</sub> slope. Obese vs. non-obese HFpEF participants were categorized based on BMI >30 kg/m<sup>2</sup>. One-way ANOVA was performed to determine if there were significant ( $p < 0.05$ ) differences between the groups. Results: The obese HFpEF group had higher VE during peak exercise than the non-obese group ( $p < 0.05$ ), which was mainly due to greater Bf ( $p = 0.08$ ) versus TV ( $p = 0.24$ ). The VE/VCO<sub>2</sub> at the submaximal workload and VE/VCO<sub>2</sub> slope were significantly higher in the non-obese HFpEF group. Conclusion: As hypothesized, obese HFpEF participants exhibited worse ventilatory function than the non-obese HFpEF patient at similar levels of exercise. However, obese HFpEF participants demonstrate a similar degree of ventilatory inefficiency compared to normal weight HFpEF participants. Since ventilatory efficiency was not abnormal in obese HFpEF it appears that their prognosis is no worse than normal weight HFpEF participants.

TP19

### **INFLUENCE OF MENSTRUAL CYCLE PHASE ON CARDIOVASCULAR DRIFT AND MAXIMAL OXYGEN UPTAKE DURING HEAT STRESS**

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Cardiovascular drift (CV drift) is related to reduced maximal oxygen uptake ( $\dot{V}O_{2max}$ ) during heat stress. Whether this relationship is modified by elevated core temperature during the luteal phase (LP) of the menstrual cycle remains unknown. PURPOSE: To test the hypothesis that the magnitude of CV drift and accompanying decrement in  $\dot{V}O_{2max}$  is greater during the LP of the menstrual cycle vs. the follicular phase (FP). METHODS: Seven women (mean±SD; age=24±5 y) completed a graded exercise test in ~22 °C to determine  $\dot{V}O_{2max}$ , followed by one 15-min and one 45-min trial at 60%  $\dot{V}O_{2max}$  in 35 °C—each immediately followed by measurement of  $\dot{V}O_{2max}$ —in the FP and LP. CV drift was measured between 15 and 45 min during the 45-min trials. The purpose of the separate 15- and 45-min trials was to measure CV drift and  $\dot{V}O_{2max}$  over the same time interval. RESULTS: Rectal temperature (Tre) at rest and during exercise was higher in the LP ( $p < 0.05$ ). Heart rate increased 9% between 15 and 45 min in both phases ( $p = 0.71$ ), while stroke volume decreased more in the LP (-18%) compared to the FP (-11%;  $p < 0.001$ ).  $\dot{V}O_{2max}$  decreased significantly over time ( $p = 0.002$ ), but menstrual cycle phases were not different (16% and 13% for LP and FP, respectively,  $p = 0.28$ ). CONCLUSION: Greater thermal strain in the LP compared to the FP did not modulate the relationship between CV drift and  $\dot{V}O_{2max}$  during exercise in the heat.

TP20

### VASCULAR PROTECTION IN RESPONSE TO ALTERED SHEAR PATTERNS AT DIFFERENT MENSTRUAL CYCLE PHASES

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Purpose: This study sought to determine whether elevations in estrogen levels throughout the menstrual cycle (early (EF) vs late follicular (LF) phase) alter vascular function in response to a vascular insult. Methods: Young, healthy females were recruited and completed two visits (EF and LF) consisting of two upper (BAFMD) and lower limb (SFAFMD) flow-mediated dilation tests, performed before (PRE) and after (POST) 30 minutes of sub-diastolic (60 mmHg) cuff inflation (SCDI). Male controls completed one visit to provide a biological sex comparison. Results: BAFMD increased over time in the EF condition, but not in the LF or male controls. At the POST time point, both EF and LF BAFMD were greater than male controls ( $p < 0.001$  and  $p = 0.01$ ); however, no difference was observed between EF and LF. When normalized for shear rate (BAFMD/shear), EF increased across time and was significantly greater than the male controls ( $p = 0.001$ ), but not the LF condition, at the POST time point. No differences across time or between conditions were revealed when examining SFAFMD. When controlling for the shear rate stimulus (SFAFMD/shear), a significant reduction across time was revealed in all groups. Conclusion: Independent of menstrual cycle phase, females displayed significant vascular protection against the SDCI-induced upper limb vascular dysfunction. No differences between menstrual cycle phases or sex were revealed in lower limb vascular function.

TP21

### ASSOCIATION BETWEEN ISOLATED VERSUS DAILY AVERAGED HEART RATE VARIABILITY, FITNESS AND BODY COMPOSITION

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Associations between heart rate variability (HRV), aerobic fitness and body composition are inconsistent, possibly due to daily fluctuation in HRV. PURPOSE: To assess correlations between HRV, aerobic fitness and body composition using isolated and daily-averaged HRV measures. A secondary aim was to determine the association between daily fluctuation in HRV (assessed by the coefficient of variation, CV), fitness and body composition. METHODS: College-age men ( $n = 10$ ) volunteered for this study. A graded treadmill test was used to determine maximal oxygen uptake ( $VO_{2max}$ ). Dual energy x-ray absorptiometry was used to assess body composition. Ultra-short (60-sec) natural logarithm of the root mean square of successive R-R intervals ( $LnRMSSD$ ) was obtained while fasted and seated on three separate days within one week.  $LnRMSSD$  from a single recording ( $LnRMSSD_{iso}$ ), the three-day average ( $LnRMSSD_{avg}$ ) and the CV ( $LnRMSSD_{CV}$ ) were used for analysis. RESULTS: Mean  $\pm$  standard deviation for  $VO_{2max}$ , body fat percentage (%BF) and fat mass (FM) were  $51.1 \pm 8.0$  ml·kg<sup>-1</sup>·min<sup>-1</sup>,  $17.4 \pm 5.7\%$  and  $13.9 \pm 4.7$  kg, respectively.  $LnRMSSD_{avg}$  demonstrated stronger associations than  $LnRMSSD_{iso}$  with  $VO_{2max}$  ( $r = 0.64$ ,  $p = 0.04$  vs.  $r = 0.47$ ,  $p = 0.17$ ), %BF ( $r = -0.57$ ,  $p = 0.08$  vs.  $r = -0.53$ ,  $p = 0.11$ ) and FM ( $r = -0.59$ ,  $p = 0.07$  vs.  $r = -0.51$ ,  $p = 0.13$ ).  $LnRMSSD_{CV}$  was positively associated with %BF ( $r = 0.64$ ,  $p = 0.04$ ) and FM ( $r = 0.70$ ,  $p = 0.02$ ) and negatively associated with  $VO_{2max}$  ( $r = -0.48$ ,  $p = 0.16$ ). CONCLUSIONS: The association between HRV, fitness and body composition is strengthened when using daily-averaged recordings. This finding is most relevant for research involving sedentary and clinical populations given that greater daily fluctuation in  $LnRMSSD$  was observed among individuals with lower aerobic fitness and greater body fat.

TP22

### SEX DIFFERENCES IN SITTING-INDUCED VASCULAR DYSFUNCTION: EVIDENCE OF AUGMENTED ANTIOXIDANT DEFENSE

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PURPOSE: This study sought to examine the role of oxidative stress in sitting-induced vascular dysfunction across genders. METHODS: On two separate occasions, ten males ( $25 \pm 5$  yrs) and eleven females ( $23 \pm 3$  yrs) had leg vascular function assessed using passive leg movement (PLM) technique before and after 1.5 hours of sitting. Superficial femoral artery (SFA) blood flow and shear rate patterns, heart rate, mean arterial pressure (MAP), and calf circumference (CC) were measured throughout sitting. One gram of vitamin C (VC) or placebo (PL) was consumed 1.5 hours prior to each sitting trial. RESULTS: All subjects ( $n = 21$ ), regardless of condition (PL or VC), reported significantly decreased SFA blood flow ( $-28.6 \pm 41.8$  ml/min;  $p < 0.01$ ) and shear rate ( $-11.3 \pm 15.5$  s<sup>-1</sup>;  $p < 0.01$ ) as well as a significant increase in MAP ( $3.6 \pm 5.1$  mmHg;  $p < 0.01$ ) and CC ( $1.2 \pm 0.3$  cm;  $p < 0.01$ ) after 1.5 hours of sitting. In the PL trial, a significant decline in leg vascular function, evaluated as  $\Delta PLMPEAK$ , was evident in males, but not females [ $(-208 \pm 51 \Delta ml/min)$  v.  $(-43 \pm 46 \Delta ml/min)$ ;  $p = 0.02$ ] after 1.5 hours of sitting. In the VC trial, both groups revealed no significant declines in  $\Delta PLMPEAK$  [ $(-13 \pm 51 \Delta ml/min)$  v.  $(-80 \pm 46 \Delta ml/min)$ ;  $p = 0.33$ ]. CONCLUSION: This study revealed that females, but not males, display a resistance to sitting-induced lower limb vascular dysfunction. The vascular dysfunction was significantly attenuated with antioxidant supplementation in males, but not females, which implies a greater inherent antioxidant defense and vascular protection in the lower limb vasculature of females.

TP23

### INTERVAL EXERCISE ENHANCES THE REVERSAL OF PRE-EXISTING ENDOTHELIAL DYSFUNCTION ON A LOW-CALORIE DIET

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PURPOSE: Endothelial dysfunction has been implicated in the pathogenesis of cardiovascular disease. Weight loss induced by a low-calorie diet (LCD) improves endothelial function, but whether combining interval exercise (INT) with LCD enhances endothelial function under energy available matched conditions is unknown. METHODS: Subjects (age:  $48.5 \pm 2.5$  yr, BMI:  $37.9 \pm 1.3$  kg/m<sup>2</sup>) were randomized to 2-wks of a LCD ( $n = 11$ ; mixed meals of 1000-1200kcal/d) or LCD+INT ( $n = 12$ ; 60min/d of supervised interval exercise at 90% HRpeak for 3 min and 50% HRpeak for 3 min). LCD+INT subjects received 350kcal post-exercise to equate energy availability between groups. Fitness ( $VO_{2peak}$ ), body composition (BodPod), vascular inflammation (VCAM, ICAM), and endothelial function (FMD; flow mediated dilation) were assessed pre- and post-test. RESULTS: LCD+INT increased  $VO_{2peak}$  ( $P = 0.02$ ) and lean mass (trend:  $P = 0.10$ ) compared to LCD, and both treatments reduced caloric intake ( $P < 0.001$ ), fat mass ( $P < 0.001$ ), and ICAM ( $P = 0.002$ ). LCD+INT and LCD tended to increase FMD ( $P = 0.11$ ), but there was notable variation. In fact, low baseline FMD was linked to enhanced FMD post-treatment ( $r = -0.66$ ;  $P = 0.001$ ). When comparing people at pre-test with endothelial dysfunction ( $< 50\%$  percentile; LCD  $n = 6$ , LCD+INT  $n = 6$ ) versus those with endothelial function ( $> 50\%$  percentile; LCD  $n = 5$ , LCD+INT  $n = 6$ ), LCD+INT elicited greater increases in FMD than LCD ( $6.6 \pm 0.8\%$  vs.  $2.8 \pm 0.9\%$ ,  $P = 0.01$ ). Overall, increased FMD was associated with elevated fitness ( $r = 0.37$ ;  $P = 0.08$ ) and lean mass ( $r = 0.46$ ;  $P = 0.02$ ), which was secondarily linked to reduced VCAM ( $r = -0.45$ ;  $P = 0.03$ ). CONCLUSION: INT exercise enhances the effect of LCD on FMD in individuals with pre-existing endothelial dysfunction through potentially a muscle fitness mediated inflammatory mechanism.

TP24

### BMI AND ITS EFFECTS ON GPA OF FEMALE UNG CADETS

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Background: GPA is vital to graduating college and commissioning into the US Army. BMI of 18.5 to 24.9 is considered healthy for a female, and successful GPA is considered (3.42). Real world military performance evaluations are used in order to evaluate cadets. Purpose: The purpose of this study is to understand the effects BMI on GPA of 30 Female Corp of Cadets. Methods: 30 female cadets were recruited from the Army Corp of Cadets from UNG. Intervention: Female cadets in the study went about their semester, participating in their normal activities and were monitored at specific intervals during the semester. Each measurement session (4 in total) included the following: Body Mass Index (BMI), Waist to Hip Ratio (WHR), Percent Body Fat and Lean Body Mass. Analysis: Statistical analysis using Linear Regression Model was used to determine statistical significance at  $P < .05$ . Linear regression was utilized to formulate the equation. BMI is a significant dependent variable when modeled with term GPA by using linear regression.  $P$ -value = 0.03, with an adjusted  $r^2$  of 0.12. Although the data is not a perfect line, the relationship is significant. The equation is as follow 'Female GPA =  $4.45 - 0.04 \cdot \text{BMI}$ '. For female cadets, a 1 kg/m<sup>2</sup> increase in BMI is associated with a 0.04 point GPA decline. Summary and Conclusions: Since an association exists between female BMI and GPA, it is recommended that assistance is provided to females with a higher BMI in order to encourage them to live healthier lifestyles, which can boost GPA.

01

### THE CALORIC COST OF THE VMI RATLINE AND IMPLICATIONS FOR PERFORMANCE

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At Virginia Military Institute (VMI), newly enrolled cadets or 'Rats,' undergo an intense 5-6 month training period in which physical, mental, and emotional stressors are abundant, referred to as the 'Ratline.' Purpose: To observe the cumulative physiological stress of the Ratline and determine its effects on health and performance. Methods: Fourteen male 'Rats' participated in data collection over three time-points in the fall semester: pre-semester or 'Hell Week' (T1), mid-semester (T2), and post-semester (T3). Laboratory measures included maximal oxygen consumption (VO<sub>2</sub>max) and body composition. Field measures included training heart rate and sleep quality, acquired via wrist-based technology. Caloric expenditure was determined via heart rate-VO<sub>2</sub> regression analysis. Caloric intake was estimated via digital photography. Results: During T1, subjects expended  $4,513 \pm 1,048$  kcal/day, which trended toward a significant difference when compared to caloric intake ( $3,732 \pm 607$  kcal;  $p = .08$ ). During the three most strenuous days of T1, caloric expenditure reached  $6,472 \pm 363$  kcal ( $p = .001$ ;  $-2700 \pm 2198$  deficit). Positive energy balance was sustained in T2 and T3. Lean mass decreased from T1 to T2 ( $-0.8$  kg,  $p = .04$ ), but rebounded by T3 ( $+1.2$  kg,  $p = .03$ ). VO<sub>2</sub>max improved with training ( $+3.99$  ml/kg/min,  $p = .02$ ). Conclusions: While there is evidence of energy deficit sustained during Ratline training, physiological adaptations appear to be uncompromised. However, adaptations and 'Rat' resilience may be enhanced by implementing alternative recovery strategies.

02

### ASSOCIATION BETWEEN BODY COMPOSITION AND BONE MINERAL DENSITY IN ELITE COLLEGIATE ATHLETES

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People who engage in regular exercise, such as collegiate athletes, are more likely to have a lower body fat percentage (BF%) and higher amount of fat-free mass (FFM). Moreover, resistance exercise results in stressors applied to the bone, which results in an increased bone mineral density (BMD). Because collegiate athletes experience a high amount of repetitive loading, it may be expected that BMD would yield a relation to body composition. Purpose: The purpose of this study was to examine the relationship between body composition and BMD in elite college athletes. Methods: Male ( $n = 45$ ) and female ( $n = 33$ ) athletes (ages 18-21 years) from a range of sports, including baseball, football, softball, and volleyball, participated in the study. Total BMD and body composition (i.e., BF% and FFM) were measured using Dual-energy X-ray Absorptiometry. Results: In terms of males, Pearson's product correlation demonstrated a significant positive association between FFM and BMD ( $r = 0.79$ ,  $p < 0.01$ ). BF% showed a significant positive moderate correlation with BMD ( $r = 0.35$ ,  $p = 0.02$ ). For females, FFM showed a moderately positive association with BMD ( $r = 0.58$ ,  $p < 0.01$ ), while BF% provided a non-significant inverse correlation with BMD ( $r = -0.21$ ,  $p = 0.23$ ). Conclusions: FFM in both male and female collegiate athletes was positively associated with BMD, while BF% yielded little significance in relation to BMD in females. These findings may reflect the diversity of female athletes (i.e., various sports) that were included within the analysis.

03

### EFFECT OF WEIGHT CHANGE FOLLOWING INTENTIONAL WEIGHT LOSS ON BONE IN OLDER ADULTS WITH OBESITY

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Purpose: To examine change in bone mineral density (BMD) and trabecular bone score (TBS) one year after an 18 month weight loss intervention among weight regainers (WR) and weight loss maintainers (WLM). Secondly, we examined associations between change in BMD/TBS and change in total body composition. Methods: Data come from a longitudinal, non-randomized comparison of 77 older adults ( $67 \pm 5$  years, 69% women, 70% Caucasian) with obesity (BMI:  $33.6 \pm 3.7$  kg/m<sup>2</sup>) who lost weight during an 18 month diet and exercise intervention and returned for a 30 months assessment. Total body mass and composition; along with total hip, femoral neck, and lumbar spine BMD, and TBS; were measured at baseline, 18, and 30 months. WR ( $n=36$ ) and WLM ( $n=41$ ) categories were defined as a  $\geq$  or  $<$  5% weight gain from the 18 to 30 month time points, respectively. Results: Of bone density outcomes, only total hip BMD was significantly reduced during the 18 month intervention period, with marginally greater reductions observed in WR [ $-3.9$  ( $-5.8$ ,  $-2.0$ ) %] than WLM [ $-2.4$  ( $-4.3$ ,  $-0.5$ ) %], group  $p=0.07$ . After adjustment for total mass lost during the intervention period, a significant reduction in total hip BMD was observed for both groups at 30 months, with marginally greater losses observed for WLM [ $-3.9$  ( $-5.7$ ,  $-2.1$ ) %] compared to WR [ $-2.6$  ( $-4.3$ ,  $-0.9$ ) %]; group  $p=0.07$ . TBS was modestly reduced from baseline at 30 months in WR [ $-2.9$  ( $-5.6$ ,  $-0.3$ ) %], but not differently from WLM [ $-1.5$  ( $-4.2$ ,  $1.2$ ) %]; group  $p=0.2$ . Change in total hip BMD was directly associated with change in total body fat ( $\beta=0.002$ ;  $p<0.01$ ) and lean ( $\beta=0.004$ ;  $p=0.01$ ) masses. Modest associations were observed for TBS, where change in total body lean mass was directly associated with change in TBS ( $\beta=0.005$ ;  $p=0.09$ ), while an inverse association was observed for change in total fat mass ( $\beta=-0.002$ ;  $p=0.09$ ). Conclusions: Loss of hip BMD persists in the year following a weight loss intervention regardless of weight regain status; however, after standardizing for initial weight loss, BMD is partially recovered with weight regain. Loss in total fat and lean masses are associated with reduced BMD, yet, loss in fat mass may signal improved bone quality.

04

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### THE EFFECTS OF TYPE OF EXERCISE TRAINING DURING PREGNANCY ON INFANT BODY COMPOSITION OUTCOMES

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05

**PURPOSE:** Evidence has shown that aerobic exercise produces beneficial morphometric outcomes for the infant. However, little research has been done on the influence of other maternal exercise modes on infant body composition. The purpose of this study is to determine the effects of aerobic, resistance, and circuit training during pregnancy on one-month-old infant body composition. **METHODS:** Participants were randomized into four groups, resistance (n=14), aerobic (n=41), circuit (n=16) and non-exercising control (n=35), and performed 150 minutes/week of supervised exercise from 16 weeks gestation until delivery. At one month of age, body composition measurements including skinfolds, circumferences, and BMI were assessed. **RESULTS:** There were no significant differences between groups regarding infant body fat percentage (p=.14), BMI (p=.65), or lean mass (p=.70). On average the resistance training group had more lean mass when compared to the other groups. **CONCLUSION:** All modes of exercise showed no differences in infant body composition outcomes. However, further data collection and analysis must be done to control for infant sex and maternal pre-pregnancy BMI. Funded in part by The American Heart Association.

### EFFECTIVENESS OF THE WINNING WEIGHS PROGRAM ON WOMEN'S HEALTH RISKS AND OVERALL WELLNESS

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06

**PURPOSE:** Winning Weighs for Women, a program offered by CaroMont Health and Fitness Center, focused primarily on healthy lifestyle behavior modifications that were applicable to women of all ages. The purpose of this program was to establish lifestyle behaviors that could lead to a decrease in chronic disease risk for certain cancers and osteoporosis, while also increasing measures of quality of life. The hypothesis was that, after completion of the program, participants would adopt lifestyle behaviors that would decrease the chance of developing chronic diseases and increase measures of quality of life. **METHODS:** Participants (N = 77) volunteered for Winning Weighs for Women, which lasted a total of 10 weeks, with 8 in-class sessions focused on educating participants on how to obtain and maintain a healthy lifestyle. Prior to and after the completion of the program, participants completed a Personal Wellness Profile (PWP) in order to assess their overall lifestyle behaviors and current health risks. Paired sample t-tests were used to analyze lifestyle changes prior to and following the intervention. **RESULTS:** Mental outlook was improved by 35.0%, whole grain intake was increased by 47.6%, saturated fat intake was decreased by 78.6%, and fruit and vegetable intake were increased by 121.4%. As a result of these behavior modifications, the risk of osteoporosis and cancer decreased by 45.4% and 66.6%, respectively. All results reported were found statistically significant (p<0.05). **CONCLUSIONS:** The 10-week behavior modification program resulted in improvements in mental outlook with concomitant decreases in osteoporosis and cancer risks, thus supporting the research hypothesis. These results further demonstrate the importance of behavior modification, nutrition education and exercise as an intervention in the prevention of chronic disease and improvement in quality of life.

### AGREEMENT BETWEEN DEUTERIUM OXIDE AND BIOIMPEDANCE SPECTROSCOPY MEASURES OF TOTAL BODY WATER

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07

The inclusion of total body water (TBW) into body composition analyses improves the accuracy of measures. However, the criterion method using deuterium dilution (D2O) is impractical for clinical settings. **Purpose:** the purpose of this study was to compare TBW estimates from two commercial bioimpedance spectroscopy (BIS) devices against D2O. **Methods:** 89 subjects (64% female; age, 18 to 82 years; body mass index [BMI], 18.0 to 39.5 kg·m<sup>2</sup>) had TBW determined via D2O dilution and whole-body BIS using two devices: a standard supine BIS device (BIS-sup), and a new commercial standing BIS device (BIS-new). Agreement between TBW from D2O and the two BIS devices was determined using the Bland-Altman method. **Results:** Mean differences between D2O and BIS devices were significantly greater than zero (ps<0.05), however the magnitudes of the differences were small (Cohen's ds<-0.20) and both devices were highly correlated with D2O (Pearson's rs>0.90, ps<0.01). Bias and limits of agreement (bias±1.96\*SD) for BIS-sup (-1.5±5.7) and BIS-new (-0.7±5.8) were small and relatively tight. The BIS devices were strongly correlated with each other (r=0.99). **Conclusions:** The results of this study demonstrate that both the standard and new BIS devices measured TBW with minimal bias and tight limits of agreement compared to D2O. These findings support the use of both the standard and new BIS device as a surrogate of D2O for the assessment of TBW in adults across a wide range of both age and BMI. Supported by: Impedimed, Inc.

### AGREEMENT BETWEEN TWO BIOIMPEDANCE SPECTROSCOPY DEVICES AND DXA FOR BODY COMPOSITION

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08

Bioimpedance spectroscopy (BIS) has been used as an alternative to the more expensive dual-energy x-ray absorptiometry (DXA) to estimate body composition. **PURPOSE:** To determine the agreement between two BIS devices in comparison to DXA for measuring body fat percentage (%Fat), fat-free-mass (FFM), and fat-mass (FM). **METHODS:** Ninety-five subjects (m=35, w=60, 30 ± 15 years, 170 ± 8.0 cm, 72.6 ± 14.8 kg) participated in the study. Both devices utilized whole body right side measurements, one device (BIS1) in supine and (BIS2) in standing position. Measurements were taken during a single visit following an 8-12 hour fast. **RESULTS:** Bland-Altman analysis revealed BIS1 significantly underpredicted values for %Fat (mean differences ± 95% limits of agreement: 3.09 ± 4.97%) and FM (2.85 ± 5.99kg) and significantly overpredicted FFM (1.15 ± 4.98kg) in comparison to DXA. When compared to DXA, BIS2 significantly underpredicted values for %Fat (1.69 ± 5.16%) and FM (1.81 ± 6.25kg). No significant difference existed between BIS2 and DXA for FFM (0.08 ± 5.32kg). Correlations between both BIS1 and BIS2 and DXA for FM, FFM, and %Fat were very strong (r ≥ .92). **CONCLUSIONS:** While BIS1 and BIS2 indicated some bias when calculating FM, FFM, and/or %Fat, the limits of agreement were fairly narrow. Indicating both to be acceptable alternatives to DXA men and women ages 18-82 with BMIs 18-39.5. This study was funded by Impedimed, Inc

### THE RELATIONSHIP BETWEEN AEROBIC FITNESS AND THE ATTENTIONAL BLINK IN COLLEGE STUDENTS

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A growing body of research has demonstrated the relationship between preadolescent fitness and cognitive function. However, our knowledge base regarding other areas of cognition in young adults remains limited. No prior research has investigated the relation of aerobic fitness to the temporal attention. Purpose: The study aimed to examine the relationship between aerobic fitness and temporal attention. Methods: A between-subject study included 25 college students to assess their aerobic fitness and task performance under an attentional blink (AB) paradigm. On day 1, a mile-run test was administered to all participants to measure aerobic fitness to determine whether they are lower-fit or higher-fit group using the Fitnessgram Health Fitness Zone criteria. On day 2, task performance was collected while participants complete an AB task. Analysis of AB task performance (i.e., T1|T2 response accuracy) was performed using a 2 (fitness: lower-fit, higher-fit)  $\times$  8 (lag: lag1, lag2, lag3, lag4, lag5, lag6, lag7, lag8) repeated measures model. Results: Results indicated that relative to task conditions within the attentional blink windows (i.e., Lag3, Lag4, and Lag5), the higher-fit group exhibited better performance in T1|T2 accuracy,  $ps \leq .04$ , while no such effect was observed for the other task conditions,  $ps \geq .42$ . Conclusion: These findings indicated that aerobic fitness may positively associated with temporal attention, and further extended the relationship from preadolescent children to young adults.

09

### THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND POST-TRAUMATIC STRESS DISORDER IN VETERANS

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PURPOSE - The purpose of this study was to explore the association between physical activity and PTSD symptomology in veterans. METHODS - Military veterans (males = 74, females = 4) were included in the study if they served, active or reserve, for a period of at least one complete contract (2-8 years). Recruitment of veterans was accomplished via word of mouth and Facebook. Participants completed an online 31-question survey, which included a demographics section, a PCL-5 (PTSD Checklist version 5) section, and the International Physical Activity Questionnaire (IPAQ). A multiple linear regression was used to predict the intensity of PTSD symptoms (as determined by the PCL-5 value) in relation to the amount of moderate and vigorous physical activity when controlling for sedentary time. The  $\alpha$  level was set at .05 for all analyses. RESULTS - The regression analysis was not significant, indicating that time spent engaged in moderate to high intensity activity was not a significant predictor of PTSD symptoms, when controlling for sedentary time ( $R = .27$ ,  $p = .094$ ). However, Pearson's Correlation Coefficient, exploring the relationship between PTSD symptoms and metabolic equivalent (MET)  $\times$  min/week, demonstrated a moderate inverse relationship ( $r = -.26$ ,  $p = .02$ ), suggesting that as level of physical activity increased, symptoms of PTSD decreased. CONCLUSION - Results from this analysis indicate that 9% of the variation in PTSD symptomology can be explained by changes in amount of physical activity one accumulates. This 9% variation translates to 5.6 points on the PCL-5. This is important to note as the VA has determined that a 5 point deviation from baseline is an indicator of the minimum amount necessary to determine that there was a change caused by the treatment for the PTSD symptoms (PTSD: National Center for PTSD, 2017).

010

### DO AEROBIC EXERCISE AND MINDFULNESS ACT SYNERGISTICALLY TO MITIGATE PSYCHOLOGICAL DISTRESS IN HIGH-STRESS COLLEGE STUDENTS?

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Mindfulness meditation (MM) and aerobic exercise (AE) decrease stress, but the combined effects are unknown. Purpose: Assess whether AE plus MM, compared to effects of MM alone, on stress in young adults. Methods: High-stress, sedentary ( $N=32$ , 27 F, 20.5  $\pm$  2.7 years, 23.9  $\pm$  5.0 kg/m<sup>2</sup>) individuals were randomized to a 4-week MM, AE+MM, or control group. MM and AE+MM groups participated in 200 minutes/week of guided MM or AE+MM. MM consisted of present moment, non-judgmental awareness. AE consisted of moderate-intensity ( $\approx$  40-60% heart rate reserve) exercise. Stress (PSS) and anxiety/depression symptoms (DASS) were measured at baseline, and after weeks 1 and 4. An analysis of variance assessed effects of group and time on PSS and DASS. Results: There were no group  $\times$  time interactions for PSS ( $p = 0.12$ ) or DASS ( $p = 0.21$ ). There were main effects of time in which PSS and DASS were significantly lower after week 1 (PSS:  $p = 0.04$ ; DASS:  $p = 0.01$ ) and at post-intervention (PSS:  $p < 0.001$ ; DASS:  $p = 0.004$ ) compared to baseline. There were large effect size (ES; Cohen's  $d$ ) changes in the pre to post PSS and DASS scores for the MM (PSS: -1.33; DASS: -1.03) and AE+MM (PSS: -1.24; DASS: -0.97) groups, and small ES changes in the PSS and DASS scores for the control group (PSS: -0.45; DASS: -0.13). Conclusion: MM may be as effective as AE+MM in combatting psychological distress in high-stress young adults. Further research should compare AE-only to AE+MM.

011

### CONFIRMATION OF EMA SELF-REPORTED AMBULATORY EXERCISE BOUTS

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Concurrent objective monitoring of physical activity (PA) is recommended for use with ecological momentary assessment (EMA) to best understand dynamic relationships between PA behavior and affective, contextual, and cognitive antecedents documented through self-report (SR). Concurrent assessment would also allow confirmation that reported bouts of ambulatory exercise occurred as described (timeframe, duration, intensity) by participants. To date, such a confirmation process has not been described in the literature. PURPOSE: Assess the utility of accelerometry to confirm EMA of SR ambulatory exercise. METHODS: Participants ( $N=29$ , 24 $\pm$ 6yr) completed four mobile surveys/d for 14-d (82% response rate) denoting exercise type and duration while wearing an ActiGraph GT3X+ (AG) on the hip (14.0 $\pm$ 3.5h/d). The Crouter 2-Regression Model (C2RM) was applied to raw AG data to distinguish continuous ambulation from other activity. Using survey meta-data (date and time-stamps), the corresponding AG data underwent visual inspection (VI) to verify the presence and duration of walking or running bouts for comparison to SR. Confirmation of SR bouts was accomplished by VI of the C2RM coefficient of variation and step counts per 10s. Basic descriptive statistics and frequency analyses were conducted. RESULTS: 93 of 128 bouts were confirmed and of these, the average SR bout duration was greater than VI bouts (4 $\pm$ 12min). The unconfirmed bouts (35) represented aggregated bouts over the 4-h time block (71.4%) and missing AG data due to non-wear (28.6%). CONCLUSION: Most ambulatory exercise reports generated via standard EMA survey items were confirmed. VI becomes more time-consuming and open to interpretation when bouts are non-continuous. Researchers should consider including specific EMA items (e.g., intermittent walk/rest bouts, multiple bouts across time blocks) to capture complexity in ambulatory exercise and explore the use of automation to reduce the overall time burden.

012

### ASSOCIATIONS BETWEEN ANXIETY, STRESS, AND GASTROINTESTINAL SYMPTOMS DURING DISTANCE RUNNING EVENTS

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**013** PURPOSE: Anxiety and stress are associated with gastrointestinal (GI) symptoms in the general population. However, scarce research has examined the associations between psychological measures and GI symptoms during endurance competition. METHODS: Ninety-six runners ( $42.2 \pm 11.9$  years; 43 men, 53 women) completed the Perceived Stress Scale (PSS), Anxiety Sensitivity Index (ASI)-3, and State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA) before running races. After their races, participants reported the severity (on a 0-10 scale) of GI symptoms (nausea, regurgitation/reflux, stomach fullness, abdominal cramps, gas/flatulence, urge to defecate) experienced during the races. Associations between psychological measures and GI symptom severity were examined using Spearman's rank-order correlations. Separate analyses were carried out for running races by distance: 16-25 km and 42-48 km. A two-sided p-value of 0.05 was used as the threshold for statistical significance. RESULTS: Average scores on the PSS, ASI-3, and STICSA-trait were 19.8 (8.5), 14.1 (11.6), and 32.2 (7.6), respectively; GI symptoms during the races were infrequent and usually mild. For the 42-48 km races ( $n = 53$ ), STICSA-trait scores correlated with nausea ( $\rho = 0.34$ ,  $p = 0.01$ ) and summed GI scores ( $\rho = 0.32$ ,  $p = 0.02$ ). For the 16-25 km races ( $n = 43$ ), STICSA-trait scores correlated with abdominal cramps ( $\rho = 0.32$ ,  $p = 0.04$ ) and summed GI scores ( $\rho = 0.32$ ,  $p = 0.04$ ). No significant correlations were found between the two other psychological measures (PSS and ASI-3) and GI symptoms. CONCLUSIONS: Trait anxiety scores are modestly, positively associated with the severity of GI symptoms experienced during distance running races. Athletes that experience excessive anxiety in their everyday lives could, in theory, reduce competition-related GI symptoms through psychological interventions, although this suggestion awaits further study.

### FACTORS INFLUENCING ATTITUDE TOWARDS, AND PARTICIPATION IN, PHYSICAL ACTIVITY IN EASTERN NORTH CAROLINA

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**014** PURPOSE: Individuals in low-income communities are at particularly high risk for chronic health conditions, and this may be due, in part, to low levels of physical activity (PA). Low PA in this population may be related to personal, environmental, and/or social barriers. We aimed to identify which factors may influence attitudes towards PA in a low-income area of North Carolina. METHODS: Participants ( $n=112$ , mean age:  $39.3y \pm 15.0$ ) were recruited from the Nash-Edgecombe counties of NC, where poverty rates of 16.5% and 23.9% are far greater than the U.S. average of 12.7%. Participants were asked to complete a survey barriers, attitudes, and participation in PA [International Physical Activity Questionnaire (IPAQ)]. Total met-min/week of PA was calculated from the IPAQ, and questions from the barriers and attitudes towards PA sections were summed to create environmental, personal, health, and social support, and positive/negative attitude towards PA scores. RESULTS: A more positive attitude towards PA was associated with higher total met-minutes/week of PA ( $r = .36$ ,  $p < 0.0001$ ). Higher personal and environmental barriers to PA were associated with a greater negative attitude towards PA ( $r = .47$ ,  $p < 0.0001$  and  $r = .43$ ,  $p < 0.0001$ , respectively) and lower total met-min/week of PA ( $r = -.41$ ,  $p < 0.0001$  and  $r = -.25$ ,  $p = .0074$ , respectively). Higher social support was associated with a more positive attitude towards PA ( $r = .32$ ,  $p = 0.0005$ ) and higher total met-min/week of PA ( $r = .20$ ,  $p = 0.04$ ). A higher reported frequency of health as a barrier to PA was associated with greater negative attitude towards PA ( $r = .43$ ,  $p < .0001$ ), but not associated with total met-min/week of PA ( $r = -.08$ ,  $p = 0.38$ ). CONCLUSIONS: Results suggest that, in a low-income area of NC, attitude toward exercise significantly influences PA participation, and attitude towards exercise is significantly influenced by personal, environmental, and social support.

### PARENTAL REWARDS FOR CHILDREN'S PHYSICAL ACTIVITY: A QUANTITATIVE AND QUALITATIVE ANALYSIS

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**015** School-based intervention studies have used rewards to promote physical activity (PA) in children. However, little research has examined parental incentivization of children's PA including reasons and types of rewards. Purpose: To investigate parent-selected rewards for children's PA in terms of prevalence, type, and motivation to incentivize or not. Methods: Parents ( $N=90$ , mean $\pm$ SD;  $39.3\pm 6.0$  y) of children ( $8.7\pm 2.1$  y) completed a web-based survey that included items regarding moderate-to-vigorous PA (MVPA, min $\cdot$ week $^{-1}$ ), use of PA rewards, and demographic characteristics. Open-ended questions to determine parents' reasoning for using or not using PA rewards, type of activity rewarded, and type of reward. Independent sample t-tests were used to determine differences between reward groups (Reward, No Reward) and parent-reported children's MVPA. Qualitative data underwent content and thematic analysis. Results: Over half (55%) of the respondents provided PA rewards. There was no significant difference between reward groups for MVPA. (Reward:  $321\pm 195$  min $\cdot$ week $^{-1}$ ; No Reward:  $344\pm 180$  min $\cdot$ week $^{-1}$ ;  $t(88)=0.862$ ,  $p>0.05$ ). Two underlying themes as to why parents did not give rewards were deemed "Expectation" (being active is expected) and "Intrinsic Motivation" (already active). Rewarded PA's were thematized as "Non-Exercise" (chores), "Sport" (performance), and "Non-Sport Activity" (outdoor play). There were two themes for types of rewards including "Tangible" (money) and "Non-Tangible" (verbal praise). Conclusions: Rewarding children's PA is prevalent within this sample of parents. Substantial variety exists regarding the type of PA incentivized and the type of reward provided. Motivations should be further explored to inform intervention design.

### COLLEGE STUDENTS' RESISTANCE TRAINING HABITS AND MOTIVATIONS

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**016** Recent data show 34% of 18-24 year old adults achieve the recommended levels of resistance training (RT), which is at least twice a week. Purpose: To describe the RT habits and motivation to RT, and the relationship between the two in Maryville College (MC) students. Methods: Participants were 70 college students who completed an online survey, which asked about RT frequency (days/wk) and RT duration (min/session). Participants also completed the Exercise Motivation Inventory (EMI). The EMI included 50 statements about motivations in exercise and was modified to be specific to RT. Participants ranked statements from "not true at all" to "very true" and scores were calculated for categories which included: weight management, ill health, revitalization, appearance, social recognition, affiliation, competition, health pressures, ill-health avoidance, positive health, weight management, appearance, strength/endurance, nimbleness and challenge. Weight status was collapsed into two groups: normal weight and overweight/obese. Independent samples t-tests were used to examine differences in motivations by frequency of RT ( $\geq 4$  days/wk vs  $\leq 3$  days/wk) and weight status. Results: Mean frequency of RT participation was  $3.0\pm 2.0$  days/wk. Thirty-nine percent of participants reported RT for a duration of  $<30$  min/session and 37% reported RT  $\leq 30$  min/session. Most commonly reported motivation was positive health ( $4.1\pm 1.0$ ) and the least common was health pressure ( $1.8\pm 1.4$ ). Those who reported RT  $\geq 4$  days/wk reported higher motivations for positive health ( $4.4\pm 1.0$  vs.  $3.8\pm 1.0$ ,  $p<0.05$ ), appearance ( $3.5\pm 1.0$  vs.  $2.5\pm 1.1$ ,  $p<0.05$ ), and strength ( $4.2\pm 1.0$  vs.  $3.5\pm 1.1$ ,  $p<0.05$ ) compared to those who reported RT  $\leq 3$  days/wk. Compared to normal weight participants, overweight/obese participants reported higher motivations for weight management ( $2.7\pm 1.4$  vs  $3.9\pm 1.0$ ,  $p<0.05$ ), ill health ( $3.1\pm 1.2$  vs  $4.1\pm 1.0$ ,  $p<0.05$ ) and health pressure ( $1.4\pm 1.2$  vs  $2.3\pm 1.3$ ,  $p<0.05$ ). Conclusion: Motivations for RT appear to vary by RT frequency and weight status; however positive health and weight management were consistently top motivations.

### A REGRESSION MODEL PREDICTING DIVISION I NCCA SOFTBALL PITCHERS' ERA BASED ON UPPER EXTREMITY KINEMATICS

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017 Understanding softball pitching arm kinematics at the initiation of foot contact (FC) could prove beneficial in overall pitching efficiency. Purpose: To determine if upper extremity kinematics (shoulder horizontal abduction, shoulder elevation, and elbow flexion) could explain season earned run average (ERA) in collegiate softball pitchers. Methods: Twenty-three NCAA Division I collegiate softball pitchers ( $20.14 \pm 1.07$  yrs;  $173.93 \pm 6.68$  cm;  $85.79 \pm 11.06$  kg) performed three maximal effort rise ball pitches to a catcher located 43 ft. away. Of the three trials collected, the second trial was chosen for analysis. Kinematic data were collected at 100 Hz using an electromagnetic tracking system. Results: A multiple regression analysis was used to determine if upper extremity kinematics could be used to predict ERA. The overall regression equation was statistically significant,  $F(3, 19) = 4.243$ ,  $p = 0.019$ . About 31% variance in ERA was affected by shoulder horizontal abduction, shoulder elevation, and elbow flexion ( $R^2 = 0.401$ , Adj.  $R^2 = 0.307$ ,  $p = 0.019$ ); with elbow flexion ( $B = -0.018$ ,  $\beta = -0.561$ ,  $t = -3.157$ ,  $p = 0.005$ ) being the only significant predictor of season ERA. Conclusion: These data indicate that at FC during the rise ball pitch, a greater degree of elbow flexion is associated with a lower ERA. Softball pitchers strive for a low ERA, thus further investigation of elbow flexion at FC in different types of pitches could assist in determining if elbow flexion at FC is a true indicator of pitching performance. A limitation to this study is that ERA is considered a plausible explanation of pitching performance, therefore future research is also needed to understand the kinematic variables that best explain pitching performance.

### ACCUTE EFFECTS OF RESISTANCE TUBING DEVICE ON HAND PATH IN YOUTH BASEBALL AND SOFTBALL HITTERS

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018 While resistance tubing training devices are better known for general fitness, the effect they have on sport specific movements is under-explored. Purpose: The acute effects of a resistance tubing training device on hand path during the swing phase from front foot contact (FC) to ball contact (BC) was investigated in 16 ( $12.2 \pm 1.85$  yrs,  $1.55 \pm 0.183$  m,  $54.0 \pm 14.8$  kg) youth baseball and softball hitters. Methods: Participants hit five balls off a tee before and after a short-term resistance tubing swing intervention using the Pitcher's Nightmare Swing Trainer (PNST). The intervention required participants to perform 20 dry swings followed by five swings off of the tee while wearing the PNST. Hand kinematic data were captured at 240 Hz using an electromagnetic motion capture system. Data from trials 2-4 pre and post intervention were time-normalized, averaged, and compared at 10% intervals for the swing phase starting at FC until BC. Paired samples t-tests were used to examine differences in vertical hand position throughout the hitting motion. Results: Results indicated significant differences in vertical hand position at 30% ( $t(15) = -2.273$ ,  $p = 0.038$ ), 40% ( $t(15) = -2.503$ ,  $p = 0.024$ ), 50% ( $t(15) = -2.783$ ,  $p = 0.014$ ), 60% ( $t(15) = -3.104$ ,  $p = 0.007$ ), and 70% ( $t(15) = -3.168$ ,  $p = 0.006$ ) of the swing phase from FC to BC. Specifically, the vertical position of the hand was higher during post-intervention swings compared to pre-intervention swings. Conclusions: These results suggest that the PNST affects vertical hand position during the middle portion of the swing, but does not affect hand position near FC or BC in youth baseball and softball athletes. Whether or not these changes prove beneficial is unclear. Future studies should examine the longitudinal effects of hand path changes on performance measures like batting average or ball exit velocity.

### KINEMATIC EFFECTS OF A RESISTANCE TUBING TRAINING DEVICE INTERVENTION ON YOUTH BASEBALL AND SOFTBALL SWINGS

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019 Purpose: To determine the effects of a 4-week swing training intervention utilizing resistance tubing on baseball and softball swings. Specifically, to examine changes in back elbow extension and center of mass (COM) translation in youth baseball and softball athletes. Methods: Ten youth baseball and softball ( $11.6 \pm 1.8$  yrs,  $150.4 \pm 19.0$  cm,  $52.0 \pm 13.6$  kg) athletes volunteered to participate. Participants were required to report to the lab prior to and following a 4-week swing intervention program for swing testing. Swing testing required the participant to hit 5 baseballs or softballs off a tee. Kinematic data were captured at 240 Hz using an electromagnetic motion capture system. Following the initial swing testing, participants were instructed on the swing intervention program using the Pitcher's Nightmare Swing Trainer. The swing intervention consisted of three days a week performing 50 swings. Results: A within-subjects MANOVA revealed significant changes in dependent variables following the 4-week swing intervention ( $\Lambda = 0.61$ ,  $F(14,166) = 3.36$ ,  $p < 0.001$ ,  $\eta^2 = 0.22$ ). Specifically, follow-up univariate tests with a greenhouse-geisser correction applied, showed significant differences in back elbow extension ( $F(2.5, 21.6) = 4.69$ ,  $p = 0.012$ ,  $\eta^2 = 0.28$ ). Conclusion: Following the swing intervention, participants showed decreased back elbow extension and increased COM translation towards the front side suggesting youth athletes overcome the resistance of the tubing using body momentum from forward translation, rather than increasing elbow extension. Further studies are needed to find a potential correlation between segmental velocities and COM translation, and to see if the same changes are observed in more developed athletes.

### INCREASING INERTIAL LOAD DOES NOT AFFECT SAGITTAL PLANE KINEMATICS DURING FLYWHEEL-BASED SQUATS

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020 Flywheel resistance training (FRT), a gravity-independent, velocity-dependent form of resistance training, has grown in popularity but little is known about joint kinematics during this type of exercise. Purpose: To determine the effects of increasing inertial load on sagittal plane kinematics during FRT squats. Methods: Nine resistance-trained subjects (3M, 6F) performed five maximal effort FRT squats with three different inertial loads (0.050, 0.075, and 0.100 kg\*m<sup>2</sup>) in random order. Subjects wore reflective markers while being videoed in the sagittal plane. Marker trajectories were tracked and joint angles and angular velocities at the trunk, knee, and ankle were calculated. Differences in joint kinematics between inertial loads were determined by repeated measures ANOVAs. Results: Peak sagittal plane joint angles were unchanged with increasing inertial load at the trunk, knee, and ankle. Knee and trunk flexion and extension angular velocities decreased ( $p < 0.05$ ) with increasing inertial load. Conclusions: Increasing inertial load reduces joint angular velocity, during FRT squats, likely due to slower velocity of movement. Increasing inertial load does not affect peak joint angles in FRT squats, which may be due to the gravity-independent nature of this exercise. Preserving joint angles with increasing load may have important implications for injury prevention during this mode of training.

### GROUND REACTION FORCES DURING SLIP EVENTS: IMPACT OF MILITARY FOOTWEAR AND LOAD CARRIAGE

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021

The US Army Annual Injury Epidemiology Report identified that 18.4% of all causes of injuries in the military were due to falls and near falls. During slip induced falls, a reduction in ground reaction forces (GRFs) has been reported as a consequence of incomplete transfer of body weight to the slipping leg in stance phase of the gait. Purpose: The purpose of the study was to analyze the impact of military footwear and load carriage task on GRFs during slip events. Methods: Sixteen male participants were tested in a repeated measures design, in standard tactical (STD) and minimalist tactical (MIN) boots, both before (PRE) and after (POST) a 16kg load-carriage task. Participants were exposed to normal dry gait (NG), an unexpected slip (US) and an expected slip (ES). The mean and peak vertical GRF during the first 120ms post-heel strike were calculated and analyzed using a 2 (STD-MIN) x 2 (PRE-POST) x 3 (NG-US-ES) repeated measures ANOVA. Results: Significant main effect difference for footwear existed for both mean GRF ( $p = 0.002$ ) and peak GRF ( $p = 0.005$ ). Pairwise comparisons revealed that STD demonstrated significantly lower GRF compared to MIN. No other significant main effect or interaction was present. Conclusions: The significantly lower mean and peak GRF in the STD can be attributed to the footwear design characteristics, specifically the cushioned mid-sole in the STD compared to MIN. However, the load-carriage task or the slip type did not impact the GRFs, suggesting the minimal need for slip recovery responses.

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### DISTANCE RUNNING STRIDE-TO-STRIDE VARIABILITY: ARE THERE GENDER DIFFERENCES FOR SAGITTAL PLANE KINEMATICS?

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022

For distance running, recent advances in motion-analysis have made it possible to quickly analyze many strides. This provides new opportunities to study stride-to-stride variability (SSV) for distance running kinematics. PURPOSE: To determine if there are significant gender differences in sagittal plane ankle, knee, and hip SSV during the stance and swing phases. METHODS: Twenty-two highly-trained (30-80 miles per week) adult runners participated in the study (8 females, 14 males,  $36.1 \pm 10.8$  years). For the data collection, runners completed a preferred warm-up and then ran three minutes (on treadmill) at their preferred running speed. Data was collected during the third minute. Six Vicon Bonita cameras collected kinematic data at 200Hz. Data were normalized into 101 data points for stance and swing. Joint angle SSV was assessed by calculating the standard deviation across 10 strides. For both stance and swing, a 2 by 3 ANOVA (male, female; hip, knee, ankle) were used to test for significance. RESULTS: No significant interaction was revealed between Gender and Joint in both Stance and Swing Phases. There was a significant main effect in Swing Phase at the Knee Joint ( $p < 0.01$ ). Bonferroni post hoc tests revealed the knee SSV (overall  $SD 3.68^\circ + 0.75^\circ$ ) during swing phase for both male and female runners was significantly ( $p < 0.001$ ) greater than both the hip (overall  $SD 2.09^\circ + 0.53^\circ$ ) and ankle (overall  $SD 2.01^\circ + 0.89^\circ$ ) joints. CONCLUSION: There appears to be no difference in SSV between male and female distance runners. The knee joint appears to be more variable than the hip and ankle joints during the swing phase.

### KINEMATIC CHANGES IN BASEBALL PITCHING DURING MATURATION IN ADOLESCENT BASEBALL PITCHERS

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023

Baseball pitching requires utilization of both the lower and upper extremities for efficient and effective movement. Optimal utilization of the extremities is dependent upon efficient transfer of energy through proper use of a stable base of support via center of mass (COM) positioning and torso kinematics. Though it is known that pitching is a total body activity, there is paucity in the literature examining these variables. PURPOSE: To analyze changes in torso flexion, torso lateral flexion, and COM positioning at foot contact (FC) in baseball pitching during maturation in adolescent baseball pitchers. METHODS: Ten participants (Visit 1:  $12.50 \pm 1.51$  yrs,  $162.06 \pm 12.36$  cm,  $54.12 \pm 12.86$  kg; and Visit 2:  $13.50 \pm 1.65$  yrs,  $168.33 \pm 13.49$  cm,  $59.13 \pm 10.46$  kg) were included in this study. Participants were instructed to visit the lab twice throughout their years of maturation, and throw maximal effort fastball pitches to a catcher at their regulation distance. Kinematic data were collected via an electromagnetic tracking system, at 100 Hz. Torso and COM kinematics were compared between the two visits. The COM position was defined as a percentage between the drive and stride leg, with 0% representing COM shifted back toward the drive leg, and 100% representing COM shifted forward to the stride leg RESULTS: A repeated measures MANOVA revealed no significant difference in fastball pitching torso kinematics (flexion and lateral flexion), as well as COM positioning at FC between the two visits ( $\Lambda = 0.43$ ,  $F_{3,7} = 3.11$ ,  $p = 0.098$ ,  $\eta^2 = 0.57$ ). CONCLUSIONS: Although no significance was revealed, the participants in this study were still undergoing anthropometric changes seen in puberty. Future studies should consider longer duration between visits, a larger sample size, and all the events of the pitch.

### FATIGUE INCREASES CENTER OF PRESSURE SWAY

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024

Posture and stability are key components in the accurate performance of a myriad of physical tasks. Recent research suggests that fatigue may lead to an increase in center of pressure (COP) oscillation, but the conditions in which balance is impaired are unclear. PURPOSE: To investigate the effects of fatigue and other perturbation conditions on the sway of the COP. METHODS: Eighteen participants completed three trials under each condition, pre- and post-fatigue protocol. The conditions were eyes open (EO), eyes closed (EC), single leg stand (SL), subtraction of seven (SS), unstable surface (US), virtual reality baseline (VB) and virtual reality perturbation (V2). The x- and y-axis COP coordinates were measured using a Bertec force plate. After the first 21 trials, the participants walked on a treadmill at a RPE of 14 for 30 minutes while carrying a 25 kg weighted backpack. Anterior-posterior (APd) and medio-lateral (MLd) displacement of COP were calculated. Results are presented in millimeters (Mean  $\pm$  SD). A two-factor mixed-design ANOVA was used to test for statistically significant differences ( $\alpha = .05$ ). RESULTS: APd increased under EC ( $12.79 \pm 2.91$ ,  $p < .001$ ), SS ( $17.01 \pm 5.63$ ,  $p = .004$ ), and V2 ( $9.80 \pm 2.78$ ,  $p = .001$ ). MLd increased under SL ( $11.76 \pm 5.82$ ,  $p = .050$ ) and SS ( $14.54 \pm 5.74$ ,  $p = .015$ ). There were no differences in COP sway when vision remained unimpaired, even on unstable surface. CONCLUSION: Fatigue appears to increase COP sway only when other mechanical or cognitive perturbations are present.

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## PHYSICAL ACTIVITY AND SLEEP QUALITY IN YOUTH WITH AUTISM SPECTRUM DISORDER

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**PURPOSE:** The purpose of this study was to compare levels of moderate-to vigorous physical activity (MVPA), sedentary behavior (SB), and sleep quality in children with Autism Spectrum Disorder (ASD) with a sample of typically developing (TD) children. **METHODS:** Activity levels and sleep quality were measured in 20 children with ASD, and 17 TD children (ages 8-17) using Actigraph GT9X Accelerometers. All participants wore the device on their non-dominant wrist for a period of seven days and nights. Non-parametric t-tests were conducted to compare differences in MVPA, SB, and several components of sleep quality (e.g. sleep efficiency, total sleep duration). Additionally, chi-square tests were conducted to compare the number of participants who met PA and sleep recommendations. **RESULTS:** Children with ASD spent fewer minutes per day participating in MVPA (70.4 vs. 127.7 minutes per day,  $p=0.0005$ ) and more minutes participating in SB (556.6 vs. 366.65,  $p<0.0001$ ) compared to TD children. Additionally, children with ASD showed less sleep efficiency (88% vs. 93%,  $p=0.008$ ), and less total sleep time (353.1 minutes vs. 540 minutes,  $p=0.006$ ) than their TD counterparts. All TD participants met the recommended amounts of MVPA per day, while only 5 (30%) of youth with ASD achieved 60+ minutes of PA on at least 6 days a week ( $p=0.0004$ ). Less than half of both groups met the recommended amounts of sleep with 5 (43%) of TD youth and 1 (6%) child with ASD achieving the 9+ hours daily ( $p=0.02$ ). **CONCLUSION:** Children with ASD are less active and have poorer sleep than TD children. Future studies should further explore potential mechanisms that influence activity levels and sleep quality in this population so that effective interventions may be designed to improve these factors.

025

## EFFECTS OF 3 WEEKS YOGA ON RPE PRODUCTION DURING TREADMILL EXERCISE

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**Introduction:** Yoga may improve lung function and reduce blood pressure and stress. Responses during perceptually anchored sub-maximal running are not well understood. This study investigated the influence of yoga (pranayama) on velocity selection and physiological responses during sub-maximal RPE production trials. **Methods:** Runners ( $n=22$ ) of various abilities ( $VO_{2max}$   $47.9 \pm 9.5$  ml/kg/min) were assigned to a Yoga (YG) or control (CT) group before completing pre and post treadmill trials where they adjusted (blindly) velocity (grade: 1%) to produce RPE of 4 and 7 (10 min each). During trials,  $VO_2$ , respiratory rate (RR), heart rate (HR), minute volume (MV), and tidal volume (TV) were recorded. YG ( $n=12$ ) practiced 3 styles of pranayama (30 min/day 6 days/wk) 3 consecutive wks. CT ( $n=10$ ) completed pre – post testing without intervention. All continued their personal physical activity regimen throughout. **Results/Conclusions:** Significant results ( $p < 0.05$ ) for YG included; self-selected running speeds (m/sec) for RPE 4 (pre  $5.77 \pm 1.01$ , post  $6.51 \pm 1.21$ ,  $p = 0.02$ ) and RPE 7 (pre  $7.45 \pm 1.15$ , post  $8.22 \pm 1.30$ ),  $VO_2$  for RPE 7 (pre  $41.9 \pm 7.0$ , post  $46.3 \pm 6.8$ ), HR for RPE 7 (pre  $185 \pm 15$ , post  $191 \pm 11$ ), TV for RPE 7 (pre  $1.87 \pm 0.35$ , post  $2.07 \pm 0.40$ ), and MV for RPE 7 (pre  $79.53 \pm 14.23$ , post  $91.83 \pm 19.22$ ). CT showed no significance in any measures (pre vs. post) except TV for RPE 7 (pre  $1.93 \pm 0.32$ , post  $2.04 \pm 0.34$ ,  $p = 0.04$ ). Results suggests 3 weeks of yogic breathing practice alters the RPE association with velocity and consequent physiological responses when intensity is regulated using RPE production. More work is needed to fully understand effects of yoga on physiological and perceptual responses during exercise.

026

## CRITERION VALIDITY OF ACTIGRAPH GT9X STEP PREDICTIONS IN YOUTH

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**PURPOSE:** To assess the criterion validity of GT9X step count predictions in a youth sample. **METHODS:** One hundred youth (ages 6-18 years) volunteered to complete two lab visits. At each visit, participants performed eight semi-structured activities (16 total, ranging from sedentary to vigorous intensity) while wearing a GT9X monitor on the right hip, both wrists, and both ankles. Video recordings from a subset of participants ( $n = 34$ ) were reviewed post hoc to identify periods in which the participant's feet were fully visible. Steps were hand-counted during those periods, and time-synced GT9X data were used to obtain corresponding step count predictions. Each period (excluding data from cycling and jumping jacks) was used as a data point in regression analysis, where hand-counted steps (criterion measure) were regressed against predicted steps from the GT9X, separately for the five attachment sites with and without applying the low frequency extension (LFE). Perfect agreement would be indicated with a slope of one and an intercept of zero. **RESULTS:** There were 330 stepping periods lasting (mean  $\pm$  SD)  $2.8 \pm 1.8$  minutes and including  $132.6 \pm 159.4$  steps. The only slopes not significantly different from one came from the hip-worn GT9X ( $b_1 = 0.996$  and  $1.022$  with and without LFE, respectively,  $p \geq 0.15$ ). All other slopes were significantly different from one, ranging from 1.112 (left ankle with LFE) to 1.473 (right wrist without LFE) with  $p < 0.001$ . The hip-worn GT9X with LFE had the closest intercept to zero ( $b_0 = -4.447$ ,  $p = 0.01$ ). All other intercepts ranged from -20.057 (right wrist with LFE) to 21.636 (hip without LFE). **CONCLUSIONS:** In youth, GT9X step counts vary in criterion validity depending on wear location and use of the LFE. Hip-worn GT9X devices may be useful step counting tools in free-living studies.

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## ASSOCIATION BETWEEN PUSH-UPS AND ANTHROPOMETRIC VARIABLES AND UPPER BODY STRENGTH IN WOMEN

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Upper body strength is important in many athletic endeavors. Only a limited number of studies exist examining factors contributing to upper body strength in females. **PURPOSE:** To identify the relationship between push-ups (PU) and anthropometric measurements to upper body strength in recreationally active females. **METHODS:** Female participants ( $n = 150$ ; age =  $20.4 \pm 1.5$  y, height =  $1.66 \pm 0.07$  m, weight =  $64.9 \pm 9.7$  kg, body fat =  $22.2 \pm 4.9$  %) performed PU to fatigue at a controlled cadence (45 bpm) along with assessment of upper body strength (bench press 1RM). Arm, shoulder to ankle, and hand to knee length, upper arm circumference, and 3-site skinfolds were also measured. Total PU were corrected for body height (PU-cm), body mass (PU-kg), and height and body mass (PU-cm-kg-100-1). Univariate and multivariate linear regression analysis was used to predict bench press 1RM from physical characteristics and PU performance, with model fit assessed using  $R^2$  and  $\Delta R^2$ . **RESULTS:** Total PU were moderately correlated with 1RM ( $r = .42$ ,  $p < .001$ ), as were PU-cm ( $r = .43$ ,  $p < .001$ ), PU-kg ( $r = .57$ ,  $p < .001$ ), and PU-cm-kg-100-1 ( $r = .56$ ,  $p < .001$ ). Hierarchical regression analysis indicated PU-kg explained a larger proportion of the variation in 1RM than either total PU ( $\Delta R^2 = 12.0\%$ ,  $p < .001$ ) or PU-cm ( $\Delta R^2 = 13.0\%$ ,  $p < .001$ ). PU-cm-kg-100-1 did not yield greater accuracy than PU-kg ( $\Delta R^2 = 0.2\%$ ,  $p = .557$ ). **CONCLUSION:** It is evident that PU performance and anthropometric measurements cannot serve as accurate predictors of 1RM bench press in a cohort of young active female participants.

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### EXAMINATION OF SPEED, AGILITY, AND POWER BY POSITION IN DIVISION II WOMEN'S SOCCER ATHLETES

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**O29** Purpose: The purpose of this study was to determine if there were any significant differences in speed, agility, and power between Goal Keepers (GK), Defenders (DEF), Forwards (F), and Midfielders (MF) in Division II Women's Soccer athletes. Methods: Twenty-four female soccer athletes, with a mean age of  $19.1 \pm 1.0$  years, mean height of  $167 \pm 5.6$ cm, and mean weight of  $60.9 \pm 5.4$ kg, participated in this study. Of the 24 athletes, there were three GK, nine DEF, five F, and seven MF. The soccer athletes attended two days of fitness testing. On day one, athletes completed the L-test for agility and the Flying 10 test for speed. On day two, athletes completed the vertical jump test as a measure of power. Results: Speed, as measured by the Flying 10 fitness test, revealed that MF were significantly slower ( $1.37 \pm 0.03$ sec) than F ( $1.24 \pm 0.03$ sec;  $p=0.02$ ) and GK ( $1.23 \pm 0.04$ sec;  $p=0.04$ ). Agility, as measured by the L-test, revealed that MF were significantly slower ( $8.90 \pm 0.18$ sec) than DEF ( $8.34 \pm 0.20$ sec;  $p=0.03$ ). Power, as measured by the vertical jump test, revealed that MF jumped significantly lower ( $38.4 \pm 0.9$ cm) compared to DEF ( $46.5 \pm 1.0$ cm;  $p<0.01$ ) and GK ( $48.8 \pm 1.23$ cm;  $p=0.02$ ). Conclusions: Midfielders consistently scored lowest on each of the fitness tests for speed, agility, and power. The results from this investigation may be useful in the development of strength and conditioning programs to enhance speed, agility, and power for soccer athletes playing in various positions within the team.

### AGREEMENT BETWEEN FITBIT AND ACTIGRAPH ESTIMATES OF PHYSICAL ACTIVITY IN YOUNG CHILDREN

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**O30** Commercial wearables are used to track physical activity (PA) levels in children and as tools for increasing PA participation in youth. However, few studies have examined the agreement between commercial and research grade devices in assessing PA in children. Purpose: To compare estimates from a wrist-worn Fitbit Flex 2 to a waist-worn Actigraph GT9X Link in elementary school children. Methods: Forty children aged 6-10 years wore a Fitbit Flex 2 (on non-dominant wrist) and an Actigraph GT9X Link (on their waist) for up to two weeks. Steps and intensity-specific estimates of PA for each device were averaged across days with at least 8 hours of wear. Results: The Fitbit Flex 2 recorded significantly more steps ( $1265.7 \pm 667.4$  steps) compared to the Actigraph GT9X Link ( $10017.3 \pm 475.6$  steps). Fitbit estimates of moderate intensity PA ( $32.7 \pm 3.1$  min) were significantly lower than for the Actigraph ( $42.1 \pm 2.4$  min). In contrast, Fitbit estimates of vigorous intensity PA ( $24.0 \pm 3.6$  min) were not significantly different than Actigraph estimates ( $26.3 \pm 2.1$  min). Conclusions: Wrist-worn consumer wearables may produce higher estimates of steps and lower estimates of moderate intensity PA in elementary school children. Absent additional evidence, consumers and researchers should be cautious when using wrist-worn consumer wearable devices to assess absolute levels of PA in youth.

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### RELIABILITY OF TIME-TO-EXHAUSTION TRIALS UTILIZING A SPEED CORRESPONDING TO A PERCENTAGE OF VO2MAX

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**O31** BACKGROUND Development of time-to-exhaustion protocols have consistently utilized specific variables, such as heart rate, derived from a VO2max test to calculate corresponding running speeds. Such calculations, however, may be more likely to provide inconsistent readings during testing due to anticipatory responses, medications, or telemetry equipment being used. Therefore, the purpose of this study was to establish reliability for time-to-exhaustion trials using speeds corresponding to a specific intensity of VO2max. METHODS: Ten recreationally-trained males and females between the ages of 18-25 years (40% male; BMI [males] =  $26.01 \pm 1.72$ ; BMI [females] =  $23.34 \pm 2.36$ ) performed a VO2max test on a motorized treadmill. Heart rate, respiratory gases, and speeds were recorded. Speeds for each individual time-to-exhaustion were determined by first calculating 80% of VO2max and then defining the corresponding speed at 80% intensity. This intensity was specifically chosen to elicit time-to-exhaustion trials that would not be excessively lengthy in duration, potentially promoting boredom. Following the VO2max test and subsequent determination of running speed, participants completed two time-to-exhaustion trials, separated by a minimum of 48 hours to reduce carryover effects. Intraclass correlation coefficients (ICC) were used to determine reliability of time-to-exhaustion trials. RESULTS: Average VO2max values were  $48.75 \pm 0.65$  for males and  $37.62 \pm 2.80$  for females. Average speeds for time-to-exhaustion trials were  $6.93 \pm 0.25$  mph for males and  $5.53 \pm 0.49$  mph for females, while time-to-exhaustion trials lasted, on average,  $28.04 \pm 8.07$  minutes for males and  $19.14 \pm 6.49$  minutes for females. A high degree of reliability was found between time-to-exhaustion trials (ICC3,1 = 0.94; SEM = 2.85). CONCLUSIONS: Utilizing speeds corresponding to 80% of VO2max may be an appropriate and reliable method of developing time-to-exhaustion trials. Although further research is warranted, these preliminary results suggest that this method may be useful for situations where heart rate may be affected by extraneous factors (e.g. medication).

### THE EFFECT OF AEROBIC EXERCISE INTENSITY ON NON-EXERCISE PHYSICAL ACTIVITY LEVELS IN OBESE AFRICAN AMERICANS

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**O32** Non-exercise physical activity (NEPA) lowers the prevalence of cardiovascular disease (CVD) and CVD risk factors independent of exercise training. Moderate and vigorous intensities have been associated with an overall decrease in CVD associated mortality. The relationship between exercise training intensity and NEPA has not been investigated. Purpose: To examine the effects of moderate intensity compared to high intensity aerobic exercise training on NEPA variables (e.g. total steps, light, moderate and vigorous intensity) and whether changes in NEPA are associated with changes in weight and waist circumference. Methods: Twenty-one overweight and obese (BMI 25-35 kg/m<sup>2</sup>) African American adults (age: 35-65 years) were randomized to 3 months of moderate intensity (50% VO2 max) or high intensity (75% VO2 max) exercise training. All participants wore an accelerometer continuously, except during exercise training. Baseline and 3 month values were collected for waist circumference (cm) and weight (kg). One-way ANOVA's and Pearson correlations were conducted for comparison between groups and between NEPA variables. Results: Change in steps from baseline to 3 months were not associated ( $p=0.109$ ) across the intervention groups. No significant association was found between change in steps with waist circumference ( $r=0.363$ ,  $p=0.784$ ) or weight ( $r=0.213$ ,  $p=0.673$ ). Conclusion: Aerobic exercise intensity was not associated with changes in NEPA. NEPA variables were not associated with a change in weight or waist circumference.

## NEUROMUSCULAR RESPONSES IN LOWER LIMB BILATERAL DEFICIT

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**D1** Purpose: This study examined the neuromuscular responses during the measurement of lower limb bilateral and unilateral muscular strength. Methods: Twelve (male: n = 6; female: n = 6) subjects (mean ± SD age: 24.5 ± 4.8 yrs, body mass: 74.2 ± 14.6 kg) completed randomized, isometric, seated leg extension bilateral and unilateral maximum isometric voluntary contractions (MIVC). On a separate day, the subjects completed a randomized, bilateral and unilateral dynamic, seated leg extension for the determination of the 1 repetition maximum (1RM) strength. The electromyographic (EMG) and mechanomyography (MMG) amplitude (AMP) and mean power frequency (MPF) were measured from the vastus lateralis of the right and left lower limbs during the MIVC and 1RM trials, and were normalized to the corresponding signal from the MVIC trials. Statistical analyses included independent and paired samples t-test ( $p \leq 0.05$ ). Results: Six of the 12 subjects demonstrated a 1RM bilateral deficit (BLD;  $-9\% \pm 2.9\%$ ). The EMG MPF was significantly greater ( $p = 0.04$ ) for the non-BLD subjects (n = 6) than the BLD subjects during the bilateral 1RM, but there were no differences between BLD and non-BLD for the EMG AMP, MMG AMP, or MMG MPF during the unilateral or bilateral assessments. For the BLD subjects, EMG MPF was significantly greater ( $p = 0.03$ ) during the unilateral 1RM than the bilateral 1RM, but EMG AMP, MMG AMP, and MMG MPF were not different. There were no differences between unilateral and bilateral neuromuscular responses for the non-BLD subjects. Conclusion: These findings indicated the BLD could be due to different motor control strategies, such as changes in muscle fiber conduction velocity, in a bilateral versus a unilateral movement of the lower limbs.

## EFFECTS OF DAIRY EXOSOME DEPLETION IN RAT SKELETAL MUSCLE AND LIVER

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**D2** Exosomes are extracellular vesicles that carry 'cargo', such as microRNA, which may interact with different tissues and regulate cellular signaling pathways. Purpose: The purpose of this study was to determine the effects of exogenous bovine exosomes on the liver and skeletal muscle in rats. Methods: Twenty-eight-day Fisher 344 rats were provided a milk-based diet that either contained exosomes (EXO+, n=12) or was exosome depleted via sonication (EXO-, n=12) for four weeks. Following the feeding period, the liver and gastrocnemius were removed and measurements of respiratory control ratio (RCR), reactive oxygen species emission (ROS), antioxidant levels, and transcriptomic analysis were performed. Except for transcriptomic data, two-tail independent samples t-tests were performed between diet groups and statistical significance was set at  $p < 0.05$ . For transcriptomic data, all annotated transcripts with FPKM scores  $> 1.0$  were analyzed between groups and any score exceeding a fold-change cut-off  $> 1.5$  fold ( $p < 0.01$ ) were considered meaningful. Results: Analysis of the diet verified that EXO- diet had decreased exosomes, however sonication enriched RNA per particle by  $> 7.5$  fold. Terminal gastrocnemius and liver masses remained unaffected by diet, although gastrocnemius muscle fiber cross sectional area was 11% greater ( $p = 0.018$ ) and total RNA (a surrogate of ribosome density) was 24% greater ( $p = 0.001$ ) in EXO- rats. Transcriptomic analysis on the gastrocnemius indicated that only 22 mRNAs were significantly greater in EXO+ versus EXO- rats, whereas 55 mRNAs were greater in EXO- versus EXO+ rats. There was no significant change in mitochondrial volume in either the liver ( $p = 0.707$ ) or gastrocnemius ( $p = 0.724$ ), however liver mitochondria from EXO- had increased state 3 and state 4 respiration rates for both complex I substrate ( $p = 0.040$  and  $p = 0.009$ ; respectively) and complex II substrate ( $p = 0.056$  and  $p = 0.011$ ; respectively). EXO-gastrocnemius had significantly increased GPX protein levels ( $p = 0.020$ ), which may explain the significant decrease in ROS emission ( $p = 0.016$ ). Conclusions: An exosome depleted diet induces changes in the liver and the skeletal muscle tissue, and these changes may be due to the enhanced mRNA nature of the EXO-diet.

## ASSOCIATION BETWEEN SEDENTARY TIME AND PHYSICAL ACTIVITY WITH GLUCOSE CONCENTRATIONS AND GLYCEMIC VARIABILITY

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**D3** Increased time spent being sedentary and decreased physical activity (PA) of all intensities have been linked to decrements in metabolic health, such as glucose metabolism. Glycemic variability has increasingly been recognized as a marker of glucose metabolism. Purpose: To evaluate the association between objectively measured sedentary time and PA with fasting and 2-hour oral glucose tolerance test (OGTT) glucose concentrations, and glycemic variability assessed by continuous glucose monitoring (CGM) in sedentary adults. Methods: Middle-aged adults (n=28; 46.0±6.1 years; BMI 32.3±6.2 kg/m<sup>2</sup>) completed a 7-day period of accelerometer and CGM monitoring, as well as performed an OGTT. Accelerometry assessed sedentary time ( $< 1.5$  METs excluding sleep time) and time spent performing light- (1.5 to  $< 3.0$  METs), moderate- (3.0 to  $< 6.0$  METs), and vigorous-intensity ( $\geq 6.0$  METs) PA was measured utilizing a Sensewear Mini Armband. Following a 12-hour fast, serum glucose concentrations were measured at fasting and 30-, 60-, 90-, and 120-minute after consuming a 75-gram glucose drink. CGM was used to calculate 24-hour glycemic variability using standard deviation, glycemic variability coefficient of variation, and the j-index [calculated as  $0.001 \times (\text{mean glucose concentration} + \text{standard deviation of mean glucose concentration})^2$ ]. For both the accelerometer and CGM, data were considered valid with a minimum wear time of 20 hours and for 5 days including 1 weekend day. Results: No glucose concentrations were found to be significantly associated with sedentary time or PA measures. Interestingly, light-intensity PA, combined time performing moderate- and vigorous-intensity PA ( $\geq 3.0$  METs), and total PA ( $\geq 1.5$  METs) were all found to be negatively associated with the j-index ( $r = -0.404$ ,  $p = 0.041$ ;  $r = -0.389$ ,  $p = 0.049$ ;  $r = -0.435$ ,  $p = 0.026$ , respectively). However, after adjustment for BMI, these associations were no longer significant ( $p > 0.505$  for all). Conclusions: These results suggest that PA of varying intensities could potentially impact glycemic variability but may be influenced by BMI. Future studies should evaluate more sensitive measures of glycemic variability to further assess its association with sedentary time and PA of all intensities.

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## CUTANEOUS REACTIVE HYPEREMIA IS ATTENUATED IN NON-HISPANIC BLACKS COMPARED TO NON-HISPANIC WHITES

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**D4** PURPOSE: Cutaneous reactive hyperemia (RH) is known to be mediated by both sensory nerves and endothelial-derived hyperpolarizing factors (EDHFs). This study was designed to assess whether there are differences in the contribution of sensory nerves, EDHFs, and mechanisms of cutaneous microvascular function between young, healthy non-Hispanic Blacks (NHB) and non-Hispanic Whites (NHW). METHODS: Twenty-four participants who self-identified as NHB (n=12) or NHW (n=12) underwent 3 bouts of arterial occlusion and subsequent RH with each bout separated by at least 10 min. An index of skin blood flow was assessed using laser-Doppler flowmetry (LDF). Following the last RH, maximal vasodilation was elicited by heating the skin from 33°C to 43°C. Cutaneous vascular conductance (CVC) was calculated (LDF/MAP) and normalized to maximum (%CVCmax). CVC data were assessed for peak RH (%CVCmax) and total RH (area under the curve, AUC; %CVCmax \* sec). RESULTS: Both the peak (49±11 vs. 64±14 %CVCmax,  $P < 0.05$ ) and total RH response (2888±911 vs. 4343±1335 %CVCmax \* sec,  $P < 0.05$ ) were attenuated in NHB compared to NHW. CONCLUSIONS: Cutaneous RH is attenuated in young, healthy, NHB compared to NHW. These data suggest cutaneous sensory nerve function and/or EDHFs are reduced in NHB and may help explain the increased risk of sensory nerve and microvascular dysfunction in NHB.

### BODY COMPOSITION, STRENGTH, AND PHYSICAL FUNCTION FOLLOWING TWO TRAINING INTERVENTIONS FOR BREAST CANCER SURVIVORS

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D5

Purpose: To examine the effects of functional impact training (FIT) and yin yoga (YY) on body composition, strength, and physical function in breast cancer survivors (BCS). Methods: 44 BCS (60.3±8.3 yrs) were assigned to a 24-week FIT (resistance+high impact exercises) or YY intervention (stretching+relaxation) 2x/wk. Pre- and post-body composition measurements were assessed via dual energy X-ray absorptiometry. Upper body strength was measured by a one-repetition maximum chest press test. Lower body strength was assessed by Biodex isokinetic knee extension and flexion at 60, 120 and 180 deg/s. The Continuous Scale-Physical Functional Performance (CS-PFP) test assessed physical function. Data were analyzed using a repeated measures analysis of variance. Significance was accepted at  $p \leq 0.05$ . Results: Body composition did not change. FIT improved upper body strength (73±18 to 83±22 kg) compared to YY (60±15 to 59±16 kg). Main time effects occurred for lower body strength with a mean extension and flexion improvement of 13% and 16%, respectively. A main time effect occurred for CS-PFP (68.53±12.87 to 73.66±12.62 U). Conclusion: Findings suggest that FIT and YY are beneficial for strength and physical function in BCS. FIT may be a high impact alternative to traditional weight training for BCS while YY may be a viable option for BCS who require a program of lower intensity.

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### IMPACT OF ACUTE SEDENTARISM ON CEREBROVASCULAR HEMODYNAMICS

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D6

Sedentary behavior, more specifically prolonged sitting (1-6 hrs), can negatively impact lower-limb hemodynamics, characterized by a decrease in leg blood flow with concomitant impairments in vascular endothelial function. It is unclear whether sitting can similarly impact the cerebrovasculature. Purpose: To test the hypothesis that 1-hr of sitting will negatively impact cerebrovascular hemodynamics. Methods: Nine participants (age=24±2 yrs, BMI=26±1 kg/m<sup>2</sup>, Female=4) completed a 1-hr sitting protocol. To examine cerebrovascular hemodynamics, blood flow through the common carotid artery (CCA) was measured via Doppler-ultrasound pre-post 1-hr of sitting (supine), as well as during the sitting intervention (10- and 60-min). In a subset (N=4), blood flow was measured in the internal carotid (ICA) and vertebral artery (VA) to estimate total brain blood flow [BBF=(ICA+VA)\*2]. Results: When measured supine, CCA blood flow was comparable pre-post sitting ( $p=0.58$ ) but decreased 10-60 mins while seated (10-mins=1099±83 vs. 60-mins=962±70 mL/min;  $p=0.02$ ). Estimated total BBF significantly decreased pre-post sitting (pre=1199±183 vs. post=847±140 mL/min;  $p=0.007$ ) but was comparable between the 10- and 60-min periods ( $p=0.91$ ). Conclusions: These preliminary findings indicate that 1-hr of sitting appears to significantly alter cerebrovascular hemodynamics, characterized by a reduction in estimated total BBF in response to sitting.

### CIRCADIAN PHASE IS ASSOCIATED WITH SELF-REPORTED CHRONOTYPE IN YOUNG, SEDENTARY ADULTS

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Chronotype, which is an individual's preferred timing of sleep and activity across the 24-hour day, is regulated by genetics, environmental exposure, and age. Chronotype is measured by subjective questionnaires that query the timing of daily behaviors. Late chronotype has been previously associated with lower level of physical activity, higher body mass index (BMI), and increased risk of Type 2 diabetes and the metabolic syndrome. A well-established measure of an individual's circadian clock timing, or phase, is the onset of melatonin secretion measured in dim light conditions (dim light melatonin onset; DLMO). Despite previous investigations, the associations between DLMO and chronotype, as well as body composition, have not been fully elucidated in young, sedentary adults. PURPOSE: To examine the association between DLMO and chronotype; and the association between DLMO and body composition measures in young, sedentary adults. METHODS: Fifty-two adults (19 male, 25.8 ± 6.0 yrs; BMI 26.1 ± 5.4 kg/m<sup>2</sup>; %Fat 34.2 ± 8.8%) participated in this study. All subjects were sedentary (< 2 hrs weekly structured exercise), non-smokers, and did not use medication. Circadian phase was measured by DLMO (time of day when saliva melatonin ≥ 4 pg/ml). Chronotype was measured as the midpoint of sleep on free days (free of social or vocational responsibilities, corrected for sleep debt; MSFsc) calculated from the Munich Chronotype Questionnaire (MCTQ) and a composite score calculated from the Morningness-Eveningness Questionnaire (MEQ; range: 16-86). Percentage body fat (%Fat) was determined by total body DXA scanning. Pearson's correlation analysis was used to determine if significant ( $p < 0.05$ ) associations were observed between DLMO and MSFsc, MEQ, BMI, and %Fat. RESULTS: DLMO (21:42 ± 01:31) was significantly associated with MSFsc (04:34 ± 01:11;  $r = 0.66$ ;  $p < 0.001$ ) and MEQ (50.0 ± 9.0;  $r = -0.52$ ;  $p < 0.001$ ). No significant associations were observed between DLMO and BMI ( $r = -0.13$ ) or %Fat ( $r = 0.04$ ). CONCLUSION: An objective measure of circadian phase was associated with subjective measures of chronotype. However, neither BMI nor %Fat was associated with DLMO in young sedentary adults.

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### THE EFFECT OF TREADMILL VS. NUSTEP ON GAIT AND LOWER EXTREMITY ELECTROMYOGRAPHY AFTER CHRONIC STROKE

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D8

The NuStep Cross Trainer (NCT) relies on similar neural networks as gait. Therefore, neurologically impaired individuals may improve walking ability after exercise on the NCT. PURPOSE: The purpose of this investigation was to compare the effects of the NCT and Treadmill (TM) on intra-exercise electromyography and post-exercise gait parameters. METHODS: 34 participants were divided into two groups; stroke (CVA) (i.e., 10 ± 5 years post-CVA) and age and sex-matched control. Participants completed two 5-minute exercise bouts on both the NCT and TM at a RPE based self-selected cadence. Gait parameters were evaluated via the Wireless Gait Assessment Tool (WiGAT) immediately following each exercise bout. Mean electromyography (mEMG) values were normalized to their maximum voluntary contractions. Change in joint range of motion was calculated (maximum-minimum degree; ΔROM) from measures at the hip, knee, and ankle. RESULTS: Healthy participants were stronger at all joints,  $p < .025$ . RPE did not differ between exercise modes,  $p > .025$ . Stroke ( $n = 15$ ) and healthy ( $n = 19$ ) did not differ in age (Mdn: 66 years vs. 57 years, respectively) or BMI (Stroke:  $M = 27.02$ ,  $SD = 4.57$  vs. Healthy:  $M = 26.46$ ,  $SD = 4.63$ ),  $p > .05$ . There were no statistical differences between the TM and NCT in the CVA population's ΔROM,  $p > .025$ . The TM elicited a higher mEMG on a majority of the studied muscles in both populations,  $p < .025$ . The NCT decreased the stance percentage (%) and increased swing % on the non-affected leg as measured by the WiGAT,  $p < .05$ . CONCLUSION: The 5 minute NCT intervention improved gait parameters in this chronic CVA population. Supported by the State of Michigan Small Company Innovation Program (SCIP).

### ELEVATED SERUM URIC ACID AND HEART FAILURE IN U.S. ADULTS: 2007-2016 NHANES

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There is limited evidence examining the relationship between elevated serum uric acid (UA) concentration and heart failure (HF) in U.S. adults. Purpose: Examine the associations between elevated UA and HF using a nationally representative sample of U.S. adults. Methods: The final sample with complete data for this analysis (N=17,412) included men and women aged  $\geq$  40 years who participated in the 2007-2016 National Health and Nutrition Examination Survey. Self-reported diagnosis of HF was assessed via interview. Elevated UA was defined as values  $\geq$  6.0 mg/dL for women and  $\geq$  7.0 mg/dL for men. Multivariable gender-stratified logistic regression was utilized to examine the odds of HF. Results: The estimated prevalence of HF was 3.85% and 3.39% among men and women, respectively. Age adjusted analysis revealed significantly increased odds of HF in men (odds ratio [OR], 2.67; 95% confidence interval [CI] 1.99-3.59, P<0.01) and women (OR, 3.25; 95% CI 2.37-4.44, P<0.01) with elevated UA. Significance remained following adjustment for education, income, race, body mass index, alcohol consumption, hypertension, diabetes, and creatinine in men (OR, 1.62; 95% CI 1.12-2.35 P=0.01) and women (OR, 2.03; 95% CI 1.33-3.09, P<0.01). Conclusions: In a representative sample of U.S. adults, having an elevated UA concentration was associated with significantly increased odds of HF when compared to adults with normal UA.

M1

### MINIMALIST STYLE MILITARY BOOT IMPROVES RUNNING ECONOMY UNDER LOAD IN TRAINED MALES

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PURPOSE: Minimalist style boots (MIN) may improve running economy for soldiers under load versus the traditional boot type (TRD). However, running economy (RE) under load with MIN has not been examined. METHODS: In this study, male participants (n = 14) completed a VO<sub>2</sub> peak test (46.6 ± 7.3 ml/kg/min) under load (16 kg) while wearing their normal athletic shoes. Treadmill speed for RE tests was determined by the slowest pace in which participants completed a full stage with a running gait pattern during the VO<sub>2</sub> peak test. Load was applied using a ~7.5 kg weighted compression garment to simulate body armor and a ruck sack of ~8.5 kg. During the second trial participants completed two, 5-min running treadmill exercise bouts with the same load arrangement while wearing MIN (~500 g) and TRD (~800 g). RE was evaluated using indirect calorimetry (TrueOne2400, Parvo Medics Inc. Provo, Utah) and calculated by averaging the 60-s average values of minutes 3-4 and 4-5 with confirmation of steady state (difference in VO<sub>2</sub> < 0.1 L/min between minutes). There was a 10-min rest period between running bouts (counter-balanced crossover design). RESULTS: Paired sample t-tests indicated a significant difference (p = 0.003) in RE between MIN (2.95 ± 0.28 L/min) and TRD (3.04 ± 0.30). Thirteen participants had lower RE during MIN producing a small-moderate effect size (Cohen's d = 0.32). RER also increased (p < .001) during TRD (0.99 ± 0.07) versus MIN (0.94 ± 0.06) Overall, leg, and breathing RPE (p < 0.05) were all improved during MIN. CONCLUSIONS: When moving at minimal running speed under load, MIN provides notable improvement in RE.

M3

### GAMING ENJOYMENT, PERCEIVED EXERTION, AND EXERCISE INTENSITY IN ACTIVE VIRTUAL REALITY GAMES

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Virtual Reality exergaming is a new avenue of physical activity that may be preferred over "traditional exercise" in historically inactive populations. Thus active virtual reality games (AVRG) could be an effective strategy for meeting the ACSM physical activity guidelines. Purpose: This study examined the efficacy of AVRGs as an exercise modality by assessing game enjoyment and exercise intensity using percent oxygen consumption reserve (%VO<sub>2</sub>R) and rating of perceived exertion (RPE) for three games on a virtual reality system. Methods: Forty-one [male (n=21), female (n=20); age: 25.2±4.4y] healthy volunteers were assessed for body composition, completed a graded exercise test to determine maximal oxygen consumption, and a familiarization period for the three AVRGs (Thrill of the Fight [TOF], Holopoint [HP], and Audioshield [AS]) during visit one. At least 48hrs later, oxygen consumption and RPE were measured during 10 mins of supine rest and during 10 mins of each AVRG. Participants further ranked the games based on their enjoyment. Results: There were no sex-differences in RPE and %VO<sub>2</sub>R thus data was pooled for both sexes. When females were asked to rank the most enjoyable game, 50% chose AS, 40% chose HP, and 10% chose TOF. When males were asked to rank the most enjoyable game, 71.4% chose HP, 19% chose TOF, and 9.5% chose AS. Using 95% confidence interval (95% CI) for %VO<sub>2</sub>R, TOF was classified vigorous (68.6±2.8%), HP moderate (49.7±2.7%), and AS light intensity (35.7±2.4%). Using 95% CI for RPE, TOF (12.7±0.4) was classified as moderate, whereas HP (10.5±0.4) and AS (9.3±0.3) were light intensity. Conclusions: These data suggest that these AVRGs can elicit significant increases in oxygen consumption that are game dependent, indicating increases in energy expenditure. Furthermore, each game had a lower intensity categorization based on RPE compared to %VO<sub>2</sub>R. Lastly, although intensity did not differ between sexes, there were differences in game enjoyment between males and females.

This research was supported by the Virtual Reality Institute of Health and Exercise by loaning the virtual reality equipment.

M2

### RELATIONSHIP BETWEEN WEIGHT HISTORY AND DEPRESSION IN U.S. ADULTS

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PURPOSE: Explore the relationship between changes in weight over time and subsequent depression status using a nationally representative sample of U.S. adults. METHODS: The study sample (n=20,505) included male and female adults ( $\geq$ 36 years of age) who participated in the 2007-2016 National Health and Nutrition Examination Survey. Weight history examined fluctuations of weight, mainly gain in weight, from self-reported current weight and self-reported weight 10 years ago. Depression status was assessed using the PHQ-9 utilizing a cut point of  $\geq$ 10 to assign a depression score. Logistic regression analysis was utilized to examine odds of depression across ranges of weight gain. RESULTS: Overall prevalence of depression among U.S. adults aged 36 years and older was found to be at 7.5% (95% Confidence Interval [CI] 6.9-8.2). Following adjustment for gender, race, education, smoking, and physical activity, those who gained 20 or more lbs. had significantly greater odds of having depression (OR 1.45; 95% CI, 1.26-1.67) compared to those gaining <5 lbs. (referent). A similar relationship was not revealed for other weight gain ranges: 5-9lbs. (OR 0.84; 95% CI, 0.62-1.14), 10-14lbs. (OR 0.90; 95% CI, 0.70-1.15), 15-19lbs. (OR 0.93; 95% CI, 0.66-1.31). CONCLUSION: Findings revealed that weight gain of 20lbs. or more resulted in significantly greater odds of a PHQ-9 score indicative of depression.

M4

### THE EFFECTS OF EXERCISE TRAINING ON COGNITION AND QUALITY OF LIFE IN BREAST CANCER SURVIVORS

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**M5** Although cognition declines with age, cancer treatment may accelerate that decline through decreased quality of life (QOL). Purpose: To evaluate the effects of 3 months of functional impact training (FIT) and yin yoga (YY) on cognition and QOL in BCS. Methods: Forty-five BCS (60.5±8.3 yrs; BMI: 29.2±7.1 kg/m<sup>2</sup>) completed Trail-Making Test A (processing speed) and B (executive function), Digit Span Forward (attention) and Backward (working memory), and Controlled Oral Word Association Test [COWAT (executive function)] to assess cognition. QOL was measured using the 36-item Short Form Survey (SF-36). Participants completed either 3 months of FIT (n=21) or YY (n=24) 2x/wk. Data were analyzed using repeated measures ANOVA. Significance was accepted at p≤0.05. Results: There were no group by time differences for any measures. There was a significant time effect for the COWAT Total score (pre:40.7±12.6; post: 42.8±12.1). For SF-36 QOL domains, there were significant time effects for physical function (pre:75.7±22.2; post:79.8±22.1), role limitations/physical (pre:67.8±39.0; post: 78.3±36.0), role limitations/emotional (pre:74.8±38.4; post: 83.0±36.0), energy/fatigue (pre:56.2±23.0; post:63.2±22.2), emotional well-being (pre:75.4±16.2; post:81.2±14.8), and general health (pre:65.4±17.4; post: 71.6±16.3). Conclusion: FIT and YY may be non-pharmaceutical options for improving QOL in BCS. Further research with a longer intervention may be needed to examine any effects of FIT and YY on cognition in BCS.

### PEAKING FOR A NATIONAL WEIGHTLIFTING COMPETITION

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**M6** Coaches are interested in knowing when their athletes are peaked relative to competition. Purpose: to investigate the time course of psychological, morphological, and performance measures following an overreach and taper period in weightlifters preparing for a national competition. Methods: Olympic Training Site weightlifters (N=11) completed a 5-week peaking phase for a national competition. Body mass, stress and recovery psychometric measures, and unloaded/loaded (20kg) squat jump height (SJH) were measured weekly and at the competition site. Vastus lateralis cross-sectional area (CSA) ultrasound measurements were taken prior to and following the training protocol. One-way repeated measures ANOVAs with post-hoc comparisons were used for analysis (p≤0.05). Results: Statistically significant time effects were found for overall recovery (p<0.001), overall stress (p<0.001), and loaded SJH (p=0.01). Planned contrasts revealed a statistical increase in overall recovery (p<0.001) and decrease in overall stress (p=0.02) the day of competition compared to baseline. 9 athletes achieved their best psychometric score within 3 days of competition. There was an increase in loaded SJH (p=0.06); 7 athletes achieved their best performance within 3 days of competition. There was a significant decrease in CSA (p=0.04), but no statistically significant changes in body mass. In competition, 6 athletes set a personal best in snatch, clean and jerk and/or total. Conclusions: Results suggest that improvements in the loaded SJ and psychometric measures correspond to successful competition performance in some weightlifters. Notably, most weightlifters appeared to be peaked within 3 days of competition.

### RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND MOTOR SKILLS IN 3-5 YEAR OLDS: NATIONAL YOUTH FITNESS SURVEY

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**M7** PURPOSE: The purpose of this study was to examine what kind of physical activity would have a positive relationship with motor skills in children through secondary data analysis. METHODS: Data from children 3-5 years old (N=352, 179 males) who participated in the National Youth Fitness Survey (2012) were used. Included in this study were demographics, anthropometrics, physical activity questionnaire by parent report, and motor skill score determined by Test of Gross Motor Development-2nd Edition. Multiple regression was conducted to examine the relationship between physical activity and motor skills controlling for sex, race, and parent's socioeconomic status. RESULTS: The most commonly reported activities were running (43%), playing outdoor games (35%), and riding a bike (34%). Motor skills standard scores were locomotor (Mean (SE)=(9.99 (.16)), object control (Mean (SE)=8.52 (0.14)), and gross motor skill (Mean (SE)=95.57 (.68)). Participation in the following activities were positively related to gross motor skill score: riding a bike (β (SE)=5.27 (2.02), p=0.02), scooter riding (β (SE)=9.83 (2.59), p=0.002), swimming (β (SE)=4.01 (1.17), p=0.004), and jumping on a trampoline (β (SE) = 7.45 (3.09), p=0.03). With the exception of riding a bike the activities positively related to gross motor skill score had a reported range of participation between 7-12%. CONCLUSION: The key findings of this study indicated that participation in specific physical activities were related to gross motor skill score in preschool aged children. Further, it showed that with the exception of riding a bike the activities that the children participated in the most were not the same as those activities that were positively related to their gross motor skill score.

### RATE OF VELOCITY, TORQUE, AND POWER DEVELOPMENT IN MIDDLE-AGED AND OLDER MALES

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**M8** Rapid contractile measures such as rate of velocity (RVD), torque (RTD) and power (RPD) development dramatically decrease with age, but have rarely been concurrently investigated. Purpose: To compare rapid contractile parameters of the knee extensors in middle-aged and older males and examine correlates of 5-chair rise (5CR) performance. Methods: Healthy, middle-aged (n = 6, age = 46 ± 2.90 yrs) and older (n = 6, age = 69 ± 3.10 yrs) males performed three maximal voluntary isotonic contractions, at 40% peak torque, and three isometric knee extensions using a dynamometer. RVD and RPD were derived from isotonic contractions, as the linear slope of the velocity- and power-time curve, respectively. RTD was obtained from the first 50 ms of the isometric torque-time curve. 5CR, the time to rise 5 times from a chair as quickly as possible, was also recorded. Groups were compared with independent samples t-tests, while Pearson correlation coefficients were used to examine relationships between age, RVD, RPD, RTD, and 5CR. Results: RVD (32.15%; p = 0.004) and RPD (53.27%; p = 0.03) were decreased in older males, but not RTD (p = 0.497). Only RVD correlated with 5CR (r = -0.588; p = 0.044). Conclusions: While preliminary, these data suggest that dynamic, rapid contractile measures are preferentially affected by age, and only RVD was related to 5CR performance.

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### IMPAIRED COMPENSATORY MUSCLE HYPERTROPHY FOLLOWING 7 DAYS OF FUNCTIONAL OVERLOAD IN APCMIN/+ MICE

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Functional overload is a robust stimulus to increase muscle mass. Few studies examined the effect of this intervention in animal model of cancer cachexia and the mechanism still needs to be investigated. Purpose: The purpose of this study was to determine if the response to 7-day functional overload in plantaris muscle would be altered in cachectic mice. Methods: Wild-type (WT, n=8) and ApcMin/+ (Min, n=8) mice at approximately 18 weeks of age were used in this study. Synergist ablation (SA) surgery by removing gastrocnemius and soleus muscles were performed on the left leg whereas the right leg served as a control under anesthesia. Puromycin (0.04  $\mu\text{mol/g}$  body weight, BW) was injected 30 minutes prior to sacrifice, then Plantaris muscles were harvested at day 7 following the surgery. After the muscles were homogenized, total protein concentration of the homogenates was measured by Bradford assay. Regular western blotting was performed using 80~100  $\mu\text{g}$  of protein. Paired t-test (control vs. overloaded muscle) and unpaired t-test (WT vs. Min) were used for statistical analysis. Results: At the time of surgery, Min mice lost approximately 10% of BW compared to their peak BW. Plantaris weight of Min mice was smaller than that of WT mice by 19%. 7 days of functional overload increased plantaris weights in both mice, but the magnitude of muscle hypertrophy in Min mice was small compared to that of WT mice (24.9% $\pm$ 5.3 vs. 43.3% $\pm$ 5.2, respectively). In coincidence with this, western blot analysis demonstrated that Min mice had reduced p70S6K activation following 7-day functional overload compared to WT mice (1.9-fold vs. 3.4-fold, respectively). Furthermore, the elevation of muscle protein synthesis rate of Min mice was smaller than that of WT mice (2.3-fold vs. 2.9-fold, respectively). Conclusions: These results suggest that anabolic response to functional overload is impaired in cachectic mice.

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U1

### DEVELOPING A NO-CUFF METHOD TO MEASURE MITOCHONDRIAL CAPACITY USING NEAR INFRARED SPECTROSCOPY

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The current method to measure mitochondrial capacity using Near Infrared Spectroscopy (NIRS) utilizes a repeated short ischemic cuff inflation. Some participants do not tolerate cuff inflation, and the test is limited to limb muscles. PURPOSE: To develop a no-cuff mitochondrial capacity test using NIRS. METHODS: The forearms of young healthy adults were tested (n=11). The no-cuff mitochondrial test consisted of measuring the rate of recovery of oxygen saturation after a short period of exercise. The exercise consisted of squeezing a hand dynamometer with vigorous contractions for approximately 1 minute to increase metabolic rate while significantly lowering oxygen saturation. The recovery curves from the no-cuff test were fit to a bi-exponential equation with one fast and one slow rate constant. The slow exponential rate constant was used as the mitochondrial capacity. The no-cuff mitochondrial capacity rate constant was compared to the mitochondrial capacity rate constant obtained by using a repeatedly inflated ischemic cuff. RESULTS: The fast rate constant was determined to be 5.8 $\pm$ 1.5 seconds, consistent with previous measurements of reactive hyperemia. The no-cuff mitochondrial capacity was 47.4 $\pm$ 6.1 seconds and the mitochondrial capacity using repeated ischemic cuffs was 48.1 $\pm$ 7.2 seconds. The coefficient of determination between the two methods was r-squared=0.80. CONCLUSIONS: The no-cuff mitochondrial capacity agreed with the previously established mitochondrial capacity using ischemic cuffs and has the potential to measure muscle mitochondrial capacity without using ischemic cuff inflation.

U3

### THE RELATIONSHIP BETWEEN MATERNAL PHYSICAL ACTIVITY AND INFANT MOTOR DEVELOPMENT

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Background: Physical activity has benefits for pregnant women and their offspring. Studies suggest that exercise during pregnancy may elicit improvements in the neurodevelopment of offspring; however, it is unknown whether or not physical activity during pregnancy is connected to infant motor development. The purpose of this study was to determine the relationship between maternal physical activity during late pregnancy and infant motor development at four months of age. Methods: Physical activity was objectively assessed during late pregnancy (32-39 weeks gestation) (N=30). The amount of time spent sedentary, and the amount of time spent participating in different intensities of exercise (light, moderate, or vigorous) was assessed over the course of 7 days by a wrist-worn Actigraph Link Device. At delivery, monthly surveys were delivered to participants regarding information on time their infant spent in different positions (supine, prone, standing), infant feeding practices (breast-fed vs. formula-fed), and other factors that could contribute to infant motor development during the first 4 months of life. Between the ages of 4-4.5 months, the motor development of the child was assessed by a trained pediatric physical therapist using the Alberta Infant Motor Scale (AIMS), a well-established test to determine infant motor development percentiles. Maternal physical activity and the infant AIMS scores were correlated using Pearson Product Moment Correlation Coefficients via SPSS. Results: Infant motor development percentiles were not correlated to time spent sedentary (r=-.02, p=.94), time spent participating in light activity (r=-.03, p=.88), and time spent participating in moderate activity (r=.04, p=.85). In addition, there was not a significant relationship between infant motor scores and the total time an infant spent in prone ("tummy time") over the course of a week (r=.06, p=.81). Interestingly, infants who were still exclusively breastfed at 4 months had a significantly higher motor score percentile compared to those who were on formula (19.0 vs. 15.8, p=0.003). Conclusions: The results of this study indicate that there is no relationship between maternal physical activity levels during late pregnancy and motor development at four months of age. However, infants who were still breastfed at 4 months of age had improved motor development scores. The long-term implications of these data are substantial as motor performance in infancy is linked to an improved-cognitive function in school age kids.

U4

### NEIGHBORHOOD RESOURCES SUPPORTING PHYSICAL ACTIVITY: PERCEIVED ACCESS AND WEIGHT-RELATED HEALTH STATUS IN YOUTH

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Previous authors have demonstrated that the availability of neighborhood parks and greenspace is positively associated with physical activity engagement and health outcomes in youth. Yet, given the documented influence of perceptions of neighborhood safety, cleanliness, and traffic calming measures on physical activity participation in youth, further investigation is needed to consider the impact of perceived park access on youth health outcomes. Purpose: To examine the relationship between perceived access to neighborhood resources supporting physical activity and weight-related health status in youth. Methods: Data from 17 urban public elementary schools, representing 733 students (mean age = 7.32 + 1.78 years; males = 372, females = 361) was collected from the 2016-2017 Roanoke Valley Community Healthy Living Index. A correlation analysis examined the relationship between perceived access to resources supporting physical activity and BMI-for-age z-scores. Results: A significant negative relationship was found between perceived access to resources supporting physical activity and weight-related health status in youth,  $r(731) = -0.08$ ,  $p = .01$ . Conclusions: As perceptions of access to neighborhood-level resources supporting physical activity increased, weight-related health status in youth improved. These findings contribute to the existing literature on neighborhood-level correlates to health by considering the impact of family perceptions of access to healthy-living resources on youth health outcomes.

U2

### THE EFFECT OF BACK SQUAT POTENTIATION ON PITCHING VELOCITY AND ACCURACY

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**U5** **PURPOSE:** The purpose of this study was to investigate the effect of a back squat potentiation protocol on pitching velocity. **METHODS:** Twelve resistance-trained males (age: 21.4±1.4 y, height: 181.2±7.6 cm, body mass: 82.9±12.7 kg) with previous baseball experience, were recruited to participate in this study. In a within subjects, counterbalanced design, participants completed two trials: 1) a dynamic warmup followed by a post-activation potentiation (PAP) back squat protocol, and 2) control trial (CON) consisting of dynamic warm-up only. The back squat PAP protocol consisted of progressive warm-up sets before completing 2 repetitions at 90% of one-repetition maximum (1RM). Next, participants performed a standardized throwing warm-up before throwing 5 pitches at a strike zone target that was positioned 18.4 m from the mound. Velocity (mph) and accuracy were recorded for each pitch. **RESULTS:** Peak throwing velocity was significantly higher in the PAP trial compared to CON (p=0.037). Average throwing velocity across each of the five throws was not different between conditions (p=0.164). There was no difference in pitching accuracy between conditions (p=0.438). **CONCLUSIONS:** A back squat potentiation protocol increased peak throwing velocity with no decrement in throwing accuracy, but average throwing velocity remained unchanged.

### PREDICTION OF REDUCED AUTOPHAGIC ACTIVATION IN HUMAN PERIPHERAL BLOOD MONONUCLEAR CELLS FOLLOWING MAXIMAL AEROBIC EXERCISE

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**U6** **PURPOSE:** Autophagy is a molecular process to not only function as a disposal system in the elimination of infectious organs, but also serve as an imperative regulator of cellular metabolism and homeostasis. Research has demonstrated that acute aerobic exercise decreases autophagic flux (process of autophagy) in human skeletal muscle. The purpose of this study was two folds: (i) to examine this phenomenon of this autophagic activity reduction in the peripheral blood mononuclear cells (PBMCs) in humans and (ii) to determine which physiological variables accounted for the most variation in the alteration of this acute aerobic exercise-mediated autophagic response. **METHODS:** Six young male subjects participated in a graded exercise test on a treadmill. The western blot analysis was used to determine the level of autophagic and apoptotic markers (LC3-I and LC3-II, Bax and Bcl-2; respectively) in PBMCs prior to, immediately following exercise, and after completion of one and two hours into recovery. **RESULTS:** A reduced activation of autophagy as evidence of a lower LC3-II/LC3-I ratio was observed in response to exercise (P < 0.001), along with increased apoptotic activity (Bax/Bcl-2 ratio) (P = 0.046). A stepwise multiple regression analysis identified Bax/Bcl-2 area-under-the-curve "with respect to increase" (AUC<sub>i</sub>) as the strongest predictor of reduced autophagic response (LC3-II/LC3-I AUC<sub>i</sub>) (P = 0.002) in comparison of other variables, including metabolic measures (e.g., glucose, insulin, index of insulin resistance). **CONCLUSIONS:** These findings are congruent with the previously observed reduction of autophagic flux in human skeletal muscle. The identification of Bax/Bcl-2 AUC<sub>i</sub> as a primary predictor indicates the importance of autophagy as a critical molecular process in promoting cell survival against exercise-induced apoptosis.

### REGIONAL DIFFERENCES IN MITOCHONDRIAL CAPACITY OF THE FINGER FLEXOR MUSCLES

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**U7** Near-infrared spectroscopy (NIRS) has been used to measure mitochondrial capacity in the forearm, but finger-specific regions of the forearm have not been compared. Purpose: This study measured forearm muscle mitochondrial capacity in the flexor digitorum profundus (FDP) and the flexor digitorum superficialis (FDS) in order to determine if there are regional differences in mitochondrial capacity in the finger flexor muscles. Methods: Ten untrained subjects of age 21.0±0.8 years were tested on the right forearm in a seated position with a continuous wavelength NIRS device (Artinis, Ltd). Manual exercise with a 1000g weight was used to activate the forearm muscles in two conditions, using the index finger or the last two fingers. The NIRS device was positioned to optimize signals from the muscles being activated. A blood pressure cuff was placed proximal to the NIRS device and was used for arterial occlusion. Mitochondrial capacity was measured as the rate constant of recovery of metabolic rate after exercise. An endurance test was performed by using a triaxial accelerometer and electrical stimulation for 3 minutes at 2, 4, and 6 Hz. Results: Mitochondrial capacity was 1.90±0.4 min<sup>-1</sup> for the index finger and 1.31±0.3 min<sup>-1</sup> for the last two fingers (p=0.003). Endurance index for the forearm was 72.9±18.4% at 6 Hz. Conclusions: The index finger had 31% higher mitochondrial capacity than the last two fingers, consistent with expected differences in habitual activity. Our study population had endurance index values consistent with untrained control subjects, and future studies will evaluate regional differences in mitochondrial capacity in subjects with higher activity levels (such as piano players).

### SITTING INCREASES ARTERIAL STIFFNESS IN HEALTHY ADULTS

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**U8** Chronic sedentary behavior increases risk for cardiovascular disease. Sitting impairs leg vascular health. Simple perturbations to increase leg blood flow prevent impairments, however, the effects on central cardiovascular health are unknown. Purpose: To investigate the effects of prolonged sitting, with and without calf raises on aortic arterial stiffness (AS) (carotid-femoral pulse wave velocity, PWV) central blood pressure (CBP), and augmentation index (AIx). Methods: After familiarization, sedentary participants (n=20, 21.7 yrs (2.9), BMI 25.7 m/kg<sup>2</sup> (5.3), 70% female) sat for 180 min with and without performing 10 calf raises every 10 minutes in a random order. Following 20 min of supine rest, baseline vascular measures were collected. Measures of and CBP and AIx were recorded at 10, 90, and 170 min of sitting. Near-infrared spectroscopy (NIRS) was used to assess total hemoglobin (tHb) concentration in the gastrocnemius muscle (index of blood pooling). Data were analyzed with a linear mixed model and are presented as mean difference (SE). Results: PWV increased significantly [0.30 m/s (0.46), p < 0.001] while AIx significantly decreased [-9.2% (11.0), p < 0.001]. tHb tended to increase with sitting with calf raises [0.9 (1.0), p=0.082] and in the control condition [2.1 (1.0), p=0.084]. Conclusions: Sitting increases aortic AS but decreases AIx, an effect which may be mediated by blood pooling in the lower leg. Intermittent calf raises are insufficient to alter AS, as PWV increased by 0.30 m/s acutely. Despite being below the clinical threshold of 1.0 m/s with chronic inactivity, the acute increases in PWV in 3 hours may increase heart burden and become meaningful over time.

## IMPACT OF STRENGTH AND POWER TRAINING ON GOLF PERFORMANCE

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The sport of golf requires a mechanically sound swing that necessitates balance, flexibility, and muscular strength from the participant. Evidence has suggested that the professional golfers on the PGA Tour who drive the ball the furthest have a significant likelihood of lower scores on par-4 and par-5 holes. Recent research indicates that increasing muscular strength and power with a training program that increases the Power Clean and Back Squat, and improves the Countermovement Vertical Jump increases club head speed in collegiate golfers. The purpose of this research was to assess the impact of a 10-week strength and power training program on golf performance. Six college-aged golfers were recruited for the study and provided a guided and supervised resistance training program over 10 weeks. The participants continued to play golf multiple times per week over the 10-week time frame. Participants showed significant increases in strength in the Squat ( $p < 0.01$ ) and Bench Press ( $p < 0.01$ ), carry distance with a 5-iron ( $p < 0.05$ ) and accuracy (decreased distance from midline) ( $p < 0.05$ ). The results of this study showed that a traditional, barbell based strength and power training program performed in conjunction with regular golf training brought about significant improvements in 5-iron carry distance as well as improvements in 5-iron accuracy. Prior research has indicated that a golf-specific training program that included resistance training resulted in significant improvements in driver ball carry among trained, high-level golfers. Other researchers have shown that traditional, non-golf-specific resistance training programs improve performance of both junior level and collegiate level golfers. The current study suggests that improving strength with a traditional strength and power training program while involved in consistent golf play, brings about changes that are equivocal or better than that of a golf-specific training program.

P1

P3

## MUSCLE QUALITY AND SIZE RELATIONSHIP TO VO2 MAX IN COLLEGE DISTANCE RUNNERS

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No research has evaluated the quality and size of muscle on VO2 max. Purpose: To determine if muscle quality or size of the knee extensors influences VO2 max. Methods: A panoramic B mode ultrasound scan of the vastus lateralis (VL) and rectus femoris (RF) was used to determine muscle quality (echo intensity: EI) and size (cross sectional area: CSA). Grayscale imaging software was used to measure number of pixels (CSA) and shades (black-white) of pixels (EI) of twenty-two varsity collegiate runners 12 males and 10 females. A graded VO2 max test was used to determine maximal oxygen uptake. Results: For all runners combined there was no significant relationship between CSA and EI with VO2 max values ( $p = 0.314-0.543$ ). For male runners there was no significant relationship across all variables ( $p = 0.241-0.726$ ). For female runners there was a significant negative relationship between VL CSA and VO2 max ( $p = 0.017$ ), but there was not a significant relationship for any other variables ( $p = 0.269-0.518$ ). Conclusion: These findings indicate that muscle size and quality does not contribute to VO2 max in males, but size may play a role in VO2 max in females as more muscle mass leads to a lower VO2. A follow up independent sample T test showed that males and females have significant different VL CSA ( $p = 0.030$ ) and VO2 max values ( $p = 0.001$ ), but when VO2 was normalized to CSA the difference were not present ( $p = 0.922$ ). Overall, muscle mass not quality may influence VO2 in college distance runners.

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## ATTEMPT PROGRESSIONS OF ELITE MALE RAW POWERLIFTERS

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PURPOSE: In powerlifting, each lifter has 3 attempts on the back squat, bench press, and deadlift. Of those 9 attempts, the heaviest load successfully lifted during each lift is summed together for a powerlifting total (PT). However, little information is available regarding attempt selection strategies to maximize PT. Therefore, the purpose of this study was to determine and compare the magnitude of progression in attempts between each discipline in elite raw male powerlifters. METHODS: Data used in this study was retrieved from the International Powerlifting Federation (IPF) online database for all Classic World Championships (CWC) from 2012-2018. Males from all weight classes who completed 9 out of 9 lifts successfully were included in the analysis ( $n = 65$  out of 712 athletes). A paired-samples t-test was used to compare attempt progressions (percent increase) between lifts with alpha level set at  $p \leq 0.05$ . RESULTS: Overall, 50.77% of the 65 lifters were medalists. Attempt progression was similar between attempt 1 and 2 for all lifts (Squat:  $5.59 \pm 1.80\%$ , Bench Press:  $5.35 \pm 2.18\%$ , Deadlift:  $5.40 \pm 2.28\%$ ), whereas between attempt 2 and 3 there was a pattern of Deadlift ( $3.75 \pm 1.84\%$ ,  $p = 0.08$ ,  $p < 0.0001$ ) > Squat ( $3.31 \pm 1.43\%$ ,  $p = 0.03$ ) > Bench Press ( $2.85 \pm 1.24\%$ ). CONCLUSIONS: These results indicate that successful elite male raw powerlifters use a consistent progression from their first to second attempts across for each discipline, but the relative progressions from second to third attempt varies. The latter may reflect an effort to contend for a podium finish, specifically using the third deadlift attempt. Further, the variation from the second to third attempt could be affected by a lifter's goal to set a personal record or could be affected by the second attempt being easier or harder than expected. Importantly, these findings provide general attempt progression guidelines for coaches working with elite raw powerlifters.

## RELATIONSHIP BETWEEN NFL SCOUTING COMBINE AND GAME PERFORMANCE OVER A 5 YEAR PERIOD

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The National Football League (NFL) performs combine testing for college players prior to the NFL Draft. PURPOSE: The intent of this study was to investigate possible relationships between NFL Combine performances and average snaps played (avgS) over a five year period. METHODS: Data from 293 college football players who participated in the 2013 Combine was included. Each participants' 40-Yard Dash, Bench Press, Vertical Jump, Broad Jump, Shuttle Run, and 3-Cone Drill was normalized to create a positional average Z-score (avgZ). AvgZ was correlated against average snaps played per season for each athlete (avgS) using Spearman rho correlations. RESULTS: A significant, positive, weak relationship existed between avgZ and avgS for Yr1 ( $r = 0.16$ ,  $p < 0.01$ ), Yr2 ( $r = 0.15$ ,  $p < 0.01$ ), Yr3 ( $r = 0.18$ ,  $p < 0.01$ ), and Yr4 ( $r = 0.12$ ,  $p = 0.04$ ). BJ was most often associated with avgS within position groups. Offensive lineman demonstrated a moderate significant relationship for Yr1 ( $r = 0.31$ ,  $p = 0.04$ ), Yr2: ( $r = 0.32$ ,  $p = 0.03$ ), Yr3 ( $r = 0.38$ ,  $p = 0.01$ ) and Yr5 ( $r = 0.32$ ,  $p = 0.04$ ). Significant low to moderate relationships were observed for defensive backs in Yr2 ( $r = 0.32$ ,  $p = 0.02$ ) and Yr3 ( $r = 0.31$ ,  $p = 0.03$ ). Linebackers demonstrated significant low to moderate relationships in Yr2 ( $r = 0.47$ ,  $p = 0.01$ ) and Yr4 ( $r = 0.39$ ,  $p = 0.03$ ). CONCLUSIONS: Data from the NFL Combine showed some correlation to avgS in the first five years of a player's career. However, due to the varying relationships, tests from the NFL Combine may need to be reconsidered.

### AN EXAMINATION OF UPPER BODY POWER AND FAT-FREE MASS IN DIVISION-I CHEERLEADERS

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Upper body power (UBP) is vital to cheerleading performance, particularly at the competitive collegiate level. Additionally, an increased fat-free mass (FFM) may provide the ability for cheerleaders to execute advanced skills during competition. Purpose: The purpose of this study was to examine the association between UBP and FFM in Division-I cheerleaders. Methods: Twelve male and thirty-three female collegiate cheerleaders were assessed for UBP using the medicine ball put test. Participants sat on an exercise bench at a 45-degree angle and tossed a medicine ball from their chest for maximum distance. Females and males used 15-lb and 20-lb medicine balls, respectively. Two trials were completed with the best result recorded for analysis. FFM was assessed via air displacement plethysmography. Results: Results indicated a significant, strong, positive correlation ( $n=45$ ;  $r_s = 0.79$ ,  $p < 0.01$ ) between UBP and FFM. Females exhibited a significant, strong, positive correlation ( $n=33$ ;  $r_s = 0.71$ ,  $p < 0.01$ ) while males demonstrated a non-significant, moderate correlation ( $n=12$ ;  $r_s = 0.45$ ,  $p < 0.45$ ). Conclusions: Results suggest that FFM and UBP are positively correlated, particularly in females. The UBP demands of cheerleading may require an increase in FFM for athletes to be successful.

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### WARM-UP WITH WEIGHTED VEST DOES NOT IMPROVE 5-KM TIME TRIAL PERFORMANCE IN COLLEGIATE CROSS-COUNTRY RUNNERS

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A recent investigation found completing six, 10-s strides while wearing a weight vest equal to 20% body mass improved a running to fatigue time trial on a treadmill. Investigators mechanistically attributed performance enhancement to a combination of increased leg stiffness and enhanced running economy. The purpose of this study was to determine if 5-km run performance on a hilly road course could be improved by weighted vest warm-up (WVWU) using a 6.8 kg weighted compression garment in male, NCAA Division I Cross Country runners ( $n = 10$ ;  $VO_2 \text{ peak} = 61.2 \text{ ml/kg/min}$ ). All participants were previously familiar with the course and also completed a course preview run and strategy session with their coach as they would do in an official meet. Two testing sessions were completed in a counter-balanced crossover design order (WVWU versus control (CON)) on the team's normal day of the week dedicated to speed work, one week apart with nearly identical training routines each week. The average wet-bulb globe temperature for each session was  $22.3^\circ\text{C}$ . CON did not differ ( $p > 0.05$ ) from WVWU in split times for mile 1 ( $339 \pm 13$  vs  $341 \pm 13$  s), mile 2 ( $312 \pm 15$  vs  $312 \pm 16$  s), mile 3 ( $339 \pm 21$  vs  $338 \pm 22$  s), or an  $\sim 0.1$  mile distance kick at the end of the run ( $71 \pm 16$  vs  $69 \pm 14$  s). Overall time was also not improved for WVWU ( $1060 \pm 49$  s) versus CON ( $1062 \pm 55$  s). The WVWU in the current study was only  $\sim 10\%$  of runners' body mass. The reduced stimulus may have not been great enough to elicit the improved tendon stiffness and running economy advantages noted in the previous investigation, but findings from this study do not support performance improvement using WVWU strategy under race simulating conditions.

### VARIATIONS IN ATHLETIC PROFILES BETWEEN DIVISION I ALL-GIRL AND CO-ED COMPETITION CHEERLEADERS

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All cheerleaders must have strength, power, and great proprioception to be successful at their sport, regardless of squad. However, decisions on squad placement may be made by coaches based on a number of variables. PURPOSE: The purpose was to compare anthropometric and performance metrics between All-Girl (AG) and Co-Ed (CE) Division I female cheerleaders. METHODS: Thirty-three (AG:  $n = 24$ ; CE:  $n = 9$ ) cheerleaders were assessed for: height (H), weight (W), body composition (BF%), vertical jump (VJ), upper body power (UP), and dominant (DHG) and non-dominant (NDHG) hand grip strength. The greater of two trials was used for VJ, UP, NDHG, and DHG analysis. Due to unequal group sizes, nonparametric Mann-Whitney U Tests were run comparing the athletic profile between AG and CE. RESULTS: Significant differences were noted in: H (median: AG: 63.5in, CE: 61.0in;  $p < 0.01$ ); W (AG: 135.0lb, CE: 121.0lb;  $p < 0.01$ ); UP (AG: 89.5in, CE: 80.0in;  $p = 0.02$ ); DHG (AG: 25.5kg, CE: 20.0kg;  $p = 0.04$ ); and NDHG (AG: 24.0kg, CE: 18.0kg;  $p = 0.04$ ). No significant differences were present in BF% ( $p = 0.14$ ) or VJ ( $p = 0.42$ ). CONCLUSIONS: Varying positions seen in AG caused a larger variation in strength and height. Training programs should account for the different demands within each squad.

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### RELATIONSHIP BETWEEN BONE MINERAL DENSITY AND GRIP STRENGTH IN COLLEGIATE ATHLETES

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Increases in bone mineral density (BMD) and hand-grip strength (HG) are important indicators of repetitive loading and resistance training. While the assessment of BMD is not always feasible, HG may provide an indicator of overall bone health. PURPOSE: The purpose was to determine the relationship between HG and BMD in collegiate athletes. METHODS: For this study, 117 athletes aged 18-19 years old were assessed for BMD via dual energy x-ray absorptiometry, while HG was assessed via a dynamometer. Pearson's product correlation was used to determine the significance of the relationship between the two measurements. RESULTS: Pearson's product correlation demonstrated a significant association between BMD and HG for both the dominant ( $r=0.75$ ,  $p<0.01$ ) and non-dominant hand ( $r=0.72$ ,  $p<0.01$ ) in the entire group. For males, BMD displayed a significantly moderate correlation with both dominant ( $r = 0.49$ ,  $p<0.01$ ) and non-dominant ( $r=0.46$ ;  $p<0.01$ ) HG. For females, BMD exhibited a significant moderate correlation between HG in the dominant ( $r=0.55$ ;  $p<0.01$ ) and non-dominant ( $r=0.49$ ;  $p<0.01$ ) hand. CONCLUSIONS: Results suggests that repetitive loading, along with increased resistance training, particularly in collegiate athletes may reflect this association between BMD and HG strength.

### **BONE MINERAL DENSITY COMPARISONS BETWEEN CONTACT AND NON-CONTACT MALE AND FEMALE COLLEGIATE ATHLETES**

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**P9** Bone mineral density (BMD) has been shown to be greater in athletes than non-athletes. However, less research has been done comparing the nature of the sport to BMD in male and female collegiate athletes. **PURPOSE:** To determine the effects of BMD between full contact (FC), limited contact (LC) and non-contact (NC) sports in male and female athletes. **METHODS:** Data from 45 male (FC: 18, LC: 21, NC: 6) and 33 female (FC: 0, LC: 16, NC: 17) Division I athletes was collected via whole body dual-energy x-ray absorptiometry (DXA). One-way ANOVAs (male and female) were run to compare BMD, bone mineral content (BMC) and body fat percentage (BF%) between sports. **RESULTS:** An omnibus significant difference was noted between BMD ( $F(2,44) = 9.79, p < 0.01$ ) and BMC ( $F(2,44) = 12.15, p < 0.01$ ) in male athletes. Post-hoc LSD analysis revealed that significance in all variables was between FC (BMD:  $1.46 \pm 0.09$  g/cm<sup>3</sup>) compared to LC ( $1.36 \pm 0.89$  g/cm<sup>3</sup>) and NC ( $1.31 \pm 0.11$  g/cm<sup>2</sup>). BF% was not significantly different ( $p = 0.09$ ). No significant differences were noted with female athletes in any of the variables: BMD ( $p = 0.29$ ); BMC ( $p = 0.51$ ); BF% ( $p = 0.29$ ). **CONCLUSION:** The nature of the sport may have an impact on an athlete's BMD/C, but only if the athlete competes in a FC sport, like football.

### **USING PET THERAPY IN SPORT PERFORMANCE: A PILOT STUDY**

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**P10** Performance outcomes can be effected by an athlete's psychological status, mood, and emotional state. A novel method of potentially altering these factors and enhancing performance is via pet therapy during the training session. **Purpose:** The purpose of this study was to examine the effects of canine presence on perception and performance during a typical strength training session. **Methods:** Subjects were seven female NCAA Division-III softball athletes. Data were collected during the softball team's normal strength and conditioning sessions. There were 4 total body lifting sessions over 2 consecutive weeks (1 push and 1 pull session per week). The experimental protocol consisted of the randomized presence of three canines during one push and one pull session. Metrics analyzed for this study were volume load (VL), session RPE (SRPE), and countermovement jump (CMJ) for each session. **Results:** VL for the total body push session was statistically greater ( $p < 0.001$ ) during the session with canines present. There were no other statistically significant findings. **Conclusions:** VL was higher on the push session when canines were present. It is difficult to theorize why the canines may have had an impact on the push session, but not on pull session. The sample size was small and the treatments were few. However, this may be evidence to pursue further research into the impact of pet therapy on exercise training.

### **BODY COMPOSITION IN NCAA DIVISION-1 FEMALE BASKETBALL PLAYERS DURING PRESEASON AND OFF-SEASON**

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**P11** Body size and composition are among the many physiological factors that influence sport performance and health. However, limited research is available examining longitudinal changes of body composition among NCAA Division-1 female athletes. **Purpose:** The purpose of this study was to assess longitudinal body composition changes over one season in NCAA Division-1 female basketball players. **Methods:** Nine ( $n = 9$ ) female NCAA Division-1 basketball players participated in this study. Data were collected in October and June in consecutive years. At each visit, body weight (BW) was measured with a calibrated digital scale and body fat percentage (BF%), fat mass (FM), and fat-free mass (FFM) were measured via air displacement plethysmography (BODPOD). **Results:** There were no statistical differences in BW (78.6 13.6 kg to 79.4 13.2 kg;  $p = 0.366$ , Cohen's  $d = 0.06$ ), BF% (20.6 7.5% to 21.7 7.8%;  $p = 0.104$ , Cohen's  $d = 0.15$ ), FM (17.0 9.1 kg to 18.1 9.3 kg;  $p = 0.156$ , Cohen's  $d = 0.12$ ), or FFM (61.6 4.9 kg to 61.3 4.7 kg;  $p = 0.498$  Cohen's  $d = 0.06$ ) during this period. **Conclusions:** No statistically significant mean changes were seen in BW, BF%, FM, or FFM from preseason to off-season. However, slight individual changes in body composition may be expected over the course of a season in this population. During the preseason to offseason, on average, NCAA Division-1 female basketball players may expect to maintain BW, BF%, FM, and FFM. Monitoring individual longitudinal body composition assessment is of value.

### **BODY COMPOSITION CHANGE OF FEMALE NCAA SOCCER PLAYERS OVER ONE YEAR**

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**P12** Body composition is a principal component of fitness that has been shown to influence athletic performance and health. However, there is limited research examining longitudinal changes in body composition of female NCAA Division-1 athletes. **Purpose:** The purpose of this study was to assess longitudinal body composition alterations over one year in female NCAA Division-1 soccer players. **Methods:** Fourteen ( $n=14$ ) female NCAA Division-1 soccer players participated in this study. Data were collected in August and September in consecutive years. At each visit, body weight (BW) was measured with a calibrated digital scale. Body fat percentage (BF%), fat mass (FM), and fat-free mass (FFM) were measured with air displacement plethysmography (BODPOD). **Results:** In one year, BW was unchanged from  $62.2 \pm 6.6$  kg to  $63.3 \pm 6.3$  kg ( $p = 0.145$ , Cohen's  $d = 0.16$ ), BF% increased from  $20.3 \pm 5.2\%$  to  $23.8 \pm 5.6\%$  ( $p = 0.014$ , Cohen's  $d = 0.65$ ), FM increased from  $12.8 \pm 4.1$  kg to  $15.3 \pm 4.6$  kg ( $p = 0.010$ , Cohen's  $d = 0.57$ ), FFM was unchanged from  $49.4 \pm 4.8$  kg to  $47.9 \pm 3.9$  kg ( $p = 0.125$ , Cohen's  $d = 0.33$ ). **Conclusions:** No statistically significant changes were seen in BW or FFM over one year in NCAA Division-1 female soccer players. However, a statistically significant increase was seen in BF% and FM over the year. Monitoring longitudinal changes in body composition of collegiate athletes should be routine. The BF% and FM changes seen in this study elucidates the value of regular body composition assessment in collegiate athletes.

### RELATIONSHIP BETWEEN REPORTED TRAINING DISTRESS, ILLNESS RATES, AND COACHES FEEDBACK IN COLLEGIATE SWIMMERS

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**P13** PURPOSE: To evaluate the relationships of athlete-reported illness, training distress (TDS), and coaches' ratings of distress and performance over the course of the competitive season. METHODS: Thirty-five NCAA Division II swimmers were recruited to the study (male n=19, female n=16; Age 19.1±1.6 y). Athletes reported illness and TDS every Monday for 19 weeks out of a 25-week season. Additionally, coaches were asked to rate visual signs of distress and performance for individual athletes each week. RESULTS: Thirty swimmers completed the protocol (body fat, males = 12.6±5.1%, females 22.6±4.5%; VO<sub>2</sub>max males = 55.8±5.10, females = 48.1±6.7 ml/kg/min). TDS scores increased above early season levels and varied widely across athletes over the study period (9.5±5.9 in weeks 3-4 to a peak of 23.8±14.5 in week 7. The percent of athletes reporting illness varied from 37% to 82%. Analysis of TDS using Principle Component Analysis (PCA) revealed that 44.9% of variance (PC1) could largely be attributed to illness prevalence. The centered PC1 TDS scores for the athletes reporting illness (1.0±3.1) and no illness (-2.0±2.5) (median±MAD) were significantly different across the season (P<0.001). TDS scores using PC1 did not differ between male and female athletes or competitive category (p>0.05). Coaches rating of distress in athletes was not related to PC1 (p=0.45), and coaches performance rating was only slightly related to PC1 (p=0.04). CONCLUSIONS: TDS and illness were significantly related in this group of swimmers throughout the competitive season. Coaches reporting of distress and performance did not correlate with reported data from swimmers. Further research should investigate strategies to reduce training stress and illness prevalence among elite athletes, and improve coach's perceptions of training-related distress.

### HAND GRIP STRENGTH AND ANTHROPOMETRIC VARIABLES IN DIVISION III SOFTBALL AND BASEBALL PLAYERS

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**P14** PURPOSE: Softball (SB) and baseball (BB) are unique in they generally designate one hand for catching and one for throwing, potentially allowing for strength inequalities. This study examined the strength of each hand in SB and BB players. It also investigated the impact of several anthropometric and sport specific factors in relation to hand grip strength. METHODS: 44 NCAA Division III athletes (SB: 22, BB: 22) volunteered. Measures of body height and weight, forearm circumference, and hand length were recorded. All players self-reported their dominant (D) and non-dominant (ND) hand as their throwing and catching hand respectfully. Sport specific parameters including position(s) played were also recorded. Maximal hand grip strength was measured with a hand grip dynamometer. Three trials were conducted per hand. RESULTS: Significant differences (p's<.05) were found in hand grip strength between D and ND hands for both sports (SB: D 37.25 + 5.15 kg, ND 33.74 + 5.33 kg; BB: D 60.09 + 11.72 kg, ND 57.74 + 11.31 kg). There was also a significant moderate positive correlation between strength and forearm circumference in BB (D: r = .54, p = .015, ND: r = .50, p = .017) but not SB (p>.05) players. Means of all baseball player anthropometric and strength measures were greater than the softball players (p's<.05). CONCLUSION: The current study revealed similar findings in NCAA Division III SB and BB players to previous research involving BB and SB players at other competition levels as well as general populations. The dominant hand was approximately 10% stronger than the non-dominant hand.

### SEASONAL BODY COMPOSITION CHANGES IN DIVISION I CROSS COUNTRY RUNNERS

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**P15** PURPOSE: To evaluate changes in body composition across a first, second, third, or fourth year of competition in Division I cross country runners. METHODS: Pre and post season measures of body composition were evaluated in first season (N=25), second season (N=24), third season (N=13), and fourth season (N=10) Division I varsity cross country runners (Total: N=46; male=25; female=21) between the years of 2014 to 2017. Total and regional body composition (fat mass [FM], percent body fat [%BF], lean mass [LM], bone mineral content [BMC], armLM, legLM) was assessed using dual-energy x-ray absorptiometry. RESULTS: First year runners significantly increased weight (change [Δ] ± SD; 1.6 ± 2.2 kg; p=0.001), LM (1.6 ± 1.3 kg; p<0.001), BMC (0.03 ± 0.05 kg; p=0.008), and armLM (0.1 ± 0.3 kg; p=0.047). Second year runners significantly increased weight (1.1 ± 1.8 kg; p=0.005), LM (1.2 ± 1.2 kg; p<0.001), armLM (0.1 ± 0.3 kg; p=0.019), and had a small but significant decrease in BMC (-0.02 ± 0.03 kg; p=0.002). There were no significant changes in body composition in third or fourth year runners. CONCLUSIONS: First and second season Division I cross country runners experience significant changes in body composition, primarily increases in LM, while third and fourth year runners experience minimal changes. Changes are likely influenced by the addition of strength and conditioning and nutrition staff that are not available in high school; the first two seasons may be key times for developing body composition characteristics in runners that can maximize performance and minimize injury throughout their career.

### TRACKING CHANGES IN PHYSICAL ACTIVITY DURING THE TRANSITION OUT OF COLLEGE SPORTS: A PILOT STUDY

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**P16** Substantial drops in physical activity (PA) following the end of a competitive sports career may lead to unique health concerns for former student-athletes (SAs). PURPOSE: To prospectively measure changes in PA that occur during the transition out of college sports. METHODS: Division I SAs (N = 8) self-reported PA during preseason using the International Physical Activity Questionnaire. SAs also self-reported their PA and wore an ActiGraph wGT3X-BT accelerometer for a 7-day period in-season and approximately 5 months after their final season. Hip- and wrist-based calculations were used to determine average daily minutes of moderate-to-vigorous PA (MVPA). T-tests with Hedge's g effect size were conducted. RESULTS: Self-reported MVPA minutes/week at post-season (M = 356) were lower than preseason (M = 1440; g = 2.4) and in-season (M = 501, g = .6). There were no significant changes in accelerometer-derived average MVPA minutes/day from in-season to post-season using wrist (M1 = 165, M2 = 166, g = 0) or hip calculations (M1 = 208, M2 = 215, g = .1). CONCLUSIONS: Self-reported MVPA decreased substantially across the transitional period. Accelerometer-derived MVPA did not change; some participants were unable to wear the monitor during in-season games due to competition regulations, likely resulting in an underestimation of observed changes. Given the pilot nature of this study, findings should be replicated using larger samples over a longer period to further examine the potential impact of this unique transition on PA and health.

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### COMPARISON OF PRECOMPETITION DAILY TRAINING LOADS IN COLLEGIATE SOCCER PLAYERS

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**P17** Reduction or variation in daily training load (TL) prior to competition is important for competition success. **PURPOSE:** To compare training load by measuring RPE Load and time spent in percent maximum heart rate (%HRHigh, %HRMid, %HRLow) in collegiate male soccer players. **METHODS:** Data from 21 players was used for analysis. Data was separated by days out from next competition (1-5 days [D]). A one-way ANOVA was used ( $p \leq 0.05$ ) to determine significant differences in the analyzed variables between days out. Post-hoc Tukey tests were run on any significant omnibus result. **RESULTS:** A significant omnibus difference ( $p < 0.01$ ) was noted between days for the following variables: RPE Load, %HRHigh, %HRMid, and %HRLow. Post-hoc analyses indicated players 1D out spent significantly less time in %HRHigh ( $11.2 \pm 11.4\%$ ) and %HRMid ( $25.7 \pm 11.9\%$ ) zones, and more time in %HRLow ( $63.3 \pm 17.0\%$ ) compared to 2D (H:  $15.7 \pm 13.3\%$ ; M:  $28.9 \pm 11.4\%$ ; L:  $55.5 \pm 19.3\%$ ), 4D (H:  $17.0 \pm 13.6\%$ ; M:  $31.6 \pm 12.9\%$ ; L:  $51.4 \pm 18.2\%$ ), and 5D (H:  $17.5 \pm 13.3\%$ ; M:  $31.0 \pm 10.1\%$ ; L:  $51.5 \pm 18.4\%$ ). RPE Load was significantly greater at 5D ( $1436.8 \pm 314.8$ au) than all other days (D1:  $1131.7 \pm 315.7$ au; D2:  $1201.3 \pm 390.1$ au; D3:  $1054.1 \pm 342.0$ au; D4:  $1223.9 \pm 634.4$ au). **CONCLUSIONS:** The data revealed the lowest TL occurred on D3 and D1. This variation and reduction in TL may reduce training monotony and strain and increase preparedness to compete.

### COMPARISON OF POSITIONAL DIFFERENCES IN 1RM SQUAT PERFORMANCE USING DIFFERING NORMALIZATION METHODS IN FOOTBALL ATHLETES

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**P18** The one repetition maximum (1RM) back squat assessment is commonly used as a tool to measure lower body strength. When used in team sport settings, comparison of absolute measures within the team becomes difficult because of the differences in athletes' body mass (BM). The use of allometric scaling has been suggested as a potential method in the making such comparisons. **Purpose:** Determine which method of normalizing BM allowed for the comparison of athletes 1RM squat based on positional groups. **Methods:** Fifty-four subjects were broken into one of three position groups (19 linemen, 13 mid-skill, and 22 skill). 1RM squat and BM was assessed on the same day. Ratio scaling was determined as absolute load lifted divided by BM. Two allometric scaling techniques were used. First, using the proposed BM raised to the exponent of 0.67. Secondly, the natural log of BM and 1RM squat was used to find the exponent most suitable for the sample by simple linear regression (0.371). Separate one-way analysis of variance for each method was used to determine if differences existed between groups. **Results:** Homogeneity of variance was not violated for any comparison. Significant differences existed between absolute BM of the three groups ( $p < 0.001$ ). Significant differences between groups were present for absolute, ratio and allometric<sup>0.67</sup> methods ( $p < 0.05$ ). No differences existed between groups when using the allometric<sup>0.371</sup> ( $p > 0.05$ ). **Conclusions:** Results suggest that when wanting to make comparison of 1RM back squat performance in a team sport with a wide range of BM values, the use of allometric scaling to the sample itself allows for comparisons.

### THE PHYSICAL AND ATHLETIC PERFORMANCE CHARACTERISTICS OF DIVISION II WOMEN SOCCER PLAYERS

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**P19** **INTRODUCTION:** NCAA Division II women's soccer is highly competitive yet there is limited information on physical and performance characteristics of female soccer players in Division II. **PURPOSE:** To determine physical characteristics of Division II female soccer athletes and to analyze relationships between physical characteristics and athletic testing outcomes. **METHODS:** Subjects (Age:  $19.09 \pm 1.15$  yrs; Height:  $165.38 \pm 9.05$  cm; Weight:  $60.02 \pm 5.2$ kg; BMI:  $21.64 \pm 1.39$ ) consisted of Division II women's soccer athletes ( $n=22$ ). Body composition (BF%) utilizing air plethysmography [BODPOD, Cosmed], Functional Movement Screening (FMS), vertical jump (VJ) and power factor (PF) analysis [Just Jump Mat, Probotics] were measured during pre-season. Descriptive statistics and Pearson product moment correlations (SPSS version 25.0) were used to analyze data. **RESULTS:** Team BF% was  $19.99 \pm 4.39\%$  with freshman ( $n=10$ ) BF% recorded at  $18.73 \pm 5.07\%$  and returners ( $n=12$ ) at  $21.0 \pm 3.62\%$ . FMS was lower in freshman ( $16.8 \pm 1.55$ ) than returners ( $17.42 \pm 1.16$ ) with 95% of the team achieving a 15 or higher composite score. Team VJ was  $19.28 \pm 2.61$  in with freshman VJ of  $18.56 \pm 2.88$  measuring lower than returners VJ of  $19.88 \pm 2.30$  in. Reactive PF was  $1.96 \pm 0.27$ , with freshman PF at  $1.94 \pm .32$  and returners PF at  $1.98 \pm .23$  respectively. There was no significant relationship between BF% and VJ ( $r = -.050$ ) or FMS and VJ ( $r = -.246$ ). **CONCLUSIONS:** Freshman had lower BF% than returners. Movement quality scores indicate athletes achieved composite scores above injury risk (Kiesel et al., 2007). Vertical jump ability was higher in returners yet both freshmen and returners had lower than recommended reactive power. BF% or movement quality did not correlate with VJ performance. Future research should continue to explore physical profile changes over time while expanding sport performance testing metrics to obtain a more comprehensive snapshot of the Division II female soccer athlete.

### CHANGES IN SNATCH BARBELL KINETICS WITH INCREASING LOAD IN MASTERS WEIGHTLIFTERS

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**P20** Limited research exists examining snatch technique and performance in Masters level weightlifters, particularly the influence of increasing load on technique. **Purpose:** To determine the influence of sex and load on peak force and power. **Methods:** 20 women ( $46.0 \pm 8.3$  yrs) and 19 men ( $49.6 \pm 11.6$  yrs) qualifying for the 2017 National Masters Weightlifting Championship completed 2 snatches using 65%, 75% and 85% of one repetition maximum. Three-dimensional barbell kinematics were recorded and used to compute first (FP) and second (SP) pull peak force (PF) and power (PP), normalized to body weight and mass, respectively. **Results:** Men demonstrated significantly greater FP ( $P=.011$ ,  $d=.89$ ) and SP ( $P=.001$ ,  $d=1.2$ ) PF than women, however no sex difference for FP PP ( $P=.073$ ). Load prompted significant ( $P \leq 0.001$ ) linear increases in FP PF ( $\eta^2 p=.88$ ), SP PF ( $\eta^2 p=.80$ ) and FP PP ( $\eta^2 p=.37$ ). Load had a different effect on SP PP between the sexes ( $P=.032$ ). Both men ( $\eta^2 p=.73$ ) and women ( $\eta^2 p=.68$ ) demonstrated significant ( $P < 0.001$ ) linear increases, however the increase was significantly greater for men ( $P=.019$ ,  $d=.78$ ). **Conclusions:** While similar PF and PP increases occurred between the three loads, the men demonstrated greater SP PP increases. The significant difference in SP PF and SP PP in men and SP PF but not SP PP in women may be a function weaker upper to lower body strength ratio in women.

### COMPARISON OF PERCEIVED EXERTION AND RECOVERY STATUS SCORES IN COLLEGIATE MALE SOCCER PLAYERS AND COACHES

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**P21** Perceived Recovery Status (PRS) and Rating of Perceived Exertion (RPE) are two methods to quantify training load and recovery to improve performance. There are limited studies comparing self-reports of coaches with athletes. **PURPOSE:** To assess subjective measures (PRS and RPE scores) received from athletes and coaches during the course of a preseason. **METHODS:** PRS scores prior to, and RPE scores after, each practice were collected on 26 Division I male soccer players (P) and 3 coaches (C). C were instructed to provide answers as to how the P felt. Nonparametric Mann-Whitney U Tests were run comparing P to C data for each of 18 preseason practice (Pr). **RESULTS:** P and C RPE were not significantly different ( $p > 0.05$ ) for 17 of the 18 practices. The only statistically significant difference occurred in Pr8 (median P: 8.0, C: 7.0;  $p = 0.04$ ). PRS comparisons were slightly more variably different (4 of 18) through preseason training: Pr2 (P: 7.5, C: 9.0;  $p = 0.02$ ); Pr5 (P: 7.0, C: 9.5;  $p = 0.02$ ); Pr14 (P: 7.0, C: 5.0;  $p = 0.01$ ) and Pr15 (P: 4.5, C: 1.5;  $p = 0.04$ ). **CONCLUSION:** Results indicate that perception of intensity of practice and recovery were fairly similar throughout preseason. As preseason progressed, a shift in PRS from C overestimating P recovery, to underestimating recovery, especially following scrimmages occurred.

### COMPARISONS IN PERCEIVED EXERTION AND RECOVERY STATUS IN FEMALE COLLEGIATE SOCCER PLAYERS AND COACHES

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**P22** Subjective measurement scales, such as Ratings of Perceived Exertion (RPE) and Perceived Recovery Status (PRS), provide insight on overall athletic performance by indicating a relationship between exercise intensity and exercise recovery. **PURPOSE:** The purpose was to compare the RPE and PRS self-reported scores of collegiate female soccer players and coaches. **METHODS:** 24 Division I soccer players (P), as well as two coaches (C), self-reported RPE scores following activity, as well as PRS scores prior to activity on the subsequent day. Data was collected daily during 20 preseason practice sessions (Pr) and analyzed using nonparametric Mann-Whitney U Tests to compare P and C scores. **RESULTS:** Significant differences ( $p < 0.05$ ) in RPE were seen in five practice sessions: Pr2 ( $p = 0.01$ ); Pr4 ( $p = 0.01$ ); Pr5 ( $p = 0.02$ ); Pr6 ( $p = 0.01$ ); and Pr12 ( $p = 0.01$ ). PRS scores were significantly different in seven practice sessions: Pr3 ( $p = 0.03$ ); Pr5 ( $p = 0.02$ ); Pr7 ( $p = 0.04$ ); Pr8 ( $p = 0.02$ ); Pr14 ( $p = 0.04$ ); Pr15 ( $p = 0.01$ ); and Pr16 ( $p = 0.02$ ). **CONCLUSION:** The results of the analysis suggest that early on, C may underestimate P intensity and recovery. As the preseason progressed, P and C self-reported RPE and PRS scores became comparable. However, discrepancies were still present following practices after scrimmages or high training loads.

### CHANGES IN HEART RATE RECOVERY AND VARIABILITY IN RESPONSE TO AN ACUTE HIGH INTENSITY LOAD

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**P23** Heart Rate Reserve (HRR) and Heart Rate Variability (HRV) are indirect markers of autonomic function and are commonly used as indices of training status. However, the variability of these measurements and measures of sport performance during an acute high intensity load are not well documented. **PURPOSE:** To determine the effects of an acute high intensity load on HRR, HRV, and measures of sport performance in collegiate female soccer players. **METHODS:** Over the course of 15 days, ten ( $n=10$ ) female collegiate soccer players age ( $20.4 \pm 0.7$ yr), height ( $165.8 \pm 6.23$ cm), weight ( $63.9 \pm 3.3$ kg), BMI ( $23.3 \pm 1.68$ kg/m<sup>2</sup>) played 6 NCAA division 1 regular season games. Using Zephyr OmniSense 5.0 accelerometers (Medtronic, Annapolis, MD), heart rate (HR), HRR, HRV, Step Impulse, Speed, and Rate Force Development were recorded. The data were analyzed using SPSS vs. 25 (Chicago IL). A repeated measures ANOVA was used to determine differences in all variables with respect to games played. Data are presented as the mean  $\pm$  standard deviation and the p value was set a priori at  $p < 0.05$ . **RESULTS:** In response to the acute high intensity load, HR was significantly reduced ( $p = 0.000$ ) over the course of 6 games. Additionally, HRV significantly increased ( $p = 0.008$ ), with the greatest improvement in game 6 ( $40.37 \pm 10.55$ bpm). However, no significant differences were observed in HRR ( $p = 0.219$ ). Performance markers were largely unchanged with the acute high intensity load, although, step impulse significantly improved ( $p = 0.005$ ), with peak performance in game 4 ( $2.64 \pm 0.12$ N.s). **CONCLUSION:** These results suggest that an acute high intensity load will positively affect HRV and Step Impulse performance, demonstrating an improvement in autonomic function and training status in collegiate female soccer players.

### COMPARISON OF COACH AND PLAYER RATE OF PERCEIVED EXERTION LOAD

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**P24** Session rate of perceived exertion (sRPE) subjectively measures the load each player experiences during a given training session, but players and coaches frequently disagree about the physiological demands of practice and training sessions. This is particularly true for practice sessions in skill-specific sports that are not easily quantified through typical volume measures like distance run or repetitions completed. **PURPOSE:** To compare sRPE load of female Division I lacrosse players to coaches predicted sRPE. **METHODS:** Three coaches and 28 players submitted an RPE based on the Borg scale, 1-10, indicating the intensity of each daily training session for an entire lacrosse season. sRPE in arbitrary units (AU) was calculated by multiplying the intensity number by the duration of the training session. Each daily sRPE for the coaches was averaged to one score, and each daily sRPE for the players was averaged to one score. These daily values were compared using an independent samples t-test and Pearson correlation. **RESULTS:** There was no statistically significant difference between the coach ( $512.4 \pm 368.3$  AU) and player ( $474.7 \pm 165.4$  AU) sRPE,  $p = 0.617$ . The daily sRPE values were moderately correlated,  $r = 0.481$ ,  $p = 0.008$ . **CONCLUSION:** These data show that coaches tended to over-predict the load on players. The results will be useful for the lacrosse coaches to structure their practices in better alignment with player load. These data, in combination with other objective measures related to mechanical loading and subjective assessments related to recovery and sleep, would further assist coaches and support staff to ensure optimal performance of the athletes.

### A COMPARISON OF MAXIMUM SPRINT SPEED RESULTS BETWEEN GPS RECORDING AND MANUAL CALCULATIONS

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Measuring maximum sprint speed (MSS) is an important metric in athlete monitoring, but the methods employed to assess this metric are widely variable. Errors with global positioning system (GPS) technology have been shown to be 0.28 m·s<sup>-1</sup> for instantaneous velocity and 0.67 m·s<sup>-2</sup> for instantaneous acceleration, so using GPS to obtain MSS may not be the best method. **PURPOSE:** To compare MSS values obtained from GPS technology to those obtained from an electronic gate timing system. **METHODS:** The MSS of 24 female lacrosse players was determined using a 20-m fly-in followed by an 80-m maximal sprint. Timing gates were placed at the start line, 30 m, 60 m, and 80 m. Sprint speed was calculated from each timing segment, and the fastest was used for the calculated MSS. The VX Sport system, measuring at 10 Hz, was used to obtain GPS-based MSS. A paired sample t-test and Pearson correlation was run to compare the two results. **RESULTS:** The calculated MSS was 25.57 ± 1.46 km·hr<sup>-1</sup>, while the GPS MSS was found to be 25.48 ± 3.38 km·hr<sup>-1</sup>,  $p = 0.723$ . There was a strong correlation found between the values,  $r = 0.746$ ,  $p < 0.001$ . **CONCLUSION:** These results suggest that the two measuring systems are very similar in their MSS results. While these results do not refute previous literature, they do indicate the potential use of GPS technology for MSS testing. GPS technology also has the potential to require fewer test administrators, saving coaches and training staff valuable time when assessing athlete fitness level. Further analyses should be conducted using electronic timing gates set at every 10 m to obtain MSS during shorter segments and compare to GPS technology. It would also be ideal to evaluate the raw GPS data to compare when in the sprint MSS was obtained (e.g. 10-20 m, 20-30 m, etc.) compared to calculated MSS.

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### PREDICTORS OF CLEAN AND JERK PERFORMANCE FROM SUBMAXIMAL JERK CHARACTERISTICS

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The ability to jerk the barbell overhead is often the limiting factor in an athlete's maximal clean and jerk (C&J). **PURPOSE:** To determine if maximal C&J performance could be predicted from several submaximal jerk characteristics. **METHODS:** 34 National Masters Olympic Weightlifting Championship competitors (19 women, 15 men, 35-65yrs) completed two C&J lifts using 85% of their maximum. Four jerk characteristics that have been suggested to relate to maximal C&J performance were computed: peak vertical barbell force (PVBF) normalized to body weight, peak vertical barbell height (PVBH), vertical (VBTR) and horizontal (HBTR) barbell travel range, and entered into a multiple regression model predicting C&J meet performance. **RESULTS:** The regression model significantly predicted meet performance ( $P=0.019$ ), however the model only explained 23.8% of the variance. PVBF was a significant predictor ( $\beta=.51$ ,  $P=.006$ ). PVBH ( $\beta=-.16$ ,  $P=.34$ ), VBTR ( $\beta=.14$ ,  $P=.42$ ) and HBTR ( $\beta=-.11$ ,  $P=.59$ ) were not significant predictors. The final model with only PVBF included explained 25.7% of the variance ( $P=0.01$ ). **CONCLUSIONS:** Jerk characteristics previously suggested critical to C&J execution did not substantially relate to meet performance. It is possible that jerk characteristics computed during submaximal lifts do not relate to maximal effort. Future research needs to consider this notion as well as further explore jerk characteristics critical for successful C&J performance.

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### LOWER-EXTREMITY TORQUE CAPACITY AND PHYSICAL FUNCTION IN MOBILITY-LIMITED OLDER ADULTS

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**PURPOSE:** Skeletal muscle weakness and an increase in fatigability independently contribute to age-related functional decline. The objective of this study was to examine the combined contribution of these deficiencies (i.e., torque capacity) to physical function, and then to assess the functional implications of progressive resistance training (PRT) mediated-torque capacity improvements in mobility-limited older adults. **METHODS:** Seventy mobility-limited (Short Physical Performance Battery (SPPB)  $\leq 9$ ) older adults (~79 yrs) were recruited and randomized to either PRT or home-based flexibility 3 days/week for 12 weeks. Torque capacity was defined as the sum of peak torques from an isokinetic knee extension fatigue test. Relationships between torque capacity and performance-based and patient-reported functional measures were examined using partial correlations adjusted for age, sex, and body mass index. **RESULTS:** Skeletal muscle torque capacity explained ( $P<0.05$ ) 10 and 28% of the variance in six-minute walk distance and stair climb time, respectively. PRT-mediated torque capacity improvements were paralleled by increases ( $P<0.05$ ) in self-reported activity participation (+20%) and advanced lower extremity function (+7%), and associated ( $P<0.05$ ) with a reduction in activity limitations ( $r=0.44$ ) and an improved SPPB score ( $r=0.32$ ). **CONCLUSIONS:** Skeletal muscle torque capacity, a composite of strength and fatigue, may be a proximal determinant of physical function in mobility-limited older individuals. To more closely replicate the musculoskeletal demands of real-life tasks, future studies are encouraged to consider the combined interaction of distinct skeletal muscle faculties to overall functional ability in older adults.

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### PARENTAL AND MENTOR INVOLVEMENT IN PHYSICAL ACTIVITY IN ADOLESCENTS WITH AUTISM SPECTRUM DISORDER

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**Purpose:** Adolescents with Autism Spectrum Disorder (ASD) typically fail to meet the recommendations for moderate-to-vigorous physical activity (MVPA) but the cause behind the lack of physical activity is not fully understood. Parental involvement has been shown to be a key facilitator in typically developing (TD) adolescents but the impact of parents and mentors on physical activity has not been examined in this population. The purpose of this study is to examine the associations among parent involvement, presence of an adult mentor, and participation in MVPA in youth with Autism Spectrum Disorder. **Methods:** Data were from the 2016 National Survey of Children's Health, a national survey that examined individual, social, and environmental health factors. The current sample included 957 adolescents (12.08 ; 82% male) diagnosed with Autism Spectrum Disorder (ASD) Participants reported the number of days they engaged in 60+ minutes of MVPA, which then was categorized into a dichotomous variable indicating whether the participants met/did not meet the recommended levels of MVPA (6+ days of the week). Children also reported whether they participated in organized sports (yes/no), the frequency of parent involvement, and presence of an adult mentor (yes/no). Physical activity was reported by the parents of participants. **Results:** Increased physical activity and participation in organized sports were observed in adolescents whose parents reported frequently attending their child's activities ( $p<0.0001$ ). There was also increased participation in sports teams with frequent parental involvement ( $p.0001$ ). There was no relationship between having an adult mentor and meeting the recommended levels of MVPA ( $p=0.12$ ), however, there was an observed relationship between mentor involvement and participation in organized sports ( $p=0.02$ ). **Conclusion:** Parental and mentor involvement lead to an increased amount of organized sports participation, but only parental involvement was related to an increase in adolescents meeting physical activity guidelines. Parental involvement is key in promoting physical activity in this population, however, further research regarding the role of adult mentors on physical activity in youth with ASD is warranted.

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### CONTRACTILE PARAMETERS OF THE KNEE EXTENSORS IN YOUNG, MIDDLE-AGED, AND OLDER MALES

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Peak power (PP) is decreased in older adults; however, less is clear regarding the determinants of PP, contractile torque and velocity. Further, it is unknown if these measures are affected differently in middle and old age. Purpose: To compare PP and its determinants for the knee extensors in young, middle-aged, and older males. Methods: Contractile properties of the knee extensors were assessed in healthy young (YM: n = 8, age = 20.5 ± 1.6 yrs), middle-aged (MM: n = 6, age = 46.0 ± 2.9 yrs) and older (OM: n = 6, age = 69.0 ± 3.10 yrs) males using a dynamometer. PP was obtained from 3 maximal voluntary isotonic knee extensions performed at 40% of isometric peak torque. Velocity (VEL) and torque (TQ) at the moment in time PP occurred were recorded. One-way analyses of variance and Games-Howell post hoc tests were used to compare groups. Results: PP was lower in OM compared to YM (50%; p = 0.021), but was similar in MM compared to YM and OM (p > 0.05). VEL was decreased in OM compared to YM (36%; p = 0.007) and MM (24%; p = 0.044); however, no differences were noted between YM and MM. TQ was similar between groups (p = 0.147). Conclusions: Our preliminary data indicate that VEL is decreased with age, while TQ is maintained, thus age-related decrements in PP may be primarily mediated by impaired velocity capacity.

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### AGE-RELATED COMPARISONS OF DYNAMIC POSTURAL STABILITY AND MAXIMAL RAPID TORQUE PARAMETERS

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Age-related comparisons of neuromuscular function involving middle-aged adults are scarce. Further, it is unclear if changes in rate of torque development (RTD) are related to postural stability. Purpose: To examine age-related differences in maximal and rapid torque measures, and examine correlates of postural stability. Methods: Young (YM: n = 8; age = 20.5 ± 1.6 yrs), middle-aged (MM: n = 6; age = 46.0 ± 2.9 yrs), and older (OM: n = 7; age = 69.7 ± 3.4 yrs) males performed a dynamic postural stability test and maximal voluntary isometric contractions (MVICs) of the knee extensors using a dynamometer. Stability index (SI) was obtained from the 20 sec postural stability test. Peak torque (PT) and RTD at 50 (RTD50) and 200 (RTD200) ms were acquired from the MVICs. Groups were compared via one-way analyses of variance, while relationships were examined using Pearson correlation coefficients. Results: Only PT (40%; p = 0.022) and RTD200 (69%; p = 0.014) were decreased in OM compared to YM, while PT was also reduced in OM (30%; p = 0.025) compared to MM. RTD200, albeit not significant, was 47% lower in OM compared to MM (p = 0.057). No torque variables were correlated with SI (p > 0.05). Conclusions: Our preliminary data indicate that late-phase torque capacity (i.e., PT, RTD200) was preferentially declined in OM, although PT nor RTD were related to dynamic postural stability.

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### EFFECTS OF ECCENTRIC ENDURANCE TRAINING ON COGNITIVE FUNCTION IN COMMUNITY-DWELLING OLDER ADULTS

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Purpose: The purpose of this study was to determine the effect of eccentric endurance training (EET) on cognitive function in community-dwelling older adults. Methods: Participants were randomly assigned to control (n = 15; 67.5 ± 2.6 yrs) and EET (n = 15; 69.0 ± 4.4 yrs) groups. The EET consisted of 8 weeks of eccentric training on a commercially available, seated eccentric step machine. Participants completed 2 sessions per week, where each session ranged from 5 to 15 minutes in duration at an intensity set based on RPE. Cognitive function was assessed using the dual-tasking Timed Up-and-Go (TUGcog), Trail Making Test, and Color-Word Stroop Test. Participants completed one day of familiarization with the assessments prior to data collection. Outcome variables were evaluated at baseline, midway, and within one week of the final training session. Results: There was a main effect for time for the Trail Making Test B, Stroop B, and Stroop C, even with one day of familiarization prior to baseline testing. There were no statistically significant changes in outcome variables following EET. However, it is notable that the average TUGcog performance improved in the EET group (baseline: 10.6 ± 3.7 sec; post: 10.0 ± 3.6 sec), with no change in the control group (baseline: 9.4 ± 1.7 sec; post: 9.4 ± 1.6 sec). Conclusions: This study indicates that 8 weeks of EET is not sufficient to yield statistically significant improvements in cognitive function. However, training volume does appear to influence the effect of exercise training on cognitive function. As such, when considering the average improvement of 0.6 seconds on TUGcog performance in the EET group, a greater training duration or volume may be required to elicit statistically significant improvements following EET.

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### GAIT FUNCTION AND SPECIFIC MUSCLE ENDURANCE TEST AMONG OLDER ADULTS

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Declines in skeletal muscle function is associated with aging which affect daily activities and quality of life. Fall risk and fall related injuries are related to muscle fatigability among older adults. Purpose: Measure calf muscle endurance and gait function in older adults. We hypothesize that gait abnormalities will be associated with reduced calf muscle endurance. Methods: Ten participants ages 55-80 years volunteered for the study. Skeletal muscle endurance was measured on the calf muscle of the participant's right leg at 2hz, 4hz and 6hz using previously established protocol. Participants walked at a self-selected speed 5-foot before and after a 20-foot mat (Protokinetics Zeno walkway). Selected gait measurements (stride length, left/right ratio step length, %CV of step length, stride width) were recorded on three trials. Pearson's r was used to test the relationship between the selected gait variables and endurance index at 6hz. ANOVA Levene's test of covariance was used to test the difference in the variance in step length of both legs. Significance was accepted at 0.05 alpha level Results: Muscle endurance at 6Hz varied from 0.3% to 1.0%. Stride length varied from 127.4cm to 168.5cm and step length varied from 64.6cm to 82.7cm. There was a positive correlation between endurance index (0.75±0.21%) and stride length (145cm±11cm) (r = 0.68, p = 0.02), and the right/left ratio step length (1.0cm±0.06cm) (r = 0.72, p = 0.01) but there was no significant relationship between endurance index and step width (r = -0.43, p = 0.11). A Levene's test verified equality of variances in step length %CV of both legs (p = 0.84). Conclusions: Muscle endurance test in the calf can be used to predict stride length and step length in older adults, which means exercise prescription aimed to improve calf muscle endurance could also help improve some selected gait functions in older adults.

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### RELATIONSHIP BETWEEN CONTRACTILE PARAMETERS AND FUNCTIONAL PERFORMANCE IN MIDDLE-AGED AND OLDER MALES

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The specific contribution of contractile torque and velocity to functional performance has not been well established. Purpose: To determine the relationship between contractile parameters of the knee extensors and 5-chair rise performance in middle-aged and older males. Methods: Healthy, middle-aged (n = 6, age = 46 ± 2.90 yrs) and older (n = 6, age = 69 ± 3.10 yrs) males performed three maximal voluntary isometric and three isotonic knee extensions using a dynamometer. Peak torque (PT) was derived from the isometric contractions, while peak power (PP) was obtained from the isotonic contractions, which were performed at 40% PT. Contractile velocity (VEL) and torque (TQ), at the moment in time PP occurred, were recorded. In addition, 5-chair rise performance, the time taken to rise 5 times from a chair as quickly as possible, was recorded. Pearson correlation coefficients were used to examine the relationship between age, PT, PP, VEL, TQ, and 5-chair rise. Results: 5-chair rise was correlated with VEL (r = -0.603; p = 0.038), but not PT (r = -0.336; p = 0.285), PP (r = -0.511; p = 0.090), TQ (r = -0.438; p = 0.154), or age (r = 0.331; p = 0.293). Conclusions: Our preliminary data indicates that velocity capacity of the knee extensors is inversely related to 5-chair rise performance, while torque capacity is not.

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### PERCEIVED BARRIERS TO HEALTH AND WELLNESS GOALS AMONG RURAL FIREFIGHTERS: A QUALITATIVE STUDY

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Ideological wellness programming for the tactical athlete should include information on overall health and wellness, injury prevention, and strength and conditioning. PURPOSE: To qualitatively assess the barriers and ideal wellness programming among rural firefighters. METHODS: Developed from previously established qualitative research on this population, investigators developed semi-structured interview questions to explore of health and wellness specific to firefighting and wellness program development. Questions were designed to understand perceived barriers to health and wellness. Researchers also asked participants to describe their ideal wellness program for a fire department. Following verbatim transcription by a trained research assistant, interviews were qualitatively analyzed using a constant comparative method and open coding approach to determine themes. RESULTS: Interviews from 40 employees were included in the analysis. The perceived barriers to health acquisition revealed four major themes: Nutrition choices; Time management; Motivation; and Limited health literacy. Three main themes emerged on the development of an ideal wellness program: Fitness and nutrition focus; Practical significance of exercises; and Social-emotional support. CONCLUSION: There are many perceived barriers to health and wellness facing rural firefighters. Prioritizing nutritional interventions may be the best strategy for firefighters, due to the large percentage of responses indicating a positive attitude towards improving this barrier.

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### EFFICACY OF A GAME-CENTERED PROGRAM FOR INCREASING PHYSICAL ACTIVITY IN CHILDREN: A PILOT STUDY

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Bingocize, a game-centered health promotion program combining bingo and exercise/health education, was shown to increase fitness and health knowledge in older adults. During inclement weather, indoor recess is the only option for preschoolers and excludes extended bouts of physical activity (PA). Purpose: To adapt Bingocize® for preschoolers and compare PA during the program to typical indoor recess. Method: Children (N=21; 3-5 yrs old) wore pedometers (GOPHER FitStep Pro) for 20 mins. during a Bingocize session, and indoor recess. A paired sample t-test was used to compare participants' total step counts in each condition (p < .05). Results: Differences between indoor recess and Bingocize were not statistically significant (t(16) = 1.43; p=.171). The range of step counts decreased for the experimental condition, and 13 of the 21 children recorded higher step counts during Bingocize. Conclusion: Results of this pilot study warrants further studies of Bingocize with children. Teachers reported Bingocize is a time-efficient, structured, and fun way for the class to stay physically active during indoor play.

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### MUSCULAR ACTIVATION DIFFERENCES DURING DAILY ACTIVITIES IN A UNILATERAL TRANS-FEMORAL AMPUTEE

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Lower-limb amputees often exhibit an increased atrophy of the remaining skeletal musculature as compared to the non-amputated side. This difference in lean mass may present variations in the contribution of physical effort between the affected and unaffected musculature. Purpose: The purpose was to examine the electromyographical (EMG) activity of the core and lower limb musculature of the amputated versus non-amputated side in a unilateral trans-femoral amputee. Methods: The participant (n=1, age = 26) performed five activities of daily living with an above-knee mechanical prosthetic (i.e., sit-to-stand, 5-m walk, 10-m walk, and stair ascent and descent without support). EMG was recorded, on both sides of the body, at the following sites and compared to a percentage of maximal voluntary contraction (%MVC): gluteus maximus, rectus femoris, biceps femoris, rectus abdominis, external obliques, and erector spinae group. Results: Results demonstrated large mean differences of 34% for the rectus femoris, 20% for the gluteus medius, and 9% for the external obliques during the five tasks. Only small mean differences were seen within the gluteus maximus (2%), erector spinae (6%), and biceps femoris (1%) between the amputated versus non-amputated limb. Conclusions: Results indicate that performing daily tasks for amputees may provide large imbalances in muscular effort between limbs.

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### SLEEP RESTRICTION NEGATIVELY INFLUENCES VISUALLY AND MEMORY-GUIDED FORCE CONTROL

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Cognitive performance is negatively influenced by sleep restriction, and athletic performance is improved through sleep extension. However, little work has quantified motor output under rigorous and controlled conditions of sleep restriction. **PURPOSE:** This study examined the effects of sleep restriction on visually and memory-guided grip force control. **METHODS:** Participants (N=9) were inpatients in a sleep restriction study, during which behavioral, physiological, and neuroimaging experiments occurred. Here, we report the results of a grip force task conducted on three days: (D1) after two nights of adequate sleep, (D2) after four consecutive nights of sleep restriction, and (D3) after one night of recovery sleep. Participants completed four 20-s trials of isometric force with their index finger and thumb, to 25% of their maximal voluntary contraction. In the full-vision (FV) condition, visual feedback was provided for the duration of the trial. In the no-vision (NV) condition, visual feedback was provided for the first 8 s of the trial, and then visual feedback was removed. Participants were to maintain force output for the remaining 12 s. **RESULTS:** In FV, participants produced less mean force on D2 relative to D1 and D3. Mean force did not differ as a function of day in NV. The coefficient of variation was higher on D2 relative to D1 and D3, in both FV and NV. **CONCLUSIONS:** These findings are the first demonstration that restricted sleep negatively impacts force control.

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### THE EFFECTS OF PSYCHING ON MOTOR CORTEX ACTIVATION AND MOTOR UNIT RECRUITMENT

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Psyching (PSY), a form of mental preparation has been shown to increase strength performance among athletes. It is possible that improved athletic performance is due to an increase in cognitive arousal. **PURPOSE:** To investigate the effect of PSY on cerebral activation, muscle activation, and torque production during isokinetic knee extension. **METHODS:** Ten healthy young adults (19-30 yrs.) with strength training experience underwent three preparatory conditions, PSY, reading comprehension (RC), and mental arithmetic (MA). Isokinetic torque output was measured via three maximal effort trials following each preparation. Electroencephalography (EEG) and electromyography (EMG) were measured throughout. **RESULTS:** EEG revealed PSY ( $-6.61 \pm 1.54 \mu V2$ ,  $p < .05$ ) to have greater cerebral activation in the central region compared to RC ( $-5.59 \pm 1.42 \mu V2$ ) and MA ( $-5.11 \pm 1.63 \mu V2$ ) as indexed by alpha band power. EMG showed PSY ( $0.69 \pm 0.06 \mu V.S$ ,  $p < .05$ ) produced greater activity in the rectus femoris, while RC ( $0.42 \pm 0.28 \mu V.S$ ,  $p < .05$ ) produced greater activity in the vastus lateralis, relative to other conditions. Average peak torque for PSY ( $110.69 \pm 7.49 \text{ Nm}$ ,  $p < .05$ ) was greater compared to RC ( $104.82 \pm 8.30 \text{ Nm}$ ) and MA ( $106.13 \pm 9.01 \text{ Nm}$ ). **CONCLUSION:** This study suggests mental preparation as an approach to enhance performance during maximal muscular effort.

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### HANDGUN SHOOTING EXPERIENCE CONTRIBUTES TO SHOOTING ACCURACY VIA INCREASED IRREGULARITY OF GUN MOTION

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**PURPOSE:** Many factors influence handgun shooting accuracy. Motor control of the limb may be impacted by training and experience. The current study was designed to investigate the intersection of handgun shooting accuracy, handgun shooting experience, and accelerations of the aiming limb. **METHODS:** Twenty (12 male, 8 female, age  $28.1 \pm 3.9$  years) experienced handgun shooters used a single limb to aim a training handgun at a bullseye target 6.4 meters away. The handgun system was equipped with a laser shot recorder for accuracy measures. Participants took 5 shots during each 10 second trial, 5 trials total. Accelerometers were affixed to the upper arm, forearm, hand, and gun barrel. Amplitude (RMS) and regularity (ApEn) of the acceleration signals were computed. **RESULTS:** Increased shooting experience was correlated with improved shooting accuracy ( $r = -0.47$ ,  $p = 0.03$ ). Experience had a nominal effect upon acceleration amplitude, positive correlations between irregularity of the acceleration signal and experience were found ( $p < 0.05$ ). Accelerations of the limb and shot score were related. Few weak to moderate ( $r = 0.19$  to  $0.39$ ) correlations between tremor amplitude and shot score suggest minor effect of increased amplitude leading to decreased accuracy ( $p < 0.05$ ). Significant negative correlations ( $r = -0.19$  to  $-0.62$ ) indicate a more irregular signal correlated with more accurate (lower) shot score ( $p < 0.05$ ). **CONCLUSION:** Improved accuracy had a significant moderate relationship with increased handgun shooting experience. Data suggests experience contributes to improved shooting accuracy, not by decreasing the amplitude of tremor, but by increasing the irregularity in the movements of the gun and limb.

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### EFFECTS OF EVIDENCE-BASED MATERIALS AND ACCESS TO LOCAL RESOURCES ON PHYSICAL ACTIVITY DURING PREGNANCY

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Physical activity (PA) during pregnancy has been shown to be safe and beneficial for improving maternal and infant health; however, only 23% of pregnant women exercise in accordance with guidelines. **PURPOSE:** To determine if the distribution of evidence-based educational materials and access to community resources will increase PA levels as well as knowledge/beliefs about being active during pregnancy. **METHODS:** Participants (8-12 weeks pregnant) completed assessments regarding their PA levels as well as knowledge/beliefs regarding PA during pregnancy. Next, participants were randomly assigned to either an intervention (IG) or control group (CG). The IG received educational information regarding PA during pregnancy, as well as access to local fitness facilities. At the end of pregnancy (32-39 weeks), all baseline assessments were repeated. **RESULTS:** 45 women completed the study (IG: 24, CG: 21). 13 women in the IG utilized PA services (prenatal yoga: 8, gym setting: 2, both: 3). The IG spent less time sedentary from the 1st to 3rd trimester, while the CG spent more time sedentary ( $p = 0.12$ ). There were no differences in step counts or knowledge/beliefs regarding PA between groups. The IG was further along the transtheoretical model than women in the CG (3rd trimester) ( $p = 0.04$ ). **CONCLUSION:** The intervention was unsuccessful at increasing PA levels to a significant degree. Future interventions should be more involved in order to have a substantial impact on physical activity-related outcomes; thus, educational materials and community resources are not enough to increase PA levels during pregnancy.

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#### **EVIDENCE-BASED EDUCATIONAL BROCHURES INFLUENCED BELIEFS AND IMPROVED KNOWLEDGE REGARDING THE BENEFITS OF EXERCISE DURING PREGNANCY**

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Purpose: Women who are pregnant report receiving little or no advice about physical activity during pregnancy from their provider. The purpose of this study was to assess the effectiveness of an evidence-based educational brochure on both immediate and two-week retention of knowledge about exercise during pregnancy. Methods: Thirty-two women of childbearing age (age: 25.0 ± 4.0 years, body mass index: 29.5 ± 6.5 kg/m<sup>2</sup>) completed a survey before exposure to an evidence-based educational brochure regarding exercise during pregnancy. Post surveys were taken immediately after viewing the educational brochure and again 2-weeks later. Results: After exposure to educational brochures, survey scores on both surveys were significantly higher immediately-post and two-weeks post compared to baseline survey scores [Survey 1 (assessing beliefs) – pre: 79.2±8.9%, post: 92.6±7.4%, 2-weeks post:92.0±6.5%, p < 0.001; Survey 2 (assessing knowledge) – pre: 65.3±16.4%, post: 81.3±14.9%, 2-weeks post:78.8±12.4%, p < 0.001]. No significant differences detected between immediate post and 2-weeks post for either Survey 1 (p = 0.72) or Survey 2 (p = 0.52); suggesting the information was retained. Conclusion: An evidence-based educational brochure is effective for improving and retaining information regarding exercise during pregnancy. Health care providers should consider providing patients with this information in order to improve knowledge and patient-provider communication on this topic.

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#### **UNDERSTANDING THE PERCEPTIONS OF DRY NEEDLING IN NCAA DIVISION I ATHLETES**

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Purpose: Dry needling is a pain management and recovery method that is becoming more popular, despite the dearth of published literature on its effectiveness. The aim of this study was to examine the perceptions of dry needling within NCAA Division I athletes for muscle pain management and/or recovery. Methods: Seventy-seven NCAA Division I Athletes completed a survey sent via e-mail. The survey consisted of 15-items, which included inclusion questions, demographics, and perception of exposure or non-exposure to dry needling. Participants that had experience dry needling were asked to rate the perceptions of that experience. Those that had not experienced dry needling were asked to rate their perceptions and reasoning for non-exposure. The frequencies and descriptive of perceptions of dry needling exposure or non-exposure were analyzed. Results: The results indicated that 66% (n=51) of participants did not have experience with dry needling, while 34% (n=26) did have experience with dry needling. Those athletes with non-exposure to dry needling reported that they would rather use other treatments (26%), they were concerned with pain or bruising (13%), or they were not sure it would work for recovery (22%). Athletes that experienced dry needling reported that dry needling was effective and comfortable for efficient and speedy recovery (61%). They also reported that they would recommend others to use this recovery treatment (50%). Conclusions: This study explored a recovery method of training that not fully understood, but very popular among athletes. In conclusion, for many athletes, dry needling is an effective treatment for muscle pain management or recovery. For other athletes, recovery treatments, such as massage therapy, e-stim, and ultrasound are preferable. Future research could compare treatment protocols for pain management and/or recovery effectiveness.

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#### **PREPREGNANCY WEIGHT STATUS MODIFIES ASSOCIATIONS OF EARLY PREGNANCY PHYSICAL ACTIVITY WITH INFANT SIZE AT BIRTH**

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Studies of the association of physical activity (PA) during pregnancy with infant size at birth have yielded inconsistent results. It also remains unknown whether these associations differ by prepregnancy weight status. Purpose: This study estimated the associations of early pregnancy PA with delivering small and large for gestational age infants (SGA and LGA, respectively), and whether they differ by prepregnancy weight status. Methods: Data come from PETALS, a diverse pregnancy cohort (n= 2,142) of women delivering at Kaiser Permanente Northern California (KPNC) from February 2014 to October 2017. Participants completed a Pregnancy Physical Activity Questionnaire (PPAQ) at 12.9 weeks gestation (SD 2.5). Infant data were obtained from KPNC's electronic health records. SGA and LGA designations were based on KPNC's race-ethnicity, gestational age, and sex-specific birthweight distributions (<10th and >90th percentiles, respectively). Multiple logistic regression models compared the highest quartiles of PA (examined by intensity and domain) to the lower three quartiles (reference); due to low levels of vigorous activity, it was examined as any versus none. Results: In the full cohort, any vigorous activity and high levels of sports/exercise activity increased the odds of SGA [aOR= 1.40 (95% CI 1.04, 1.87) and 1.45 (1.05, 1.99), respectively], but were not significantly associated with LGA [aOR=0.96 (95% CI 0.69, 1.33) and 0.68 (0.46, 1.02), respectively]. Interaction terms suggested that associations differed by prepregnancy weight status (P < .10). Among women with prepregnancy BMI < 25 kg/m<sup>2</sup> (n= 940), vigorous activity and sports/exercise activity significantly increased the odds of SGA [aOR= 1.63 (95% CI 1.05, 2.53) and 1.93 (1.22, 3.05), respectively] but were not associated with LGA [aOR=0.57 (95% CI 0.30, 1.09) and 0.63 (0.30, 1.30), respectively]. In those with prepregnancy BMI ≥ 25 kg/m<sup>2</sup> (n= 1,202), these types of activity were not significantly associated with SGA or LGA. Conclusions: These findings suggest that vigorous intensity activity and sports/exercise activity during early pregnancy may increase the risk of SGA, particularly among women entering pregnancy underweight or normal weight.

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#### **THE EFFICACY OF ACTIVE REHABILITATION VERSUS STANDARD REST IN RECOVERY FROM CONCUSSION: A SYSTEMATIC REVIEW**

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The need to optimize the recovery process from concussion is becoming more and more urgent as incidence rates continue to remain high. PURPOSE: To determine the effectiveness of active rehabilitation protocols in accelerating recovery from concussion compared to the standard rest protocols with gradual return to activity. METHODS: Four database searches spanning 2001 to September 2018 with search terms 'concussion', 'recovery', 'exercise', 'rest', and 'rehabilitation'. Studies needed to provide a direct comparison between exercise and rest protocols for inclusion. RESULTS: Ten articles were included after a searches yielded 546 results. Exercise following concussion is indicated to provide greater symptomatic relief assessed via cognitive symptom scales and physiological measures in an average shorter amount of time compared to rest. CONCLUSIONS: Physical activity has benefits in acute phases following concussion in accelerating the recovery process.

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**DUAL TASKING INFLUENCES STROOP TEST REACTION TIME**

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In daily life many people have to dual task, or perform a motor task and a cognitive task simultaneously. It is thought that dual tasking results in impaired performance of one or both tasks. Purpose: To determine the influence of dual tasking (cycling and walking) on Stroop test performance accuracy and reaction time compared to performing the Stroop test during a control, seated condition. Methods: Participants completed three testing sessions: control, cycling, and walking each separated by 3 days. The control session was performed first for all participants and served as a baseline measure of performance. During this session, participants sat at a desk in a quiet room with a laptop in front of them on which to complete the Stroop test. Stationary cycling and treadmill walking were performed in a randomized order and at each participant's self-selected pace. During stationary cycling, the computer was placed on a shelf that was secured to the handlebars of the bicycle. For treadmill walking, the laptop was secured to the control panel of treadmill. For each testing session participants, completed three, 1-minute Stroop trials, using a custom written MATLAB computer program. A 2-minute rest period followed each Stroop trial. During the control condition, participants The reaction time and accuracy for each trial were determined by the computer program and averaged for each condition. Repeated measures ANOVAs compared accuracy and reaction time across dual task conditions ( $P < 0.05$ ). Results: Thirteen healthy adults ( $n=10$  female; age:  $20.8 \pm 1.7$  years; body mass index:  $23.4 \pm 2.8$  kg/m<sup>2</sup>) participated in this study. Both accuracy ( $P=0.013$ ) and reaction time ( $P=0.046$ ) differed across dual task conditions. There were no pairwise differences between tasks for accuracy; however, there was a trend toward significance between walking ( $99.0 \pm 1.1\%$ ) and control ( $96.8 \pm 2.8\%$ ), with participants being more accurate while walking ( $P=0.057$ ). For reaction time, participants demonstrated slower response times during control ( $0.94 \pm 0.12$  s) compared to cycling ( $0.86 \pm 0.10$  s)  $P=0.015$ ). Conclusions: The results suggest that the dual task of cycling while performing the Stroop test enhances reaction time but not accuracy of responses. Stationary cycling may be an effective modality for dual task training.

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**DIFFERENCES IN LATENCY AND PREDICTIVE ABILITY OF HORIZONTAL SACCADE BETWEEN TWO POPULATIONS OF COLLEGE STUDENTS**

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PURPOSE: The Center for Disease Control (CDC) reports 1.4 million Americans sustain traumatic brain injuries (TBI) each year but the ability to diagnose and treat TBI is difficult due to the inability to determine the specific areas in the brain affected. Thus, the purpose of this research is to assess visual tracking changes (saccade and reaction times) as one objective measure to establish differences in healthy populations and those with TBI. This first study evaluated differences in a military college-aged healthy population and a traditional college population to establish baselines. METHODS: The i-Pas unit (Neurokinetics, Inc.) is a novel mobile, non-invasive eye tracking device used for identification and longitudinal differences within populations. The parameters of the study included 30 different tests, including testing of saccade random horizontal and vertical, light reflex, visual reaction time, saccade predictive horizontal. It was the hypothesis of the researcher that college students (ages 18-22) from a military training population ( $N=17$ ) would respond differently than a traditional college student ( $N=75$ ) as it relates to horizontal saccade by demonstrating a longer latency period and less predictive ability than traditional college students. RESULTS: The results of the study supported the hypothesis, finding that on average military college students had longer latency periods ( $-0.08$  seconds) whereas traditional college students had shorter periods of latency ( $-0.11$  seconds) as well as finding that military college students had less predictive ability than their traditional college counterparts (46.77% and 49.22%, respectively). CONCLUSIONS: The findings of this study will be useful in understanding the healthy military population in comparison to the military population with TBI. However, more studies are needed to support and provide baselines to understand differences in visual tracking to aid in the diagnosis and treatment of TBI.

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**MONITORING BALLERS ON A BUDGET: LESSONS LEARNED FROM LOW-COST ATHLETE MONITORING**

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PURPOSE: The purpose of this study was to determine the feasibility of using heart rate (HR) monitors and session rating of perceived exertion (sRPE) to track training load for lacrosse athletes in practices and games and develop a load estimation during games. METHODS: Twelve Division I female lacrosse players wore chest straps and watches throughout training sessions to measure cardiovascular load (CVL), and sRPE was collected after each session. Acute:chronic (A:C) training ratio was measured over a 7-day and 28-day period using CVL and sRPE. Since athletes could not wear the HR monitor in regulated games, a multiplier was developed using HR data from 10 off-season games and play time to estimate the CVL of the athlete. The estimated CVL was compared to the actual CVL obtained during an exhibition game. RESULTS: There was a moderate relationship between the CVL and sRPE load assessments ( $r = 0.445$ ,  $p = 0.147$ ). The mean A:C over the 12-week assessment period was  $0.93 \pm 0.17$  AU and  $1.13 \pm 0.40$  AU for CVL and sRPE load respectively, which is in the ideal range of A:C workload. The actual CVL ( $416.9 \pm 100.6$  AU) of an exhibition game compared poorly with CVL estimations using the game clock ( $227.2 \pm 117.3$  AU,  $r = 0.223$ ,  $p = 0.565$ ), running stopwatch ( $354.4 \pm 145.7$  AU,  $r = 0.195$ ,  $p = 0.616$ ), and running stopwatch excluding halftime ( $287.8 \pm 147.0$  AU,  $r = 0.195$ ,  $p = 0.615$ ). CONCLUSION: CVL and sRPE are feasible and cost-effective methods for monitoring training and A:C workload. CVL estimations for games were inaccurate, so sRPE should be used for low-cost game load assessment.

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**THE EFFECT OF ACUTE EXERCISE ON BASELINE CONCUSSION MEASURES**

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Current recommendations for high school and collegiate sports is to undergo a baseline concussion testing from a multidimensional approach. These assessments are mostly completed with the athlete is at rest. Purpose: To examine the effects of exercise on a standard concussion baseline protocol, including measures of neurocognitive performance, balance, and vestibular/oculomotor functioning. Methods: Participants were 92 college students (51 males) from 3 universities. Average age of the participants was 21.0 years ( $SD=1.7$ ). Participants were matched based on age, sex, and concussion history. One participant from each pair was randomly selected to complete a 15-minute acute exercise protocol while the other was a control. Each participant than immediately completed, in random order, 5 concussion-based tests: Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT), Sport Concussion Assessment Test 5th edition (SCAT5), King Devick (KD), Balance Error Score System (BESS) and Vestibular/Oculomotor Screening (VOMS). Results: Independent samples revealed no difference between groups on age ( $t(90)=-.56$ ;  $p=.58$ ) and chi-square analyses revealed no difference in groups on sex ( $\chi^2=.04$ ;  $p=.83$ ). Independent samples t-tests showed significant differences between groups on symptoms on both the PCSS ( $t(91)=2.0$ ;  $p=.04$ ) and SCAT symptoms ( $t(59.6)=2.6$ ;  $p=.01$ ). Significant differences were noted between groups on concentration scores on SCAT ( $t(91)=2.0$ ,  $p=.05$ ). Conclusion: Given the findings from the current study, it is important to take a multidimensional approach to sideline concussion management. Relying solely on symptom reporting may be problematic, as exercise may mask concussive symptoms, allowing athletes to return to play too soon.

### RELIABILITY AND ANALYSIS OF ISOMETRIC HAMSTRING TESTING IN ELONGATED POSITIONS

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**P49** Hamstring evaluation and strengthening in a lengthened position may be beneficial to reduce injury and optimize strength/function. Purpose: To establish intersession reliability and determine sex, limb and position differences of isometric lengthened hamstring testing. Methods: Healthy (24.3±3.2yrs) men (n=20) and women (n=20) completed bilateral isometric hamstring testing. Participants were seated in a fixed dynamometer (Biodex S4, Biodex, Shirley, NY) with 60° of hip flexion. Peak torque (Nm/kg) during three 5s maximal effort repetitions performed in each of four knee flexion positions (75°, 55°, 35° 15°) was determined for both the dominant and non-dominant limbs. Results: Except for 75°, intraclass (2,1) correlation coefficients ( $\geq .73$ ) and coefficient of variations (10.0 to 12.6%) demonstrated moderate to high reliability. Results of a sex by limb by position analysis of variance did not reveal any significant differences between the limbs. Significantly ( $P=.003$ ,  $\eta^2p=.124$ ) less torque was produced as the knee became more extended, with the 35° to 15° decrease between being significantly more than 55° to 35°. Higher torque existed for the men ( $P=.026$ ,  $\eta^2p=.124$ ). Conclusion: As expected, men produced greater overall torque at all angles than women however they both demonstrated similar changes in peak torque across the positions. The lack of differences between limbs supports using limb symmetry indexes. Future research should consider the efficacy of hamstring testing and strengthening in elongated positions.

### PERCEPTIONS OF NCAA DIVISION I BASEBALL PITCHERS ON TREATMENT MODALITIES FOR PITCHING ARM HEALTH

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**P50** PURPOSE: To investigate the perceptions of college baseball pitchers on the modalities and treatments available for arm recovery. METHODS: The survey included 50 items and took about 10 minutes to complete. First, the pitcher was asked to report how often they performed any of the following treatment modalities for the health of their arm. Nine different treatment modalities were listed (heat, ice, rolling techniques, stretching with an athletic trainer, Graston work, band work, electrical stimulation, dry needling, and taking anti-inflammatories), plus an option for "other." Responses were on a 6-point scale, ranging from "daily" to "never." RESULTS: Results showed that pitchers were devoted to certain modalities that they preferred, regardless of time, over 70% of athletes listed using recovery modalities multiple times per week. The majority of responses reported perceptions of effectiveness for heat and rolling techniques. Additionally, the pitchers believe that dry needling and Graston techniques are most effective, although most of them do not perform them regularly. CONCLUSION: The modalities, they are time specific and highly individualistic. As a whole, each modality had its own time specific occurrence, heat was more popular before throwing, ice was more popular after throwing. Some modalities were more popular than others, and some were both popular and done before and after throwing (rolling techniques and stretching with the ATC). The more elaborate modalities, the treatments that took longer or had a varied immediate response were less popular than others.

### SPORT FIELD MECHANICAL PROPERTIES INFLUENCE MUSCLE RECRUITMENT PATTERNS AND METABOLIC RESPONSE

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**P51** PURPOSE: The study analyzed the influence of field mechanical properties on muscular activation patterns and metabolic response during the performance of a sequential set of agility drills designed to induce muscle fatigue. METHODS: Eleven male athletes were fitted with a standard multi-purpose training shoe. The test protocol consisting of four high-intensity trials on two fields with different properties. Time-dependent field properties were analyzed using ASTM protocols. A 30-meter pretest and posttest sprint determined fatigue and player performance. Lower extremity EMG and metabolic activity were analyzed: oxygen consumption (VO<sub>2</sub>), heart rate (HR), respiratory exchange ratio (RER), metabolic equivalent (MET), and energy expenditure (EE). RESULTS: A difference was calculated for muscle activity across trials ( $p = 0.01$ ) for both surfaces. Muscle activity was 13% lower on the field with less mechanical energy return ( $p = 0.01$ ). Metabolic components (VO<sub>2</sub>, HR, RER, MET, and EE) were significantly different across trials ( $p = 0.01$ ) but not significantly different between fields. CONCLUSIONS: The findings indicate field mechanical properties influence muscle activation patterns. The field exhibiting the greatest magnitude of energy return produced the lowest sprint and agility course times.

### LATENCY OF THE PERONEUS LONGUS AND PERONEUS BREVIS DURING UNEXPECTED AND EXPECTED INVERSION PERTURBATIONS

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**P52** PURPOSE: Although various devices are used to mimic lateral ankle sprain injuries in a laboratory setting, anticipation to inversion perturbations can alter motor control strategies and prevent an accurate assessment of injury mechanisms. Therefore, the aim of this study was to examine response latency of the peroneus longus (PL) and peroneus brevis (PB) during unexpected (UE) and expected (EXP) inversion perturbations. METHODS: Physically active participants (n = 21) with no self-reported history of a lateral ankle sprain completed UE and EXP single leg drop landings onto a tilted platform rotated 25° in the frontal plane from a height of 30 cm. Surface electromyography (EMG) was used to record muscle activity of the PL and PB during the UE and EXP perturbations. Latency was determined from the rectified EMG signal as the time in milliseconds from initial foot contact to the point where muscle activity exceeded 5 standard deviations above the averaged 200 ms pre-landing muscle activity. Dependent samples t-tests were used to compare latency of the PL and PB between UE and EXP landing conditions ( $p < 0.05$ ). RESULTS: No differences in the latency of the PL ( $p = 0.513$ ) or PB ( $p = 0.427$ ) between landing conditions. CONCLUSIONS: While different motor control strategies may be utilized in anticipation to injurious perturbation, these results indicate anticipating the inversion perturbation did not reduce the response latency of the PL or PB.

### CHRONIC ANKLE INSTABILITY ALTERS SPATIOTEMPORAL POSTURAL CONTROL DURING A LATERAL STEP DOWN TEST

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**PURPOSE:** While deficits postural control (PC) are well-documented in individuals with chronic ankle instability (CAI), traditional center of pressure (COP) and time-to-boundary (TTB) measures of PC have been underutilized to quantify deficits during functional tests.

**P53** The purpose of this study was to assess PC using COP and TTB measures between individuals with and without CAI during a lateral step down test. **METHODS:** Thirty participants (CAI=15; Controls=15) completed a 25 cm lateral step down test on each leg while standing on a force platform. Traditional COP and TTB measures in the medial/lateral (ML) and anterior/posterior (AP) directions were analyzed using a 2 (group) x 2 (limb) mixed ANOVA. **RESULTS:** No significant results were found for COP measures. The CAI group exhibited lower TTB ML absolute minimum on their affected limb compared to the matched limb of the control group ( $p = 0.002$ ). Additionally, individuals with CAI on average demonstrated significantly lower TTB ML mean of minima ( $p = 0.004$ ) and TTB standard deviation of minima in both ML ( $p < 0.001$ ) and AP directions ( $p = 0.002$ ). **CONCLUSIONS:** Sensorimotor constraints associated with CAI negatively alter spatiotemporal PC when performing a lateral step down test. Furthermore, traditional COP measures did not reveal any between group differences indicating that a spatiotemporal analysis should be used when assessing PC in CAI cohorts.

### GROUND REACTION FORCES DURING SINGLE-LEG DROP LANDINGS ON AN INVERTED SURFACE

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**P54** **PURPOSE:** The purpose of this investigation was to analyze the vertical, medial, and posterior components of the ground reaction force (GRF) during unexpected (UE) and expected (EXP) single-leg drop landings onto an inverted surface. **METHODS:** Participants with no self-reported history of a lateral ankle sprain ( $n = 15$ ) performed UE and EXP single-leg drop landings from a height of 30 cm onto a force platform that was rotated 25° in the frontal plane. The vertical, medial, and posterior components of the GRF were recorded from the force platform during landing, normalized to each participants' body weight, and time-averaged at each discrete time point during the first 150 ms after initial foot contact. Dependent samples t-tests were used to compare each component of the GRF at each discrete time point between the UE and EXP landing conditions ( $p < 0.05$ ). **RESULTS:** The UE landing condition produced a significantly increased medial GRF from 52-120 ms post-landing when compared to the EXP landing condition ( $p = 0.001-0.049$ ; effect size = 0.60-2.39). **CONCLUSIONS:** Our findings suggest that a protective landing strategy likely emerges to increase dynamic joint stabilization and efficiently attenuate medial loading on the ankle joint complex when landing on an unstable surface.

### EFFECTS OF ACTIVE SITTING ON READING AND TYPING TASK PRODUCTIVITY

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Active sitting allows the body to stay dynamic while in a seated position. While research has evaluated the health benefits of active sitting, there has been little research conducted on the effects of active sitting on productivity. **Purpose:** The purpose was to evaluate the effects of various chairs (active versus non-active) on typing and reading task productivity. **Methods:** Four male ( $n = 4$ ) and ten female participants ( $n = 10$ ) performed various typing and reading tasks for 10 minutes while sitting on each of the following: office chair (OC), stability ball (SB), and active sitting chair (ASC). Reading comprehension (RC), words per minute (WPM), accuracy, and errors were measured following each task. Additionally, perceived productivity was measured using a self-reported rating of difficulty scale (1-10). **Results:** In terms of RC, there was no difference between the chairs ( $p = 0.16$ ). However, significant differences in perceived productivity were found between OC and SB ( $p < 0.01$ ), SB and ASC ( $p = 0.04$ ), and OC and ASC ( $p < 0.01$ ). For the typing task, no differences were demonstrated for errors ( $p = 0.87$ ) or accuracy ( $p = 0.91$ ). However, a significant difference in WPM was found between OC ( $38.8 \pm 10.5$ ) and ASC ( $35.9 \pm 9.5$ ) ( $p = 0.02$ ,  $ES = 0.30$ ). For perceived productivity of typing, a significant difference was observed when comparing OC and ASC ( $p < 0.01$ ) and SB and ASC ( $p < 0.01$ ). **Conclusions:** Results suggest that various types of active sitting may have a minimal negative effect on typing task performance and perceived productivity.

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### AN ACTIVE GLOVE ARM IS ASSOCIATED WITH DECREASED KINETICS IN THE WINDMILL SOFTBALL PITCH

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**P56** **Purpose:** To determine if glove arm kinematics have an influence on pitching pelvis/trunk kinematics and pitching shoulder kinetics during the windmill softball pitch. **Methods:** Thirty-nine college softball pitchers ( $20.0 \pm 1.4$  yrs.;  $174.7 \pm 6.1$  cm;  $82.0 \pm 13.0$  kg;  $10.7 \pm 2.7$  yrs. of experience) threw 3 change-up pitches to a catcher while kinematic and kinetic data were collected with an electromagnetic tracking system. Pearson product moment correlations were run to determine any relationships between glove arm kinematics (shoulder flexion, elbow flexion, shoulder horizontal abduction) with pelvis/trunk kinematics and/or pitching shoulder kinetics during four phases of the windmill softball pitch. Phase 1 was considered the time from the pitching arm being at 3 o'clock and 12 o'clock during the 360° motion. Phase 2 was when the pitching arm was between 12 o'clock and foot contact. Phase 3 was between foot contact and ball release, and phase 4 was between ball release and follow through. Significant correlations found with glove arm kinematics occurring before another variable were put through a linear regression to identify any potential cause and effect. **Results:** Results revealed glove arm elbow flexion during phase 1 significantly predicted normalized pitching shoulder internal/external rotational moment during phase 4 ( $t = 2.60$ ,  $p = 0.013$ ). Also, glove arm shoulder horizontal abduction during phase 1 significantly predicted normalized pitching shoulder moment in phase 3 ( $t = -2.40$ ,  $p = 0.021$ ) and pelvic angular velocity during phase 3 ( $t = -3.20$ ,  $p = 0.003$ ). **Conclusion:** An active glove arm, defined by a more extended elbow and more horizontally abducted shoulder during phase 1 of the windmill softball pitch, was predictive of a more efficient kinetic chain later in the pitching motion, and thus could possibly play a role decreasing injury susceptibility by lessening pitching shoulder joint loads.

### COMPARISON OF SINGLE-LEG HOPPING PARAMETERS ACROSS DIFFERENT ARTIFICIAL TURF SYSTEMS AND NATURAL TURFGRASS

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During locomotion, leg spring parameters are adjusted to maximize efficiency and reduce injury risk based on the stiffness of the surface. **PURPOSE:** This study compared leg spring parameters during single-leg hopping on different modern sports turfs, including three artificial turf systems with different structural components and a natural turfgrass surface. **METHODS:** Seven participants (ages 19-30 yrs; height =  $1.79 \pm 0.08$  m; mass =  $75.9 \pm 10.1$  kg) were recruited for this study. Each participant performed three trials of single-leg hopping in place on each of the four surfaces at a self-selected pace. Kinematics were collected using the Xsens MVN Awinda inertial motion capture system. Data were then imported into Visual3D where estimated ground reaction force and subsequent leg spring parameters were computed. For each participant, vertical stiffness and hopping frequency data from three trials for each of the four surface conditions were included in the statistical analysis. **RESULTS:** A repeated-measures MANOVA indicated significant differences present between surface conditions for vertical stiffness ( $F(6,15) = 3.48, p=.023, \eta^2 = .582$ ), with pairwise comparisons revealing vertical stiffness on turf 3 ( $18.3 \pm 6.3$  kN/m) to be significantly less than on turf 2 ( $20.6 \pm 6.2$  kN/m;  $p = .023$ ) and natural turfgrass ( $21.6 \pm 6.2$  kN/m;  $p < .01$ ). Hopping frequency was not significantly different between surface conditions. **CONCLUSION:** Modern artificial turf system innovations continue to utilize various structural components in an effort to reduce the overall stiffness of synthetic surfaces. However, it appears that individuals still interpret some artificial turfs to be stiffer than alternatives and therefore lessen the vertical stiffness of their leg spring while maintaining their preferred self-selected hopping frequency.

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### POSTURAL STRATEGY DURING SENSORY ORGANIZATION TEST WHEN EXPOSED TO ALTERNATIVE FOOTWEAR AND WORKLOAD

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Alternative footwear and physiological workloads have been previously reported to impact balance performance. However, postural strategy involved during balance maintenance when exposed to alternative footwear, workload and different balance tests with and without conflicting sensory inputs is not known. **Purpose:** The purpose of the study was to examine the impact of alternative footwear with a low-intensity workload on postural strategy during the sensory organization test (SOT). **Methods:** Eighteen healthy male adults were tested for balance following a repeated measures study design, using the six balance conditions of the SOT (NeuroCom Equitest™), in three alternative footwear [cros (CC), flip-flops (FF) and Vibram minimalist shoes (MIN)], before (pre) and after (post) a self-selected one-mile walk. SOT strategy scores were analyzed using a 3 (footwear) x 2 (pre-post) x 6 (SOT conditions) repeated measures ANOVA. **Results:** A significant main effect for SOT balance conditions ( $p < 0.05$ ) was evident with no other significant interaction or main effect for footwear and workload. Pairwise comparisons revealed significantly greater ankle strategy for the SOT conditions that did not involve conflicting somatosensory input and a significantly greater hip strategy for the SOT conditions that involved conflicting somatosensory input. **Conclusions:** Alternative footwear type or the low intensity workload did not significantly impact postural strategy, however the SOT balance conditions elicited significantly different contribution from the ankle-hip postural strategy in maintaining balance. Conflicting somatosensory input rather than conflicting visual input elicits a greater hip strategy independent of footwear and workload.

### CHANGES IN BAT SWING KINEMATICS ACROSS THE STRIKE ZONE IN COLLEGIATE BASEBALL PLAYERS

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Previous studies have examined bat velocity at ball contact (BVBC) by asking participants to swing at a ball in a position of their choosing, unfortunately this is not practical in a game situation. **PURPOSE:** The purpose of this study investigated changes in BVBC throughout an individual's strike zone in collegiate baseball players. **METHODS:** Thirteen (age:  $19.69 \pm 1.18$  years, height:  $184 \pm 6.16$  cm, mass:  $93.32 \pm 9.8$  kg) NCAA division I baseball players participated in one testing session over their fall season. Participants completed an on-deck warm-up, prior to testing. In order to make the strike zone relative to each participant, we placed the tee in varying positions based on their respective stance and hitting tendencies. Once this was determined, participants were asked to swing a bat at a ball placed on a tee in a random position of their strike zone. Each swing was separated by a period of 20 seconds to allow investigators to readjust the tee in another location of their strike zone. A series of repeated measures ANOVA's at an alpha level ( $p=.05$ ) were used to analyze BVBC over the strike zone. **RESULTS:** Significant differences in BVBC were seen across location and zone across the strike zone ( $p < .05$ ). **CONCLUSION:** Both athlete and sport coach can use this data to work on hitting technique and bat speed depending on where they are deficient in comparison to an area(s) of strength.

### ANKLE KINEMATICS IN INDIVIDUALS WITH CHRONIC ANKLE INSTABILITY DURING UNEXPECTED AND EXPECTED DROP LANDINGS

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**PURPOSE:** Although deficits in dynamic frontal plane ankle stabilization are well-documented in chronic ankle instability (CAI) participants, anticipatory ankle kinematics during inversion perturbations are less known. This study examined the impact of anticipation on ankle kinematics during single-leg drop landings on an inverted surface. **METHODS:** Thirty participants (CAI=15, Control=15) completed unexpected and expected single-leg drop landings onto a 20° inverted surface from a height of 30 cm. Ankle inversion angle at initial contact, time to maximum inversion angle, maximum inversion angle and inversion velocity were assessed using a 2 (group) x 2 (landing condition) mixed ANOVA ( $p < 0.05$ ). **RESULTS:** Significantly less time to maximum inversion angle ( $p = 0.041$ ) and greater maximum ankle inversion angle ( $p = 0.010$ ) was found in the CAI group. Regarding landing condition, significantly less ankle inversion angle at initial contact ( $p = 0.003$ ) and greater maximum ankle inversion angle ( $p < 0.001$ ) was observed during the unexpected landings. **CONCLUSIONS:** Altered frontal plane ankle kinematics in the CAI group suggests reductions in dynamic frontal plane ankle stabilization. However, both groups displayed similar ankle kinematics when the inversion perturbation was expected. More research is needed that examines unexpected and expected perturbations to further understand the clinical implications of these findings.

### INFLUENCE OF POSTURE-CUEING GARMENTS ON SCAPULAR POSITIONING DURING A SOFTBALL HITTING TASK

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**PURPOSE:** Posture-cueing garments have recently become a popular trend among athletes. These garments are designed to improve postural alignment and athletic movements. Proper posture during athletic tasks allows for optimal force production, power output, and transfer of energy throughout the kinetic chain. The purpose of this study was to examine the differences of scapular positioning among collegiate softball athletes during front toss hitting while wearing two different garments. **METHODS:** Ten NCAA Division I Collegiate softball athletes (age:  $20.3 \pm 1.5$  yrs; height:  $166.6 \pm 6.3$  cm; mass:  $68.0 \pm 7.5$  kg) participated. All kinematic data were collected at 240 Hz using an electromagnetic tracking system. Each athlete performed five maximal effort swings from a front toss practice pitcher located 9.14 m away. Post collection all trials were event marked at stance, load, foot contact (FC), ball contact (BC), and follow through (FT). **RESULTS:** Significant differences were found in scapula anterior/posterior tilt. Differences are shown in the shirt by event interaction, ( $F(2.04, 38.82) = 9.23, p < .001$ ). A paired samples t-test results revealed greater scapular anterior tilt of the lead scapula and greater posterior tilt of the rear scapula at FC ( $t(19) = 2.09, p = .05$ ), and greater posterior tilt of the lead scapula and greater anterior tilt of the rear scapula at FT, ( $t(19) = -2.09, p = .05$ ). No significant differences were shown between garments. **CONCLUSION:** Scapula positioning at FC and FT support movement of the shoulder from a more closed to a more open position at ball contact which promotes more efficient energy transfer. Posture-cueing garments provide athletes with improved athletic performance, however, more research on the effects of posture-cueing garments during dynamics movements is warranted.

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### SUSPENSION TRAINING IMPROVED STATIC POSTURAL STABILITY AND DYNAMIC POSTURAL CONTROL IN COLLEGE-AGE FEMALES

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Suspension training (SuT) is a form of instability exercise that requires the individual to recruit core musculature and peripheral stabilizer muscles to maintain proper body position and balance. **PURPOSE:** The effectiveness of SuT in improving dynamic postural control and static postural stability after six weeks of SuT using the TRX suspension trainer was investigated. **METHODS:** Twenty untrained females ( $21.0 \pm 1.4$  years) followed a six-week TRX program that consisted of 18 60-minute interval style workouts. Control subjects ( $n=13$ ) maintained their normal activity. Dynamic postural control was assessed using the Star Excursion Balance Test (SEBT). Static postural stability was assessed using the Balance Error Scoring System (BESS). Dependent measures t-tests were conducted to identify changes within groups for SEBT and BESS performance. **RESULTS:** Left leg stance SEBT change scores indicated significant improvements in the medial ( $3.0 + 5.8$  cm;  $p=0.034$ ) posteromedial ( $4.2 + 8.0$  cm;  $p=0.032$ ), posterior ( $6.8 + 6.4$  cm;  $p<0.001$ ), posterolateral ( $6.3 + 6.7$  cm;  $p<0.001$ ), and lateral directions ( $5.8 + 7.2$  cm;  $p=0.002$ ). Right leg stance improvement occurred in the posterior direction ( $4.7 + 8$  cm;  $p=0.015$ ). BESS change scores indicated a reduction in error frequency in both SuT ( $-2.7 + 3.8$  errors;  $p=0.005$ ) and control groups ( $-8.3 + 5.5$  errors;  $p=0.027$ ). **CONCLUSIONS:** Six weeks of TRX suspension training facilitated improvements in dynamic postural control and static postural stability in both right- and left-leg stances. Further research is needed to elucidate the effect of lower limb dominance on the development of postural control during a SuT workout.

### INFLUENCE OF PLYOMETRIC TRAINING ON LOWER EXTREMITY DEXTERITY AND STIFFNESS

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**PURPOSE:** This study evaluated the effect of 5-week plyometric training on lower extremity stiffness (LES) and dexterity (LED) **METHODS:** 11 female D3 collegiate soccer players' stiffness and dexterity were measured pre-and post a 5-week plyometric intervention. The intervention emphasized explosiveness through repetitive rapid eccentric stretch of a muscle immediately followed by a contraction of the same muscle. Three single leg hop tests, as well as, 15 LED trials were performed before and after the intervention. Kinematics and kinetics were measured during the single leg hop test with 14 Vicon Bonita 10 cameras (Vicon, Denver, CO) and a Bertec force plate (Bertec Corporation, Columbus, OH). Stiffness was computed as the ratio between vertical force and maximum vertical displacement of the center of mass after ground contact. The mean LES of the three pre and post-test hops was kept for analysis. LED was measured as the mean vertical force during compression of a spring predisposed to buckling that was placed over the force platform. Pre and post LED scores were the means of all 15 pre and post-trial means. **RESULTS:** Paired sample t-tests were used to compare pre and post-test means of stiffness and dexterity. No significant differences were found between pre-and post-test stiffness ( $t(10) = 1.43, p = 0.1840$ ) and dexterity ( $t(10) = 1.20, p = 0.2565$ ). **CONCLUSIONS:** Plyometric training protocol pre- and post intervention did not contribute to change in LED or LES. Although agility is associated with LED and plyometric training influences agility, the results here indicate that stretch-shorten cycle training does not impact LED. More research should be conducted to find protocols that improve LED, as it has been linked with injury.

### HIP, KNEE, AND ANKLE CONTRIBUTIONS ARE ALTERED DURING SLOPED WALKING IN INDIVIDUALS WITH ACLR

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Anterior cruciate ligament (ACL) rupture is a commonly sustained injury among athletes. **PURPOSE:** To compare joint moment contributions at the knee, ankle, and hip during flat, incline, and decline walking between limbs in individuals with ACL reconstructed (ACLR). **METHODS:** We analyzed 8 participants with ACLR. Each participant walked flat, uphill, and downhill at 0, 10, and -10 degrees with pre-determined speeds (1.3 m/s, 1.0 m/s, 1.0 m/s). Kinematic and kinetic data were collected during the final 30 seconds of each condition using 17 cameras (Vicon) and an instrumented split-belt treadmill (Bertec). Joint moment contributions at the hip, knee, and ankle were determined by dividing the peak sagittal joint moments by the sum of all three peak moments during stance. A 2x3 (limbcondition) ANOVA was implemented to evaluate interlimb differences across conditions, with post-hoc bonferroni adjustments. **RESULTS:** No significant main effect of limb or limbcondition interaction was found. Hip contributions were 13% greater during incline walking (28% contribution) compared to decline (15% contribution). During decline walking (57% contribution) knee contributions were 42% greater compared to incline (15% contribution) and 41% greater compared to flat walking (16% contribution). During flat walking (54% contributions) ankle contributions were 27% greater compared to decline (27% contributions) and 30% greater during incline walking (57% contributions) compared to decline. **CONCLUSIONS:** These results suggest that individuals with ACLR are capable of maintaining lower extremity joint symmetry with respect to walking at an incline and decline. Future studies will investigate differences in lower extremity joint contributions between individuals with ACLR and a healthy, age-matched control group. This study was supported by an Auburn University Undergraduate Research Fellowship.

### FRONTAL PLANE TIBIOFEMORAL ALIGNMENT IS RELATED TO KNEE LOADING DURING SINGLE-LEG LANDINGS

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**P65** **PURPOSE:** The purpose of this study was to determine the relationship between frontal plane tibiofemoral alignment and knee loads during single-leg landings. **METHODS:** Three-dimensional kinematics and ground reaction forces of 19 participants were recorded during single-leg landings from 90% max jump height. Varus (n=7) and valgus (n=12) groups were determined using knee alignment measured from the hip (functional prediction method), knee (center of epicondyles), and ankle (center of malleoli) joints. Kinematic and force data were filtered at 15 Hz. An x-y-z cardan sequence and the right hand rule were used for angular computations. Internal moments were expressed in the distal segment and normalized to mass (Nm/kg). The landing phase was from initial contact to peak knee flexion. T-tests compared knee biomechanics between varus and valgus groups. Correlations determined relationship between alignment and knee biomechanics. **RESULTS:** The varus group had greater peak knee adduction angles ( $8.9 \pm 3.1^\circ$  vs.  $4.3 \pm 3.0^\circ$ ;  $p < 0.01$ ) and abduction moments ( $-1.33 \pm 0.48$  Nm/kg vs.  $-0.87 \pm 0.21$  Nm/kg;  $p < 0.01$ ) compared to the valgus group. The valgus group had greater peak abduction angles ( $-4.3 \pm 2.1^\circ$  vs.  $2.4 \pm 2.2^\circ$ ;  $p < 0.01$ ). Alignment was strongly related to knee abduction angles ( $r = 0.81$ ) and moderately related to adduction angles ( $r = 0.61$ ) and abduction moments ( $r = -0.64$ ). **CONCLUSIONS:** Tibiofemoral alignment is related to knee joint landing patterns and loading. Excessive adduction patterns and abduction loading may affect medial compartment loading in varus populations. Frontal plane tibiofemoral alignment may influence success of training programs targeting landing mechanics.

### JOINT MOMENT CONTRIBUTIONS DURING FLAT, INCLINE, AND DECLINE RUNNING IN INDIVIDUALS WITH ACLR

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**P66** Incline and decline running have been shown to alter joint moments as compared to flat ground, yet this has not been widely investigated in anterior cruciate ligament reconstructed (ACLR) individuals. **PURPOSE:** To compare ankle, knee and hip joint moment contributions during flat, incline and decline running between limbs in ACLR individuals. **METHODS:** 8 participants (4 males, 4 females, mean age  $20 \pm 2$  yrs) provided consent to participate. Participants ran during flat ( $0^\circ$ ), incline ( $10^\circ$ ) and decline ( $-10^\circ$ ) treadmill conditions, with predetermined speeds of 2.5m/s ( $0^\circ$ ) and 1.8m/s ( $10^\circ$  and  $-10^\circ$ ). Kinematic and kinetic data were collected during the final 30s of each condition using 17 cameras (Vicon) and an instrumented split-belt treadmill (Bertec). Joint moment contribution percentages at the hip, knee and ankle were determined by dividing the peak, sagittal, external joint moments (N.mm/kg) by the sum of all three joint moments during stance. A 2x3 (limb x condition) ANOVA was used to evaluate interlimb differences across conditions with post-hoc Bonferroni adjustments. **RESULTS:** No significant main effect of limb or limb x condition interaction was found. Hip contributions were 10% greater during incline running as compared to decline running (22-13%). In decline running, knee contributions were 44% greater when compared to incline running (59-15%) and 37% greater when compared to flat running (59-22%). Ankle contributions were 26% greater in flat running when compared to decline running (55-29%) and 34% greater in incline running when compared to decline running (63-29%). **CONCLUSIONS:** Hip, knee, and ankle joint moment contributions are altered with flat, incline, and decline running in persons with ACL-R. Individuals with ACLR did not display asymmetries in joint contributions between the involved and uninvolved side.

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### NOVEL EVIDENCE OF CORTICAL CONTROL IN SEVERE SLIP RESPONSES

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**P67** During a human slip response, an ensemble of muscular activations appear in an attempt to maintain balance and prevent a fall. The slip response has several key events that appear reflexive in nature. However, there is little information regarding corticospinal contribution to the slip response. **Purpose:** To examine corticospinal activity in lower extremity slip recovery corrective responses across slip severity. **Methods:** One hundred participants were recruited for this study. Participant's lower extremity gait kinematics, kinetics, and electromyography (EMG) on the quadriceps (Q), hamstrings (H), dorsiflexors (TA), and plantarflexors (MG) were collected during normal gait (NG) and an unexpected slip (US). The slip was classified based on slip severity, using heel slip distance, and velocity. Once classified, EMG spectral power was examined in the Piper frequency band between gait trials, and groups using a mixed model analysis of variance. **Results:** Spectral power showed no differences in NG trials. However, Spectral power in the Piper frequency band was increased in the Q and H, during the US trial for severe slips, but not minor slips. **Conclusion:** We show here novel contributions of the corticospinal pathway to the slip recovery response, particularly in musculature used in the recovery response.

### FRONTAL PLANE CENTER OF PRESSURE SHIFTS OF COLLEGIATE GOLFERS

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**P68** The interaction of the feet and ground throughout the golf swing is a vital component that allows a golfer to perform the complex series of movements that lead to proper impact with the ball. Inefficient shifts of a golfer's center of pressure (COP) may lead to reflexive swing alterations with deleterious effects in performance. **PURPOSE:** The purpose of this study was to examine the COP location at major positions throughout the swing in varsity collegiate golfers. **METHODS:** While standing on a BodiTrak Pressure Mat, 13 collegiate golfers hit multiple shots with 5 different clubs. Changes in medial lateral center of pressure were examined between clubs, and swing position using a 5 x 3 (Club [Driver, 8 iron, 6 iron, 4 iron, gap wedge] x position [take-away, backswing, impact]) repeated measures analysis of variance. **RESULTS:** Results of the analysis revealed a significant position main effect ( $p < 0.001$ ), but no effect of club, or the club by position interaction. Pairwise comparisons of position further suggest that at the backswing, the CoP was closer to the back foot, while at impact, the CoP was closer to the front foot, irrespective of the club used. **CONCLUSION:** Results of this study suggest that collegiate level golfers have similar COP locations throughout the swing regardless of the club swung. This advocates the instruction of singular footwork mechanics across clubs, rather than different swings.

#### NOVICE BASEBALL PITCHERS ARE UNABLE TO MAINTAIN BALL VELOCITY WHEN USING SHORTENED STRIDE LENGTHS

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Skilled baseball pitchers are able to compensate for the effects of altered stride length on ground reaction force to maintain wrist velocity (which is indicative of ball velocity). **PURPOSE:** To determine the effect of stride length on peak vertical ground reaction force (Fzpeak) of the stride leg and wrist velocity in novice baseball pitchers. **METHODS:** Ten college-aged males with no baseball experience were instructed to pitch a baseball as fast and accurately as possible. After instructions and a standardized warmup, a total of 15 throws (5 Normal-stride [NS], 5 Over-stride (NS +10% [OS]), and 5 Under-stride (NS -10% [US]) were performed on a dimensionally correct pitching mound equipped with a force platform (1200 Hz). Marker trajectory data (32 reflective markers) was tracked from 10 high-speed cameras at 240 frames/sec. Fzpeak was normalized for body weight (N/BW) and wrist velocity (m/s) was measured at ball release. **RESULTS:** When all stride lengths were combined, significant correlations were found between Fzpeak and wrist velocity ( $r=0.37$ ;  $p<0.05$ ). However, there was no effect of stride length on Fzpeak (NS=1.29±0.13, OS=1.35±0.09, US=1.31±0.14;  $p>0.05$ ). Yet, wrist velocity was slower for the US (13.45±1.10) conditions compared with NS (14.14±1.01,  $p<0.01$ ) and OS (14.28±1.03,  $p<0.001$ ). **CONCLUSIONS:** These results confirm the relation between ground reaction force and wrist velocity found in skilled pitchers. And although stride length did not influence ground reaction force, novice pitchers were unable to maintain wrist/ball velocity when using shortened stride lengths.

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#### THE EFFECT OF SHIN-TORSO ALIGNMENT ON MUSCLE ACTIVITY OF THE LOWER EXTREMITY IN HOCKEY PLAYERS

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Ice hockey is a sport prevalent with overuse injuries occurring throughout a season. These overuse injuries are commonly due to fatigue-related degradation of mechanics. There is a large variation in the technique used for ice hockey skating. The positioning of a hockey player while skating is vital because it can impact muscle activation. Improper positioning can cause increased activation in a particular muscle, which places more stress on that muscle. Over time this can lead to muscle fatigue and an increased likelihood of injury. **PURPOSE:** To measure muscle activation patterns and joint angle changes of the lower extremity in ice hockey players during three different simulated skating positions. **METHODS:** Electromyography sensors were placed on muscles of the quadriceps, hamstrings, and low back. Additionally, electrogoniometers were placed on the hip, knee, and ankle joints. Players performed 45-second trials on a slide board in three different positions: forward lean (FL), shin torso alignment (STA), and upright (UR). Muscle activation and joint angle differences were recorded and analyzed using a repeated measures ANOVA with  $p = 0.05$ . **RESULTS:** Across the three positions, significant differences ( $p < 0.029$ ) were found for muscle activation in the posterior musculature: gluteus maximus and semitendinosus (FL > STA > UR). A significant difference ( $p < 0.035$ ) was found for the vastus lateralis (UR > STA). Large effect sizes were found for the vastus lateralis ( $\eta^2 = 0.214$ ) and a medium effect size was found for the rectus femoris ( $\eta^2 = 0.061$ ) across all positions. Significant differences were present for joint angles across trials. **CONCLUSIONS:** The FL exhibits greater posterior muscle activation and UR exhibits more anterior muscle activation. The STA skating position provides more of an equal distribution of muscle activation and could result in a reduction of fatigue-related injuries that may otherwise be present over an extended period of time.

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#### NO CHANGE TO MUSCLE EXCITATION DURING A RUN TO FATIGUE

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Heart rate and perceived exertion are commonly used as stopping criteria when using running protocols to compare biomechanics under a fatigued state. It is unclear if the presence of these criteria correspond with a change in muscle excitation. **Purpose:** To assess lower extremity muscle excitation between beginning, middle and end of a run to fatigue. **Methods:** 9 recreational runners (20.89 ± 1.36 years) ran on a treadmill at a self-selected pace until they reached 85% maximum heart rate, or reported 17 on the Borg Scale. Bilateral surface electromyography (EMG) of the rectus femoris (RF), vastus medialis oblique, biceps femoris (BF), lateral head of gastrocnemius (LG), and gluteus medius were recorded every 5 minutes for 20 seconds until the criteria was met. Moving root mean square (RMS) for each EMG signal was plotted for the first, middle and last trial. The mean RMS of each muscle was calculated for each trial. Separate repeated measures ANOVAs were run to assess differences in mean RMS across time. **Results:** There were no statistically significant main effects for time for any of the muscles ( $P>0.05$ ). Visual comparison of the trends in magnitude across time did not show a consistent pattern among the muscles evaluated. **Conclusion:** It appears that although a runner exhibits signs of fatigue through elevated heart rate and/or perceived exertion, magnitude of the muscle excitation of the lower extremity may not significantly change.

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#### EFFECT OF RUNNING SPEED ON KNEE JOINT BIOMECHANICS IN MALE AND FEMALE NOVICE RUNNERS

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Increased magnitude of joint angles and moments at the knee, particularly in the frontal plane, have been linked to injury in runners. Both running speed and sex are known to influence running biomechanics. However, no study has assessed the differential effects of speed on knee biomechanics in males and females. **PURPOSE:** To determine the influence of running speed on mechanics at the knee in male and female novice runners. **METHODS:** Thirty novice runners participated (male: n=15). Gait analysis was conducted on a treadmill while participants ran at 2.2, 2.7, and 3.1 m/s. Peak knee flexion angle (KFA), knee abduction angle (KABA), knee extension moment (KEM) and knee adduction moment (KADM) were measured during the stance phase. Dependent variables were compared across speeds using repeated measures ANOVA, with sex as a between subjects factor. **RESULTS:** KEM ( $p=.00$ ) and KADM ( $p=.01$ ) increased in magnitude with speed in both males and females. A trend towards greater KFA ( $p=.08$ ) with running speed was also observed. Sex and speed had a significant interaction effect on KABA ( $p=.02$ ), where females increased magnitude of KABA with speed, while males maintained similar values. **CONCLUSIONS:** Increased running speed in novice runners may result in increased magnitude of biomechanical parameters at the knee. Female novice runners appear uniquely prone to increased knee abduction angle with increased speed. This suggests that novice runners should be judicious in addition of faster paced running to their training program.

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### IMPACT OF PROGRESSION RUN ON SAGITTAL PLANE STANCE PHASE KINEMATICS

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The impact of fatigue on distance running kinematics is commonly studied by having runners complete exhaustive runs that alter joint kinematics quite dramatically. In this study, we attempt to assess minor changes that occur during a non-exhaustive progression run, by comparing sagittal plane joint-angle plots for the entire stance phase. **PURPOSE:** Compare baseline and final stance phase kinematics for a 16-minute treadmill progression run to determine if there are significant differences among the hip, knee and ankle. **METHODS:** Nineteen runners participated (18-45 years). Kinematic data were collected using 6 Vicon motion-analysis cameras. Baseline data were collected during a 4-minute run at self-selected marathon pace. A 16-minute progression run ending at marathon pace was then completed. The first 10 clean strides were analyzed during the last minute of the 4-minute run and the last minute of the 16-minute progression run. Stance phase data for each stride was normalized to 101 points. Average joint angle curves for the baseline run were compared to those from the end of the progressive run (for all 101 points). The mean difference score was calculated to quantify kinematic change for the entire phase. Parvo metabolic testing was completed simultaneously to confirm that the progression run caused a significant increase in heart-rate and VO<sub>2</sub>. A one-way ANOVA was used to test for joint differences. **RESULTS:** Kinematic change was calculated for the hip ( $1.9 \pm 1.0^\circ$ ), knee ( $3.4 \pm 2.7^\circ$ ) and ankle ( $1.8 \pm 0.8^\circ$ ). There was a significant joint difference ( $p < 0.05$ ). Post-hoc analysis revealed the knee kinematic change to be significantly greater than the hip and ankle. **CONCLUSION:** The sub-maximal progression run appeared to alter knee kinematics the most. Overall, the kinematic changes were minor, but it is important to note that the knee changes were approximately 80-85% greater than the hip and ankle. This analysis may help to better understand performance and/or injury.

**Abstract Withdrawn**

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### IMPACT OF A PROGRESSION RUN ON STRIDE-TO-STRIDE VARIABILITY OF SAGITTAL PLANE JOINT KINEMATICS

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With recent improvements in motion-analysis, it has become easier to assess many distance running strides to determine how consistent a runner's kinematics are. **PURPOSE:** Determine if stride-to-stride variability (SSV) is altered by a 16-minute submaximal progression run for sagittal plane stance phase joint angles (hip, knee, and ankle). **METHODS:** Nineteen runners (18-45 yrs) participated. Six Vicon Bonita cameras were used to collect kinematic data at 200 Hz. A Parvo metabolic cart was used to confirm the progression run caused fatigue. Baseline data was collected utilizing a 4 minute run at self-selected marathon race pace. After a 5-minute rest period the runners completed a 16-minute progression run which ended at marathon pace for the final data collection. Ten strides were used for SSV calculations. Stance phase joint angles were normalized to 101 data points. SSV was then determined for each joint by calculating the standard deviation (SD) across the 10 consecutive strides. The baseline and final SSV were compared using a 2-way ANOVA. **RESULTS:** The progression run increased the heart rate significantly ( $158.6 \pm 13.4$  to  $169.6 \pm 14.3$ ). Baseline and final SSV data were compared for the hip ( $1.23 \pm 0.37^\circ$  vs.  $1.17 \pm 0.37^\circ$ ), knee ( $1.47 \pm 0.39^\circ$  vs.  $1.51 \pm 0.44^\circ$ ), and ankle ( $1.20 \pm 0.50^\circ$  vs.  $1.21 \pm 0.40^\circ$ ). The ANOVA and post-hoc testing revealed the knee to be the most variable joint overall. However, there were no significant increases in SSV between baseline and final measures. **CONCLUSION:** Despite experiencing metabolic and kinematic changes, the runners maintained the consistency of their mechanics.

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### CORRELATION OF TANDEM WALK TIME AND GAITRITE VARIABLES IN HEALTHY DIVISION I ATHLETES

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The motor control system can often be impaired in collegiate athletes following a concussion. These impairments can be assessed through gait analysis where gait refers to the manner in which locomotion is achieved through the movement of lower limbs. The tandem walk test and a walkway system can be utilized to easily detect impairments of the motor control system through gait assessment. **Purpose:** To assess the relationship between tandem walk time and GaitRITE variables such as; gait velocity (GV), cadence (CA), percent of time spent in double support phase (PDS), and stride length (SL). **Methods:** 37 healthy Division I athletes ( $20 \pm 2$  years) performed three tandem walking test trials in a lab setting for time. 10 trials of normal walking were performed down a GaitRITE to measure GV, CA, PDS, and SL. All trials were averaged and assessed for normality. A Pearson product correlation was run to assess the relationship between average tandem walk time and variables measured by the GaitRITE. **Results:** There were no significant correlations between average tandem walk time and GV ( $p=.23$ ), CA ( $p=.75$ ), PDS ( $p=.23$ ), or SL ( $p=.11$ ). **Conclusion:** The sideline tandem walk test may not be an accurate measure to assess gait impairments. Future research should explore the possibility of a more accurate and sensitive sideline measure to determine the presence of gait abnormalities.

### IMPACT OF A PROGRESSION RUN ON SAGITTAL PLANE SWING PHASE KINEMATICS

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There is a need for robust kinematic measures capable of identifying small changes in distance running kinematics that occur with fatigue. **PURPOSE:** Determine if changes occur in sagittal plane kinematics at the hip, knee, and ankle during the swing phase of a 16-minute progression run. **METHODS:** Seventeen runners participated (injury free and 15+ miles per week). Six Vicon Bonita cameras were used to collect sagittal plane kinematic data at 200 Hz. A Parvo metabolic cart was used to confirm that heart rate and VO<sub>2</sub> increased significantly. During testing, participants ran 4 minutes at self-selected marathon race pace (baseline). The participant was then provided a 5-minute rest prior to a 16-minute progression run that ended with four minutes at marathon pace (final). For both baseline and final, 10 strides were used to generate average swing phase joint angle plots (normalized to 101 data points). The baseline and final plots were compared and an average difference score was calculated to determine kinematic change at each joint. **RESULTS:** Kinematic changes from baseline to fatigue were compared for the hip (2.2±1.1°), knee (3.6±2.5°) and ankle (1.8±1.1°). A one-way ANOVA showed a significant joint difference ( $p < 0.05$ ). A Games-Howell post-hoc revealed the knee kinematic change to be significantly greater than the ankle ( $p < 0.05$ ). **CONCLUSION:** A moderately challenging progression run appeared to alter swing kinematics most at the knee joint. It is important to determine the clinical utility of this approach.

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### BMI IS DIRECTLY RELATED TO GROUND REACTION FORCE AND LOADING RATE DURING STAIR DESCENT

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Obesity is strongly associated with impaired physical function during activities of daily living (ADLs) such as descending stairs - an activity requiring greater demands on the musculoskeletal system than level gait. **PURPOSE:** To examine how obesity affects vertical ground reaction force (vGRF), loading rate, and joint moments during stair descent. **METHODS:** 14 normal and 17 obese (BMI: 22.4 ± 1.8 v. 33.1 ± 2.2) subjects descended a 3-step staircase (h: 16.25 x l: 27.8) at a self-selected speed. A 3D motion analysis system was used (Motion Analysis Corp, Santa Rosa, CA) to collect kinematic and kinetic data. **RESULTS:** Average and Instantaneous Loading rates were both higher in the obese group compared to normal ( $p < 0.0001$ ). BMI was directly related to average loading rate (189.7x + 3000;  $r^2 = 0.208$ ,  $p = 0.010$ ), instantaneous loading rate (192.3x + 2983;  $r^2 = 0.206$ ,  $p = 0.010$ ) and vGRF (39.48x + 80.18;  $r^2 = 0.535$ ,  $p < 0.001$ ). Interestingly, there were no differences between the obese and normal groups for frontal or sagittal knee moments or time to impact. Furthermore, no between group differences were seen when the data was normalized to body weight (BW). **CONCLUSION:** Obesity-induced increases in vGRF and loading rate during stair descent are likely driven by excess body mass. The effect of weight loss on loading rate during stair descent deserves further attention.

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### JOINT WORK REDISTRIBUTION FROM LEVEL TO UPHILL WALKING IN OLDER ADULTS

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On level surfaces, older adults have greater hip joint work and less ankle joint work than younger adults, indicating a redistribution of joint work with age, a phenomenon known as biomechanical plasticity. Since inclined gait emphasizes hip work and is more difficult than the level gait, we hypothesize that the redistribution of joint work with age would be greater in magnitude in inclined vs level gait. **Purpose:** To examine the redistribution of joint work in older adults from level to incline walking. **Methods:** 11 participants (age: 76 ± 4 yrs, BMI = 24.4 ± 2.4 kg/m<sup>2</sup>) walked at a set speed on a level surface (1.8m/s) and on an inclined surface (1.6m/s). Right leg kinematics, kinetics and ground reaction forces were collected for this study. Joint work was calculated using inverse dynamics. **Results:** The joint work at the hip, knee, and ankle for incline walking (0.59 ± 0.16 J/kg, 0.22 ± 0.11 J/kg, 0.43 ± 0.08 J/kg) was significantly greater than level walking (0.24 ± 0.07 J/kg, 0.08 ± 0.03 J/kg, 0.21 ± 0.04 J/kg) (t-test, all  $p < 0.001$ ). The hip to ankle work ratio for level walking increased from 1.14 during level walking to 1.35 during incline walking. **Conclusion:** Older adults increased joint work at all joints during incline walking despite the slower speed. However, the hip to ankle joint work ratio also increased during incline walking, indicating that there is a redistribution of joint work in older adults in inclined vs level walking. The findings from this study indicate that older adults also increase biomechanical plasticity on inclined surfaces.

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### INFLUENCE OF BILATERAL ASYMMETRY ON COUNTERMOVEMENT JUMP PERFORMANCE OUTCOMES

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Assessing bilateral symmetry is common when vertical jumps are measured using dual (left and right) force plates. Examining asymmetry among mechanistic-type variables, such as those related to the timing and magnitude of force production, provides enhanced diagnostic information and may help explain jump performance. **Purpose:** To determine how asymmetry in mechanistic variables influence common countermovement jump (CMJ) performance outcome variables. **Methods:** Participants of this study were seventeen male military college cadets (age: 21.4 ± 1.3 y; height: 1.77 ± 0.06 m; body mass: 81.5 ± 10.0 kg). Participants performed three maximal CMJs on dual force plates. Following data collection, symmetry index (SI%) values were calculated for the following CMJ variables: peak force (PFSI%), Time to peak force (TTPFSI%), rate of force development (RFDSI%), Braking impulse (BISI%), and Time to takeoff (TTTSI%). Zero-order Pearson's product-moment correlation coefficient was then used to examine relationships between SI% and five common CMJ outcome variables (jump height (JH), net impulse (NI), peak force (PF), peak velocity (PV), and peak power (PP)). **Results:** Statistically significant negative relationships were observed between RFDSI% and JH ( $r = -0.597$ ,  $p = 0.011$ ), RFDSI% and PV ( $r = -0.559$ ,  $p = 0.020$ ), and PFSI% and PP ( $r = -0.510$ ,  $p = 0.036$ ). Moderate negative relationships were observed between PFSI% and JH ( $r = -0.426$ ), NI ( $r = -0.336$ ), and PV ( $r = -0.418$ ). Trivial to small relationships were observed between SI% for all other mechanistic variables and CMJ outcome measures. **Conclusions:** These results indicate that asymmetry related to the rate and magnitude of force production during the movement negatively influence several common CMJ outcome measures.

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**UCL STIFFNESS RESPONSE TO A MODERATE PITCHING BOUT**

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Purpose: The effect of a single pitching bout on the material stiffness of the ulnar collateral ligament (UCL) was investigated in five competitive baseball pitchers (age:  $20.0 \pm 2.6$  years). Differences in the response were compared between one pitcher with arm trouble and four asymptomatic pitchers. Methods: Shearwave ultrasound elastography was used to measure the material stiffness of the UCL prior to, and on the four days following, a moderately-intense pitching bout. The pitching bout consisted of a minimum of 50 full-effort pitches in either a practice or game situation. Pitch velocity was measured and maintained within 10% of expected maximum velocity to ensure full effort was given. Participant arm health was measured using the Kerlan-Jobe Orthopaedic Clinic Shoulder and Elbow Score (KJOC) prior to the first imaging session. Results: Four pitchers reported "playing without any arm trouble" with a mean KJOC score of 90.4 out of 100.0. One pitcher reported "playing, but with arm trouble" and had a KJOC score of 60.2. The four asymptomatic pitchers showed an immediate increase in UCL stiffness (+15.99%) compared to baseline followed by a marked decrease, trending towards returning to baseline values on days 2-4. The UCL stiffness of the pitcher who was "playing, but with arm trouble" showed a much different immediate response (-29.47%) before returning towards baseline values on days 2-4. Conclusions: UCL material stiffness in a pitcher with arm trouble responded differently to a moderate pitching bout compared to a small sample of asymptomatic pitchers. A decrease in material stiffness of the UCL immediately following a pitching bout may be evidence of elbow distress and be useful in the identification of pitchers with increased injury risk.

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**THE RELATIONSHIP BETWEEN BMI, LEAN MASS, AND BODY FAT PERCENTAGE WITH BALANCE IN COLLEGIATE ARCHERS**

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For shooting sports, static balance can have a dramatic impact on successful athletic performance. More specifically, archers need to have a firm foundation and adequate balance during practice and competition. Prior studies, using various athlete types, have evaluated the relationship between body composition and flexibility, coordination, etc. However, there appears to be no prior studies that compared BMI, body fat percentage (BF%), leg lean mass (LLM), and trunk lean mass (TLM) with balance in archers. PURPOSE: To investigate the potential relationship between BMI, BF%, LLM, and TLM on balance in collegiate archers. METHODS: After having height, weight, and age recorded, 11 (7 males, 4 females) collegiate archers had their body composition (ie. BF%, LLM, TLM, and BMI) assessed. Then, after the completion of a warm-up and a series of flexibility tests (ie. sit and reach, back scratch test, and trunk extension), subjects had their balance, with a balance system, evaluated via an athletic single leg assessment feature. RESULTS: There was no relationship between balance and BF% ( $p = .79$   $r = -.091$ ) and a low correlation occurred with balance and BMI ( $p = .387$   $r = .290$ ). However, there was a moderately high correlation between balance and TLM ( $p = .028$   $r = .656$ ) and a high correlation between balance and LLM ( $p = .003$   $r = .801$ ). CONCLUSIONS: BF% appears to have no relationship with balance, while BMI has very little impact. Yet, LLM and TLM may influence static balance. Future research may be required to evaluate LLM and TLM with balance using a larger population in order to further explore this potential relationship.

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**THE EFFECTS OF ANKLE TAPING ON DOUBLE LEG BALANCE AFTER PLYOMETRIC EXERCISES**

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Ankle taping (AT) is a common preventative method to decrease the likelihood of ankle ligament injuries. Ankle proprioception and postural control can be altered due to the restriction caused by AT and therefore, athletes need to be aware of the potential changes. PURPOSE: To compare AT center of pressure displacement (COPDsp) vs no ankle taping (NT) COPDsp, in the X- and Y- direction, before and after a fatiguing plyometric protocol. METHODS: Descriptive data (Ht., Wt., BF%, age) was measured for 13 averagely fit college-age males. AT and NT sessions were prescribed in a counterbalanced order. Both sessions were separated by no less than 72 hours and no more than 96 hours of recovery. Each subject completed the same plyometric protocol and balance testing pre- and post- fatigue with eyes closed (EC) and open (EO) trials. Significant differences for COPDsp between pre- and post- fatigue and both taping sessions were measured using a 2x2x2 RMANOVA. Paired-Samples T-test was used to compare interactions between each variable. Statistical significance was set at  $p < 0.05$  for all analyses. RESULTS: The interaction between AT and NT, EC and EO, and COPDsp was significant ( $p = 0.006$ ). COPDsp in X and Y-direction approached significance in pre-AT EO trials (.1347 vs .1695 cm,  $p = 0.055$ ) when compared to pre-NT EO trials (.4078 vs .5214 cm,  $p = 0.052$ ). CONCLUSIONS: AT restricted the range of motion for the ankle, decreasing COPDsp in both directions. Future studies may seek to evaluate collegiate athletes with experience wearing AT and the resulting effects during a dynamic balance test.

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**CHANGE IN DIRECTION TASK ACROSS DIFFERENT PLAYING SURFACES**

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The following study was designed to focus on one of the most important, and poorly understood variables regarding agility performance; shoe to surface interface. PURPOSE: The purpose of this project was to compare performance on 4 different playing surfaces (one natural turfgrass and three artificial turf systems of varying blade heights and infills) in light of plant leg, approach angle during a change of direction (COD) task. METHODS: Seven participants between the ages of 19 and 30 (height =  $1.79 \pm 0.08$  m; mass =  $75.9 \pm 10.1$  kg) were recruited for this study. Participants were allotted time to warm up before performing three change of direction trials (5-10-5) for maximal effort. Time to complete the task was measured with a photogate timing system, while approach angle was measured using standard video analysis. The camera was positioned 10 feet from the COD task and the angle was measured utilizing Dartfish® Software. RESULTS: A repeated measures MANOVA indicated significance differences between the approach angle on surface 1, and surface 2 and 3, ( $p = .039$ ,  $p = .010$ , respectively). With respect to time to complete the COD trials on each surface, the fastest times appeared on surface 1, along with the smallest approach angle. CONCLUSION: It is tempting to conclude that the smallest angle and shortest times mean that surface 1 was preferable. However, the natural surface produced like approach postures, but poorer performance which suggests that the surface plays a large role in performance. Previous research has indicated that artificial surfaces yield better performance outcomes, but this project advances the field by indicating that the performance outcome differences are not due to approach posture.

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### COMPARISON OF STIFFNESS IN HEALTHY FEET AND FEET WITH PLANTAR FASCIITIS USING SHEER WAVE ELASTOGRAPHY

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Purpose: Plantar fasciitis (PF) is a common condition resulting from inflammation of the aponeurosis connecting the calcaneus to the metatarsal heads. Little is understood about the pathogenesis of PF. The purpose of this study is to compare the plantar fascia stiffness in the feet of participants with PF to participants with healthy feet. Methods: Ultrasound Sheer Wave Elastography (SWE) was performed on 10 PF and 7 healthy participants to investigate material properties of the feet using an Aixplorer ultrasound system (SuperSonic Imagine, Aix-en-Provence, France). SWE measurements were taken at the proximal and distal regions of the plantar fascia at 40% and 75% distance of foot length, respectively. A 1 mm circle of interest was positioned in the center of the structure and the mean shear modulus was calculated. Given the small sample size, data were descriptively analyzed and a Hedge's g effect size (ES) was calculated. Results: When comparing healthy proximal plantar fascia to symptomatic, the stiffness was greater in the healthy group; 214 (91) kPa vs. 144 (105)kPa (ES .72). In the distal region, healthy vs. symptomatic was 93 (47)kPa vs. 84 (27)kPa (ES .26). When compared to symptomatic feet, the average value for nonsymptomatic feet in the proximal region was 206 (60)kPa (ES .73), and 112 (50)kPa in the distal region (ES .70). The shear modulus of the plantar fascia was greater at the proximal plantar fascia than the distal plantar fascia in both healthy and symptomatic feet, which indicates inhomogeneous values across different regions of the fascia. Conclusions: The shear modulus in asymptomatic feet was stiffer than that of symptomatic feet, especially in the proximal region. This loss of plantar fascia modulus may be diagnostic of PF, particularly in the proximal region.

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### DO DISTANCE RUNNING SAGITTAL PLANE KINEMATICS BECOME MORE BILATERALLY ASSYMETRIC DURING A PROGRESSION RUN?

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For distance running, clinicians and researchers are interested in determine how bilaterally symmetric (or asymmetric) kinematics are. It is unclear if fatigue influences bilateral symmetry. PURPOSE: Assess bilateral symmetry (during stance and swing) at baseline and at the end of a 16-minute treadmill progression run to determine if runners become less symmetric at the hip, knee and/or ankle. METHODS: Nineteen runners (18-45 years, 15+ miles per week) participated in the study. Kinematic data were collected at self-selected marathon pace (baseline data) and again at the end of a 16-minute progression run (final data). Average joint angle plots were compared for the right and left leg (10 strides). The mean difference score was calculated (symmetry score for the phase). Parvo metabolic testing was completed simultaneously to confirm fatigue. A two-way ANOVA was used to test for significant bilateral difference. RESULTS: Baseline and final bilateral differences were calculated for hip stance (2.6±1.1°; 3.0±1.6°) and swing (3.4±1.7°; 4.2±2.2°), knee stance (2.8±1.0°; 3.6±2.6°) and swing (5.3±2.5°; 6.1±2.5°), and ankle stance (2.6±1.6°; 3.3±2.7°) and swing (3.1±1.1°; 3.5±1.6). There were no significant differences between baseline and final measures. Post-hoc analysis revealed the knee swing to be significantly more asymmetric than the other conditions. CONCLUSION: The progression run did not appear to influence bilateral symmetry at the ankle, knee, and/or hip. Knee swing appears to be the most asymmetric phase.

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### COMPARISON OF OPTIMAL AND ISOMETRIC FORCE IN SQUATS

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Lower limb posture is a major determinant of endpoint force production. PURPOSE: This study compared measured endpoint forces (EF) to optimal endpoint forces (OEF) predicted based on lower limb posture during an isometric squat. METHODS: 35 individuals were recruited to perform 8 maximal effort isometric squats at 4 different lower extremity postures. Postures were determined from kinematic data taken during countermovement jumps. Four postures taken at equal intervals of the range of motion used in the concentric phase of the jump were selected. Participants were placed in these postures while standing over two force plates. Participants were asked to push vertically with as much force as possible. Kinematic and kinetic data were collected using Vicon cameras and AMTI forceplates. The dot product between EF and OEF as well as vertical EF and vertical OEF were kept for analysis. RESULTS: A one-way repeated measures ANOVA showed an interaction between posture and the dot product of EF and OEF ( $F(3,102) = 8.28, p < 0.001$ ). A mixed model ANOVA showed significant main effects for posture ( $F(3,102) = 73.10, p < 0.001$ ) and EF/OEF comparison ( $F(1,34) = 108.88, p < 0.001$ ). A significant posture by EF/OEF comparison was found ( $F(3,102) = 5.42, p = 0.002$ ). CONCLUSIONS: Lower limb posture influenced endpoint force production, and the most extended posture showed the least optimally oriented endpoint force. EF in isometric squats is not always aligned with the optimal direction.

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### RELATIONSHIP OF LUMBOPELVIC-HIP STABILITY ON BALL SPEED IN FEMALE WINDMILL SOFTBALL PLAYERS

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The dynamic movement of the windmill softball pitch requires the body acting as a kinetic chain working in a proximal to distal manner. If the end result is to generate the greatest ball speed, one has to transfer energy via proximal stability for distal mobility. Optimal energy transfer from the lower to upper extremity requires the stability of the lumbopelvic-hip complex (LPHC). PURPOSE: To examine the relationship between LPHC stability, as defined by knee valgus while performing a single leg squat (SLS), on ball speed during the windmill softball pitch. METHODS: Eleven right-handed softball pitchers (13.7 ± 2.1 yrs; 163.8 ± 8.0 cm; 66.3 ± 11.0 kg; 48.4 ± 5.1 mph) volunteered to participate. Kinematic data were collected via an electromagnetic tracking system. Participants performed a SLS on their stride leg (left leg) and threw three fastball pitches for strikes to a catcher (43 ft). Stride leg knee valgus was assessed at 45° of knee flexion during the SLS. RESULTS: A Pearson correlation coefficient determined a significant strong positive relationship between SLS knee valgus and ball speed ( $r(11) = 0.63, p = 0.04$ ). CONCLUSION: The SLS is a common clinical assessment used to evaluate LPHC stability and injury susceptibility. The positive relationship of increased knee valgus during the SLS and increased ball speed are unexpected. It has been established that decreased knee valgus during the SLS has been associated with LPHC stability; and a more stable LPHC is needed for efficient energy transfer in throwing. Thus, the current findings bring about greater inquiry into, not only LPHC stability in youth softball pitchers, but also a need for further investigation into the pitching mechanics of these youth.

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## EFFECTS OF FOUR YEARS OF COLLEGE ATHLETIC PARTICIPATION ON NORMAL WALKING VARIABLES

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Abnormalities in college athletes can often be due to pain, injury, surgery, neurological injury or disorders, and many other factors. An abnormal gait pattern can often lead to an increase in fall risk as well as back pain, poor mechanics and future injury. Although acute abnormalities are often studied, the long-term effects of participation in collegiate athletics is not heavily researched. Purpose: To evaluate the effects of participating in four years of collegiate athletics on normal walking gait mechanics. The variables of interest include Velocity, H-H Base of Support (H-HBSup), and Double Support Percent (DS%). Methods: Nine collegiate NCAA Division I athletes who had all participated in their respective sport for at least 4 years were used in this study. All participants completed testing prior to the start of their first athletic competition and following their last athletic competition. The participants were instructed to walk at a normal self-selected pace for ten trials down a pressurized walkway. The ten trials were averaged and a one-way ANOVA were run on the variables of interest to determine any variations between the baseline and post-athletic career data. Results: No significant differences were noted between baseline and post-athletic career, velocity ( $p=.778$ ); H-HBSupL ( $p=0.673$ ); H-HBSupR ( $p=0.774$ ); DS%L ( $p=0.534$ ); DS%R ( $p=0.503$ ). Conclusion: These results suggest that there may be no effect on normal walking mechanics after participating in four years of collegiate athletics. Examining more sensitive gait mechanics, such as gait initiation, could reveal more subtle changes if any were to exist.

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## THE EFFECT OF CUEING ON CADENCE, EFFICIENCY AND PERFORMANCE IN THE RECREATIONAL RUNNER

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Self-verbal cueing may improve cadence, efficiency, and performance in runners. Purpose: The influence of self-verbal cueing and participant education on running cadence, a measure of efficiency and performance, was investigated in 14 recreational runners. Methods: Following screening examination, participants completed a warm up on a motor-driven treadmill, followed by 2 sets of 5 minutes running at self-selected pace with a 10-minute rest between to establish baseline values. Educational instruction was provided to the experimental group on self-verbal cueing. Following 4 weeks of training both groups completed re-assessment, with the experimental group utilizing self-verbal cueing. Kinematics were collected with a 14 camera Vicon Bonita 10 camera system. Results: With self-verbal cueing, experimental mean cadence improved by 6.225 +/- 5.237 steps/min, representing a 3.739% increase while the control mean cadence was -0.302 +/- 4.666 steps/min, representing a 0.119% change. Running speed followed a similar trend with experimental mean speed improving by 0.162 +/- 0.075 m/s while the control mean speed was -0.082 +/- 0.139 m/s. An independent samples t-test compared mean values between experimental and control groups respectively ( $t(12)=2.41, p=0.033$ ;  $t(12)=2.12, p=0.055$ ). Statistical analysis was performed utilizing SAS Enterprise Guide 7.1 (SAS Institute Inc., Cary, NC). Conclusions: These findings suggest that self-verbal cueing is effective at increasing running cadence while maintaining efficient stride length. Increased cadence has been shown to reduce impact forces, and cueing may positively impact performance without adversely impacting speed.

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## GAIT SUFFERS MORE THAN COGNITION DURING TREADMILL DESK USE

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PURPOSE: The concept of dual tasking states that humans have limited cognitive resources and when two tasks are performed simultaneously, more attention will be allocated to the primary task, causing an impairment in the secondary task. Research is lacking regarding working-age adults who use active workstations, such as a treadmill desk. Therefore, the purpose of this study was to investigate the effects of dual tasking in adults while walking on a treadmill desk and performing cognitively demanding tasks. METHODS: A total of  $n=48$  adults ages 18-65 (mean  $37.73 \pm 16.53$  years) were enrolled in this study. Participants walked on a treadmill desk at a self-selected speed ranging between 0.5 and 2.0 miles per hour while completing two cognitively demanding tasks (typing test and phoneme monitoring test, which measures ability to listen to a story and answer questions). On a different day, the same tasks were completed while seated. Step length, stride length, and gait cycle, as well as coefficients of variation (CV) for each variable were assessed by the OptoGait system during the treadmill desk session. Dual task cost (DTC) for each task was also calculated; the formula for the cognitive tasks was  $ABS((\text{performance while seated} - \text{performance while walking})/\text{performance while seated}) * 100$  while formula for gait parameters was  $ABS((\text{gait parameter at baseline} - \text{gait parameter during cognitive task})/\text{gait parameter at baseline}) * 100$ . A higher DTC indicated a greater decrement during the dual tasking. RESULTS: The DTC for stride length was significantly greater than the DTC for phoneme monitoring quiz score and phoneme monitoring overall score ( $p=0.000$  and  $p=0.000$  respectively) but was not significantly greater than DTC for typing accuracy ( $p=0.078$ ) or typing speed ( $p=0.172$ ). The DTC for step length was significantly greater than DTC for typing accuracy but not typing speed ( $p=0.005$  and  $p=0.146$ ) and was greater for phoneme monitoring overall score but not quiz score ( $p=0.010$  and  $p=0.345$ ). CONCLUSIONS: Overall, the dual task cost of gait was greater than the dual task cost of typing and phoneme monitoring, two cognitively challenging tasks. These data suggest that during dual tasking, adults' gait patterns suffer more than their cognitive performance.

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## TREADMILL DESK WALKING IMPROVES TYPING PERFORMANCE IN YOUNG BUT NOT MIDDLE-AGED ADULTS

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PURPOSE: Exercise-induced arousal has been shown to increase cognitive task performance; however, the effect of age and work-related tasks are unknown. The purpose of this study was to compare typing test speed and accuracy in both young adults and middle-aged adults while walking on a treadmill desk versus a traditional seated desk. METHODS: College-aged individuals ( $n=21$ ) and middle-aged adults ( $n=25$ ) were recruited for this study. Participants completed a three minute typing test while walking on a treadmill desk at a self-selected speed (mean speed for young adults = 1.5 mph, middle-aged adults = 1.4 mph) and while sitting at a desk. An OptoGait system was used to measure gait parameters in real time during the walking condition. RESULTS: There were no significant differences in any gait parameters when comparing young vs middle-aged ( $p>0.05$ ) or while comparing typing while walking vs walking only ( $p>0.05$ ). Further, there were no differences in typing test scores by age group ( $p>0.05$ ). Young adults scored higher on typing speed ( $p=0.00$ ), typing accuracy ( $p=0.00$ ), completed less typing errors ( $p=0.00$ ), and received less error deductions ( $p=0.00$ ) when walking on a treadmill desk compared to when seated. CONCLUSION: Results suggests that young adults improve typing performance when walking at a self-selected speed without impairment to gait parameters. This study supports the theory that cognitive arousal associated with exercise or physical activity can be applied to a work-related task. The same effect was not observed in middle-aged individuals, implying that these arousal effects may have an age cut off. Support by: Samford University Faculty Development Grant

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### **EFFECT OF DUAL-TASKING DURING TREADMILL DESK USE ON GAIT CHANGES IN YOUNG AND MIDDLE-AGED ADULTS**

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**P93** PURPOSE: Treadmill desks have been used regularly to increase physical activity and decrease sedentary time in the work environment. However, dual-tasking, such as walking and performing a cognitive task, may result in diminished performance of one or both tasks. The effect of using a treadmill desk on gait changes while dual tasking has not been studied in various age groups. Therefore, the purpose of this study was to examine the effect on gait parameters during dual tasking (treadmill desk use and cognitive task performance) in young versus middle-aged adults. METHODS: A total of n=23 young (age range 18-25; mean age 21.13±1.66 years) and n=25 middle-aged (age range 45-65; mean age 53.00±5.11 years) male and female participants were recruited and completed a total of four cognitive tests (Stroop Color & Word Test, Sternberg Test of Working Memory, Phoneme Monitoring, and Serial 7 Subtractions). During all testing, participants walked on a treadmill desk at a self-selected speed between 0.5 and 2.0 miles per hour. Step length, stride length, and gait cycle, as well as coefficients of variation (CV) for each variable were assessed by the OptoGait gait analysis system. RESULTS: There were no statistically significant differences between the young and middle-aged groups in step length, stride length, or gait cycle or in CV for those parameters ( $p > 0.05$  for all comparisons) while walking on a treadmill desk and simultaneously performing cognitive tasks. CONCLUSIONS: Middle-aged individuals do not have altered gait mechanics compared to young people while dual tasking using a treadmill desk. These data indicate that fall risk due to gait instability is not elevated in middle-aged compared to young adults due to effects of dual-tasking and that safety concerns should not limit use of treadmill desks in middle-aged adults.

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### **EFFECT OF REPEATED MOTOR CONTROL TESTING ON TIME TO PEAK LOWER EXTREMITY MUSCLE ACTIVITY**

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**P94** PURPOSE: Postural control has demonstrated the ability to adapt lower extremity muscle activity (LEMA) to rapidly changing environmental conditions with repeated exposure. A common method for assessing postural responses to external perturbations is the Motor Control Test (MCT). Previous studies have demonstrated decreased LEMA with repeated MCTs without changes in reaction time, yet no study has examined peak LEMA onset latencies. Thus the purpose of this study was to evaluate time to peak LEMA (TTP) after repeated MCT exposure. METHODS: Eighteen healthy participants completed the study. Post familiarization, participants performed five full randomized MCTs over six testing sessions. The first five sessions occurred on consecutive days, with the sixth occurring two days after the fifth. Muscle activity was recorded using a Noraxon EMG system from the right vastus medialis (Q) and semitendinosus (H). TTP was calculated in seconds (s) for the first forward medium perturbation and was analyzed using a 1x6 [Condition x Day] RMANOVA at  $p \leq 0.05$ . RESULTS: Significant main effect was noted for Q with Day 1 (1.091s ± 0.99) exhibiting a higher TTP than Days 2 (0.904s ± 0.4) and 3 (0.708s ± 0.124) but not Days 4, 5, and 6. No significant differences were found for H across all days. CONCLUSIONS: Previous literature has demonstrated that muscle activity onset latencies change after repeated perturbations. Our findings demonstrated that Day 1 Q muscle activity took longer to reach peak LEMA than Days 2 and 3 suggesting an adaptation to repeated exposure, but this response was short-lived which may represent an over compensation of the postural control system to the initial perturbations.

### **EXCESSIVE WEIGHT GAIN THROUGHOUT ADULTHOOD IS ASSOCIATED WITH SHORTER TELOMERE LENGTHS, PRO-INFLAMMATION, AND PSYCHOLOGICAL STRESS**

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**P95** PURPOSE: More than 70% of United State adults are overweight or obese. This contributes to the development of pro-inflammatory diseases and higher levels of daily perceived psychological stress (PPS), which exacerbate pro-inflammatory disease pathology. Telomeres are TTAGGG repeats at the ends of cellular chromosomes that protect DNA from damage and degradation. While telomere lengths (TL) within immune cells typically shorten with age, little is known about lifestyle factors that may accelerate TL shortening. METHODS: Eleven normal-weight (NW) and 12 overweight/obese (OW/OB) middle-aged adults (40-64 years) reported weight recall at each decade of life. Each subject reported PPS and provided blood samples for plasma TNF- $\alpha$  concentration and immune cell TL analysis. RESULTS: Differences in reported weight between the OW/OB and NW groups were apparent at age 30 ( $p = 0.015$ ), and increases in weight gain since age 30 in OW/OB compared to NW subjects ( $p = 0.002$ ) were associated with shorter TL (group difference:  $p = 0.003$ ;  $r = -0.394$ ,  $p = 0.032$ ), elevated plasma TNF- $\alpha$  concentrations (group difference:  $p = 0.046$ ;  $r = 0.374$ ,  $p = 0.040$ ), and greater levels of PPS (group difference:  $p = 0.011$ ;  $r = 0.415$ ,  $p = 0.025$ ). Furthermore, shorter TL were associated with elevated plasma TNF- $\alpha$  concentrations ( $r = -0.435$ ,  $p = 0.019$ ) and indices of PPS ( $r = -0.625$ ,  $p = 0.001$ ). CONCLUSION: These data suggest that excessive weight gain leading to systemic pro-inflammation and elevated PPS may accelerate TL shortening.

### **INFLAMM-AGING IS ASSOCIATED WITH IMPAIRING THE PROCESS OF MAINTAINING TELOMERE LENGTH IN LPS STIMULATED PBMCs**

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**P96** PURPOSE: This study examined the impact of the inflamm-aging phenotype on the capacity of isolated PBMCs to express a key mechanistic component involved in maintaining longer telomere lengths, human telomerase reverse transcriptase (hTERT), following ex vivo cellular stimulation with lipopolysaccharide (LPS). METHODS: Plasma inflammatory cytokines (i.e., IL-6, IL-10, TGF- $\beta$ , and TNF- $\alpha$ ), PBMC telomere lengths, and LPS-stimulated hTERT mRNA expression following ex vivo stimulation of PBMCs with LPS in 15 middle-aged (40-64 years) and 15 young adults (20-31 years) were quantified. RESULTS: Aging was accompanied by the accumulation of centrally located visceral adipose tissue ( $p \leq 0.005$ ), in the absence of weight gain ( $p = 0.932$ ) or changes in BMI ( $p = 0.081$ ), and alterations in the systemic inflammatory milieu (decreased plasma concentrations of the anti-inflammatory cytokine TGF- $\beta$ ; increased plasma concentrations of the pro-inflammatory cytokine TNF- $\alpha$  [ $p \leq 0.050$ ]). Likewise, shorter telomere lengths in middle-aged compared to young adults ( $p = 0.011$ ) were associated with increased age, body fat percentages, and plasma TNF- $\alpha$  concentrations ( $r = -0.404$ ,  $p = 0.027$ ;  $r = -0.427$ ,  $p = 0.019$ ;  $r = -0.323$ ,  $p = 0.041$ , respectively). Finally, the capacity of PBMCs to express hTERT mRNA following cellular stimulation was impaired in middle-aged compared to young adults ( $p = 0.018$ ), and negatively associated with telomere lengths ( $r = 0.353$ ,  $p = 0.028$ ). CONCLUSIONS: Inflamm-aging is associated with the impaired the capacity of PBMCs to express hTERT mRNA and provides a mechanistic target to counter age-related telomere attrition and disease.

#### **EFFECT OF MODERATE INTENSITY EXERCISE TRAINING ON HEART RATE VARIABILITY IN OBESE ADULTS DURING EXERCISE**

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**PURPOSE:** To examine the impact that continuous, moderate intensity exercise (MIE) training has on autonomic function, as measured by heart rate variability (HRV) in obese individuals during exercise. **METHODS:** Eleven obese individuals [5 men, 6 women; Body mass index (BMI) =  $39.2 \pm 6.3$ ] underwent 12 weeks of exercise training at 60% of predicted VO<sub>2</sub>max, determined via submaximal treadmill test. Body composition was assessed via dual-energy x-ray absorptiometry, and HRV was obtained via Polar RS800CX, and analyzed with Kubios HRV software. **RESULTS:** Predicted VO<sub>2</sub>max ( $28.2 \pm 3.5$  mL.kg<sup>-1</sup>.min<sup>-1</sup> and  $27.4$  mL.kg<sup>-1</sup>.min<sup>-1</sup> for baseline and follow-up, respectively,  $P > 0.05$ ) and body composition was unchanged after training. During early exercise (METs =  $3.0 \pm 0.7$  and  $2.9 \pm 0.3$  for baseline and follow-up, respectively,  $P < 0.05$ ) heart rate was significantly lower following training ( $116.1 \pm 13.3$  vs.  $106.5 \pm 12.5$  bpm,  $P = 0.001$ ). The standard deviation of R-R intervals (SDNN), root-mean square of differences between adjacent R-R intervals (RMSSD), high frequency components (HFlog), and the standard deviation of instantaneous beat-to-beat variability (SD1) were all improved following exercise training, suggesting greater sympathovagal balance. HRV during the last stage of exercise (METs =  $5.8 \pm 0.8$  and  $5.8 \pm 1.0$ ,  $P > 0.05$ ), when parasympathetic withdrawal has occurred, did not change following training. **CONCLUSION:** Despite no changes in cardiorespiratory fitness or body composition following 12-weeks of MIE, autonomic functioning improved. This suggests that improvements in long-term health outcomes can be achieved independent of body composition or cardiorespiratory fitness adaptations.

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#### **ANTHROPOMETRIC AND PHYSIOLOGICAL OUTCOMES ARE IMPROVED AFTER ONCOLOGY CERTIFIED NURSE-SUPERVISED EXERCISE TRAINING IN CANCER SURVIVORS**

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**PURPOSE:** Although studies demonstrate varied benefits of exercise in cancer survivors, continued research is needed to determine the optimal cancer-specific exercise training program. The purpose of this study was to evaluate the anthropometric and physiological effects and safety of an Oncology Certified Nurse (OCN)-supervised, American College of Sports Medicine (ACSM)/American Cancer Society (ACS) Certified Cancer Exercise Trainer (CET)-facilitated exercise training program model in cancer survivors across multiple cancer diagnoses. **METHODS:** Oncologists referred eligible cancer survivors to "Moving On," a 12-week, 3 days/week exercise training program, after having completed chemotherapy or on maintenance therapy. Body mass index (BMI), body composition, peak oxygen uptake (VO<sub>2</sub>peak), muscle strength and endurance, and injury incidence were evaluated in interested and eligible program participants pre- and post-intervention. **RESULTS:** Survivors (N=11) who completed the program with  $\geq 80\%$  attendance were evaluated. No change in BMI or fat mass occurred. Body fat free mass (FFM) and truncal FFM increased  $3.5\%$  ( $p=0.02$ ) and  $3.8\%$  ( $p=0.01$ ), respectively. VO<sub>2</sub>peak increased  $20.2\%$  ( $p<0.01$ ). Upper ( $n=8$ ) and lower ( $n=9$ ) body muscular strength increased  $27.4\%$  ( $p<0.05$ ) and  $19.1\%$  ( $p<0.05$ ), respectively. Upper and lower body muscular endurance increased  $76.8\%$  ( $p<0.001$ ) and  $76.3\%$  ( $p=0.001$ ), respectively. No injuries were reported. **CONCLUSION:** Cancer survivors across multiple diagnoses who participate in an OCN-supervised, CET-facilitated program may experience significant anthropometric and physiological benefits with reduced incidence of injury.

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#### **INCREASING REHABILITATION ADHERENCE AND FUNCTION THROUGH PERSONALIZED FEEDBACK IN STROKE**

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Therapy compliance is poor after stroke; feedback may improve compliance. **Purpose:** Function and adherence to robotic therapy with two levels of text-based feedback was evaluated in stroke survivors. **Methods:** Nine post-stroke volunteers with upper extremity impairments attempted 2 hours of daily home-based robotic therapy for 3 months. Subjects were divided into groups that received no text (N), generic texts (G), or personalized (P) text messages daily. Those in the G group received daily encouragement to continue prescribed therapy. The P group received a message quantifying their current activity time, defined as the percentage of achieved prescription, along with words of encouragement. **Results:** Action research arm test (ARAT), Barthel, and Center for Epidemiologic Studies Depression (CES-D) scores, and robot activity time were analyzed in 5 volunteers (4 in the N group, 1 in the P group). Mean change in pre and post ARAT scores for N group was  $-10\%$ ; for P group  $45\%$ . Mean change for Barthel in N group was  $11\%$ ; no change in P. Mean change in CES-D for N group was  $17\%$  and P group  $82\%$ . The P group improved in the ARAT while the N group regressed. The N group improved in the Barthel but obtained the same post score as the P group. CES-D scores in both groups improved. The N group averaged  $3.2\%$  (SD .056) and the P group  $29.8\%$  of the total prescribed time for robotic therapy. No data was available for the G group. **Conclusion:** Results indicate that personalized feedback yields greater adherence and functional improvement compared to no feedback. We theorize a motivational component leads to improved function via compliance. Funded by the VA Office of Rural Health.

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#### **THE FEASIBILITY AND EFFECT OF WEIGHT LOSS INTERVENTION ON PATIENTS WITH FIBROMYALGIA**

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Nearly 4 million adults in the United States are living with Fibromyalgia (FM). Of those diagnosed, as many as 70% are considered overweight or obese. **Purpose:** To assess the feasibility of an exercise and dietary weight loss program for patients with FM. **Methods:** Participants ( $n=10$ ) engaged in a 24-week group based, behavioral intervention. Self-reported measures were utilized to assess function, symptoms, and pain as an assessment of FM severity. Body mass was measured through dual-x ray absorptiometry (DXA) scan at baseline and follow up. Feasibility was analyzed by examining recruitment rates, session attendance, change in exercise minutes, and the occurrence of adverse events. Paired samples t-tests and Cohen's D were used to assess change and effect size. **Results:** On average, participants were  $54.9 \pm 6.2$  years of age and had a mean BMI of  $35.57 \pm 8.02$  kg/m<sup>2</sup>. The sample was predominately female (100%), white (80%) and married (70%). Despite efforts, recruitment rate was low at 4.1%. Participants attended 47% of exercise sessions, and had high retention for both DXA scans (80%) and follow up measurements (100%). A significant increase in minutes walked was observed ( $29.62 \pm 9.25$  mins;  $p = 0.031$ ). However, no significant improvement was seen in disease severity ( $p = 0.66$ ) or pain ( $p = 0.47$ ). **Conclusions:** While target sample recruitment was low, group session attendance was similar to previous research. The intervention appeared to be well tolerated, as shown through retention and exercise minute measures. There were no significant changes in FM severity or pain, despite moderate weight loss.

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### EFFECT OF HIGH INTENSITY AEROBIC TRAINING ON FITNESS AND HEALTH IN INDIVIDUALS WITH PARKINSON'S DISEASE

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Parkinson's disease (PD) is a neurodegenerative disorder characterized by movement dysfunction. Impaired mitochondrial capacity, as well as glucose and lipid toxicity, have been linked to neuronal dysfunction and apoptosis. Although aerobic exercise impacts these outcomes, little is known in PD. PURPOSE: We tested the hypothesis that high intensity aerobic exercise (AEX) would improve aerobic fitness and metabolic outcomes. METHODS: Nineteen subjects (11 female, age: 67.5 ± 1.4 yrs) with idiopathic PD (Hoehn and Yahr stage 2 or 3) were enrolled in a 16-week supervised aerobic exercise program. Subjects exercised 3d/wk at a rating of perceived exertion (RPE) of 15–17 for 30 min. They also performed 30 min. of unsupervised exercise 2d/wk at an RPE of 10–12. Paired sample t-tests were used to assess fitness (VO<sub>2</sub>peak), 6 min. walk (m), body weight (kg), body fat % (BIA), respiratory exchange ratio (RER; indirect calorimetry), blood pressure (BP), heart rate (HR), as well as fasting glucose and free fatty acids (FFA) pre/post intervention. RESULTS: AEX increased VO<sub>2</sub>peak (p=0.004) and distance covered during the 6 min. walk (p=0.0001). AEX also reduced systolic BP (p=0.007) and fasting FFA (p=0.03). There were no alterations in body weight, body fat %, diastolic bp, HR, RER or fasting glucose. CONCLUSION: An AEX intervention improves fitness and metabolic health independent of weight loss in PD.

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### DIABETES AND LACTATE THRESHOLD

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Lactate is a byproduct of glucose utilization in muscle cells, and lactate threshold is reached when lactate production exceeds lactate usage in the body during exercise. It has been thought universally that the better the training level in an individual, the later the onset of lactate threshold. We evaluated the onset of lactate threshold in type 1 diabetics and non-diabetics to see if the timing is different between the two groups. Purpose: The purpose of this study was to determine if Type 1 Diabetics have a similar or different timing of the onset of Lactate Threshold during exercise in comparison to non-diabetics. Method: Before beginning testing, height, weight, body fat percentage, and physical activity levels are assessed. Nine healthy Type 1 Diabetics, and nine healthy non-diabetics, were tested in a single session during which a treadmill VO<sub>2</sub>max test was performed including lactate and blood glucose testing. Results: Diabetics had a significantly (p<0.05) higher amount of lactate than non-diabetics during exercise independent of speed or fitness level. At 4.5 mph, Diabetics had an average lactate value of 6.4mmol/L while non-diabetics had an average lactate value of 3.1mmol/L. Glucose values were also significantly (p<0.05) higher in diabetics versus non-diabetics at all times, Type 1 diabetics averaging 99 mg/dL higher than non-diabetics. Body fat percentage and max heart rate were not statistically significant between the two groups. Conclusion: Results of this study suggest that individuals with Type 1 Diabetes have a significantly higher amount of lactate in the body than non-diabetics during exercise (p<0.05) regardless of the speed or fitness level of the individual.

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### COMPARISON OF PHYSICAL ACTIVITY LEVELS DURING THERAPEUTIC CAMP ACTIVITIES IN YOUTH WITH DISABILITIES

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Youth with disabilities have limited opportunities to engage in leisure time physical activity (PA). Outdoor therapeutic recreation (TR) camps provide diverse PA opportunities that include structured (dramatic, functional, game, constructive) and unstructured (free time) activities that have the potential to benefit these individuals cognitively and physically. However, little is known about the PA levels during these activities. Purpose: To compare the PA levels of youth attending an outdoor TR camp, across various activity contexts. Methods: Youth (n=29; 14.6±3.9 y) with disabilities attending an overnight TR camp, participated in the study. PA was assessed using ActiGraph GT3X or GT3X+ accelerometers worn on a self-selected location (wrist, hip, or ankle) for four days. Participants engaged in 14 activities of varying contexts based on the primary skill addressed, creating five distinct areas (Gross/Functional, Game, Drama, Fine/Constructive, or Free Time). The mean vector magnitude [VM; counts per minute (cpm)] of individual activities was used to calculate the PA level of each area. One-way ANOVAs were used to determine differences in VM for each area as well among individual activities within an area. Results: There were no differences (p=.999) in the mean VM for any area: Gross/Functional (2516.76 ±1585.6 cpm), Game (2779.38 ±1482.8 cpm), Drama (2561±1344.6 cpm), Fine/Constructive (2593.05±1520.9 cpm), and Free Time (2502.20 ±1346.5 cpm). Additionally, there were no differences (p=.999) among activities within each domain. Conclusion: The results revealed a consistent level of PA across all areas of activity. These findings suggest the activities offered in this outdoor TR program provide an opportunity for youth with disabilities to accumulate PA that may also benefit them cognitively and physically.

### BODY COMPOSITION, STRENGTH AND PHYSICAL FUNCTION IN SHORT AND LONG TERM BREAST CANCER SURVIVORS

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Previous data have found that breast cancer survivors (BCS) have poorer body composition, strength, and physical function compared to age and weight matched controls. Whether these changes improve over time after treatment remains uncertain. PURPOSE: To compare body composition, strength, and physical function between short-term (ST; <4 years; n=17; age=57±9 yrs) and long-term (LT; >4 years; n=24; age=62±7 yrs) BCS. METHODS: Body composition [lean mass (LM), fat mass (FM)] was assessed using dual-energy X-ray absorptiometry. Lower body strength was assessed using the Biodex leg extension/flexion system at 60 degree isometric knee extension. Upper body strength was assessed using one repetition maximum chest press. Physical function was measured using the continuous-scale physical function performance test. Independent t-tests were used to compare ST and LT-BCS. Significance was accepted at p ≤ 0.05. RESULTS: Time since treatment completion was 1.8±1.0 yrs for ST and 11.8±6.9 yrs for LT. There were no differences in body weight, LM, FM, and upper and lower body strength between groups. Total physical function (ST:64±14; LT:73±11 U) and the functional domains for endurance (ST:66±15; LT:75±12 U) and balance (ST:65±15; LT:75±12 U) were significantly lower in ST-BCS. CONCLUSION: Findings indicate that without exercise, body composition and strength do not improve whereas physical function improves over time following treatment. Funding: ACSM Doctoral Student Grant; NSCA Doctoral Graduate Student Grant.

### EFFECTS OF 3 WEEKS YOGIC BREATHING PRACTICE ON VENTILATION AND RUNNING ECONOMY

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Background and Objectives: Yogic breathing techniques (pranayama) positively impact respiratory function (RF) in non-endurance trained individuals. This study investigated effects of routine pranayama practice on RF, running economy (RE) and perceptual responses. Study Design: A between subject's case-control study design was incorporated. Methods: Twelve runners practiced three styles of pranayama (30 min/day 6 days/week) for 3 consecutive weeks (YG) and completed a VO2 max tests on a treadmill (trial 1), Basic RF tests, and constant workload RE trials at 60, 70, and 80% VO2 max (trial 2/3). A control group (n = 10) (CT) completed the same pre – post testing without intervention. Pre vs. post values for resting forced vital capacity (FVC), peak expiratory flow rate (PEFR) and forced expiratory flow volume in one second (FEV1). Measures during exercise included respiratory rate (RR), minute volume (MV), tidal volume (TV), ratings of perceived exertion (RPE) and RE (VO2) and were compared at a lower (60% VO2 max) (LOW), moderate (70% VO2 max) (MOD), and high (80% VO2 max) (HIGH) intensity. Results & Conclusion: Yoga improved FVC (pre 6.7 ± 6.39, post 5.4 ± 2.7, p = 0.06), and FEV1 (pre 5.6 ± 2.7, post 4.6 ± 2.2, p = 0.03) with no significant outcome for PEFR or RE variables. However, RPE-L for HIGH had an interaction (p < 0.05) showing a decrease for YG and an increase for CT. The current study suggests 3 weeks of yogic pranayama fails to significantly impact RE, however some evidence indicates YG may positively alter perceptual responses at individually prescribed workloads as well as some resting ventilator measures. Pranayama may have application towards the athletic community in terms of perceived exertion. More work is needed to definitively establish benefits of YG for runners and fitness enthusiasts.

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### EXPIRATORY FLOW LIMITATION IN ELITE ADOLESCENT CYCLISTS DURING EXERCISE

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Expiratory flow limitation (EFL) has been reported in pre-pubescent adolescents and elite endurance athletes; however, the occurrence of EFL in elite adolescent endurance athletes has not been determined. Purpose: To determine incidence and severity of EFL in elite adolescent male cyclists. Methods: Seven elite adolescent male cyclists (16.4±1.1 years; 174.0±3.1 cm; 59.8±2.4 kg) completed an incremental test to exhaustion to determine peak oxygen consumption (VO2peak) on a cycle ergometer. Arterial oxygen saturation (SpO2) and dyspnea were assessed at the end of each stage. Subjects performed maximal flow volume loops pre- and post- exercise to assess forced vital capacity (FVC), forced expiratory volume in 1-second (FEV1), FEV1/FVC, forced expiratory flow between 25-75% of FVC (FEF25-75%) and peak expiratory flow (PEF). The occurrence and severity of EFL was quantified as the percentage of the tidal volume that overlapped with the maximum flow volume loop. Results: The elite adolescents peak O2 consumption was 71.3±9.6 mL/kg/min. The average peak power and peak ventilation were 360.7±40.5 watts and 155.5±18.2 L/min, respectively. At VO2peak, six of the seven subjects exhibited significant EFL with only one subject exhibiting EFL at 80% of VO2peak (p<0.001). The mean EFL severity was 64.3±34.6%, with a range of severity from 36.4-93.0%. There was no significant change in pulmonary function from pre- to post-exercise in FVC, FEV1, FEV1/FVC, FEF25-75%, or PEF. The elite male cyclists also showed a significant reduction in SpO2 (84.7±7.8%) and increased dyspnea rating at peak exercise (8.8±0.8), ps<0.01). Conclusions: Elite adolescent male cyclists have a high occurrence of and severity of EFL at maximal exercise, which may limit exercise tolerance.

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### DOES ACUTE PREPRANDIAL EXERCISE ATTENUATE POSTPRANDIAL AIRWAY INFLAMMATION IN ACTIVE YOUNGER AND OLDER ADULTS?

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A single high-fat meal (HFM) is associated with increased airway inflammation. While exercise may modify postprandial airway inflammation, the protective effect may be diminished by age. Purpose: To determine whether an acute bout of preprandial exercise attenuates postprandial airway inflammation in active younger and older adults. Methods: 8 younger active (YA: 23.5±/4.5 y/o) and 3 older active (OA: 65.7±/2.6 y/o) who habitually exceed PA guidelines completed two HFM sessions in a randomized order. In exercise + HFM (EX+HFM), subjects exercised at 65% of VO2peak heart rate to expend 75% of the caloric content of the HFM. Subjects visited the lab after a 12-hour fast to consume the HFM (12 kcal/kg BW: 57% fat, 39% CHO, 4% protein). Triglycerides (TG) and exhaled nitric oxide (eNO) were measured at baseline, 2- and 4-hours post-HFM. Results: Baseline eNO was not significantly different between YA and OA (p=0.05). eNO increased from baseline to 2 hours by 13.1±/26.9% following the HFM, but only 2.0±/11.6% during the EX+HFM in YA adults, and was 3.7±/10.9% in the HFM alone and 6.1±/11.3% in the EX+HFM in OA adults. However, when analyzing all subjects together, airway inflammatory responses were not significantly different across time (p=0.13), age (p=0.33), or condition (p=0.36). There was a significantly greater TG response in the HFM condition compared to the EX+HFM condition in OA (p<0.05), which was also lower in the YA (p<0.05). Conclusions: With these preliminary analyses, airway inflammation does not appear to be altered by age or preprandial exercise in active individuals. However, exercise attenuates the TG response across age.

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### THE EFFECTS OF PROLONGED SITTING ON CEREBRAL PERFUSION AND EXECUTIVE FUNCTION

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Purpose: Little is known about the effects of prolonged sitting on cerebrovascular function. We hypothesized intermittent calf raises (every 10min) would: (i) prevent venous pooling in the lower extremities; (ii) maintain cerebral perfusion; (iii) maintain executive function. Methods: 20 healthy, yet sedentary subjects (19-35 years old) were recruited to participate in two 3 hr sitting conditions: control (CON) and experimental heel-raise (HEEL) study. Cerebral perfusion (total haemoglobin, tHb) and tissue oxygenation (tissue saturation index, TSI) were measured using near-infrared spectroscopy (NIRS) and the Stroop-color test evaluated executive function. Measurements were made at 10, 90 and 170min. Results: There were non-significant time effects for cerebral tHb (p=0.287) and TSI (p=0.923); however, calf raises decreased tHb (p=<0.001, d=0.633) but had no effect on TSI (p=0.761). There was a non-significant time (p=0.641) and condition (p=0.083) effect for the Stroop-color test. Conclusion: Intermittent calf raises prevent venous pooling in the lower extremities in healthy, yet sedentary young subjects, but do not improve cerebral perfusion or executive function.

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### THE RELIABILITY OF LOWER-LIMB PULSE-WAVE VELOCITY ASSESSMENTS USING AN OSCILLOMETRIC TECHNIQUE

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Sedentary behavior appears to target the athero- and arterio-sclerotic susceptible vasculature of the lower extremities. For example, vascular function in the leg is acutely impaired following periods of prolonged sitting. Purpose: Studies have relied on techniques which are challenging to perform, therefore impeding further study. Consequently, there is a pressing need to identify precise (reliable), yet simple, techniques for evaluating lower extremity vascular health. Oscillometric assessment of pulse-wave velocity (PWV) in the leg may be one potential solution. The current study aimed to determine the between-day reliability of femoral-ankle PWV (faPWV) in supine and seated positions using the oscillometric-based SphygmoCor XCEL device. Methods: 15 participants (22.1 y, 80% F; BMI 22.7) were tested on three mornings in a fasted state, separated by a maximum of 7 days. In a balanced, randomized order, faPWV was measured in sitting and supine positions using SphygmoCor XCEL. Carotid-femoral PWV (cfPWV) was also assessed for quality control. Results: The intra-class correlation coefficient (ICC) for supine faPWV (ICC = 0.89) was above the 0.75 criterion, but not for seated (ICC = 0.54). The standard error of measurement (SEM) was 0.42 m/s and 0.95 m/s in the supine and seated positions, respectively. Similarly, reliability measures for cfPWV met the criterion in the supine (ICC = 0.75, SEM = 0.42 m/s) but not seated positions (ICC = 0.66, SEM = 0.48 m/s). Conclusions: These findings indicate that, in a healthy cohort, faPWV can be determined in supine position with acceptable precision using SphygmoCor XCEL. The next step is to measure precision in populations of varying age and health states. The use of these devices may provide researchers with a simple and precise way of investigating the impact of sedentary behaviors.

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### THE EFFECTS OF RESISTANCE TRAINING ON CARDIOVASCULAR FUNCTION

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PURPOSE: Chronic hypertension is associated with arterial stiffness, which is recognized as a risk factor for stroke and coronary artery disease. During resistance exercise, there is an increased pressure load, with systolic blood pressure increasing up to 400 mmHg. Although chronic hypertension results in arterial stiffening and decreased cardiovascular function, the acute elevation of pressure with resistance exercise has not been consistently shown to be detrimental to cardiovascular function. Although regular aerobic exercise results in improved arterial compliance, the effects of long-term resistance training is unclear. The purpose of this study is to compare blood pressures and arterial stiffness in males who consistently strength train ( $\geq 3$  days/week for the previous year) versus males who do not strength train to determine if regular strength training results in stiffer arteries or elevated pressure. METHODS: Eight (5 trained, 3 untrained) young (ages 18-40) males underwent measurements of central (aortic and carotid) and peripheral (brachial) blood pressures and artery stiffness (carotid beta stiffness). RESULTS: Untrained males had significantly higher carotid beta stiffness and brachial, carotid, and aortic diastolic blood pressures (DBP) compared to strength trained males (Beta stiffness = 7 vs 5 AU; brachial DPB=70 vs 64 mmHg; carotid DBP=70 vs 64 mmHg; aortic DBP=71 vs 64 mmHg, respectively). CONCLUSIONS: Males who participated in regular strength training had lower pressures and less stiff arteries compared to males who did not. This indicates that the acute hypertension associated with resistance exercise does not lead to detrimental effects on cardiovascular function, even with long-term resistance training.

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### AEROBIC TRAINING AND VASCULAR PROTECTION: INSIGHT FROM ALTERING BLOOD FLOW PATTERNS

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Adequate blood flow patterns are essential in maintaining vascular homeostasis. Exercise-induced increases in antegrade, or forward, blood flow is a major modulator of vascular health; however, as vascular function in the conduit arteries is normalized as aerobic training progresses it is unknown if aerobically-trained vessels can adequately counteract vascular insults. Purpose: The study sought to determine the ability of aerobically-trained individuals to counteract an acute vascular insult (increased retrograde shear). Methods: Ten young male trained rowers (20 $\pm$ 1 yrs) and ten male recreationally active controls (24 $\pm$ 1 yrs) were recruited for this study. Subjects completed two brachial artery (BA) flow mediated dilation (FMD) tests separated by a 30 minutes of sub-diastolic cuff inflation (60 mmHg) of the forearm. BA diameter, blood flow, and shear rate were evaluated prior to and throughout both FMD tests. Results: The sub-diastolic cuff inflation intervention resulted in significant increases in retrograde shear rate ( $p < 0.001$ ) and oscillatory shear index ( $p < 0.001$ ) over time (pre- to post-FMD measures). Significant reductions across time were revealed in brachial artery (BA) dilation (absolute:  $p = 0.008$ ; relative change:  $p = 0.011$ ) and the post-cuff release hyperemic response (BA blood flow AUC:  $p < 0.001$ ; BA shear rate AUC:  $p = 0.001$ ), but no group differences were observed in these variables. Conclusions: This study revealed that individuals with prior upper limb training were unable to attenuate the vascular dysfunction associated with acute increases in retrograde shear.

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### SUPINE AND STANDING HEART RATE VARIABILITY RESPONSES TO TRAINING IN WOMEN'S SOCCER PLAYERS

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The heart rate variability (HRV) recording position that best reflects previous day training load remains unclear. PURPOSE: To assess supine and standing HRV responses to standardized offseason training in collegiate women's soccer players. METHODS: Over four weeks, players ( $n = 12$ ) performed resistance training, soccer practice and cardiorespiratory conditioning on Mondays and Thursdays. Soccer practices only were also held on Wednesdays and Fridays. Players recorded HRV (natural logarithm of the root mean square of successive R-R intervals, LnRMSSD) in the supine and standing position daily after waking with a validated mobile device. Training load from each session was quantified via the session rating of perceived exertion method (sRPE). RESULTS: The sRPE from Mondays (982.5  $\pm$  264.5 au) and Thursdays (936.6  $\pm$  178.2 au) was greater ( $p < 0.05$ ) than Wednesdays (468.4  $\pm$  136.6 au) and Fridays (300.7  $\pm$  134.4). Standing LnRMSSD from Mondays (3.65  $\pm$  0.53 ms) was greater ( $p < 0.05$ ) than Tuesday's (3.40  $\pm$  0.52 ms) and Friday's (3.37  $\pm$  0.55 ms). No main effect was observed for supine LnRMSSD (range: 4.38  $\pm$  0.49 – 4.60  $\pm$  0.40 ms,  $p = 0.10$ ). CONCLUSIONS: Decrements in standing LnRMSSD were observed following the days with the greatest training load. HRV measured in the standing position was more sensitive to previous day training than supine measures.

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### ACUTE EFFECTS OF WATER AND SPORTS BEVERAGE INGESTION ON HEART RATE VARIABILITY

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Sports teams acquire pre-training heart rate variability (HRV) in athletes to assess training status. However, pre-training hydration practices may acutely affect cardiovascular dynamics and thus obscure resting-HRV. **PURPOSE:** To determine the effects of 591 ml of cold water and Gatorade ingestion on HRV. **METHODS:** Recreationally-trained, college-age men (n = 6) and women (n = 3) volunteered for this study. On separate days after an overnight fast, subjects ingested 591 ml of water, Gatorade or control (10 ml water) in a randomized order. R-R intervals were recorded for 10 minutes (min) pre- and for an additional 25 min post-fluid ingestion. The natural logarithm of the root-mean square of successive R-R intervals (LnRMSSD) was calculated from min 5 – 10 pre-ingestion to establish baseline (T1) and again at 5 – 10 min post- (T2) and 20 – 25 min post-fluid ingestion (T3). **RESULTS:** A significant condition × time interaction was observed (p < 0.0001). LnRMSSD did not change across time for control (T1 = 4.19 ± 0.36 ms, T2 = 4.17 ± 0.39 ms, T3 = 4.27 ± 0.31 ms, p > 0.05). LnRMSSD increased following both water (T2 = 4.52 ± 0.26 ms) and Gatorade (T2 = 4.66 ± 0.38 ms) ingestion at T2 and remained significantly elevated at T3 only for Gatorade (T3 = 4.54 ± 0.37 ms) relative to control (p < 0.05). **CONCLUSIONS:** Ingestion of a sports beverage alters HRV for at least 25 min. Fatigue-related decrements in LnRMSSD may be masked by acute fluid ingestion and result in a misinterpretation of training status.

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### BREATHING LIMITED AIR SITUATIONAL TRAINING MASKS VERSUS SELF-CONTAINED BREATHING APPARATUS FOR FIREFIGHTERS: A PILOT STUDY

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Firefighters' peak capacity is negatively impacted by the use of a Self-Contained Breathing Apparatus (SCBA), an essential piece of safety equipment worn during structural firefighting. Routine training with SCBAs can be cost-prohibitive and inefficient. The Breathing Limited Air Situational Training Mask (Blastmask) is used to simulate the SCBA. **Purpose:** To examine the physiological and perceptual responses elicited in firefighters during steady state exercise using the Blastmask compared to the SCBA. **Methods:** Current male firefighters (n=10; age = 29.5±7.7; BMI=26.9±2.7) performed two separate 10-minute steady state treadmill exercise trials: SCBA and Blastmask. Paired-samples t-tests were conducted to determine differences between mean heart rate (HR), mean pulse oximetry, perceived stress, rate of perceived exertion of the session (RPE-S), and for each minute of breathing (B-RPE) across the two trials. **Results:** There were no significant differences between SCBA and Blastmask for HR (SCBA: 144.1±17.7bpm; Blastmask: 142.7±17.4bpm; p = .07), pulse oximetry (p = .50), stress (p = .31), or RPE-S (p = .08). Firefighters reported greater B-RPE (p < .01) when using the Blastmask. Mean HR was strongly correlated between sessions (r = .89). **Conclusions:** The Blastmask appears to elicit similar physiological and perceptual response during steady state exercise when compared to the SCBA. The Blastmask may therefore be an appropriate supplemental, cost-effective training aid for firefighters.

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### AVERAGED RESTING HEART RATE VARIABILITY MEASURES MAY NOT CORRELATE WITH HEART RATE RECOVERY IN FEMALES

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It is unclear if averaged resting heart rate (RHR) or its variability (HRV) provide a greater indication of cardiac autonomic (CA) recovery. **Purpose:** To examine resting CA function as a single day measurement vs. the average of multiple days as predictors of cardiovascular recovery in female participants. **Methods:** Eighteen apparently healthy females (23±3yrs; 65.7±8.0kg) completed four total visits (V1-V4), where CA activity was recorded throughout a 10-min resting period. Following the V4 recording, a treadmill graded exercise test (GXT) was performed followed by a 5-min active cool down and 25-min resting period. Resting CA activity was assessed through RHR and HRV (via root mean square of successive R-R differences; RMSSD). Resting variables were measured as; day of (DO), three day (3DAv), and four day (4DAv) averages. Heart rate recovery (HRR) was calculated as the maximal HR achieved minus the HR at: 1-min (HRR1), 3-min (HRR3), or 5-min (HRR5) of recovery. **Results:** Pearson's Product correlations revealed no significant correlations between RMSSD DO, 3DAv, 4DAv and HRR1, HRR3, or HRR5. However, moderate positive relationships between RHR DO, 3DAv, and 4DAv were present: HRR1 (DO: r = 0.574, 3DAv: r = 0.632, 4DAv: r = 0.640; p < 0.05), HRR3 (DO: r = 0.522, 3DAv: r = 0.578, 4DAv: r = 0.585; p < 0.05), and HRR5 (DO: r = 0.531, 3DAv: r = 0.538, 4DAv: r = 0.557; p < 0.05). **Conclusion:** Single or averaged measures of HRV demonstrated no meaningful relationship to HRR. However, RHR was a stronger predictor of recovery, suggesting a disconnect between measures of CA activity.

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### THE IMPACT OF POSTTRAUMATIC STRESS DISORDER ON PERIPHERAL VASCULAR FUNCTION

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The physiological manifestations of posttraumatic stress disorder (PTSD) have been associated with an increase in risk of cardiovascular disease (CVD) independent of negative lifestyle factors. Peripheral vascular dysfunction may be a mechanism by which PTSD increases CVD risk via increases in oxidative stress, inflammation, and/or sympathetic nervous system activity. **PURPOSE:** This study sought to examine peripheral vascular function in those with PTSD compared to age-matched controls. **METHODS:** Eight individuals with PTSD (5 women, 3 men; age 22±2 years), and sixteen healthy controls (CON; 10 women, 6 men, 23±2 years), participated in the study. Leg vascular function was assessed via passive leg movement (PLM) technique and evaluated with Doppler ultrasonography. PLM-induced increases in leg blood flow were quantified as peak change in blood flow from baseline (ΔPeak LBF) and blood flow area under the curve (LBF AUC). **RESULTS:** Significant differences in leg vascular function were revealed between groups. The PTSD group reported significantly lower ΔPeak LBF (PTSD: 294.16 ± 54.16; CON: 594.78 ± 73.70 ml·min<sup>-1</sup>; p = 0.01) and LBF AUC (PTSD: 57.23 ± 24.37; CON: 169.923 ± 29.835 ml; p = 0.02) when compared to the CON group. **CONCLUSION:** This study revealed that lower limb vascular function is impaired in individuals with PTSD when compared to healthy counterparts.

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### IMPACT OF UNINTERRUPTED SITTING ON COGNITIVE FUNCTION AND CEREBRAL PERFUSION

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It has been established that prolonged, uninterrupted sitting negatively impacts peripheral vascular health. It is unclear whether uninterrupted sitting can have an impact on cognitive function or cerebral perfusion. Purpose: To examine whether 3 hours of uninterrupted sitting will negatively impact cognitive function and cerebral perfusion, and if a 10-min walk following sitting could enhance cognitive function and cerebral perfusion. Methods: Twenty participants (age=26±7 yrs; BMI=30±7 kg/m<sup>2</sup>; 7 female) were asked to sit uninterrupted for 3 hours followed by a 10-min walk on a treadmill (3 mph, 1% grade). Cognitive function (Stroop test) and cerebral perfusion (near infrared spectroscopy; total hemoglobin—tHb) were assessed pre- and post-sitting and following the walk. Results: Following sitting, there was no change in Stroop times; however, both Color and Text times decreased following the 10-min walk (e.g., Color Time: 10 mins sitting, 19±3 sec vs. Post walk, 16.7±3.6 sec, p<0.001, d=0.66). A similar finding was noted for change in reaction time (e.g., p=0.036, d=0.5 for Color trial). Cerebral perfusion did not change during sitting but increased during the walking bout (180 mins sitting=415±38 μM vs. 10 mins of walking=432±42 μM; p<0.001, d=0.44). Conclusions: These findings suggest that though 3 hours of uninterrupted sitting does not alter cognitive function or cerebral perfusion, a brief 10-min bout of moderate-intensity walking can improve cognitive function, an effect possibly related to increases in cerebral perfusion.

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### IMPACT OF ATHLETIC COMPRESSION SOCKS ON LOWER-LIMB HEMODYNAMICS AND TISSUE OXYGENATION

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Compression socks (CS) are marketed to an athletic population as a tool to improve exercise performance and recovery. One theory is that CS enhance muscle blood flow and oxygenation, in part, due to reduced venous pooling. Limited evidence is available to support this notion. Purpose: To test the hypothesis that CS will augment leg blood flow and tissue oxygenation at rest and during exercise as compared to a no-sock control (CON). Methods: In eleven volunteers (age=32±3; BMI=26±1 kg/m<sup>2</sup>; female=2), popliteal artery blood flow (BF; Doppler-ultrasound), and gastrocnemius muscle perfusion (tHb; index of blood pooling), tissue oxygenation (TSI%), and deoxy-hemoglobin levels (HHb; near-infrared spectroscopy) were monitored at rest (supine), upon standing, and during a 3-min treadmill walk (3-mph, 1% grade). Results: Leg BF exhibited a ~6-fold increase during exercise (p<0.001), but was comparable between CS and CON for all time points (p=0.48). Levels of tHb were comparable at rest and during exercise (p>0.05) but were greater in CON during standing (CS=423±5 vs. CON=445±8μM; p=0.003). TSI% was also similar between rest and exercise (p>0.05) but lower in CON upon standing (CS=59±1 vs. CON=55±1%; p<0.001). HHb levels were similar at rest (p=0.17), but greater during standing (p<0.001) and exercise in CON (CS=30±3 vs. CON=35±3μM; p<0.001). Conclusions: These findings indicate that CS do not enhance leg blood flow, but may reduce blood pooling upon standing, and increase venous outflow (i.e., lower HHb) during exercise.

### CHARACTERIZING THE CENTRAL HEMODYNAMIC RESPONSE TO ORTHOSTASIS: INFLUENCE OF SEX, FITNESS AND BODY COMPOSITION

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Interindividual responses to orthostasis exists. However, few studies provide insight into the potential mechanisms. Purpose: To examine individual influences (i.e., sex, fitness, and body composition) on the central hemodynamic response to a modified head-up tilt (HUT). Methods: Volunteers (N=14, age=22±1 yrs, BMI=28±1 kg/m<sup>2</sup>, female=7) underwent assessments of pulse wave analysis, heart rate variability, and near-infrared spectroscopy over the gastrocnemius muscle while supine, followed by a 5-min HUT (torso; 70°). Aerobic fitness (VO<sub>2</sub> peak; 3-min step test) and body composition (body fat%; skinfolds) were estimated. Results: During HUT, heart rate (+5±1 bpm; p<0.001), reflection magnitude (+4±2%; p=0.017), and gastroc perfusion (+4±1 μM; p<0.001) increased, with no change occurring in augmentation index—AIx (p=0.31) or mean arterial pressure (p=0.95). The low-high frequency component ratio increased during HUT (LF/HF: +2.8±1.5 AU) but was only significant at p=0.08. Females exhibited an increase in AIx to HUT (females=+7±2 vs. males=-1.9±3%; p=0.38). Independent of sex, there was a relationship between VO<sub>2</sub> peak and LF/HF change to HUT (r=0.68; p=0.02). No interactions were noted for body fat% and HUT. Conclusions: These findings indicate that individual differences (sex and fitness) influence the cardiovascular response to HUT. Future studies should account for individual differences to HUT and other autonomic stressors.

### EFFECTS OF AEROBIC AND RESISTANCE EXERCISE ON INFANT HEART MATURATION

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PURPOSE: Research shows that prenatal aerobic exercise is associated with fetal cardiac benefits. However, the effects of resistance exercise on infant cardiac function are unknown, thus, the purpose of this study was to determine the effects of resistance exercise on infant heart rate (HR) and heart rate variability (HRV). METHODS: Participants were randomized into four groups, aerobic (n=5), and resistance (n=5), circuit (n=3) and a control (n=3) and trained from 16-weeks gestation until delivery. Exercise groups participated in three, 50-minute moderate-intensity exercise sessions per week. After birth, one-month infant HR and HRV measurements were obtained. A one-way ANOVA was performed to compare means between the exercise and control groups. Three contrasts were performed to compare the means of infant HR and HRV between the three training groups, using a Bonferroni Correction. RESULTS: The average infant HR and HRV were significantly lower (p=0.01) and higher (p=0.01), respectively, among infants born to aerobically-trained moms compared to infants of resistance-trained and control (p=0.01) and (p=0.02) moms. CONCLUSION: Our pilot data suggest that aerobic exercise training during pregnancy may elicit greater cardiac benefits in the infant compared to resistance and circuit training. Larger studies with more precise measures of cardiac function are recommended. Funded in part by The American Heart Association.

**HEART RATE RESPONSE DURING ESPORT: FORTNITE**

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Esports, or competitive video gaming, has rapidly increased in online play and viewing. A myriad of literature focuses on heart rate (HR) and traditional athletic competition, little research has addressed the heart rate responses of individuals playing Esports and none in the Esport: Fornite. Purpose: Determine the heart rate response during a 3-hour seated session of the Esport: Fortnite. Methods: Individuals (n=15; age = 21.1±2.1 years; BMI = 26.4±3.5; Esport mean hours per week = 11.3) who play at least 6 hours of Esports per week were recruited to participate in the study from around the University of Mississippi. A 15-minute seated HR was collected using a Polar H10 heart rate monitor and the Polar Beat app on two separate occasions. Participants wore the Polar heart rate monitor during their regular Esport: Fortnite session time for 3-hours while recording their stats from each solo match. Separate paired sample T-tests were conducted to compare mean seated vs. mean seated Esport session HR and peak seated HR vs. peak seated Esport session HR. Results: There was a significant increase in mean seated Esport session HR compared to resting seated HR (76.2 ± 2.3bpm vs. 68.2 ± 9.3bpm; p < 0.05) and peak seated Esport session HR (120.0 ± 18.5bpm vs. 80.1 ± 11.7bpm; p < 0.05). Conclusions: Understanding the physiological response to Esports is critical given its rise in popularity and this initial study suggests Esport: Fortnite increases individuals seated heart rate, suggesting a physiological stressful event.

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**LOW-CALORIE DIET WITH OR WITHOUT INTERVAL EXERCISE REDUCES POST-PRANDIAL AORTIC WAVEFORM IN OBESE WOMEN**

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Purpose: Arterial stiffness is considered a strong predictor of cardiovascular disease. Women have higher values of arterial stiffness compared to men, suggesting that women are at a greater risk of heart-related complications. While low calorie diet (LCD) reduces arterial stiffness, in part through lowering CVD risk factors, no study has tested if interval exercise (INT) adds to the benefit of LCD on arterial stiffness in obese women. Methods: Twenty-four obese women (49.2 ± 2.4yrs; 37.9 ± 1.3kg/m<sup>2</sup>) were randomized to LCD (n=12; mixed meals of ~1200 kcal/d) or LCD+INT (n=12; 60 min/d of supervised interval exercise at 90% HRpeak for 3 min and 50% HRpeak for 3 min). An additional 350kcal was provided to LCD+INT post-exercise to equate energy availability between groups. Augmentation index (AI, systemic aortic waveform) and carotid-femoral pulse-wave velocity (cfPWV) were measured during a 75g OGTT before and after the intervention to assess arterial stiffness. Blood pressure and fasting lipids (TC, HDL, LDL, TG) were also measured. Results: LCD+INT increased VO<sub>2</sub>peak (L/min) and HDL compared to LCD (P=0.03 and P=0.04, respectively). However, both interventions decreased body fat, fasting SBP, TG, LDL and TC (each P<0.01). Although there was no effect on cfPWV, LCD and LCD+INT decreased AI tAUC<sub>120min</sub> (P=0.04). Pre AI<sub>10min</sub> correlated with pre fasting DBP (r=0.40, P=0.04) and decreased AI<sub>10min</sub> (r=-0.45, P=0.03). Conclusion: Independent of exercise, LCD reduces post-prandial aortic waveform. Additionally, only individuals with elevated AI<sub>10min</sub> pre-intervention respond to treatment. Together, these data suggest reduced systemic arterial stiffness given no effect on cfPWV. Further work is warranted to determine how dietary manipulation, with and without exercise, impacts fasted vs. post-prandial arterial stiffness to optimize CVD risk reduction.

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**THE EFFECTS OF GENDER DIFFERENCES AND BODY COMPOSITION ON CENTRAL HEMODYNAMICS DURING ADOLESCENCE**

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Atherosclerosis is one of the leading causes of cardiovascular disease worldwide and continues to rise across the globe. Yet, there is a paucity among current literature in regards to how body composition and central hemodynamic properties such as mean arterial pressure (MAP), pulse pressure (PP), and pulse wave velocity (PWV) interact among adolescent males and females. Purpose: The purpose of this study was to observe adolescent gender differences and interactions in MAP, PP, and PWV values with different body compositions. Methods: This study consisted of twenty-four adolescent males and females (10 males, 14 females; age 16.5 ± 0.7). Anthropometric measurements, MAP, PP, and PWV was evaluated. Results: Values indicated an increasing trend with PWV between males and females (5.1 ± 0.9 m/s vs 5.2 ± 0.6 m/s) with a significant increase of percent fat mass (FM%) between males and females (16.9 ± 7.6 % vs 28.9 ± 7.5 %) (p<0.001). PP was significantly lower among males and females (35.6 ± 4.7 mmHg vs 30.4 ± 3.5 mmHg) (p<0.046) with MAP showing an increasing trend among females. No significant differences were found between MAP and gender. A significant correlation was found between FM% when compared to PWV (p<0.028). Conclusion: Major findings indicate that PWV is mainly based on FM% and that PP is significantly lower among adolescent females. This shows that sex may be a main factor in determining PP and may be due to both intrinsic sex differences and the influence of sex hormones after puberty.

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**USING LOWER LOADS ATTENUATES THE CARDIOVASCULAR REPOSE TO BLOOD FLOW RESTRICTED HANDGRIP EXERCISE**

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Although handgrip training combined with blood flow restriction (BFR) increases muscle size and strength, concerns exist regarding an augmentation of the cardiovascular response during exercise. Purpose: To determine the relative safety of BFR handgrip exercise by comparing cardiovascular response to low and moderate-load protocols with and without BFR. Methods: The cardiovascular response of 15 males (age=24±5 years, BMI=27.2±5.6 kg/m<sup>2</sup>) was assessed after 5 minutes of: BFR only (BFR), handgrip exercise at 40% maximal voluntary contraction (MVC) with BFR (40BFR), 60% MVC with BFR (60BFR), and 60% MVC only (60noBFR). Results: Exercise conditions increased heart rate similarly: 40BFR [4.3 bpm, (p=.011)], 60BFR [7.7 bpm, (p=.003)], 60noBFR [9.3bpm, (p=.008)]. The increase in mean arterial pressure during exercise was lower during 40BFR compared to 60BFR [-6.5 mmHg, (p<0.001)]. Augmentation index 75 was lower during 60noBFR compared to baseline [-33.25%, (p=.028)], BFR [-30.41%, (p=.003)], and 40BFR [-20.16%, (p=.012)]. The rate pressure product following exercise was lower during 40BFR compared to 60BFR [-864.14 bpm\*mmHg, (p=.001)]. Tissue saturation index decreased from baseline during 40BFR [-1.45%, (p=.003)] only. Conclusion: Unilateral handgrip BFR exercise performed at a lower load may attenuate the hemodynamic response to moderate loads with and without BFR.

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**SEX DIFFERENCES IN AUGMENTATION INDEX IN ADOLESCENTS**

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Augmentation index (AIx) is an indicator of arterial stiffness which is suggestive of greater all-cause mortality risk in adults. In adolescence, arterial stiffness is indicative of early vascular aging and may be predictive of cardiovascular disease in adulthood. Arterial stiffness is seen more often in adolescent males than females. This trend tends to persist in adults. AIx is a noninvasive way to measure arterial stiffness as it is a parameter derived from brachial blood pressure and it's usually standardized to 75 beats per minute (AIx75). AIx and AIx75, however, are only verified measurements of arterial stiffness in adults and further research is necessary to create adolescent reference values. **PURPOSE:** This study sought to observe differences of AIx in adolescent males and females. **METHODS:** The AIx75 of 24 adolescents (14 females, 10 males; age  $16.5 \pm 0.7$ ) was found through derivation of aortic blood pressure estimated from brachial blood pressure by the SphygmoCor systems use of verified transfer functions. **RESULTS:** The resting male heart rate was lower than the resting female heart rate ( $65 \pm 8$  bpm vs.  $68 \pm 11$  bpm, respectively). Aortic systolic blood pressure was higher in males than females ( $99 \pm 9$  mmHg vs.  $97 \pm 8$  mmHg, respectively) while the aortic diastolic blood pressure was lower in males than females ( $64 \pm 7$  mmHg vs.  $66 \pm 8$ , respectively). Adolescent females had a higher AIx75 than males ( $4.1 \pm 6.7\%$  vs.  $1.8 \pm 7.1\%$ , respectively). **CONCLUSION:** Adolescent females had a higher AIx75 than adolescent males. However, there is no significant differences in AIx75 between males and females. Large standard deviations signify variable AIx75 measurements even in a small cohort, as augmentation index has multiple factors that influence outcome.

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**RESTING HEART RATE VARIABILITY DOES NOT INFLUENCE STATE-TRAIT ANXIETY INVENTORY**

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Heart rate variability (HRV) has been shown to relate to various physiological conditions, but recently has been associated to mood states such as anxiety. Importantly, limited information is available regarding resting HRV and its relationship to measures of anxiety. **Purpose:** To examine if resting HRV correlates to a commonly used mood scale modified six item State-Trait Anxiety Inventory (STAI-6). **Methods:** Eighteen apparently healthy females (23 yrs; 65.7 8.0kg) completed four total visits (V1-V4), where participants completed a STAI-6 upon entering the lab. Following this, HRV activity (via root mean square of successive R-R differences; RMSSD) was recorded throughout a 10-minute resting period. The last 5-minutes of each 10-minute recording were analyzed. In order to determine a relationship, the following time points were measured and compared: Single visit HRV (V1HRV) and STAI-6 (V1STAI-6); average of all 4 visits HRV (4DHRV) and STAI-6 (4DSTAI-6). **Results:** A Pearson product correlation demonstrated no significant relationship between the V1HRV and V1STAI-6 ( $r=0.04$ ,  $p=0.87$ ) or 4DHRV and 4DSTAI-6 ( $r=0.16$ ,  $p=0.53$ ). **Conclusion:** The findings of this study suggest that resting HRV is not related to the outcome of the STAI-6 and therefore may not be a viable indicator of a participant's state of anxiety. Future studies should examine other mood-based measurements when comparing to resting HRV.

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**NOCTURNAL HYPERTENSION STATUS AND C-REACTIVE PROTEIN LEVELS BEFORE AND AFTER AEXT**

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C-Reactive Protein (CRP) is an inflammatory biomarker linked to endothelial dysfunction, resulting hypertension, and cardiovascular events. Recent evidence shows a superior predictive value of nighttime blood pressure (BP) values, in particular, for cardiovascular outcomes. **Purpose:** To assess whether circulating CRP levels differ between nighttime hypertensives (HTN) and normotensives (NTN) and examine the ability of exercise training to affect CRP levels. **Methods:** Non-smoking, middle-to-older age, sedentary African Americans underwent an aerobic exercise training (AEXT) program for 24 weeks. Participants were required to maintain a constant weight throughout the study. CRP and BP were measured from fasted blood samples and 24-hour BP monitoring, respectively, before and after the AEXT program. Upon study completion, subjects were divided into groups based on average asleep BP values and baseline circulating CRP levels. **Results:** At baseline, NTN had significantly lower circulating CRP than HTN based on nighttime systolic values ( $p < .01$ ). Although there was no difference between NTN and HTN classified as low- (<1mg/L) or high- (>3mg/L) risk for cardiovascular disease based on CRP levels, there was a difference in circulating CRP between groups at average risk ( $p < .05$ ). CRP did not significantly decrease ( $p = .095$ ), however, after 6 months of AEXT the HTN group experienced a greater decrease in CRP than the NTN group ( $p = .01$ ). **Conclusions:** Our results suggest that nighttime HTN status may correspond to cardiovascular disease risks predicted by CRP. Nocturnal SBP may be a discriminating additive factor to consider for health by those at average risk for future events by CRP levels. For both HTN and NTN, AEXT may alter CRP, with HTN likely to see a greater effect. Supplementary studies are needed to examine the relationship between additional variables and nocturnal HTN.

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**STABILITY OF HRV FROM ADOLESCENCE TO YOUNG ADULTHOOD; COMPARISON OF PRETERM AND TERM BORN PERSONS**

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Heart rate variability (HRV), a marker of autonomic dysfunction, decreases with age, and precedes development of cardiometabolic outcomes, but few studies have examined HRV longitudinally. **Purpose:** To examine HRV in a cohort of 110 persons born preterm at 14 yrs of age and in young adulthood, ages 18-21 years old and 20 term born peers. **Methods:** A 5 minute resting ECG was recorded and analyzed using Nevrokard Software. The root mean square of the standard deviation (RMSSD) and high frequency (HF) were used to reflect HRV in the time and frequency domains, respectively. Variables were natural log transformed to improve distributional characteristics. A mixed model ANOVA was used to examine between group differences over time. Intraclass correlation coefficients (ICC) were examined for HRV stability over time. **Results:** The RMSSD (mean + SD) decreased significantly ( $p < 0.001$ ) from adolescence to young adulthood in both preterm ( $87.8 + 50.5$  vs.  $59.3 + 34.0$  ms) and term groups ( $86.1 + 58.5$  vs.  $58.3 + 25.3$  ms), with no between group differences. Likewise, HF (mean + SD) significantly ( $p < 0.001$ ) other time in both groups, ( $4546 + 5211$  vs.  $2336 + 3042$  ms<sup>2</sup>) for the preterm group and ( $4839 + 7189$  vs.  $2318 + 2956$  ms<sup>2</sup>) for the term group. For measures of RMSSD and HF, ICCs were .470 and .590 (respectively) in the term group and .438 and .409 in the preterm group. **Conclusion:** HRV decreased from adolescence to young adulthood in both term and VLBW groups with no group differences. However, the lower ICCs observed in the VLBW group suggest that HRV may not be as stable over time when compared to the term born group. Future research should examine other factors that may influence HRV as persons born preterm with VLBW mature.

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### EFFECT OF PNEUMATIC LEG COMPRESSIONS ON ARTERIAL STIFFNESS AND CENTRAL HEMODYNAMIC LOAD DURING PROLONGED SITTING

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Prolonged sitting (1-6 hrs) negatively impacts the peripheral vasculature, but this effect is attenuated with frequent interruptions (e.g., walking, fidgeting). It is unknown if sitting can similarly impact markers of arterial stiffness and central hemodynamic load, and if intermittent pneumatic leg compressions (IPC) can alleviate this response. Purpose: To test the hypothesis that sitting (3-hrs) increases aortic stiffness and central hemodynamic load, an effect that is attenuated with lower-leg IPC. Methods: Thirty volunteers (age=25±1 yrs, BMI=29±1 kg/m<sup>2</sup>, female=10) underwent assessments of arterial stiffness (aortic pulse wave velocity, aPWV), rate pressure product (RPP), and sub-endocardial viability ratio (SEVR) pre-post 3-hrs of sitting. In a subset (N=10), IPC (120 mmHg; 3 compressions/min) was applied to legs during sitting. Results: Sitting reduced RPP (pre=7902±306 vs. post=7331±267 bpm\*mmHg; p=0.002), but increased SEVR (pre=151±5 vs. post=169±6%; p=0.002) and aPWV (pre=5.8±0.2 vs. post=6.1±0.2; p=0.04). Compared to sitting only, IPC produced a lower RPP (p=0.007) and greater SEVR (p=0.04), with no change occurring in aPWV (p=0.55). Conclusions: These findings indicate that sitting increases arterial stiffness, but does not negatively affect central hemodynamic load. IPC may provide a more favorable response to sitting, characterized by a larger reduction in central hemodynamic load and prevention of arterial stiffening.

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### ECG STRESS TESTING AS A SCREENING TOOL FOR SUDDEN CARDIAC DEATH IN DIVISION II COLLEGE ATHLETES: A PILOT STUDY

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PURPOSE: Two-thirds of sudden cardiac deaths are attributable to underlying cardiovascular diseases in young college athletes. A 12-lead exercise stress test is a screening tool that can detect underlying cardiovascular conditions that may predispose college athletes to sudden cardiac death and ensure athletes meet the physical demands of training and competition. The purpose of this study was to evaluate the electrocardiographic (ECG) characteristics of division II collegiate athletes using the Seattle Criteria for 12-lead ECG interpretation by the European Society of Cardiology (ESC). METHODS: Thirty athletes (Males = 12; Females = 18) of various ethnicities (Caucasian = 60%, African American = 27%, and Latino or Hispanic = 13%) from basketball (48%), soccer (27%), volleyball (13%) football (6%), and cross country teams (6%) completed cardiovascular screening with resting and exercise 12-lead ECG analysis. ECG abnormalities were compared with race, gender, and sports using a mixed model ANOVA. RESULTS: Although sports teams were not predictors for an abnormal ECG, 20% of athletes presented with abnormal ECGs. The highest independent predictor of abnormal ECGs was found in African American males, when compared to Caucasians, Latinos or Hispanics (p=0.035). Male athletes also demonstrated a significantly greater prevalence of left ventricular hypertrophy than females (p=0.04). CONCLUSIONS: Increasing prevalence of sudden cardiac death in college athletes warrants future research that evaluates the value of implementing 12-Lead ECG as a standard screening tool for college athletes.

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### MODERATE INTENSITY EXERCISE TRAINING IMPROVES HEART RATE VARIABILITY IN OBESE ADULTS DURING ACUTE EXERCISE RECOVERY

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PURPOSE: To examine the effect of twelve weeks moderate intensity exercise training on autonomic function, measured by heart rate variability (HRV), after acute exercise in obese individuals. METHODS: Eleven obese individuals [5 men, 6 women; Body mass index (BMI) = 39.2 ± 6.3] underwent a 12-week exercise intervention at 60% of predicted VO<sub>2</sub>max, determined via submaximal treadmill test. Body composition was assessed with dual-energy x-ray absorptiometry. HRV was collected via Polar RS800CX and analyzed with Kubios HRV software. RESULTS: Predicted VO<sub>2</sub>max (28.2 ± 3.5 mL·kg<sup>-1</sup>·min<sup>-1</sup> and 27.4 mL·kg<sup>-1</sup>·min<sup>-1</sup> baseline and post-training, respectively, P > 0.05) and body composition were unchanged with training. Two-minute, post-exercise recovery heart rate (HR) was lower after training [124.5 ± 8.0 beats per min (bpm) and 116 ± 12 bpm, respectively, P < 0.01]. The standard deviation of R-R intervals (SDNN), root-mean square of differences between adjacent R-R intervals (RMSSD), high frequency components (HF log), and the standard deviation of instantaneous beat-to-beat variability (SD1) were all greater following training (P = 0.03, 0.03, 0.048 and 0.03, respectively). CONCLUSION: With no change in body composition or cardiorespiratory fitness levels following a 12-week moderate intensity aerobic exercise intervention, HRV was improved during the immediate post-exercise period following acute exercise. Attenuated HR recovery reflecting impaired autonomic function has been shown to be predictive of cardiovascular and all-cause mortality risk. Results suggest an improvement in autonomic function may occur, and that it is independent of cardiorespiratory fitness and body composition changes in obese adults.

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### EFFECT OF WEIGHT LOSS ON PHYSICAL FUNCTION IN OVERWEIGHT AND OBESE INDIVIDUALS

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Reducing weight and improving body composition may be critical for improving physical function in overweight and obese individuals. Purpose: Investigate changes in physical function before and during weight loss. Methods: Data were obtained from women (n=116, age 48.6±12.8 years; weight 104.2±22.1 kg) and men (n=16, age 54.4±10.7 years; weight 114.6±25.5 kg) enrolled in a medical supervised comprehensive weight loss program at Wake Forest Baptist Health Weight Management Center. Mean follow up was 4.3 months. Body composition, grip strength, gait speed, chair rise time, and predicted VO<sub>2</sub>max was determined before and during weight loss. Paired samples t-tests analyzed differences at baseline and after weight loss. Pearson correlations examined relationships between pre-and-post functional exercise tests and lean mass (LM), and fat mass (FM). Results: Mean weight loss was 11.4±10.4 kg. Approximately 79% of weight loss was from fat mass: [FM (48.9±17.9 to 39.7±14.4kg, p<.001) and LM (59.2±11.9 to 56.8±11.2 kg, p<.001)]. Grip strength (30.6±10.8 to 32.8±9.2 kg, p<.001), chair rise time (8.9±2.6 to 7.9±3.1 s, p=.026), and predicted VO<sub>2</sub>max (32.5±3.6 to 34.7±4.2 ml/kg/min, p=.002) all improved during follow-up, but gait speed decreased (1.5±0.2 to 1.4±0.2 m/s, p=.005). Body composition changes were not related to changes in function. Conclusions: A comprehensive weight loss generally improves physical function. It is uncertain of the mechanism since these were not related to body composition changes.

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### HOME-BASED EXERCISE IMPROVES CARDIORESPIRATORY FITNESS AND MUSCLE STRENGTH DURING METASTATIC PROSTATE CANCER TREATMENT

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Exercise is a potential mechanism for improving side effects caused by androgen deprivation therapy (ADT), and a home-based exercise intervention may help in eliminating barriers to physical activity. PURPOSE: To assess the physiological changes following a home-based exercise intervention in men with metastatic castration-resistant prostate cancer (mCRPC) receiving ADT and androgen receptor signaling inhibitors. METHODS: mCRPC patients (n=7, median age = 71y ± 10, BMI=29.64 kg/m<sup>2</sup> ± 3.4) undergoing ADT completed body composition, muscular function, physical function, and cardiorespiratory fitness assessments before and after a 12-week home-based exercise intervention using walking and resistance bands. Fatigue was assessed using the FACIT-Fatigue questionnaire. Quality of life (QoL) was measured using the Functional Assessment of Cancer Therapy-Prostate questionnaire. Depression was assessed using the Hospital Anxiety and Depression scale. Changes were assessed using paired-samples t-tests. RESULTS: Following training, leg press maximal strength significantly increased by 10.7% ± 6.7 (p=0.023, d=0.241) and peak oxygen consumption significantly increased by 9.7% ± 22.4% (p=0.013; d=0.446). Depression scores showed a trend to decrease (-37.3% ± 28.8, p=0.098). Short performance physical battery (SPPB) scores were 10.3 ± 2.2 but were unchanged with training (p=0.331). No significant difference occurred in any other variable tested. CONCLUSIONS: Preliminary analyses suggest home-based exercise training improves strength and cardiorespiratory function during treatment for mCRPC but these did not appear to translate into functional improvements or QoL. These patients appear to have treatment related reductions and appear to have modest reductions in physical function and may benefit from programs like this to minimize side effects of anti-cancer therapies.

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### PATIENT COMPLIANCE IN VARIOUS CLINICAL SETTINGS

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PURPOSE: Examine the relationship between patient compliance and background information from patients and clinicians to identify variables which impact exercise prescription compliance and overall satisfaction of the patient. METHODS: Questionnaires were given to 40 patients and their corresponding clinicians at 2 physical therapy and 2 chiropractor clinics. Patients completed questionnaires prior to therapy sessions and clinicians completed them upon conclusion of patient's sessions. Patient questions included age, education, type of injury, income, eagerness to complete therapy, personal feelings of their clinician, perception of their progression, and compliance with their protocol. Clinician questions included age, education level, title, satisfaction with patient compliance, and satisfaction with profession. Both patients and clinicians were blinded to the results and coded with identifier numbers. RESULTS: Pearson's r correlations and two-tailed tests showed patients are more likely to view exercises as helpful if their recovery was progressing quickly (r = .4239, p < .01). Eagerness to do therapy was related to how quickly recovery progressed (r = .4413, p < .01) and how much time the clinician spent with the patient (r = .3721, p < .05). Clinician title and age were positively associated with whether the clinician was distracted (r = .5503, p < .001; r = .3618, p < .05). There is a log odds decrease of 2.35 in the likelihood of frequent exercise completion when your clinician has a more prestigious title (S.E. .92, p < .05). CONCLUSIONS: Supervisors can consider working with employees to limit distractions, increase patient/client interaction and pleasantness to aid patient compliance.

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### THE VALIDITY AND REPRODUCIBILITY OF A 5-MINUTE ENDURANCE TEST OF THE DIAPHRAGM MUSCLE

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Diaphragmatic function could be important in treating respiratory failure. Electrical stimulation and accelerometer-based mechanomyography have been used to identify the endurance index of various muscles, but not of the diaphragm. PURPOSE: Measure the validity and reproducibility of an endurance test of the diaphragm muscle using electrical stimulation of the phrenic nerve. METHODS: Ten healthy subjects (21.2±1.1 yrs) were tested in the supine position on two separate occasions within one week. Custom-made stimulation electrodes were placed on the left (n=9) or right (n=1) phrenic nerve, which lies underneath the sternocleidomastoid muscle. The stimulation intensity to induce a vigorous contraction was determined. An accelerometer was placed on the abdomen. The endurance test consisted of 5 minutes of electrical stimulation on 5 Hz, with a sampling rate of 400 Hz. The average acceleration per minute was recorded. The endurance index, which equals the ending value/peak value\*100, was then calculated. A series of practice tests were performed before data collection. RESULTS: The test was successfully completed 21/24 times. The time to find the phrenic nerve was 57.0±54.6 s for trial 1 and 28.8±29.2 s for trial 2. The average endurance index for trial 1 and 2 were 71.6±9.9% and 69.6±13.6%, respectively (between days, p=0.61, CV=8.96%). CONCLUSIONS: The time to find the phrenic nerve decreased with practice. The endurance test was reproducible and did not have an order effect. With additional training and testing, the diaphragm endurance test may be practical in clinical populations.

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### ENDURANCE INDEX OF THE RECTUS AND BICEPS FEMORIS

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Approximately 30% of all anterior cruciate ligament (ACL) injuries in female athletes are due to physical contact. The majority of ACL injuries do not involve contact and occur late in games when muscles are fatigued. Muscular fatigue reduces force and joint stability, which leads to greater translational movement and increased risk of injury. Purpose: To determine the Endurance Index (EI) for the rectus femoris (RF, quadriceps) and the biceps femoris (BF, hamstrings). Methods: 22 college-aged females (20.7±1.3 yrs) completed accelerometer-based mechanomyography (aMMG) and strength testing. aMMG requires electrical muscle stimulation (EMS) at low frequency (4 Hz) and amperage (25 mA) for three 5-min periods and contractions were recorded using an accelerometer. The EI was calculated from aMMG data as the percent change from peak acceleration for each period and muscle. An isokinetic dynamometer was used to assess strength (60 deg/sec) of the quadriceps and hamstring muscles. Data were analyzed using 2-way repeated measures ANOVA with preplanned comparisons. Results: A significant interaction between muscle and time (p=0.013) indicates that the EI for the BF (T0 100%, T1 61.4±18.3%, T2 54.6±20.2%, T3 52.8±21.9%) declined significantly more over the periods of stimulation than the RF (T0 100%, T1 76.7±11.6%, T2 70.2±14.3%, T3 70.5±28.6%). The quadriceps muscle groups were 2.2-fold stronger than the hamstrings (90.9±14.9 vs 42.2±10.2 Nm; p<0.001) though there was no relationship between strength and EI. Conclusion: These data suggest that the BF may fatigue before the RF during athletic events in healthy females, and the resistance to fatigue is unrelated to muscle strength. Supported by Mini-Magellan Grant from the Office of Undergraduate Research.

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### FEASIBILITY AND ADHERENCE TO HOME-BASED EXERCISE DURING METASTATIC CASTRATION-RESISTANT PROSTATE CANCER TREATMENT

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Metastatic castration-resistant prostate cancer (mCRPC) is treated with androgen deprivation therapy (ADT) and androgen receptor signaling inhibitors, resulting in extensive muscle atrophy. Exercise interventions have attenuated changes in body composition with localized cancer but limited data exists during advanced disease. **PURPOSE:** To assess the feasibility of and adherence to a home-based exercise program in men with mCRPC on ADT. **METHODS:** Patients completed fitness assessments before and after a 12-week home-based exercise intervention (with weekly phone contact) involving walking and resistance bands. Feasibility (target: 67%) was measured as the % of patient who completed the intervention. Adherence (target: 75%) to the overall program, the specific exercise modes, and the specific resistance training exercises were determined as the number completed over the number prescribed. **RESULTS:** 13 subjects completed baseline testing and 7 completed the intervention (54%), which was lower than the target value. Adherence reached but did not significantly exceed the target value of 75% for overall (82.7% ± 9.5; p=0.076), walking (80.7% ± 14.2; p=0.326), or resistance training (85.3% ± 12.5; p=0.072). Core focused exercises had significantly lower adherence (58% ± 35.7; p<0.001). **CONCLUSIONS:** Feasibility estimates were lower than expected but the individuals that completed the intervention had high adherence levels, which may potentially alleviate some ADT-related side effects. These preliminary findings suggest home-based interventions make exercise more accessible, but the limited supervision or advanced disease appear to limit completion in some patients. Supported by a Physical Activity and Survivorship Pilot Grant.

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### SEX DIFFERENCE IN ABSOLUTE AND RELATIVE TO FAT FREE MASS VO2 AT AEROBIC THRESHOLD IN ADOLESCENTS

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**PURPOSE:** The aim of this study was to observe the magnitude of sex difference in aerobic threshold between male and female adolescents when VO<sub>2</sub> is expressed in absolute terms and relative to total body mass (BM) and to fat free mass (FFM). Aerobic threshold (AerT) was evaluated as the measure of cardiorespiratory fitness. **METHODS:** Twenty-two healthy children (9 males, age 16.67±0.5 years, FFM 57.98±7.89 kg; 13 females, age 16.38±0.87 years, FFM 45.17±15.95 kg) completed body composition tests and the VO<sub>2</sub> at AerT was measured breath-by-breath via cardiopulmonary exercise test on a cycle ergometer (15 W/min). V-slope and ventilatory equivalent methods were used to assess AerT. **RESULTS:** There was a significant difference between males and females in absolute VO<sub>2</sub> at AerT (1184.11±222.30 mL/min vs. 942.31±202.27 mL/min, respectively, p<0.05). VO<sub>2</sub> relative to BM at AerT was still higher in males compared to females (16.89 ± 2.20 mL/kg/min vs. 16.38 ± 3.14 mL/kg/min, p=0.678). However, females exhibited higher VO<sub>2</sub> relative to FFM at AerT compared to males (20.43±2.92 mL/kg/min vs. 21.57±2.86 mL/kg/min, p=0.537). **CONCLUSION:** Our results show that adolescent females' FFM may be capable of uptaking more oxygen at AerT compared to that of adolescent males, suggesting that sex difference in VO<sub>2</sub> during exercise may manifest in function of FFM in adolescents.

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### MEASURES OF REPRODUCIBILITY FOR THE ENDURANCE INDEX

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The Endurance Index (EI) is a relatively new technique to assess the resistance to local muscular fatigue. However, limited data is available regarding the reproducibility of the EI. **Purpose:** To determine the reproducibility of the EI for the rectus femoris. **Methods:** The dominant leg of 8 female participants (20.8±1.6 yr) was assessed on 3 nonconsecutive days within a two-week period. During each visit, low frequency (4 Hz) electrical stimulation (EMS) muscle twitches for three 5-min periods separated by 30 sec of rest. Data was collected via accelerometer, compiled and calculated as a percent change. Participants performed leg extensions (60 degrees/sec) maximal voluntary contractions (MVC) at each visit via isokinetic dynamometer. Data were analyzed using ANOVA with preplanned comparisons, intraclass correlation (ICC) and coefficient of variation (%CV). **Results:** The EI was not different between Trials 1, 2 and 3 (p=.758) though the EI changed significantly over Time (T0=100%, T1=79.8±5.3%, T2=70.0±6.9% and T3=68.1±8.6%, p<.001). Contrasts revealed significant differences between T0 and T1 (p<.001), and T1 and T2 (p=.002) but no difference between T2 and T3 (p=.495). ICC revealed moderate reproducibility (T1=.785, T2=.468 and T3=.266). %CV (T1=7.0%, T2=13.0% and T3=15.1%). No differences were detected between MVC trials. ICC was 0.905 and %CV was 3.73%. **Conclusion:** The EI for the quadricep muscle groups was found to be moderately reproducible while strength measures were highly reproducible.

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### THE EFFECTS OF GENDER DIFFERENCE AND BODY COMPOSITION ON MAXIMAL AEROBIC CAPACITY

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Maximal oxygen consumption (VO<sub>2</sub>max) is considered the gold standard assessment of aerobic capacity. Absolute VO<sub>2</sub>max tends to be higher in males than females due to greater body weight and fat free mass (FFM). To account for body size, values are commonly normalized by body weight. However, normalization by FFM may provide a more accurate assessment of aerobic capacity. **Purpose:** The aim of the study was to compare the VO<sub>2</sub>max normalized by FFM between male and female adolescents. **Methods:** Twenty-two individuals (13 females, 9 males; age 16.5 ± 0.7 years) performed a graded cardiopulmonary exercise test on a cycle ergometer with a 15 watt per minute incremental protocol. Standard criteria of maximal effort were used to determine if VO<sub>2</sub>max was reached. Respiratory parameters were analyzed breath-by-breath using the COSMED K5. Body composition was measured using the Bod Pod and expressed as percentages of fat mass, and FFM. **Results:** Males reported a significantly higher percentage of FFM than females (83.3 ± 8.0% vs. 72.6 ± 5.4%, respectively, p=0.001). Absolute VO<sub>2</sub>max was significantly higher in males than females (2343.8 ± 553.6 mL/min vs. 1792.4 ± 249.9 mL/min, respectively, p=0.005). This difference was maintained after normalizing VO<sub>2</sub> by body weight (33.5 ± 6.1 mL/kg/min vs. 30.6 ± 5.5 mL/kg/min, respectively). VO<sub>2</sub>max normalized by FFM indicated females had higher VO<sub>2</sub>max values than males (41.4 ± 8.0 mL/FFM/min vs. 40.1 ± 5.7 mL/FFM/min, respectively). **Conclusion:** When normalized by fat free mass, female adolescents appear to demonstrate higher aerobic capacity than males during maximal effort exercise.

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#### **EFFECTS OF A STRETCHING INTERVENTION ON MUSCULAR STRENGTH AND PERFORMANCE**

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The benefits of stretching programs on general health and exercise programs have been supported in the past, however, there is little support on the effects of long term, chronic stretching interventions (CSI) on muscular strength and performance for adolescent athletes. **PURPOSE:** To assess the effects of a CSI on muscular strength and performance in adolescent female soccer players. **METHODS:** A retrospective analysis of 11 adolescent females (15.5±1.1 yrs., 165±5.7 cm, 60.5±5.5 kg) who completed a CSI was conducted on the following strength and performance measures: One repetition max (1RM) back squat (BS), 1RM bench press (BP), vertical jump height (VJ), 20 yard dash (20YD) and pro-agility shuttle (PAS) time. The CSI lasted 6 months and consisted of stretches performed statically and dynamically either before or after practice sessions. Paired sample t-tests were conducted to examine significance with an alpha level set a priori to  $P \leq 0.05$ . **RESULTS:** There were significant decreases in the PAS (.17±.08 sec.,  $p=.04$ ) and in 20YD times (.07±.01 sec.,  $p=.04$ ), however no significant differences were noted in BS (19.3±9.0 kg,  $p=.23$ ), BP (3.9±1.3 kg,  $p=.11$ ) and VJ (.3±.3 cm.,  $p=.15$ ) **CONCLUSION:** These results suggest that CSI can improve selected muscular strength and performance measures in adolescent athletes, indicating further research is needed to understand its significance for all programming.

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#### **OBJECTIVELY MEASURING RESISTANCE TRAINING EXERCISES WITH THE WRIST-WORN ATLAS MONITOR**

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Along with 150 minutes of aerobic activity, the Physical Activity Guidelines also recommend muscle-strength training at least twice a week. While devices for monitoring physical activity have focused mainly on measuring aerobic activity, recently, some devices have been developed to track resistance training exercises (number of repetitions and exercise type). **Purpose:** To assess the ability of a wrist-worn activity monitor to identify the number of repetitions and the type of strength training exercise during a 14-exercise circuit training routine. **Methods:** 159 male and female participants (24.0±6.5 years) completed two sets of 12 repetitions of a circuit-style workout consisting of 14 different strength training exercises while wearing the Atlas activity monitor on the left wrist. Repetition number and exercise type data from the Atlas were compared to the researcher observed repetitions and exercises to determine percent accuracy. Additionally, mean absolute percent error (MAPE) and mean absolute error (MAE) were calculated for repetitions. **Results:** Overall, the device recorded 11.0 out of 12 repetitions for each exercise. The Atlas was the most accurate for detecting push-ups (11.9 repetitions), and least accurate for lunges (9.0 repetitions). The Atlas recorded more than 11 of 12 repetitions on all but three exercises. Overall, exercise type was correctly identified by the Atlas 78.4% of the time. Bicep curls was correctly identified 97.5% of the time and was the only exercise not significantly different ( $p > 0.05$ ) from the observed (100%). However, 11 of the 14 exercises did have  $>70\%$  exercise identification accuracy. Classification accuracy for upper body exercises ranged from 97.5% (biceps curls) to 54.7% (bench press), while lower body accuracy ranged from 92.5% (calf raises) to 78.6% (squats). For all exercises, MAPE ranged from 1.99% and 31.66% and MAE was 0.24-3.80 repetitions. **Conclusion:** Overall, the Atlas activity monitor demonstrated good validity for repetitions and exercise type for most upper and lower body exercises.

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#### **THE RELATIONSHIP OF PERSEVERANCE, PSYCHOLOGICAL FACTORS, AND CONDITIONING TO PERFORMANCE IN LACROSSE**

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**PURPOSE:** To evaluate psychological and physical capabilities in relation to on-field performance in Division I female lacrosse players. **METHODS:** Field players at a small Division I institution participated in the study: defenders ( $n = 4$ ), attackers ( $n = 7$ ), and midfielders ( $n = 9$ ). Participants completed three conditioning tests and three psychological assessments [12-item Grit assessment, Athletic Coping Skills Inventory (ASCI-28), Performance Profile] prior to the start of the competitive season. End-of-season game statistics were used to evaluate on-field success for each player. All data were all standardized to z-scores, and multiple linear regression analyses were completed using the assessments as independent variables and game statistics as the dependent variable. **RESULTS:** For the whole team, total conditioning, and specific sub-categories of both the ASCI and Performance Profile were significantly associated with successful on-field performance, predicting 31.4 to 53.0% of the variance ( $p < 0.05$ ). Conditioning, the ASCI-28, and the Performance Profile accounted for 61.4 to 100% of the variance in on-field performance for the midfielders ( $p < 0.05$ ). Only the ASCI-28 and Performance Profile loaded as predictors for the attackers, accounting for 75.0 to 99.8% of the variance in play ( $p < 0.05$ ). **CONCLUSIONS:** Pilot data indicate that variance in game performance may be predicted from conditioning and psychological assessments. Subsequent data will be combined with current data to improve statistical power and variance of on-field performance in participants. The current psychological assessments, and potentially others may then be used to assist with talent identification for recruiting players.

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#### **ATTITUDES TOWARDS PHYSICAL ACTIVITY PARTICIPATION AND SCHOOL ENGAGEMENT IN ELEMENTARY SCHOOL CHILDREN**

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Numerous benefits are associated with physical activity participation with recent evidence indicating this may transfer into the classroom environment. **Purpose:** The purpose of this study was to investigate the relationship between attitudes towards active or passive physical activity participation and classroom engagement in elementary school children. **Methods:** Students ( $n = 67$ ) in grades 3-5 completed The Children's Self-Perceptions of Adequacy in and Predilection for Physical Activity (CSAPPA) and The Elementary Student Engagement Instrument (SEI). **Results:** A statistically significant positive correlation ( $r = .31$ ,  $P < .05$ ) was found between the CSAPPA and SEI indicating that students who prefer active participation in physical activity also report higher levels of engagement within the school environment. No statistical difference was noted between males and females or across grade levels. **Conclusion:** The results of this research support the benefits of physical activity participation within the school environment. The lack of statistical difference with regard to sex is also noteworthy in that research connecting physical activity and classroom engagement frequently indicates differences between males and females. This is possibly attributed to the inclusive culture established by the school which promotes and supports opportunities for all students. These findings are particularly relevant in light of current trends to reduce time spent in physical education, free play, and other physical activity opportunities within the school day.

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**PERCEIVED PHYSICAL ABILITY AND SELF-PERCEPTION OF ADEQUACY AND ENJOYMENT FOR PHYSICAL ACTIVITY IN ELEMENTARY STUDENTS**

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How children perceive their physical ability is important in understanding their reported adequacy, preferences, and predilection of physical activity. This relationship is useful in identifying lifelong physical activity behaviors. Purpose: The relationship between perceived physical ability and classroom engagement was investigated in elementary school children. Methods: Students (n = 120) in grades K-5 completed the Perceived Physical Ability Scale (PPAS) and the Children's Self-Perceptions of Adequacy and Predilection for Physical Activity (CSAPPA). Results: A statistically strong significant positive correlation ( $r = .49, P < .01$ ) was found between the PPAS and CSAPPA indicating that students with higher perceived physical ability also reported higher scores on the CSAPPA. The high CSAPPA scores are indicative of students having a higher likelihood of choosing physical activity over a non-active option. No significant differences were noted between males and females or across grade levels. Conclusions: Based on these results students who have a greater perception of their physical ability also report being more likely to select a physically active option when given the choice. The findings of this study are noteworthy as previous studies have shown that differences between male and female students may exist with similar measures. These results may be indicative of the environment that has been created at the study site. The study site promotes a culture centered on respect, care, and a growth mindset within its student body. Future research comparing student to teacher ratio, cohesive student groups, and school schedules should be conducted to compare students' PPAS and CSAPPA results. Programs designed to enhance perceived physical ability and enjoyment of physical activity are needed to promote lifetime physical activity habits.

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**WHAT A DIFFERENCE A MENTALLY-TOUGHENING OFF-SEASON MAKES: A CASE OF NCAA DI ROWERS**

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Non-contact injuries in US collegiate athletics during offseason have increased. Despite the widespread acceptance of mental toughness (MT) training in the strength and conditioning world, coaches do not tend to measure the effectiveness of their regimens. Strength and conditioning coaches (SCC) tend to design mostly physical and not psychological protocols to increase MT. Purpose: Triggered by current incidents in Big 12, in Pac-12, and most recently, in Big Ten -in which SCCs were purportedly involved, researchers attempted to investigate the effectiveness of an offseason physical training protocol on the MT levels of Division I rowers. Methods: Fourteen student-athletes and their strength and conditioning coach (multi-rating) assessed, via Qualtrics, the players' levels of MT using the Mental Toughness Index (MTI). Results: No statistically-significant effect was found between pre- and post-offseason intervention [ $F(1, 54) = 0.13, p = 0.71$ ] nor between the perception of that effect between players and coach [ $F(1, 54) = 1.23, p = 0.27$ ]. Conclusions: The levels of athletes' MT between the pre- and post-intervention measurements did not increase significantly and the perceptions of the assessors were not significantly different either. Therefore, the results suggest that the intervention did not work in regard to increasing the MT levels of the team. Furthermore, the MTI scores indicate coach-athlete compatibility in recognizing this theoretical construct. In an effort to support the student-athletes' well-being and avoid similar media backlash, more similar research projects are crucial so as to move from anecdotally-based to evidence-based strength and conditioning MT training protocols. However, during that attempt, coaches need to share their protocols for reasons of evaluation and replication.

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**ENJOYMENT ASSESSMENT IN CHILDREN AFTER STRUCTURED FITNESS BASED PROGRAM**

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PURPOSE: Feelings of enjoyment are strong predictors of children's continued participation in exercise. Differences in enjoyment may explain differences in outcome measures post intervention. The purpose of this project was to determine if exercise enjoyment differed based on body composition outcomes following a structured fitness based program. METHODS: 21 children (M Age =  $9.38 \pm 3.82$  yrs.) participated in an 8-week, structured fitness intervention consisting of 1-hour weekly sessions. Weekly sessions provided fitness opportunities in a fun non-competitive environment with the purpose to elicit moderate-to-vigorous physical activity. Enjoyment and body composition was assessed pre and post intervention. Enjoyment was assessed using the Intrinsic Motivation Inventory (IMI) questionnaire and iDXA assessed changes in body composition. Paired t-test examined differences in pre/post measures and logistic regression examined differences in enjoyment between participants who reduced body fat percentage and those that increased body fat percentage. RESULTS: Overall 12 participants showed positive changes in body composition, however, there were no significant changes in body composition ( $p = .308$ ) or enjoyment ( $p = .309$ ) over the course of the intervention. The logistic regression showed that for every 1-point increase in the enjoyment scale of the IMI increased the odds of an improvement in body composition by 1.4. Participants who scored above a 48 on the IMI enjoyment scale after the intervention showed positive changes in body composition. CONCLUSION: Within interventions settings, differences in enjoyment may account for outcome variable differences in children.

**MANIPULATING THE FITT PRINCIPLE DOES NOT AFFECT ADHERENCE TO ACSM'S RECOMMENDED PHYSICAL ACTIVITY GUIDELINES: A SYSTEMATIC REVIEW**

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Purpose: To systematically review the effect of FITT (frequency, intensity, time, type) principle manipulation on exercise adherence. Methods: Electronic databases were searched from inception until February 2018. Inclusion criteria were: (1) adults > 18 y; (2) randomized controlled trial; (3) manipulated frequency, intensity, time, or type; (4) adherence was the dependent variable. Results: 32 studies met the inclusion criteria. 8 studies assessed frequency, 15 studies assessed intensity, 17 assessed time, and 12 assessed type. There was no significant effect of manipulation of FITT components on exercise adherence. Only 4 studies incorporated a behavioral component; however, each of these studies reported an increase exercise adherence. Behavioral components included a measure of affective response and enjoyment. Conclusions: Manipulating components of the FITT principles does not seem to affect adherence to ACSM's recommended physical activity guidelines. Inclusion of a behavioral component measurement may be most advantageous to increase adherence to ACSM's recommended physical activity guidelines.

### IMPLEMENTATION OF EXERCISE IS MEDICINE ON CAMPUS AT THE UNIVERSITY OF NORTH CAROLINA - CHAPEL HILL

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Purpose: The University of North Carolina at Chapel Hill was recently registered as an Exercise is Medicine (EIM) campus. To enable effective and sustainable implementation of EIM within Campus Health, the purpose of the current study was to anonymously survey students and determine: current exercise behavior, barriers and motives, interest in receiving exercise advice and by whom, and appropriate methods of communication. Methods: 500 surveys were distributed in Campus Health services between January-April 2018. Results: The 407 responders were evenly distributed among college status (20% Freshman, 21% Sophomore, 16% Junior, 17% Senior, 23% Graduate Student, 3% Post-Doc). Time was the biggest barrier to exercise (57%). More than half wanted to receive guidance about exercise (48% Agree, 10% Strongly Agree), and agreed they would be more likely to exercise if they were given advice about exercise (46% Agree, 11% Strongly Agree). Students wanted a referral to an exercise professional (41%), and to receive initial advice and communicate through email (56%). Conclusions: Students attending Campus Health are interested in receiving exercise guidance and, following a referral, this advice should be delivered by trained exercise professionals, e.g., the Exercise and Sport Science Department. Findings from this study will be used to implement a full trial in Counseling and Psychological Services.

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### PREVALENCE OF DEPRESSION AND ANXIETY AMONG ROTC COLLEGE STUDENTS

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P150 United States Reserve Officers Training Corps (ROTC) college students go through large amounts of physical, mental, and emotional training. Many students complete this training in conjunction with normal stressors of an undergraduate degree program. The psychological response to these stressors may include depression and anxiety which have been studied in active U.S. military populations but not within ROTC. Purpose: To examine the prevalence of depression and anxiety among female and male ROTC students. Methods: Volunteer ROTC recruits (n=102, male: n=75, female: n=27), age: 21.5±16.2 years, height: 74.4±10.1 cm, weight: 74.4±11.6 kg). Participants self-reported height and weight and completed the Center for Epidemiological Studies Depression Scale and the Spielberger State-Trait Anxiety Scale. Results: Basic descriptive statistics and Chi-square analysis were used. Prevalence for depression for all participants was 26.5%. Gender specific depression prevalence was estimated at 6.9% for females and 19.6% for males. State anxiety scores revealed 6.9% above average norm. Trait anxiety scores show 22.5% above the average norm. Gender specific state anxiety revealed 1.0% for females and 5.9% above average norms for males. Gender specific trait anxiety showed 6.9% for females and 15.7% above average norms for males. Conclusions: ROTC students displayed risk factors for depression and anxiety when compared by gender and military recruits. Identifying symptoms of depression and anxiety will lead to overall healthier ROTC. Maintaining adequate mental health for recruits allows for a potential of a long-term employment in the U.S. armed forces. Understanding possible causes of depression and anxiety within ROTC students allows programs to tailor training strategies to avoid these risk factors.

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### SELF-DETERMINATION FOR EXERCISE AMONG EMPLOYEES

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Desire2Move (D2M) was an 8-week program that encouraged university employees to engage in moderate-to-vigorous physical activity (MVPA). Purpose: The purpose of this study was to examine gender and age differences for exercise behavioral regulations. Methods: Sixteen departments (207 employees) competed as teams to earn the greatest average minutes of MVPA that participants logged with MapMyFitness. One week after D2M, the program coordinator emailed an online survey to 167 participants that included demographics and the Behavioral Regulation in Exercise Questionnaire-3 (BREQ-3). Results: Although 63 employees consented (37.7% response rate), 11 did not complete the survey, and half were randomly selected to complete the BREQ-3. Participants were 26 university employees (41.85 years ± 13.17) who were non-Hispanic (87.5%), White (52.0%), females (57.7%) with graduate degrees (69.2%). They reported greater identified (3.33 ± 0.55), intrinsic (2.90 ± 0.88), and integrated (2.83 ± 0.94) exercise behavioral regulations. Independent samples t-tests revealed possible gender and age differences for intrinsic motivation,  $t(24) = 1.80$ ,  $p = .085$ , and external regulation,  $t(20) = 2.99$ ,  $p = .007$ , respectively. Specifically, males (3.25 ± 0.63) reported greater intrinsic motivation than females (2.65 ± 0.96), and younger participants (18-44 years; 0.93 ± 0.79) reported greater external regulation than older participants (> 45 years; 0.25 ± 0.34). Conclusions: D2M participants were autonomously motivated for exercise and males may have enjoyed the exercise program more than females. It is unclear if D2M attracted motivated individuals or if the program changed their motivation. Therefore, further examination of how D2M may impact exercise motivation is warranted.

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### SCREENING ATHLETES FOR DISORDERED EATING: ARE WE ASKING THE RIGHT QUESTIONS?

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Little data is available to evaluate the performance of these Preparticipation evaluations (PPE) screening questions in practice. Purpose: The performance of consensus PPE screening questions was examined in comparison to the validated 5-question SCOFF screening tool to detect eating disorders. Methods: 230 collegiate athletes (194 male) completed an anonymous survey including 3 consensus PPE questions regarding eating habits (prior history of eating disorder, adherence to a special diet, and current attempts to gain or lose weight) and the SCOFF screening tool. Results: 10 athletes (4.3%, 3.6% of males, 8.3% of females) screened positive for an eating disorder using the SCOFF tool. The standard PPE questions combined to identify 43% of athletes as having concerning dietary habits (sensitivity 50%, specificity 59%, positive predictive value 5%, negative predictive value 98%). One athlete self-reported a diagnosed eating disorder. This individual was detected using the SCOFF tool and was not detected using the PPE questions. An analysis of the component questions identified the single question "Do you worry that you have lost control over how much you eat?" from the SCOFF tool to be the most sensitive and specific (70%, 100%) in collegiate athletes to detect eating disorders. Conclusions: Our results suggest that the current consensus PPE screening questions are neither sensitive nor specific to detect eating disorders in collegiate athletes. Further studies are needed to determine the appropriate questions for screening in the collegiate athlete population.

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### EFFECTS OF A SINGLE BOUT OF YOGA ON SELF-ESTEEM, SELF-EFFICACY, AND HAPPINESS OF COLLEGE STUDENTS

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**PURPOSE:** The purpose of this study was to determine the effects of a single bout of yoga on happiness, self-esteem, and self-efficacy for exercise in a volunteer sample of 25 college students from a public university in southeastern United States. Previous research explored long-term effects of yoga on mental health, but the effects of a single bout of yoga are unclear.

**P153 METHODS:** Volunteers from a summer-session yoga course completed 26 items on demographics, happiness, self-esteem, and self-efficacy for exercise, before and after their first 30-minute yoga session. **RESULTS:** Dependent t-test showed no significant differences in pre and posttest scores of measured variables % happy ( $M=62.7$ ;  $M=62.9$ ;  $p=.031$ ), % unhappy ( $M=23.2$ ;  $M=25.1$ ;  $p=.442$ ), % neutral ( $M=33.5$ ;  $M=30.6$ ;  $p=.459$ ), self-esteem ( $M=28.8$ ;  $M=29.6$ ;  $p=.362$ ), self-efficacy to exercise ( $M=16.0$ ;  $M=17.4$ ;  $p=-1.077$ ). **CONCLUSIONS:** Although no significance was found, future research should focus on the impact of yoga (both single-bout and long-term effects) on health variables in a larger sample, and within diverse populations. Future research should also consider the effects of other exercise protocols, including steady state aerobic, high-intensity interval training, and resistance training.

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### INDIVIDUAL DIFFERENCES PREDICT HIGH INTENSITY INTERVAL AND MODERATE INTENSITY CONTINUOUS EXERCISE ENJOYMENT

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**P154** Preference for (P) and tolerance of (T) high intensity exercise has been shown to influence self-selected intensity and persistence with exercise beyond the ventilatory threshold. However, exploration of P and T remains relatively unexplored with respect to high intensity interval exercise (HIIE). **PURPOSE:** Assess the extent to which P and T account for and predict affective responses to and enjoyment of HIIE versus moderate intensity continuous exercise (MICE). **Methods:** Participants [ $N=24$ , 9 males; age ( $M \pm SD$ );  $25.9 \pm 9.2$  yrs; estimated  $VO_{2peak}$  ( $M \pm SD$ );  $34.6 \pm 10.2$  ml·kg<sup>-1</sup>·min<sup>-1</sup>] completed 35-min of HIIE and MICE following a randomized, within subjects design. Participants reported having subsyndromal post-traumatic stress. Affective valence was assessed before, during, and after exercise. Enjoyment was assessed immediately after exercise only. Data were analyzed using linear regression analyses. **RESULTS:** After accounting for age, sex, and body mass index (BMI), T explained an additional 49.9% unique variance in enjoyment of HIIE [ $F_{change}(1,20) = 22.04$ ,  $\beta = 0.713$ ,  $P < 0.001$ ] while P explained 31.8% unique variance [ $F_{change}(1,20) = 10.05$ ,  $\beta = 0.590$ ,  $P = 0.005$ ]. After accounting for age, sex, and BMI, T explained an additional 18.6% unique variance in enjoyment of MICE [ $F_{change}(1,20) = 4.71$ ,  $\beta = 0.435$ ,  $P = 0.042$ ] while P did not explain a significant variance. P nor T accounted for significant variance of in-task affect of HIIE or MICE. **CONCLUSIONS:** P and T both accounted for significant variance in enjoyment of HIIE and MICE. While P and T did not predict affective valence during exercise, individuals with higher P and T scores may be better suited for HIIE. As exercise enjoyment has been a leading cause of adherence, it is highly recommended participants engage in activities they enjoy.

### ADULTS' SMARTPHONE USE PREDICTS BEING AN "ACTIVE COUCH POTATO"

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**P155** Purpose: To investigate the relationship between smartphone use, television viewing, and the "Active Couch Potato" (ACP) (i.e., simultaneously physically active and highly sedentary) in adults. **Methods:** A sample of 401 adults ages 18 - 80 (mean  $\pm$  SD =  $40 \pm 16$  years) completed validated surveys about smartphone use, television viewing, physical activity, and sedentary behavior. Regressions and t-tests were used to examine the data. **Results:** Mean smartphone use was  $239 \pm 224$  minutes per day. Of the participants, 127/401 (32%) were coded as ACP. ACP was significantly positively ( $\beta = 0.001$ ,  $p = 0.006$ ) associated with smartphone use. ACP was not ( $\beta = 0.000$ ,  $p = 0.757$ ) associated with television viewing. Physical activity was significantly greater ( $t = 3.993$ ,  $p = < 0.001$ ) in the ACP ( $58 \pm 35$  Godin score) than non ACP ( $45 \pm 30$  Godin score) and sedentary behavior was significantly greater ( $t = 15.711$ ,  $p = < 0.001$ ) in the ACP ( $681 \pm 195$  minutes per day) versus the non ACP ( $365 \pm 183$  minutes per day). ACP engaged in significantly greater ( $t = 3.545$ ,  $p < 0.001$ ) smartphone use ( $297 \pm 270$  minutes per day) than the non ACP ( $212 \pm 197$  minutes per day). There was not a significant difference ( $t = 0.213$ ,  $p = 0.831$ ) in television viewing between the ACP ( $145 \pm 148$  minutes per day) and non ACP group ( $148 \pm 128$  minutes per day). **Conclusion:** Similar to college students, smartphone use predicts being an ACP and television viewing does not. Future research is warranted using objective, experimental methods to manipulate the effect of smartphone use on the ACP.

### EXAMINING INTRA-INDIVIDUAL VARIABILITY OF PERCEIVED PHYSICAL DISCOMFORT IN YOUNG ADULTS: A POTENTIAL EXERCISE ANTECEDENT

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**P156** Ecological Momentary Assessment (EMA) allows the observation of intra-individual variance in cognitive, perceptual, psychological, and contextual variables that may impact recurrent health behaviors such as exercise. Perceptions of physiological states (pain, illness) likely influence behaviors, but most assessments are cross-sectional. **PURPOSE:** Obtain preliminary estimates of intra-individual variability in perceived physiological states. **METHODS:** A secondary analysis was conducted using data from young, healthy adults ( $N=29$ ) undergoing EMA of exercise antecedents (4 surveys/d across 14-d). Extracted variables pain, stiff, and achy were scored on a 7-point Likert scale. Individual item scores were summed to create a "physical discomfort" score (PD; Cronbach's  $\alpha=0.847$ ). Data were retained from compliers (completed  $>75\%$  of EMA surveys). Compliers ( $n=20$ ,  $23 \pm 4$  y,  $BMI=25.6 \pm 3.1$  kg/m<sup>2</sup>, 60% female) completed  $89 \pm 5\%$  of surveys. Missing data were imputed with the participant's daily means. Two way mixed intra-class correlation coefficients (ICC) were calculated with 95% confidence intervals (CI) for pain, stiff, achy, and PD across all time blocks and across daily means.  $ICC \leq 0.5$ , between 0.5-0.75, between 0.75-0.9, and  $\geq 0.9$  indicate poor, moderate, good, or excellent consistency. **RESULTS:** Indices of PD were generally low: pain= $0.9 \pm 1.2$ ; achy= $1.3 \pm 1.4$ ; stiff= $1.5 \pm 1.5$ . Poor consistency was observed across time points for pain ( $ICC=0.32$ ;  $CI=0.21-0.51$ ), achy ( $0.44$ ;  $0.31-0.63$ ); stiff ( $0.48$ ;  $0.34-0.67$ ), and PD ( $0.49$ ;  $0.35-0.67$ ). Poor-to-moderate consistency was observed across daily means for pain ( $0.46$ ;  $0.31-0.66$ ), achy ( $0.57$ ;  $0.41-0.75$ ), stiff ( $0.60$ ;  $0.45-0.77$ ), and PD ( $0.59$ ;  $0.43-0.76$ ). **CONCLUSION:** Relatively frequent assessment of PD may be necessary within EMA to capture important fluctuations. Understanding the timing, magnitude, and direction of fluctuations could expose points of vulnerability relating to exercise behavior.

### **SOCIAL MEDIA-BASED PHYSICAL ACTIVITY PROMOTION BY REGIONAL CRAFT BREWING ESTABLISHMENTS**

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Nationally distributing craft breweries have capitalized on the positive relationship between physical activity (PA) and alcohol consumption by marketing to active populations at the national level (sponsoring competitions, sports associations, obstacle races). Despite the rapid expansion of regional craft breweries in the U.S., community-level PA promotion by such establishments is not empirically documented. **P157** PURPOSE: Preliminarily assess PA promotion by regional craft breweries at the local level. METHODS: Facebook posts by 15 craft breweries located in a medium-size Southeastern city were screened over one year (Nov 2016-Oct 2017), with PA-related posts coded by activity type. Non-parametric correlations assessed associations between breweries' total PA posts, proportion of PA-to-general Facebook posts, built environment factors via Geographic Information System (GIS), and business characteristics obtained from surveys completed by brewery operators. RESULTS: Of 3845 Facebook posts, 147 referred to PA (median=4.5; IQR=8.75; mean=9.5±13.2; range=0-47). PA posts pertained to fitness classes (29.2%), biking (24.5%), running, (21.8%), outdoor activities (12.2%), sports (4.1%), and miscellaneous PA (8.2%). Brewery walkability (GIS walk score: 5-89), was inversely related to total PA posts ( $r=-.362$ ,  $p=.184$ ) and proportional PA posts ( $r=-0.510$ ,  $p=0.052$ ). Percentage of annual sales from craft beer was positively related to total PA posts ( $r=0.408$ ,  $p=0.212$ ) and proportional PA posts ( $r=0.189$ ,  $p=0.579$ ). CONCLUSIONS: The National Craft Brewer Association's core concept of community involvement through philanthropy, sponsorship, and volunteerism could encompass the promotion of PA. This is exemplified in the variety of PA advertised by regional craft breweries in this localized sample.

### **SELF-EFFICACY AND EXERCISE ADHERENCE IN KNEE OSTEOARTHRITIS**

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Osteoarthritis (OA) is the most common joint disorder in the U.S. The Strength Training for Arthritis Trial (START) was an 18-month intervention investigating if high- or low-intensity strength training reduces pain and improves function. **P158** PURPOSE: To examine associations between baseline self-efficacy and adherence to strength training sessions in the START study. METHODS: At baseline, participants completed the Activities-Specific Balance Confidence and Exercise Self-Efficacy Scales. Adherence is defined as the number of sessions attended divided by the number of sessions prescribed. RESULTS: At baseline, participants (M age=65 years; 41% Female) in both the high- (n=127) and low-intensity (n=126) groups reported high exercise self-efficacy (M=90.3%, SD=15.1 and M=91.1%, SD=15.1) and moderate self-efficacy for balance activities (M=78.3%, SD=19.6 and M=79.5%, SD=20.0), respectively. Adherence was good overall, with participants attending 63% of strength training sessions over 18 months. Baseline self-efficacy was not significantly correlated with adherence ( $p>.05$ ), and high attenders (>70% sessions) did not report significantly greater exercise self-efficacy at baseline than low attenders (90.2% vs. 91.3%,  $p>.05$ ). CONCLUSION: Although baseline self-efficacy was not related to adherence, future investigations will evaluate how changes in self-efficacy impact exercise adherence over time.

### **OUTDOOR PHYSICAL ACTIVITY, TIME SPENT OUTDOORS, AND NATURE AFFINITY LEVELS AMONG COLLEGE STUDENTS: A PILOT STUDY**

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Spending time outdoors and outdoor physical activity (OPA) has been shown to have various benefits to the college population. Engaging in nature can increase overall physical activity levels and improve one's affinity to nature. PURPOSE: The purpose of this study was to evaluate baseline data collected from the Student Outdoor Champion pilot study which utilizes peer counseling to promote OPA. METHODS: Fifteen college students completed the baseline survey during early Spring 2018. The online survey took approximately 15 minutes to complete and contained questions regarding their basic demographics, time spent outside versus inside, knowledge and engagement in guidelines for physical activity, and the Nature Affinity Scale (5-point Likert scale). RESULTS: Approximately 50% reported they often spend time outside, yet 26% spend time outside engaged in regular activity. While approximately 50% know the recommended guidelines for physical activity and reported meeting the guidelines for vigorous physical activity, less than 15% met the guidelines for moderate physical activity. Additionally, 50% stated they spend at least 1-2 hours outside on a typical weekday. Out of the 14 questions on the Nature Affinity Scale, 8 questions were overwhelmingly positive where they either agreed or strongly agreed with the statements. CONCLUSIONS: Overall, college students reported enjoying being outside and having a fondness for nature but were not physically active outside. Interventions that provide resources and education about the benefits of OPA may be warranted. **P159**

### **EXERCISE AFFECTS NEURAL ACTIVATION IN OLDER ADULTS**

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PURPOSE: Acute exercise (EX) affects neural activation (NA), as assessed with functional magnetic resonance imaging (fMRI), in children, adolescents, and young adults. This effect has been suggested as a possible mechanism in the relation of exercise and behavioral measures of cognition, however this has not yet been tested in older adults. We investigated the effect of EX on NA during the Stroop Color-Word Test (SCWT) in a within-subject, counterbalanced design. METHODS: Four healthy, right-handed older adults (M=70.8±4.8) completed two separate visits including an EX visit (30-min of cycling at 55-65%Heart Rate Reserve) and a rest visit (30-min of seated rest). After each condition, participants completed the SCWT during an fMRI, with 30-sec blocks for each condition. Results here are limited to the incongruent condition [i.e. color words presented in a different color ink]. RESULTS: Reaction time and accuracy during the incongruent SCWT blocks did not differ between post-EX (776.56ms, 80.3%; respectively) and post-rest [763.28ms, 85.7%; respectively ( $p>.15$ )]. However, there were condition-related differences in NA. At post-EX, there was greater activation in the prefrontal cortex, postcentral gyrus, cerebellum VI, inferior frontal gyrus, and paracingulate gyrus compared to post-rest. Further, at post-EX there was a reduction in activation within the temporal pole. CONCLUSION: Although preliminary, these data support previous work that acute EX affects NA and extends the literature with the inclusion of older adults. There was high variability in SCWT performance in this small sample, and results presented at SEACSM will include additional participants. Findings and conclusions will be adapted to reflect the final data analyses. **P160**

**THE DOSE RESPONSE EFFECT OF MUSIC TEMPO ON CARDIORESPIRATORY FITNESS**

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**P161** PURPOSE: To evaluate the effect of music tempo using self-selected music on cardiorespiratory fitness (CRF) and heart rate (HR) in recreationally trained athletes. METHODS: Subjects included eleven recreationally trained females (Mean  $\pm$  SD: 19.5  $\pm$  1.1 yrs; 164.1  $\pm$  5.4cm; 64.3  $\pm$  10.9kg; 23.0  $\pm$  7.2%BF). Subjects were surveyed by music preference where songs were ranked to compile a single group self-selected playlist. The playlist was then modified to pre-determined music tempo conditions using beats per minute (bpm) (CONT: no music; MOD: 110-120bpm; HIGH: 145+ bpm). Each trial included the 12 Minute Cooper Test (12MCT) performed around a 183m perimeter artificial turf field. Subjects were fitted with wireless HR monitors prior to performing a 10min standardized warm-up. Subjects were instructed to mark their total running distance when end time was signaled upon completing the CONT. The second (MOD) and third (HIGH) trials repeated the 12MCT with the standardized music playlist according to the pre-determined music tempo separated by a minimum of 24hrs. Music was projected through two amplified speakers placed in the center of the field. VO<sub>2</sub>max was predicted using [ml/kg/min = (distance in meters – 504.9)/44.73]. Separate 1x3 repeated measures ANOVAs were used to evaluate CRF and average HR (HRave) across conditions. The LSD post hoc test was used when significance was observed. Alpha was set to (p < 0.05); all data are presented as mean  $\pm$  SD. RESULTS: A main effect was observed with music tempo and CRF (F<sub>1,10</sub> = 31.3, p = 0.001;  $\eta^2$ =0.76). Pairwise comparisons revealed that music tempo significantly increased CRF (CONT: 30.7 $\pm$ 3.8ml/kg/min; MOD: 32.7 $\pm$ 4.2ml/kg/min, p = 0.02; HIGH: 36.4 $\pm$ 1.6ml/kg/min, p = 0.001). No differences in HRave (p > 0.05) were observed across conditions (CONT= 185.27 $\pm$  8.5bpm, MOD= 182 $\pm$  6.7bpm, HIGH= 182.2 $\pm$  9.2 bpm). CONCLUSION: A dose response exists with music tempo and aerobic exercise significantly increasing CRF while maintaining HR.

**TAKING THE FAMILY TO THE GREAT OUTDOORS: PARK PRESCRIPTION IMPACT ON FAMILY OUTDOOR PHYSICAL ACTIVITY**

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**P162** Being physically active outdoors is linked with positive health outcomes. With low rates of physical activity (PA) & increased prevalence of overweight individuals across all age groups, the need to get children & parents active outdoors, is ever present. PURPOSE: To determine the feasibility of an outdoor PA intervention on outdoor PA within the family. METHODS: Parents with children aged 5-13 years living in a county served by a single pediatrician office completed surveys on 3 separate occasions which included an in office well-child visit followed by online surveys at 1 & 3 months later. The survey consisted of 8 questions using a 5 point Likert scale. Questions included amount of PA performed individually, with a child, or together as a family, indoors & outdoors. The intervention (N=38) consisted of a pediatrician talking to the parent & child about the importance of outdoor activity, writing a prescription for PA activity outdoors for the child, as well resources containing information on being active outdoors. A total of 32 parents acted as controls & saw their child's pediatrician as normal. Feasibility of conducting the intervention was assessed through qualitative interviews with the pediatricians. RESULTS: A mixed ANOVA (p<0.05) showed no difference between the groups by time interaction, but revealed a significant main effect of time with less time spent outside with their child, as a family together, & doing PA outside together. The child spent the same amount of time doing PA with friends indoors after 3 months, but decreased their time doing PA with friends indoors at 1 month in both the control and intervention group. Pediatricians indicated the intervention took about 5 minutes to deliver & that parents responded positively, especially to receiving the maps of local parks. CONCLUSION: Overall, families spent less time outdoors & being physically outdoors together over the course of the study, which could be due to a small sample size and seasonality.

**PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOR LEVELS IN CHURCHGOING ADULTS IN A SOUTHEASTERN CHURCH**

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**P163** PURPOSE: The purpose of this study was to determine if physical activity levels (min/wk), physical activity bouts/wk, and amount of sedentary behavior (SED) differed between individuals who reported attending church once a week versus several times per week. METHODS: This was a cross-sectional study of 44 churchgoing adults (47.4 $\pm$ 15.5 y, 63.6% female, 27.7 $\pm$ 6.8 kg/m<sup>2</sup>) who completed a survey assessing physical activity levels and churchgoing frequency. An independent t-test was used to assess differences in min/wk of PA, bouts/wk of PA, and hrs/day of SED between those reporting once a week and several times per week church attendance. RESULTS: Among respondents, 59.1% of respondents reported attending church once a week. Differences between individuals who reported attending church once a week vs. several times a week were as follows: min/wk of PA (282.8 $\pm$ 140.7 vs. 206.1 $\pm$ 179.6, p=0.12), number of PA bouts/wk (4.1 $\pm$ 1.7 vs. 2.7 $\pm$ 1.3, p<0.01), and hrs/day of SED (6.1 $\pm$ 2.0 vs. 7.8 $\pm$ 2.0, p=0.01). CONCLUSIONS: In this sample, self-reported weekly churchgoers reported a greater number of weekly PA bouts and lower amounts of daily SED. These results suggest targeting individuals who attend church multiple times per week to increase PA levels and reduce SED. Future research should investigate to see if similar results are found in other churchgoing samples.

**DO ALL EMPLOYEES DESIRE2MOVE?**

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**P164** Desire2Move (D2M) was an 8-week program in which employees competed as teams to achieve the greatest average minutes of moderate-to-vigorous physical activity (MVPA). Purpose: This study explored program effectiveness according to employee activity status. Methods: During registration, eligible employees indicated they were regularly active (RA) or non-regularly active (NRA) using the following definition of "regular activity": "engaging in physical activity 3 times per week, for 30 minutes each session, for the past 3 months". During D2M, all participants recorded minutes of MVPA using MapMyFitness and NRA participants included mild intensity activities and received doubled minutes. Each team captain sent an online survey to participants before and after D2M that included demographics and the Godin Leisure-Time Exercise Questionnaire (GLTEQ). Results: Participants were 130 RA and 77 NRA employees. Baseline survey results from a sub-sample of participants indicated RA participants (n = 19) were more likely to be White (88.2%) and NRA participants (n = 15) were more likely to be female (84.6%). During D2M, RA participants averaged over 150 minutes of MVPA each week, but NRA participants did so during weeks 2-4. Paired t-tests revealed RA participants significantly increased MVPA (GLTEQ) from pre- (49.1 METS/week  $\pm$  20.9) to post-program (62.2 METS/week  $\pm$  29.5), but NRA participants did not (pre-program 14.2 METS/week  $\pm$  17.5; post-program 32.8 METS/week  $\pm$  41.2). Conclusions: D2M successfully attracted and enabled more RA employees to maintain and increase their MVPA participation in comparison to NRA employees. Additional incentives and behavior change techniques that specifically target NRA employees are needed to improve program reach and effectiveness.

**A PILOT STUDY INVESTIGATING THE USE OF TEXT MESSAGES TO INCREASE PHYSICAL ACTIVITY AMONG OLDER ADULTS**

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**P165**

Mobile technology is gaining attention as a tool to facilitate active lifestyles; however, little research has focused on older adults. Purpose: This pilot study investigated the use of theory-based text messages among adults 60 years and older for increasing moderate-to-vigorous physical activity (MVPA). Methods: Participants (n = 36) were recruited from local senior centers, via email, and social media. They were between the ages of 60 and 78 years (66.86 years  $\pm$  4.54) and were White (57.5%) females (75%). All participants received a Fitbit Zip to monitor MVPA during the 12-week intervention. However, only participants randomized into the intervention group (n = 17) received daily text messages five days/week. The theory of planned behavior guided text message development and targeted common barriers of MVPA. Results: At baseline, both groups engaged in low levels of MVPA (intervention = 44.24 minutes  $\pm$  84.57; control = 59.75 minutes  $\pm$  105.39). A 2 (group) x (2) time repeated measures mixed ANOVA revealed no statistically significant interaction for MVPA,  $F(1, 31) = .003$ ,  $p = .96$ , or main effect for time,  $F(1, 31) = 1.14$ ,  $p = .29$ , or group,  $F(1, 31) = .57$ ,  $p = .45$ . ANOVA showed no significant group difference for total minutes of MVPA during the intervention,  $F(1, 31) = .001$ ,  $p = .90$ . Conclusions: Few studies have examined the delivery of PA interventions to older adults with mobile phones while incorporating popular wearable technology to measure MVPA. Although findings from this pilot study were not significant, we recommend further investigation of the effectiveness of theory-based prompts delivered with mobile technology among larger, more diverse samples.

**MENTAL HEALTH IN FIRST RESPONDERS AND MILITARY PERSONNEL: IS PHYSICAL ACTIVITY A VIABLE OPTION?**

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**P166**

Mental Health (MH) is a growing concern among first responders and military personnel, with a relatively large percentage presenting with disorders. However, many avoid or remove themselves from treatment, which has been previously related to treatment stigmas. Purpose: Compare physical health (PH) and MH stigmas, and explore whether physical activity is a viable option for treatment. Methods: The Perceived Stigma and Barriers to Care for Psychological Problems and Self Stigma of Seeking Help questionnaires were provided through an online survey, along with researcher developed questions regarding physical activity behavior. Separate paired-samples t-tests were used to compare PH versus MH treatment stigmas, and descriptive statistics were used to denote interest in physical activity for mental health treatment. Results: 35 first responders and/or military personnel (36.2 $\pm$ 11.6 years; 80%Male) currently residing in the United States, completed the survey. When comparing PH and MH, differences ( $P < 0.001$ ) were observed between perceived (PH=1.99; MH=2.56) and self-stigmas (PH=2.17; MH=2.52). The majority (91.4%) of participants indicated interest in using physical activity for MH improvement. Additionally, 29 participants (82.9%) indicated they would be more willing to undergo physical activity as a treatment mechanism for MH than traditional methods (e.g., medication, psychotherapy). Conclusions: This study expands upon previous stigma literature by emphasizing the discrepancies between physical and mental health stigmas. Additionally, these findings suggest physical activity as a viable option to circumnavigate MH stigmas in first responders and military personnel.

**IMPACT OF ACUTE TENNIS ACTIVITY ON SELECTIVE ATTENTION AND READING COMPREHENSION IN CHILDREN**

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**P167**

Moderate-intensity aerobic exercise (running) acutely improves cognitive function in grade-school children. Other forms of physical activity that are perhaps more enjoyable may also elicit the same effects of moderate-intensity jogging. Purpose: The impact of a bout of tennis activity on selective attention and reading comprehension scores was investigated in grade-school children age 9-12. Methods: Each subject completed a 15-20 min period of group tennis drills (TEN) and a control session in which tennis videos were viewed in a quiet room (CON) on different days in a counterbalanced and randomized order. Intensity of exercise sessions was assessed using step count and METS provided by ActiGraph pedometers. Selective attention scores were measured immediately before (PRE) and after (POST) each treatment using the d2 test of attention, and were analyzed using a repeated measures 2 x 2 ANOVA (Time x Condition). Reading comprehension was assessed after each treatment using the DIBELS oral reading fluency (ORF) and Retell scales for students' appropriate age level. Dependent t-tests were used to compare ORF and Retell scores between groups. Results: The intensity of the tennis sessions was verified to be of moderate-intensity (4.07  $\pm$  0.23 METS). POST d2 scores (M = 427.36) were significantly higher than PRE (M = 373.25;  $p < .001$ ). There was no significant main effect for Condition on d2 scores ( $p = .197$ ). There was a trend toward a significant interaction effect between Time and Condition. Specifically, the improvement in d2 score following TEN (69.21  $\pm$  39.41) was greater than that following CON (39.00  $\pm$  31.80), though this difference was not significant ( $p = .061$ ). There was no significant difference in ORF score or Retell scales between TEN and CON. Conclusion: These results suggest that a brief bout of moderate-intensity tennis activity does not induce the same cognitive improvements in grade-school children as has been reported for aerobic exercise.

**EXPLORING QUALITATIVE DETERMINANTS OF REGULAR GROUP INDOOR CYCLING PARTICIPATION IN A DIVERSE SAMPLE OF ADULTS**

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**P168**

While many adults struggle to acquire adequate amounts of physical activity, non-Hispanic Blacks (NHB) are of particular concern due to established health disparities. As such, there is a need to identify exercise modalities in which NHB participate regularly, and investigate the reasons for regular participation. One mode of exercise gaining popularity is group indoor cycling (GIC). PURPOSE: To investigate the motivation for regular GIC class participation in a racially diverse sample. METHODS: Eligible participants attended GIC classes at a rhythm-based cycling studio at least one day/week for the preceding three consecutive months. Participants completed a questionnaire that included two open-ended questions: 1) "Why do you continue to regularly choose GIC classes for exercise?" and 2) "How does the environment at this cycling studio motivate you to continue to choose GIC for exercise?" Three investigators independently analyzed data using established procedures for thematic analysis. RESULTS: Seventeen adults (88% female; 71% NHB; 29% Non-Hispanic White (NHW); age: 32.1 $\pm$ 7.4 yrs; body mass index: 26.2 $\pm$ 3.6 kg/m<sup>2</sup>) participated. Five main themes emerged as reasons for regular class participation in NHB and NHW, respectively: music selections (83 and 80%), studio atmosphere (67 and 40%), social support (67 and 80%), physical health (58 and 100%), and enjoyment/fun (42 and 60%). CONCLUSIONS: The music (majority hip-hop/rap) in this studio may have played an integral role in attracting NHB to participate in classes regularly, while NHW participants were most motivated by physical health. More research is needed to gain a deeper understanding of cultural relevance as it relates to motivational factors for exercise, which could inform future strategies for promoting regular exercise in various populations and settings.

### HYDRATION STATUS IS ASSOCIATED WITH COGNITIVE PERFORMANCE IN OVERWEIGHT OLDER ADULTS

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Background: Previous research has established links between cognition and hydration in athletes and young adults; however, there is limited work exploring this relationship in older adults. Purpose: This study investigated the links between tests of attention, inhibition, working memory and hydration status in a group of older adults. Methods: Overweight/obese older adults aged 50-69 (n=24, 70% female, BMI=32±4, moderate+vigorous intensity exercise 54+73 min/wk) completed three study sessions. Session 1 included a health history and physical activity questionnaire, weight and height measurements. Session 2 included assessment of hydration status using urinary specific gravity (USG) and three computerized cognitive tasks: Visuospatial Span, GoNoGo, and AX-Continuous Performance Task (CPT). Session 3 included an assessment of body composition (DXA). Bivariate correlations were used to explore the relationship between hydration and cognitive performance. Results: Mean USG was 1.016±0.008. USG was not correlated with working memory (r=-0.15, p=0.49). However, USG was marginally associated with response time on the CPT (r=-0.39, p=0.06), such that individuals who were better hydrated performed more slowly on the attention task. Research suggests that that older adults may slow performance on challenging tasks to maintain accuracy. Post hoc analyses demonstrated evidence of a speed-accuracy tradeoff during the final blocks of the CPT; accuracy was inversely correlated with USG (r=-0.49, p=0.01) and response time was again marginally inversely correlated with USG (r=-0.37, p=0.07). Conclusions: Among older, overweight adults, hydration status may impact cognitive fatigue during an attention task such that adequately hydrated individuals may favor accuracy over speed, relative to hypohydrated individuals.

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### GENERATING AND APPLYING A PHYSICAL ACTIVITY MODEL FOR AN UNDERSERVED COMMUNITY: A MIXED METHODS APPROACH

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Physical activity (PA) determinants differ depending on the population being studied. Purpose: A PA predictive model for an underserved community was generated and further insight of the results were gained by conducting focus groups with parents and school staff. Methods: Previous literature was used to identify PA predictors and to form constructs of a survey. The survey was given to 35 families at a school-based event. Cronbach's alpha was used to assess construct reliability, and a stepwise regression was run to determine predictors. Significant predictors were presented and discussed with community focus groups. Results: Parental PA support (a=.9), parental perceived barriers (a=.8), parental dietary intake (a=.8), PA beliefs (a=.6), screen time (a=.6), and gender were included in a forward stepwise regression. The overall model was significant (p=.001), where parental support of PA (B=.567, p=.024), gender (B=.462, p=.010), and PA beliefs (B=.579, p=.016) were significant predictors of PA. Conclusion: This innovative approach enabled community participants to prioritize their actions more efficiently in addressing the most pressing determinants contributing to low levels of physical activity among their children. These results will contribute significantly to the design of a subsequent physical activity intervention among community children and their families.

### EFFECTIVENESS OF 6-ISCHEMIC CUFF MITOCHONDRIAL CAPACITY ANALYSIS

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Near-Infrared Spectroscopy (NIRS) has been used to measure muscle mitochondrial capacity. The current method requires the use of 22-ischemic per test. PURPOSE: To determine the effectiveness of using a shorter 6-Cuff analysis protocol to study muscle mitochondrial capacity compared to the currently used 22-Cuff analysis protocol. METHOD: Two independent, unidentified data sets were analyzed (bicep n=48, forearm n=41) from previous studies using a NIRS device (Artinis, Ltd.). Both data sets have previously calculated 22 cuff rate constants for each test and were gathered in the method as described in T.E. Ryan, et al., 2012. Each sample was analyzed with a custom MATLAB program; with a curve-fit using the first six ischemic cuffs and an end resting value. The resulting rate constant was then compared with the known value to evaluate the association between the two analysis protocols. RESULTS: The rate constants were not significantly different between the 22 cuff and 6 cuff: bicep (1.43±0.32min<sup>-1</sup>, 1.44±0.35min<sup>-1</sup>, p =0.56), forearm (1.93±0.42min<sup>-1</sup>, 1.94±0.43min<sup>-1</sup>, p = 0.66). The bicep rate constants, when compared to each other, had an equation of y=0.99x+0.02, R<sup>2</sup>=0.83. The forearm sample's rate constants, when compared to each other, had an equation of 0.94x+0.12, 0.87. CONCLUSIONS: The 6-Cuff analysis program provides the same results as the longer and more uncomfortable 22 cuff analysis. The results were consistent for two different data sets, suggesting that the 6-Cuff approach can be used in place of the 22-Cuff approach.

### IDENTIFICATION OF NON-WEAR USING A HIP WORN ACTIGRAPH GT9X

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A key component to analyzing free-living physical activity (PA) monitor data is identifying periods of non-wear. Traditionally, this has been done by calculating periods of consecutive zeros which is an indicator of non-movement. The assumption is that extended periods of non-movement (e.g. >60-s consecutive zeros) indicate the device not being worn. Thus, it is unclear whether current non-wear criteria indicate true non-wear or simply non-movement. Purpose: To examine a decision tree approach using hip-worn ActiGraph GT9X (AG) device movement and position data to identify non-wear periods. Methods: Thirty participants (mean±SD; age, 23±2.3 years; BMI, 25.2±3.9 kg/m<sup>2</sup>) wore an AG on the right hip during a continuous 80-min lab protocol. Raw 80 Hz triaxial acceleration data were used to calculate the inclination angle of each axis and a vector magnitude before being averaged into 60-s epochs. Non-wear data were considered to be the time prior to the start of the trial and time following the conclusion of the trial when the device was at rest on a table. The decision tree was built using the RPART package in R. Tree parameters were tuned to find the optimal complexity parameter (cp), the value by which a split reduces the prediction error, yielding a final cp of 0.00067. A total of 4082 observations (n = 3193 wear, n = 889 non-wear) were available for training. Data were split 60/40 into training (n = 2449) and holdout (n = 1663) data sets. Results: The four most influential predictors of non-wear were the individual y- and z-axis raw acceleration and inclination angles. Cross-validation on the holdout data yielded a classification accuracy of 93.7% with a sensitivity and specificity of 86.5% and 95.5%, respectively. Conclusion: This approach provides an easy to interpret method for identifying non-wear using a hip-worn AG in adults with a high degree of accuracy.

### IMPROVING THE EFFICIENCY OF MITOCHONDRIAL CAPACITY MEASUREMENTS USING NEAR INFRARED SPECTROSCOPY

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Near Infrared Spectroscopy (NIRS) has been used to noninvasively measure muscle mitochondrial capacity. Previous protocols have required 2 tests and up to 50 cuff inflations. **PURPOSE:** Develop a new protocol for testing mitochondrial capacity that decreases the number of ischemic cuffs, increases comfort for participants, and improves curve fitting of the data, all while retaining reliability of the test. **METHODS:** The forearm flexor muscles of sixteen young, healthy individuals were tested ( $23 \pm 4.1$  years). A resting metabolism value was collected after 5 min of complete rest before and after the test. The test involved 4 sets of 6 ischemic cuff inflations, preceded by 30s of electrically induced twitch contractions. Analysis was performed on mitochondrial metabolic rates using a customized MATLAB program. **RESULTS:** The post-test resting metabolism values were higher than the pre-test resting values ( $-0.038 \pm 0.02$ ,  $-0.018 \pm 0.01$ ,  $P < 0.01$ ). There was no significant difference in the mitochondrial capacity for the four sets ( $1.50 \pm 0.51$ ,  $1.42 \pm 0.54$ ,  $1.26 \pm 0.41$ ,  $1.29 \pm 0.47$ ,  $P = 0.76$ ). **CONCLUSION:** The main finding of this study is that a test of mitochondrial capacity using four sets of 6 cuffs can be performed in less time ( $t \approx 25$  min) than two sets of 22 cuffs ( $t \approx 45$  min). While the use of a post-test resting metabolism value did slightly lengthen the time needed to complete the study in relation to using the pre-test value, this value appeared to be more accurate than using the pre-test resting metabolism. The use of the post-test resting values provided lower residuals and better agreement with previous data on the forearm muscles.

### COMMON TENDENCIES FOR WINTER WEIGHT GAIN IN APPARENTLY HEALTHY COLLEGE AGED INDIVIDUALS

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**PURPOSE:** This study focused on common tendencies observed for weight gain within sixteen apparently healthy college aged individuals. Factors that contributed to weight gain observed during the winter months included: changes in caloric intake, decrease in physical activity and the possibility of the psychological influence of Seasonal Affective Disorder (SAD). The sixteen participants involved in this study completed a questionnaire entailing their amount of physical activity and mood as well as completing a dietary analysis and activity log. **METHODS:** The subjects in this study included both females and males ( $N = 16$ ) with ages ranging from 21-32. Pre and Post-tests to acquire measurements for height, weight and percent body fat via BIA were administered to all participants. Each individual completed a three day dietary analysis as well as an activity log to determine caloric intake and expenditure. Pre and Post Health Questionnaires were administered to assess factors such as sleep, general mood, food consumption and levels of physical activity. **RESULTS:** There was a significant change in body weight between pre and post body comp/weight collection. An increase in calories during the post dietary recall reveals that the participants consumed more during the winter months, which increased the average weight. The questionnaire also revealed that with the change from summer to winter, there was a significant change in eating, sleeping and activity habits. The caloric increase from summer to winter was large enough to justify that people commonly eat more during the winter months with poor food choices adding to the increase in caloric intake. **CONCLUSION:** In conclusion it was determined that there is as significant tie between weight gain and lower activity during the winter months.

### GENDER DIFFERENCES IN THE DUAL TASK COST OF TREADMILL DESK WALKING

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**PURPOSE:** Changes in walking gait parameters have been shown in older adults while dual tasking, with older men showing greater gait instability than older women during over ground walking. With treadmill desks becoming a popular way to increase physical activity in the workplace, it is important to understand the dual task cost of walking on a treadmill while performing job-related tasks. The purpose of this study is to investigate whether dual task cost differs between adult men and women during treadmill desk walking. **METHODS:** Adult men ( $n = 23$ ; mean age =  $37.6 \pm 16.9$  years) and women ( $n = 25$ ; mean age =  $37.8 \pm 16.5$  years) walked under single task (treadmill desk walking only) or dual task (treadmill desk walking while counting backwards by 7 and while typing) conditions at self-selected speeds (mean speed for men =  $1.5 \pm .49$ ; mean speed for women =  $1.5 \pm .43$  mph). Gait parameters were measured during walking using the OptoGait system. A dual task cost (DTC) value was calculated using the formula (Single task score – Dual task score)/Single task score\*100. **RESULTS:** There were no significant difference in typing performance DTC scores or serial 7 subtraction performance DTC scores in men compared to women ( $p > 0.05$ ). The DTC of stride length during the serial 7 subtraction test was significantly greater in men than women ( $p = 0.043$ ). The DTC of gait cycle coefficient of variation was significantly higher in men during the typing test than women ( $p = 0.029$ ). There was no significant difference in the DTC of other gait variables ( $p > 0.05$ ). **CONCLUSION:** The results of this study reveal a higher dual task cost on certain gait parameters in men compared to women when walking on a treadmill desk. This suggests men may find motor task more challenging when simultaneously performing cognitively demanding tasks. The same motor task difficulty is not observed in women, indicating dual task performance could be a function of gender.

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### IMPLICATIONS OF MARITAL AND PARENTAL STATUS IN THE EVALUATION OF CARDIAC AND METABOLIC BIOMARKERS IN LOSEWELL PARTICIPANTS

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Marital status may improve outcomes of weight loss programs. **Purpose:** To determine how marital and parental status of participants in a weight management program affect cardiac and metabolic biomarkers. **Methods:** This was a retrospective cohort study of 853 participants in a 12-week physical activity-based weight loss program offered through Greenville Health System between 2012 and 2017. Cardiovascular and metabolic biomarkers (e.g. body mass index (BMI), waist circumference, weight, hemoglobin A1C, and total cholesterol) were measured prior to the first class and following completion of the program. These biomarkers were analyzed using student t-tests based on the following variables: 1. Is the participant currently married? 2. Does the participant have children? **Results:** Married participants improved/lowered their BMI (3.12% vs. 2.05%), overall weight (6.83 lbs vs. 4.87 lbs), and total cholesterol (9.63 points vs. 4.46 points, 4% vs 0.97%) significantly more than single participants. There was no significant difference in outcomes between participants with children and participants without children. **Conclusions:** Marital status has a significant effect on cardiovascular and metabolic biomarkers, particularly BMI, weight, and total cholesterol whereas parental status has no significant effect on any of the measured biomarkers.

### COMPARING A 3-COMPARTMENT MODEL TO CRITERION MEASURES FOR ESTIMATING BODY COMPOSITION IN ATHLETES

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Multi-compartment models are emerging as a criterion method of analyzing body composition, thereby reducing the error associated with standalone laboratory measures. PURPOSE: The purpose of this study was to compare a 3-compartment model (3-C) with two gold standard lab measures (i.e., air displacement plethysmography (ADP) and dual-energy x-ray absorptiometry (DEXA)). METHODS: Sixty-nine male and forty-eight female athletes completed three body composition measures (i.e., DEXA, ADP, and bioelectrical impedance spectroscopy (BIS)). Body fat percentage (BF%) was calculated using a 3-compartment (3C) model, consisting of total body water (via BIS), body volume (via ADP), and body weight. RESULTS: For males, results showed a significant mean difference when comparing 3-C (13.2±7.0%) and DXA (16.5±9.5%;  $p < 0.01$ ), but no difference between 3-C and ADP (12.0±8.0%;  $p = 0.09$ ). For females, a significant difference was seen with 3-C (23.5±7.2%) and DXA (28.5±6.6%;  $p < 0.01$ ); however, there was no difference between 3C and ADP (22.2±7.1%;  $p = 0.34$ ). CONCLUSIONS: DEXA may provide overestimates of BF% for both male and female athletes, while ADP provided no significant differences when compared to a multi-compartment model.

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### COMPARISON OF DUAL-ENERGY X-RAY ABSORPTIOMETRY AND AIR PLETHYSMOGRAPHY IN COLLEGE ATHLETES

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Body composition is a highly important metric in regards to overall physical activity as well as sports performance. While many studies compare laboratory measures of body fat percentage (BF%), few studies have compared measures using elite athletes. PURPOSE: The purpose of this study was to compare dual energy x-ray absorptiometry (DEXA) and air displacement plethysmography (ADP) for determining body composition in Division-I collegiate athletes. METHODS: Seventy-eight athletes (males:  $n = 45$  and females:  $n = 33$ ) underwent BF% testing via DEXA and ADP. Both tests were completed on the same visit. RESULTS: For the group, results indicated a significant mean difference between DEXA (21.6 ± 10.3%) and ADP (16.4 ± 9.2%) when comparing BF% ( $p < 0.01$ , ES = 0.53). When factored for gender, male BF% exhibited a significant mean difference between DEXA (16.3 ± 9.5%) and ADP (11.8 ± 8.0%) ( $p < 0.01$ , ES = 0.51). For females, there was also a significant mean difference for BF% between DEXA (28.5 ± 6.6%) and ADP (22.2 ± 7.1%) ( $p < 0.01$ , ES = 0.92). CONCLUSIONS: These results, which are consistent with previous research, indicate significantly greater BF% values for DEXA when comparing athletic populations.

### THE EFFECT OF RACE AND POSITION ON ABDOMINAL ADIPOSITY IN FOOTBALL LINEMEN

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Excess abdominal fat has been shown to be associated with cardiometabolic disease risk. Retired football players have been found to be at an increased risk for obesity-related diseases. Purpose: To evaluate the effect of race and position on abdominal fat (visceral adipose tissue [VAT] and android fat percentage [%fat]) in NCAA Division I football linemen. Methods: Thirty-four linemen (Mean ± SD, Height: 192.0±4.1 cm; Weight: 132.0±15.1 kg; %fat: 27.1±7.2 %) were enrolled in the present study. Participants completed a total body dual-energy X-ray absorptiometry (DXA) scan. Regions of interest were automatically set by DXA software and manually adjusted by a trained DXA technician to estimate VAT and android %fat. Participants were stratified by race (Black:  $n = 23$ ; White:  $n = 11$ ) and position (Offense:  $n = 18$ ; Defense:  $n = 16$ ). Separate 2-way analysis of variance tests were completed to determine the effect of race and position on VAT and android %fat. Results: For VAT, the interaction effect was not significant ( $p = 0.056$ ); there was a significant effect of race (B: 0.57±0.34 kg; W: 1.51±0.56 kg;  $p < 0.001$ ) and position (O: 1.22±0.60 kg; D: 0.49±0.34 kg;  $p < 0.001$ ). For android %fat, there was no interaction ( $p = 0.855$ ) or race effect (B: 31.47±11.26%; W: 40.87±8.59%;  $p = 0.123$ ); there was a significant position effect (O: 42.06±5.62 %; D: 26.03±9.90 %;  $p < 0.001$ ). Conclusions: White linemen had greater VAT compared to Black linemen. The relationship of VAT to disease risk should be investigated in each race separately. Offensive linemen, regardless of race, had greater VAT and android %fat compared to defensive linemen. Football linemen, especially offensive linemen with increased abdominal adiposity, may benefit from tracking metabolic health during their collegiate career to mitigate obesity-related disease risk once retired from sport.

### SELF PERCEPTION OF BODY IMAGE, WEIGHT CONTROL PRACTICES, AND BODY COMPOSITION IN NCAA DIVISION I ATHLETES

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Preoccupation with body weight may lead to unhealthy body image and weight control practices. Purpose: This cross-sectional study assessed self-perceptions of body image, common weight control practices and body composition of NCAA Division I female athletes. Methods: 23 female athletes from basketball (BB) and cross country (XC) teams were recruited. Participants completed a body composition assessment via bioelectrical impedance, a 69-item Multidimensional Body-Self Relations (MBSRQ-69) and a 25-item Weight Control Practices (WCP) questionnaire. The frequency of WCP and mean differences of body composition and MBSRQ-69 were compared between the two teams. Results: Body weight (77 ± 14 kg and 56 ± 3 kg,  $p < 0.001$ ) and BF% (28.4 ± 9.3% and 20.2 ± 4.9%,  $p = 0.02$ ) was significantly higher in BB compared to XC athletes. Appearance, Fitness, and Health Evaluation, Overweight Preoccupation, Self-Classified Weight and Body Areas Satisfaction subscales of MBSRQ-69 were not significantly different ( $p > 0.05$ ) between teams. However, Health ( $p = 0.03$ ) and Fitness Orientation ( $p = 0.07$ ) was higher in XC compared to BB athletes. In addition, athletes with higher BF% were less fitness orientated ( $p = 0.004$ ) but more preoccupied with their weight ( $p = 0.06$ ). The most common WCP included weighing themselves, increasing intake of fruits and vegetables and cutting out sweets and junk food. Conclusions: In addition to the physical demands of each sport, it appears the greater health and fitness orientation of XC compared to BB athletes may explain differences in body composition and weight control practices of each type of athlete.

### THE INFLUENCE OF VARIOUS MARKERS OF PHYSICAL ACTIVITY ON ENERGY BALANCE

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Sedentary time and physical activity predict energy balance in adults. Purpose: To quantify the influence of indicators of physical activity and sedentariness on energy balance in adults. Methods: A total of 41 adults ( $31 \pm 4.8$  years old) arrived at the laboratory between 6:00 am and 9:00 am after fasting for at least 10 hours. Bioelectrical impedance analysis (BIA) was conducted and a dual-energy X-ray absorptiometry (DEXA) scans were performed, and 4-compartment body composition was determined. Resting metabolic rate (RMR) was measured. Participants were provided an Actigraph GT3x accelerometer and instructed in its use. They returned 3-4 weeks later to repeat the BIA and DEXA assessments and turn in accelerometers. Accelerometer data were downloaded and physical activity energy expenditure (PAEE), step counts (STEPS), sedentary time (SED), and time spent in moderate-to vigorous physical activity (MVPA) were recorded. Energy balance (EBAL) was determined by analyzing changes in fat mass [FM] and fat-free mass [FFM]. Results: STEPS·kg FFM<sup>-1</sup>·day<sup>-1</sup> ( $r = -0.42$ ,  $p < 0.01$ ), SED ( $r = 0.397$ ,  $p = 0.01$ ), and RMR ( $0.383$ ,  $p = 0.013$ ) were significantly correlated with EBAL. Multiple linear regression analysis resulted in a model that included SED, RMR, and PAEE (kcal·kg FFM<sup>-1</sup>·day<sup>-1</sup>) as predictors (EBAL = SED(0.852) + RMR(0.88) - PAEE(24.8) - 1214.6), accounting for over 41% of the variability in EBAL ( $p < 0.01$ ). Conclusions: SED and PAEE were both independently associated with EBAL. Given the influence of body mass on PAEE, expressing physical activity (e.g., PAEE or STEPS) relative to body mass (e.g., FFM) may improve the efficacy of exercise prescription for EBAL and weight management.

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### PHYSICAL PERFORMANCE VARIABLES IN PRE-ADOLESCENT INDIAN CHILDREN – EXPLORING TRENDS AND CORRELATIONS TO OBESITY

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Obesity is a leading cause of health-related conditions in children and adults. There have been several studies conducted to understand the impact of obesity worldwide; however, pre-pubertal children and adolescents are an understudied group. Purpose: To address the gap in the literature, this investigation examined Indian pre-adolescent children. We measured physical performance variables to determine if they are predictors of childhood obesity. Methods: Participants (N = 80) were pre-adolescent Indian children, 7 to 11 years of age, from Indian schools. Obesity was determined by Body Mass Index (BMI) and skinfold thickness, to create two groups: obese (n = 40) and non-obese (n = 40). An equal number of males and females were in each group. All participants completed a battery of physical performance assessments, including zipper test, shuttle run, number of sit-ups, sit and reach test, and standing broad jump. Scores were collected and divided into quartiles, and odds ratios were calculated to determine if participants with obesity were more likely to be in lower quartiles. Results: Number of sit-ups predicted obesity (Q1[OR=1.55], Q2[OR=1.13], Q3[OR=0.83], Q4[OR=0.55]). Trends were observed for the sit and reach test (Q1[OR=1.47], Q2[OR=1.22], Q4[OR=0.42]). No differences between groups or trends were observed for the zipper, shuttle run, and standing broad jump tests. Conclusion: Number of sit-ups and distance achieved in the sit and reach test may provide good indices for identifying children who are obese. These findings suggest that physical fitness should be considered along with BMI and skinfold thickness to determine whether a child is obese. Future work should focus on longitudinal studies that can determine whether these tests are predictive of obesity beginning in early childhood.

### COMPARISON BETWEEN CALORIC EXPENDITURE SITTING ON A STANDARD CHAIR, STABILITY BALL, AND BALANCED ACTIVE SITTING

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Chronic sedentary behaviors can be detrimental to health and increase the risk of mortality. Products, such as active sitting chairs, have emerged as a way to reduce sedentary behaviors in office settings. PURPOSE: To determine the cardiovascular and metabolic responses to sitting on a standard chair (SC), stability ball (SB), and active balanced sitting chair (ST). METHODS: Participants (n=17) performed a 10-minute reading task while sitting on the SC, SB, and ST in a randomized order. Caloric expenditure (kcal) and heart rate (HR) responses were measured using a portable metabolic analyzer and heart rate monitor, respectively. RESULTS: Results indicated significantly greater HR responses on the ST ( $84 \pm 14$  bpm) compared to SC ( $74 \pm 11$  bpm;  $p < 0.01$ ) and SB ( $69 \pm 21$  bpm;  $p < 0.01$ ). Additionally, ST ( $27.6 \pm 7.6$  kcal) exhibited significantly greater kcal versus SC ( $16.4 \pm 3.3$  kcal;  $p < 0.01$ ) and SB ( $16.8 \pm 2.5$  kcal;  $p < 0.01$ ). For kcal/min, ST provided significantly greater values ( $2.8 \pm 0.8$ ) versus SC ( $1.6 \pm 0.3$ ;  $p < 0.01$ ) and SB ( $1.7 \pm 0.31$ ;  $p < 0.01$ ). CONCLUSIONS: While SB and SC demonstrated no differences in HR or kcal responses, using the active sitting chair may provide a feasible way to reduce sedentary office behaviors.

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### SEDENTARY BEHAVIOR IN ADOLESCENTS AND PARENTS ENROLLING IN AN ADOLESCENT WEIGHT MANAGEMENT PROGRAM

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Purpose: Sedentary behavior (SB) is an independent risk factor for cardiometabolic disease. The purpose of this study was to assess SB during waking hours in adolescents and parents enrolling in an adolescent weight management program. Methods: Adolescents (N=82; 63% female;  $13.7 \pm 1.2$  yrs;  $34.8 \pm 7.0$  kg/m<sup>2</sup>; 58% racial/ethnic minority) and their parents (85% female;  $44.2 \pm 7.0$  yrs;  $36.1 \pm 7.3$  kg/m<sup>2</sup>; 51% racial/ethnic minority) wore an accelerometer (Actigraph GT3X+) on the non-dominant wrist for 7 days. Wear time of >10 hrs/day for  $\geq 5$  days was required for inclusion; to exclude sleep, activity from 11PM to 6AM was not used. Data were analyzed using published cut-points specific to adolescents and adults. Results: Evaluable data were available for 65 adolescents and 61 parents. Adolescents were sedentary 88.5% of wear time and SB duration was related to body weight ( $r=0.285$ ,  $p=0.021$ ) and body mass index (BMI) ( $r=0.272$ ,  $p=0.028$ ). There were no gender differences in SB duration ( $p>0.05$ ). Parents were sedentary 71.0% of wear time, which was positively related to body weight ( $r=.287$ ,  $p=0.025$ ), but not BMI. Parent and adolescent SB were not significantly correlated. Conclusion: A large percentage of waking hours were spent in sedentary activity. Family-based lifestyle interventions that address adolescent obesity should include focused strategies for reducing SB in addition to increasing moderate/vigorous physical activity.

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### THE EFFECT OF ACUTE EXERCISE ON DUAL-ENERGY X-RAY ABSORPTOMETRY (DXA) BODY COMPOSITION RESULTS

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**P185** **PURPOSE:** The purpose of this study was to investigate the effects of acute exercise prior to Dual-energy X-ray absorptiometry (DXA) scanning on body composition results. **METHODS:** College-aged males and females were recruited for this study. In a within groups counterbalanced study design, participants were fasted and scanned under three conditions: no exercise/baseline (BL), low intensity exercise (LI), or high intensity exercise (HI). For the exercise trials, participants completed a one mile walk/run at 50-60% or 80-85% of predicted maximum heart rate for LI and HI, respectively. Body composition was measured by the DXA immediately following the exercise bouts. Total body, arm, leg, and trunk % region fat mass, total mass, lean mass, fat-free mass, and bone mineral content were analyzed. **RESULTS:** Leg % region fat mass was lower with HI versus BL ( $p=0.046$ ). Total body mass was significantly lower with LI versus BL ( $p=0.001$ ). Trunk lean mass was significantly lower with LI versus BL ( $p=0.043$ ). Trunk total mass was lower with LI versus BL ( $p=0.016$ ). Fat-free mass and bone mineral content was largely unaffected regardless of condition. **CONCLUSION:** This study suggests that acute exercise prior to DXA scan may influence body composition results and may be intensity dependent.

### INFLUENCE OF HIGH INTENSITY BODY-WEIGHT CIRCUIT TRAINING IN ADULTS WITH TYPE II DIABETES

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**P186** **Purpose:** To determine the effectiveness of a 15-week intervention of a minimal dose high-intensity bodyweight circuit (HIBC) program in persons with type 2 diabetes (T2D) on markers of metabolic function, autonomic balance, and body composition. **Methods:** Three females (55±4yrs) and two males (64±1yrs) with T2D underwent assessments of glycosylated hemoglobin (HbA1c) and fasting plasma glucose (FG), insulin (INS), and lipids. Body composition was determined using dual-energy x-ray absorptiometry, aerobic fitness (submaximal treadmill test), blood pressure (SBP/DBP), and resting heart rate (RHR) were assessed. Participants completed 15-weeks of bodyweight circuit training (10 banded bodyweight squats, 5 modified pull-ups, 5 modified push-ups, 10 abdominal crunches). Participants completed as many cycles as possible in each session. Session duration progressed from 5-10 minutes, as tolerated, and session frequency progressed from 3-4 sessions per week. All assessments were repeated after 15 weeks of training. **Results:** Body composition: Pre and Post changes in mean weight ( $p=0.395$ ), body fat % ( $p=0.632$ ), lean mass ( $p=0.372$ ). Aerobic fitness: estimated  $VO_{2max}$  ( $p=0.232$ ), SBP ( $p=0.062$ ), DBP ( $p=0.90$ ), RHR ( $p=0.727$ ). Metabolic biomarkers: FG ( $p=0.942$ ), HDL ( $p=0.271$ ), LDL ( $p=0.671$ ), HbA1c ( $p=0.810$ ), INS ( $p=0.762$ ). **Conclusion:** The HIBC did not appear to be effective in improving markers of metabolic function or health-related physical fitness in the five participants. However, when removing a singular outlying participant, several factors demonstrate substantial improvements in several outcome measures. HIBC may be an appropriate and appealing intervention for those with T2D.

### EPOC AND ENJOYMENT RESPONSE FOLLOWING SELF-PACED CONTINUOUS AND INTERMITTENT WALKING

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**P187** Many Americans do not meet the current physical activity guidelines. **Purpose:** To investigate the acute changes associated with exercise oxygen uptake ( $VO_2$ ) and excess post-exercise oxygen consumption (EPOC) following self-paced intermittent interval walking. **Methods:** Ten participants (6 men and 4 women) completed one continuous, one intermittent, and one intermittent interval walking (IIW) protocol. Each protocol intensity was self-regulated in a moderate rating of perceived exertion (RPE) range (RPE 12-13) and 30 min in duration. Intermittent walking consisted of three 10 min bouts of walking, while IIW consisted three 10 min cycled work bouts of 30 s (RPE-13) followed by active recovery bouts of 120 s (RPE-12). Continuous walking consisted of 30 min of walking. Enjoyment responses were captured following the initial 5 min of pre- and post-exercise rest and at six evenly distributed time points during exercise. **Results:** Accumulated  $O_2$  uptake during exercise and EPOC values were significantly higher with intermittent walking ( $43,204 \pm 4,685$  mL and  $3,676 \pm 443$  mL, respectively) and IIW ( $42,958 \pm 4,327$  mL and  $3,422 \pm 244$  mL, respectively) than continuous walking ( $19,521 \pm 1,992$  mL and  $1,412 \pm 159$  mL, respectively; all  $p < 0.05$ ). Exercise enjoyment during and after exercise did not differ among the walking protocols (all  $p > 0.05$ ). **Conclusion:** Self-paced intermittent exercises of moderate-intensity elicited significantly higher accumulated  $O_2$  uptake and EPOC values than continuous walking of similar enjoyment and duration.

**Abstract Withdrawn**

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#### ASSOCIATIONS OF MUSCLE FIBER TYPE AND INSULIN SENSITIVITY, BLOOD LIPIDS, AND VASCULAR HEMODYNAMICS IN PREMENOPAUSAL WOMEN

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Purpose Cardiometabolic disease remains a leading cause of morbidity and mortality in developed nations. Consequently, identifying and understanding factors associated with pathophysiological processes leading to chronic cardiometabolic conditions is critical. Metabolic health, arterial elasticity (AE), and insulin sensitivity (SI) may impact disease risk, and may be determined in part by myofiber type. Therefore, the purpose of this study was to test the hypothesis that type I myofiber composition is associated with high SI, greater AE, lower blood pressure, and blood lipids; whereas, type IIx myofibers are associated with lower SI, lower AE, higher blood pressure, blood lipids. Methods Muscle biopsies were performed on the vastus lateralis in 16 subjects (BMI = 27.62 ± 4.71 kg/m<sup>2</sup>, age = 32.24 ± 6.37 years, 43% African American). The distribution of type I, IIa, and IIx myofibers was determined via immunohistochemistry performed on frozen cross-sections. Pearson correlation analyses were performed to assess associations between myofiber composition, SI, AE, blood pressure, and blood lipid concentrations. Results The percentage of type I myofibers positively correlated with SI and negatively correlated with systolic blood pressure (SBP), diastolic blood pressure, and mean arterial pressure (MAP); whereas, the percentage of type IIx myofibers were negatively correlated with SI and large AE, and positively correlated with LDL cholesterol, SBP, and MAP. Conclusions These data demonstrate a potential link between myofiber composition and cardiometabolic health outcomes in a cohort of premenopausal women. Future research is needed to determine the precise mechanisms in which myofiber composition impacts the pathophysiology of impaired glucose and lipid metabolism, as well as vascular dysfunction.

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#### BONE MINERAL DENSITY IN DISTANCE RUNNERS: EVIDENCE FOR THE MALE ATHLETE TRIAD?

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Reduced bone mineral density (BMD) increases risk for overuse injuries and often is accompanied by other physiological indicators (low energy availability and reproductive hormone levels) indicating a "female athlete triad". Emerging evidence suggests similar trends for male distance runners. PURPOSE: To compare male and female distance runners' BMD, energy intake, and incidence for overuse injury. METHODS: Forty female (age=20.2±1.6) and male (age=20.6±2.3) cross-country runners were evaluated. Using dual-energy X-ray absorptiometry (DEXA), body composition and total/femoral neck BMD were measured. Musculoskeletal injury history, dietary intake, and training distance were also assessed. RESULTS: Male runners had higher (p=0.0003) mean total BMD (1.225±0.095) compared to females (1.157±0.064 g/cm<sup>2</sup>) but similar femoral neck density. However, female runners had higher (p=0.03) BMD z-scores relative to their sex and age-matched population (z = 0.945 ± 0.74) than males (z=0.55±0.52). Athletes with recent skeletomuscular injuries (n=15, 8 men/7 women, BMD=1.194±0.075, z=0.73±0.62) were not different (p > 0.05) than athletes without injury (BMD=1.11±0.06, Z=0.76±0.70). Male runners trained greater distances versus females (96.6±8.34, 79.8±18.2 km/wk) and had lower (p=0.0004) energy intake relative to FFM (38.1±9.74 vs 52.2±13.9 kcal/kg, respectively). CONCLUSIONS: Similar to women, low energy availability in male runners may predispose them to lower total BMD when compared to the general population, suggesting evidence for a "male athlete triad".

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#### THE EFFECT OF MUSCLE LENGTH ON MUSCLE ENDURANCE AND OXYGEN SATURATION

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Passive stretch changes force production by reducing cross bridge overlap, and previous studies have shown that increased muscle length can reduce muscle oxygen levels. Purpose: To measure the effect of passive stretch on muscle specific endurance and oxygen saturation in the vastus lateralis and medial gastrocnemius muscle groups. Methods: The two muscles were studied in stretched and relaxed positions in 10 healthy individuals (21+1 yrs.). Endurance was measured with a triaxial accelerometer as declines in twitch acceleration during 3 minutes of stimulation at 2, 4, and 6 Hz. A Near Infrared Spectroscopy device was used to measure muscle oxygen levels. Results: The endurance index was lower in the stretched position in the gastrocnemius (51+9.6%, vs 77+9.1%, p=0.008) and the vastus lateralis (54+8.9%, vs 75+9.6%, p<0.001) muscle groups. Blood flow measured by time to half recovery, was slower in the stretched positions for the gastrocnemius (11.4+1.0s, vs 8.2 +1.1s, p<0.001) and the vastus lateralis (9.8 + 1.9s and 6.3 + 0.7s, p<0.001). However, oxygen saturation during the endurance tests were not different (p= 0.304) between stretched and relaxed conditions for the quad (76.8+ 6.8%, vs 82.2 + 11.9%) or the gastrocnemius (75.0 + 11.6%, vs 80.3 + 5.5%) at the end of the 6Hz interval. Conclusions: The stretched position reduced muscle endurance compared to the relaxed position in both muscles and blood flow was reduced.

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#### A COMPARISON OF ACCELEROMETER WEAR SITES IN THE ASSESSMENT OF SKELETAL LOADING

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Accurate methods for the assessment of ground reaction forces (GRFs) during habitual physical activities will improve our understanding of skeletal loading in a free-living context. Advances in accelerometry technology, providing a wider dynamic range, higher sampling frequency, and prolonged battery life, may provide simple and inexpensive methods to do so. However, the optimal wear site for assessing GRFs has not been identified. PURPOSE: We aimed to assess the relationship between GRFs and accelerations from ankle-, hip-, and wrist-worn accelerometers during several habitual physical activities. METHODS: Peak vertical ground reaction force (vGRF<sub>peak</sub>) was assessed in n=13 healthy young adults (25.0 ± 2.8 yrs, 61% female) during 8 trials of walking (3.2 ± .4 mph), jogging (5.9 ± .9 mph), and running (8.6 ± 1.2 mph) over an in-ground force plate at self-selected speed. Correlations between Actigraph GT9X Link (±8g, 100Hz) peak vertical accelerations (vACC<sub>peak</sub>) and vGRF<sub>peak</sub> were calculated for each participant individually and compared between wear sites using Fisher's r<sub>z</sub> transformation. RESULTS: Small to moderate correlations were identified between vACC<sub>peak</sub> and vGRF<sub>peak</sub> during walking (r range = .35 - .40), jogging (r range = .26 - .37), and running (r range = .30 - .35), however, there was no difference among wear sites (all p > .05). CONCLUSIONS: Wear site did not influence the predictive ability of the accelerometer across several habitual physical activities. The weak relationships between estimated and actual GRFs suggest that vertical accelerations from the Actigraph GT9X Link may be a poor estimate of skeletal loading.

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### COMPARING TWO MUSCLE SPECIFIC ENDURANCE TESTS

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A nine-minute muscle specific endurance protocol has been developed for clinical populations. A shorter protocol would provide increased ease of use in clinical populations. Purpose: To compare a shorter five minute five Hz protocol to the already developed longer nine minute two, four, six Hz protocol. Methods: The forearms of young healthy adults were tested (n=8). Each subject was tested twice; once with the five-minute protocol and the other time with the nine-minute protocol. The tests were performed on separate days in a balanced order. Two electrodes were placed on the forearm with an accelerometer in between that measured muscle twitch acceleration. The current was adjusted to get a vigorous contraction and this amplitude was constant within each subject. The endurance index (EI) was calculated by dividing the end twitch by the start twitch and multiplying times one hundred. Results: Endurance Index values for four and six Hz were 70.8% + 16.8% and 57.0% + 18%, respectively. The Endurance Index for five Hz was 56.8 + 16.1%. Four Hz compared to five Hz had an R2 value of 0.76, and six Hz compared five Hz had the R2 value of 0.93. Conclusions: The short five Hz correlated with both the longer four Hz and six Hz, although it correlated better to the six Hz. The five Hz test is shorter and can potentially be used in various populations in the clinical setting.

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### NEURAL ACTIVATION OF THE THORACOLUMBAR FASCIA DURING THE FUNCTIONAL MOVEMENT SCREEN

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Both athletic and the general population require stable movement patterns between the upper and lower extremities, as these two must work collaboratively to complete activities of daily life. Assessing coordination can be achieved using the screening tool the Functional Movement Screen (FMS) in concert with surface electromyography (sEMG) of the muscles comprising the thoracolumbar fascia (TLF). PURPOSE: To determine the bilateral neural activation of the gluteus maximus (GM) and latissimus dorsi (LD) during the FMS. METHODS: Twelve males (22.8±2.01yrs, 177.4±7.9 cm, 83.2±10.5 kg) volunteered to participate in this study. sEMG was used to assess relative muscle activation (%MVIC) of the right and left GM muscles (RGM, LGM, respectively) and the right and left LD muscles (RLD and LLD, respectively) during the 7 exercises of the FMS. Paired sample t-tests were conducted to examine significance with an alpha level set a priori to P≤0.05. RESULTS: While analyzing average activation for all 7 exercises, results indicated no significant differences between the RGM and LLD (50.9±29.4 vs. 40.7±12.8, p=.1). However, a significant effect was apparent with the difference between LGM and RLD (51.0±20.7 vs. 31.6±12.4, p=.0005). CONCLUSION: The findings suggest a potential for the contralateral functionality of the LD and GM via TLF, however, a larger sample size is necessary to fully support the connection via TLF.

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### ENDOGENOUS TESTOSTERONE AND BODY COMPOSITION CHANGES DURING INTENSIVE BODYBUILDING PROGRAM IN OLDER HEALTHY MALE

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It is generally accepted that endogenous total testosterone (TT) decreases with age in men and this decline in TT is associated with age-related decline in muscle mass (MM). It is less understood whether this relationship between TT and MM is bidirectional in older men. Purpose: To determine if an intensive one year bodybuilding program designed to increase MM and reduce body fat (BF) results in increased TT in a fit older man. Methods: Body composition and TT were analyzed before and after a one year intensive bodybuilding program that included high volume resistance training six days/week and a high calorie, low fat diet in a 60 year old healthy physically active male, height 5'7", weight 173 lbs. Results: Respective pre to post intervention changes were as follows: skeletal MM increased from 86.6 lbs. to 90.4 lbs.; BF decreased from 20.6 lbs. (12% BF) to 11.0 lbs. (6% BF); and TT increased from 380 ng/dl (50th percentile age related norms) to 519 ng/dl (76th percentile age related norms). Conclusions: Data from this exploratory case study suggest that increases in MM with corresponding decreases in BF may positively impact TT in older men. Investing time and resources into additional research in this area may be warranted.

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### THE CORTISOL AWAKENING RESPONSE IS DEPENDENT ON OBJECTIVE MEASURES OF PHYSICAL ACTIVITY AND SLEEP QUALITY

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The cortisol awakening response (CAR) is a distinct rise in cortisol observed during the waking period. CAR has been shown to be influenced by both self-reported sleep and exercise variables. However, it is unknown whether objective sleep and physical activity tracking would predict CAR. PURPOSE: We aimed to test the hypothesis that actigraph-based physical activity and sleep quality would predict next-day CAR. METHODS: Male (n=22) and female (n=62) college-aged students (19.06±1.89yrs; 72.60±19.79kg; 161.36±53.99cm) wore accelerometers (ActiGraph, GT3X) for four consecutive 24-hour periods. Saliva samples were collected each morning, immediately after waking (Cort0) and after 30 mins (Cort30); cortisol was analyzed in duplicate. CAR was calculated as the relative difference between Cort30 and Cort0. Only subjects with two complete days of data were included in the current analysis. Activity was analyzed as minutes in sedentary, light, moderate, vigorous (VIG) and very vigorous (VVIG) activity and relative daily percentages of each (%). Sleep was analyzed as total sleep time (SleepTotal) and number of awakenings (Wake#). Random intercept multilevel regressions were used to analyze relationships between physical activity and sleep data predicting CAR. RESULTS: Models revealed significant interactions between sleep quality (Wake#) and VIG (p=0.02) and VIG% (p=0.04) to predict next-day CAR. In separate models, significant interactions were observed for VVIG% and SleepTotal (p<0.01). CONCLUSIONS: In our subjects, increased vigorous activity and decreased sleep time and quality are associated with increased CAR the following morning. Given the present analysis was completed in non-athletes, findings should be replicated in subjects with significantly greater vigorous activity levels.

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### HIGH SCHOOL SOFTBALL PLAYER WITH TYPE 1 DIABETES 72-HOUR GLUCOSE RESPONSE: A CASE STUDY

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Physiological health for an individual with type 1 diabetes (T1D) can improve with exercise however control of blood glucose for athletes can be a challenge, especially during and 24-48 hours after competitions. Athletes with T1D may experience elevated glucose levels on game days (GD) compared to general practice (GP), even if expending a similar amount of energy. Purpose: The purpose of this case study was to examine average daily glucose for a 72-hour period starting on and following a day of GP compared with a GD for a high school softball player with T1D. Methods: After informed consent a 14-year-old female wore a Fitbit® Charge 2 during the same time period in which her continuous glucose monitor and insulin pump were being observed. Results: A paired sample T-test showed a significant difference ( $p=0.04$ ) in daily glucose averages (DGA) on GD compared to GP ( $GD=204 \pm 28.87$  vs.  $GP=143.3 \pm 22.65$  respectively), and no difference between average daily activity and energy expenditure. The daily glucose maximum was also significantly higher ( $p=0.03$ ) on and after GD compared to GP ( $369.3$  vs.  $245.3$ ). Conclusions: Results from this case study show that an athlete with T1D can experience significantly higher blood glucose levels on a GD compared to GP even though there were similar levels of activity and less energy expenditure. Future investigations should further explore the game day stress phenomenon so athletes with T1D can better prepare for a prolonged hyperglycemic state.

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### SHIFT WORK ALTERS T-CELL BUT NOT NATURAL KILLER CELL FREQUENCIES

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Sleep restriction reduces immune function whereas the effects of shift work and alterations in circadian rhythm are less clear, in part due to methodological differences. PURPOSE: To examine the effects of 4 days of simulated shift work on circulating lymphocyte populations in a highly-controlled environment. METHODS: Fifteen healthy ( $26 \text{ yr} \pm 5$ ,  $22.3 \text{ kg/m}^2 \pm 3.1$ ) but sedentary adults (6M:9F) matched for sleep, physical activity and dietary intake completed this study (night shift  $n=7$ , slept from 0800-1700; day shift  $n=8$ , slept from 2200 to 0700). Fasted blood samples were obtained before and the morning after the last shift day. Immune cells were isolated using density gradient centrifugation and were labelled to identify natural killer (NK) and T-cell frequencies using flow cytometry. Data are expressed as mean  $\pm$  SD. RESULTS: There were no group differences at baseline. A significant group x time interaction for CD3+ T-cells was observed, with night shift increasing from  $56.9\% \pm 5.9$  to  $65.8\% \pm 6.6$  while day shift decreased from  $62.0\% \pm 5.5$  to  $57.1\% \pm 6.2$  ( $p=0.032$ ). CD3+CD4+ T-cells showed a similar increase with night shift but did not reach significance ( $p=0.148$ ). CD3+CD8+ and mucosal associated invariant T-cells along with NK cell population were unchanged. CONCLUSIONS: NK cell proportions appear stable when night shift workers were given equal access to sleep and other factors were strictly controlled. The unexpected changes in T-cell proportions may be a short-term compensatory response when compared to chronic sleep deprivation, although CD4+ T-cells exist within multiple T-helper subsets which may also influence the results. Supported by a Collaborative Research Network Grant and National Health and Medical Research Council of Australia grant.

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### IMPACT OF FITNESS ON MACROPHAGE POLARIZATION FOLLOWING ACUTE AEROBIC EXERCISE

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Coronary artery disease (CAD) is characterized by the skewing of macrophages toward a pro-inflammatory CD86+ M1 phenotype, as compared to a normal balance between M1 and anti-inflammatory CD206+ M2 cells. Aerobically fit individuals have reduced CAD incidence compared to their unfit counterparts, partially due to chronic alterations in immunity. Although acute exercise can affect immune cells, its impact on macrophage polarization in fit and unfit individuals remains unknown. PURPOSE: To determine differences in macrophage polarization between fit and unfit individuals following an acute bout of aerobic exercise. METHODS: 14 fit (VO2 peak; males:  $\geq 45 \text{ mL O}_2/\text{kg}/\text{min}$ , females:  $\geq 35 \text{ mL O}_2/\text{kg}/\text{min}$ ) and 14 unfit subjects (VO2 peak; males:  $< 40 \text{ mL O}_2/\text{kg}/\text{min}$ , females:  $< 30 \text{ mL O}_2/\text{kg}/\text{min}$ ) performed 30 minutes of moderate intensity (60% VO2 peak) cycling. Blood samples were taken pre-exercise, immediately, 1 hour, and 2 hours post-exercise. Monocytes were isolated and cultured for 7 days with autologous serum. Macrophages were stained using antibodies against CD86 and CD206 and flow cytometry was performed. RESULTS: A main effect for time was not significant ( $p=0.098$ ) in either macrophage phenotype. However, there was a significant between-subjects main effect for group in CD206+ M2 macrophages ( $p=0.028$ ). A profile plot suggested reduced M2 percentages at 1H and 2H in unfit subjects. CONCLUSION: Acute exercise preserves anti-inflammatory M2 macrophage polarization in fit individuals. This is likely due to reduced inflammation which may aid in CVD prevention.

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### SERUM URIC ACID LEVELS IN HEALTHY ADOLESCENTS

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Uric acid (UA), a biomarker of inflammation has been linked to obesity, hypertension, metabolic syndrome and other health concerns that can lead to poor cardiometabolic health (CMH). PURPOSE: To investigate the influence of physical activity (PA), body mass index (BMI) and sleep on UA levels among adolescents from a larger, longitudinal study assessing CMH. METHODS: Subjects [ $N=146$ ; Age= $16.6 \text{ yr} \pm 0.38 \text{ yr}$ , 59.5% female, 63.6% Caucasian], came to the lab for a fasted blood draw, anthropometric measures and assessment of PA and sleep [Godin and Pittsburgh Sleep Quality Index, respectively]. Serum UA was assessed using the BioAssays Quantichrom UA assay kit. An analysis of covariance (ANCOVA) was used to test mean differences in UA between genders and race, controlling for BMI, PA and sleep. Multivariate adaptive regression splines (ARS) were used to examine the nonlinearities among sex, race, BMI, PA, and sleep. RESULTS: ANCOVA indicated that UA was higher for males than females ( $p<0.001$ ) after controlling for BMI, PA, and sleep; BMI was significantly associated with changes in serum UA ( $p<0.001$ ). ARS selected males, Caucasians, and BMI as significant predictors of UA with a spline in BMI at  $26 \text{ kg/m}^2$ . In this cohort, sleep and PA were not correlated with UA levels. CONCLUSION: Congruent to previous studies, these findings indicate change in BMI and sex as contributing factors to UA differences in our adolescent cohort. Future studies should employ objective measures of PA and sleep to examine their potential influence on UA or other inflammatory markers in adolescents over time.

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#### FITNESS-RELATED DIFFERENCES IN POLARIZATION OF LIPID-EXPOSED MACROPHAGES FOLLOWING ACUTE EXERCISE

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Compared to anti-inflammatory "M2" (CD206+) macrophages, pro-inflammatory "M1" (CD86+) macrophages are considered highly atherogenic. Cardiovascular fitness is linked to decreased atherosclerotic plaque formation and may, therefore, alter macrophage functionality following exposure to physiological stress and elevated lipids. Purpose: To determine fitness-related differences in the polarization of lipid-exposed macrophages following acute, moderate-intensity exercise. Methods: Eight fit (VO<sub>2</sub> peak; M:  $\geq 45$  mL O<sub>2</sub>/kg/min, F:  $\geq 35$  mL O<sub>2</sub>/kg/min) and 12 unfit subjects (VO<sub>2</sub> peak; M:  $< 40$  mL O<sub>2</sub>/kg/min, F:  $< 30$  mL O<sub>2</sub>/kg/min) performed 30 minutes of moderate intensity (60% VO<sub>2</sub> peak) cycling. Blood samples were collected pre-, immediately post-, 1 hour- and 2-hours post-exercise. Mononuclear cells were isolated and cultured with LDL (52 $\mu$ L/1x10<sup>6</sup> cells) and palmitate (6 $\mu$ L/1x10<sup>6</sup> cells) for 4 hours and with autologous serum for 7 days. Macrophages were stained with antibodies against CD86 and CD206 for flow cytometric analysis. Results: A mixed between-within ANOVA found no significant between-subjects main effects for CD86 (p=0.667) and CD206 (p=0.675) expression. A main effect of time was significant for the expression of CD206 (p=0.033). A profile plot suggests that CD206 was increased, primarily in fit subjects, following LDL and palmitate stimulation pre-, immediately post-, and 1-hour post-exercise. Conclusion: Fitness may increase "M2" macrophage polarization in response to acute exercise and lipid exposure, thereby protecting fit individuals from atherogenesis.

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#### MONOCYTE ADHESION MOLECULE EXPRESSION FOLLOWING AN ACUTE BOUT OF MODERATE INTENSITY CYCLING

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Monocyte adhesion to the endothelium is a key step in the development of atherosclerosis. It is well established that higher CV fitness is associated with a reduced risk for CV disease. PURPOSE: To investigate the impact of fitness on monocyte surface receptor expression of CD11c and VLA4 following an acute bout of exercise. METHODS: 9 fit (VO<sub>2</sub> peak; males:  $\geq 45$  mL O<sub>2</sub>/kg/min, females:  $\geq 35$  mL O<sub>2</sub>/kg/min) and 13 unfit (VO<sub>2</sub> peak; males:  $< 40$  mL O<sub>2</sub>/kg/min, females:  $< 30$  mL O<sub>2</sub>/kg/min) subjects performed 30 min of moderate intensity (60% VO<sub>2</sub> peak) cycling. Blood samples were obtained pre-exercise, immediately, and 1 h post-exercise. Monocytes were stained with antibodies against CD14, CD16, VLA4, and CD11c and were analyzed via flow cytometry. A mixed between-within repeated measures ANOVA was used to determine the impact of fitness on VLA4 and CD11c following a submaximal bout of exercise. RESULTS: There were no significant between-subjects main effect for groups in either of the monocyte subsets (p>0.083). A main effect for time was significant in VLA4 (p=0.004) and CD11c (p=0.014) expression in non-classical and classical monocytes, respectively. A profile plot suggested that VLA4 was increased 1 h post-exercise and CD11c was reduced immediately post-exercise. CONCLUSION: Monocyte receptor expression does not appear to be impacted by physical fitness in young, apparently healthy adults. Nevertheless, an acute bout of cycling altered the expression level of monocyte adhesion molecules to varying degrees depending on the specific monocyte subset.

#### THE EFFECT OF COLD AMBIENT TEMPERATURE AND PRECEDING ACTIVE WARM-UP ON LACTATE KINETICS IN FEMALE CYCLISTS AND TRIATHLETES

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Purpose: to evaluate the effect of cold ambient temperature on lactate kinetics with and without a preceding warm-up in female cyclists/triathletes. Methods: Seven female cyclists/triathletes participated in this study. Peak power output (PPO) of each participant was determined during a peak oxygen uptake (VO<sub>2</sub>peak) testing. Experimental visits consisted of: 1) thermoneutral temperature (20°C, NEU); 2) cold temperature (0°C) with no active warm-up (CNWU); and 3) cold temperature (0°C) with a 25 min active warm-up (CWU). During each condition, participants performed a lactate threshold (LT) test followed by a time-to-exhaustion (TTE) trial at 120% of the participant's previously determined PPO. Null hypothesis testing was used to examine group differences in physiological and perceptual data. Magnitude-based inferences were employed to examine performance effects. Results: Power output at LT was 182.1  $\pm$  26.4, 200.0  $\pm$  22.6, and 192.9  $\pm$  30.1 W for NEU, CNWU, and CWU, respectively. Power output at LT with CNWU was 10.2  $\pm$  2.6% greater than with NEU, and the effect was considered very likely small (ES= 0.59). At LT, there were no significant differences among groups in VO<sub>2</sub>, lactate concentration, heart rate, or rating of perceived exertion. TTE at 120% PPO was 11% longer with CNWU than with CWU (ES =0.62, likely small). Conclusion: These findings suggest that power output at LT was higher in CNWU compared to NEU and CWU. Additionally, TTE at 120% of PPO was higher in CNWU compared to CWU and no different than NEU. These findings indicate that lactate kinetics differs in cold vs. thermoneutral conditions as well as with the addition of an active warm-up in the cold as compared to no warm-up.

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#### THE RELATIONSHIP BETWEEN NATURE CONNECTEDNESS AND PHYSICAL ACTIVITY PATTERNS IN A SAMPLE OF COLLEGIATE STUDENTS, FACULTY, AND STAFF

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PURPOSE: A strong relationship exists between PA and NC; the most physically active individuals are also the most nature connected. Designing PA programs and modifying college campuses through the lens of biophilia can provide a more logical, evidence-based approach to improve overall health and wellness. The purpose of this study is to identify the relationship between physical activity (PA) and nature connectedness (NC) in a sample of collegiate faculty and students. METHODS: Participants completed two surveys: The International Physical Activity Questionnaire, and the Connectedness to Nature Survey. Demographic data (age, race, campus affiliation) was also collected. RESULTS: 82 participants total (male=18.8%, female=81.2%). Participants reported a mean score of 2.39 on the NC scale. On average, participants accumulated 3330 minutes of weekly sedentary activity, 743 min of walking activity, 308 minutes of moderate activity, 339 minutes of vigorous activity. Spearman correlations showed no correlation between NC and PA (vigorous, p= .782; moderate, p= .577; walking, p= .374; sitting, p=.774). CONCLUSION: College affiliates report an affinity for nature, and high levels of PA which may suggest the need for more biophilic spaces. More studies are needed to determine stronger relationships between PA and NC in the collegiate setting.

**Abstract Withdrawn****WHAT NINE DAYS OF SCBA TRAINING DOES TO BODY WEIGHT AND HYDRATION IN FIREFIGHTER RECRUITS**

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Fire service personnel are exposed to extreme ambient temperatures as well as compromised heat dissipation due to impermeable protective clothing (PPC) and added weight of the self-contained breathing apparatus (SCBA) unit. SCBA training creates physiological and psychological challenges. Recruits drop out during SCBA training has been due to heat related illnesses which may be further related to body weight and body water changes during these nine training days. Purpose: Examine if the application of ACSM's position stand on Exercise and Fluid Replacement was appropriate for new fire fighter recruits during 9 days of SCBA training in an effort to prevent heat related illnesses by tracking body weight (BW), specific gravity (SG) and total body water (TBW). Methods: Seventeen healthy firefighter recruits with an average age of  $27 \pm 4.5$ , HT  $1.80 \text{ m} \pm 0.08$ , BW of  $89.13 \text{ kg} \pm 14.53$ , body fat percentage  $17.79 \pm 5.45$  and BMI  $27.51 \pm 4.04$ . Hydration (SG) was measured using a refractometer pen, BW and TBW was measured using the InBody 770. Measurements were taken pre and post training days. Results: There was no statistical difference in average SG or TBW over SCBA training. There was a significant difference in BW ( $p = 0.00$ ) over the course of SCBA training, with the greatest average loss occurred on day 6 ( $-1.03 \pm 0.65 \text{ kg.}$ ) during maze training. The greatest changes in specific gravity was on days 9 ( $-0.007 \text{ gmL}^{-1}$ ), and 4 ( $-0.003 \text{ gmL}^{-1}$ ). Training days 6-9 showed an average decrease in specific gravity. Conclusion: The maze training had the greatest impact on weight loss during 9 days of fire academy. Average SG fluctuated little, but following day 6 there were 6 recruits whose SG was  $> 1.020$  for the next 3 days. Fire service administration may consider reducing training intensity following maze training. Following ACSM guidelines did help deter heat injury during SCBA training. Grants/Funding: McNair Scholarship

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**HEAT ACCLIMATION PROTECTS C2C12 MYOTUBES AGAINST SUBSEQUENT CHALLENGE WITH HYPOXIA AND LPS**

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Heat acclimation (HA) may protect skeletal muscle against novel stress exposure. Purpose: This study investigated HA-mediated cross tolerance in C2C12 myotubes. Methods: Differentiated myotubes were heated ( $40^\circ\text{C}$ ) for 2h/d over 6d (HA) or maintained at  $37^\circ\text{C}$  (CN). HA and CN myotubes were challenged with hypoxia (1% FIO<sub>2</sub> [H]) or hypoxia + lps (500 ng/ml [H+L]) for 2h. Cell lysates were collected at +0h and +12h following challenge. Protein markers of heat shock response (HSR), inflammation, and apoptosis were assessed with western blot. Data were analyzed with two-way ANOVA with Newman-Keuls post-hocs. Results: Phosphorylation of HSF-1 was increased at +0h in HA [+59%,  $p=0.03$ ], HA(H) [+62%,  $p<0.01$ ] and HA(H+L) [+51%,  $p=0.03$ ], but did not increase until +12h in CN(H) [+86%,  $p<0.01$ ] and CN(H+L) [+77%,  $p=0.01$ ]. Likewise, HSP70 did not increase until +12h in CN(H) [+158%,  $p=0.01$ ] and CN(H+L) [+153%,  $p=0.04$ ]. I $\kappa$ B $\alpha$  phosphorylation was reduced in HA at +0h ( $-56\%$ ,  $p=0.01$ ). Whereas, TLR4(+77%,  $p=0.01$ ) and NF $\kappa$ B (+117%,  $p=0.03$ ) were increased in CN(H+L) at +12h. SIRT1 was reduced in CN(H) [ $-55\%$ ,  $p=0.03$ ] and C(H+L) [ $-70\%$ ,  $p<0.01$ ] at +0h. This may have contributed to increased phosphorylation of JNK at +12h in CN(H) [+75%,  $p<0.01$ ] and CN(H+L) [+55%,  $p=0.03$ ]. At +12h terminal effector caspase-3 also trended towards increase in CN(H) [+28%,  $p=0.07$ ] and increased in CN(H+L) [+74%,  $p=0.02$ ]. Conclusions: HA activates the HSR and elevates SIRT1, conferring lower inflammatory and apoptotic drive. This HA-mediated cross tolerance is not evident until +12h, suggesting benefits of HA could be missed if an extended time course is not followed.

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**POKEY MON SLOW: A NATURAL EXPERIMENT CAPTURES PHYSICAL ACTIVITY PROFILES OF PLAYING POKÉMON GO**C. Beach<sup>1</sup>, G. Billstrom<sup>1</sup>, E. Anderson Steeves<sup>2</sup>, J.F. Oody<sup>1</sup>, & J.A. Steeves<sup>1</sup>. <sup>1</sup>Maryville College, Maryville, TN, <sup>2</sup>University of Tennessee, Knoxville, TN

Several studies have documented changes in physical activity (PA) volume related to playing Pokémon Go (PMG); however, none have described the intensity or unique patterns of PA while playing PMG. Purpose: The purpose of this study was to describe objectively measured PA between greenway PMG users and non-PMG users. Methods: From June to August 2016, 100 participants walking on a greenway wore an ActiGraph GT3X accelerometer. Minute-by-minute accelerometer data (vector magnitude and steps) were used to generate and compare PA profiles between PMG users ( $n=13$ ) and non-PMG users ( $n=87$ ). Multiple linear regression was used to examine the relationship between PMG user status and accelerometer derived continuous variables. Results: The non-PMG users consistently maintained a high vector magnitude ( $\sim 7000$  counts/minute [CPM]) and stepping rate ( $\sim 110$  steps/minute) from onset to the end of their PA bout, creating a box shaped PA profile. In contrast, the PMG users' PA profile was inconsistent, characterized by many peaks and valleys, caused by a wide range of vector magnitudes. Stepping rates of PMG users rarely exceeded 100 steps/minute for more than 5 minutes at a time, and the vector magnitude was approximately 50% less than non-PMG users, rarely reaching above 4,000 CPM. Regression models showed differences in sedentary, light, moderate, vigorous, MVPA, and steps/minute between PMG users and non-PMG users after controlling for cofounders ( $p<0.05$ ). Conclusions: PMG users are likely moving at a slower pace and stopping more to play PMG than non-PMG users. The potential impact of PMG as a PA intervention in select populations should be explored further, given these findings.

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**FACTORS LEADING TO DISCREPANCIES IN ACCUMULATED PHYSICAL ACTIVITY DURING SCHOOL HOURS IN ELEMENTARY SCHOOL STUDENTS**

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Inconsistently implemented state physical activity (PA) mandates lack oversight and regulation. Purpose: This study quantifies sex and racial differences of in-school PA among fourth grade students. Methods: Students (N=148) from eight rural, low socioeconomic schools wore accelerometers during school for one week. Teachers recorded data related to PA setting and duration. Results: Of the 148 students, only 12 met the 150 minutes of in-school moderate-to-vigorous physical activity (MVPA) per week, in accordance with the state's mandate. Students spent a significant percentage of the total school day sedentary (75.7±5.7%, mean±SD). Males spent significantly more of daily recess engaged in MVPA than females (24.9% and 18%, respectively). White students spent a higher percentage of recess in MVPA than Non-White students (29.2±13.1% and 21.1±13.1%, respectively). Schools with a certified physical education instructor (n=2) participated in significantly more minutes of MVPA during recess (9.1±7.3) and physical education class (3.1±2.0) than other schools (5.2±2.7 and 2.5±1.8, respectively). Conclusions: Very few students achieved the state-mandated 30 minutes of MVPA per day during school hours; however, schools with certified physical educators achieved more MVPA throughout the school day. Recess PA contributed considerably to this discrepancy, highlighting the importance of encouraging active play and other types of PA during breaks in the school day.

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Abstract Withdrawn

**RECESS AND OVERWEIGHT AND OBESITY IN CHILDREN 5-11 YEARS OF AGE: 2013-2016 NHANES**

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There is limited evidence examining reported weekly volume of recess and odds of overweight and obesity using large nationally representative samples of U.S. children. Purpose: Examine the associations between reported weekly volume of recess, and overweight and obesity in a nationally representative sample of U.S. children. Methods: The study sample included male (n=1,434) and female (n=1,409) children 5 to 11 years of age who participated in the 2013-2016 National Health and Nutrition Examination Survey. Overweight and obesity were defined using the 85th and 95th percentile of body mass index of the same age and sex. Proxy respondents answered interview questions regarding the number of days/week and minutes/day that the child participates in recess. Results: Compared to a referent group participating in recess five days/week for > 30 minutes/day, analysis revealed significantly higher odds of obesity in females reporting no recess participation (Odds Ratio 1.81; 95% Confidence Interval, 1.03-3.16, P=0.0397). This relationship was independent of age and race/ethnicity. A similar relationship was not revealed for prediction of overweight in females or overweight and obesity in males. Conclusions: In a large nationally representative sample of U.S. children, reporting no recess was associated with significantly higher odds of obesity in females.

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**THE EXAMINATION OF JUDO ON PHYSICAL ACTIVITY AND SLEEP IN CHILDREN WITH AUTISM SPECTRUM DISORDER**

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BACKGROUND: The aim of this study was to examine the effects of an 8-week judo program on moderate-to-vigorous physical activity (MVPA), sedentary behavior (SB), and sleep quality in children with Autism Spectrum Disorder (ASD). METHODS: Participants included 15 children (ages 8-17, with a formal diagnosis of ASD). The sample participated in an 8-week judo program (45 minutes, 1X week), with measures taken at baseline and at the end of the 8-weeks. In order to assess activity levels and sleep quality, participants were instructed to wear Actigraph GT9X Accelerometers for 7 days and nights, only removing the device during water-based activities. Non-parametric paired t-tests were conducted to compare differences in MVPA, SB, and sleep quality (i.e. sleep efficiency, total sleep time, number of awakenings, and wake after sleep onset) pre and post judo. Chi-square tests compared the number of participants who met sleep and MVPA recommendations. RESULTS: Results indicate participants spent a significantly greater percentage of time in daily MVPA (8% vs 4%, p=0.05) following the program, however, actual MVPA minutes per day did not reach statistical significance (74.46 vs. 48.58 minutes per day, p=0.1) There was a significant increase in total sleep duration (572.56 vs 333.8, p=0.008) following the program, and although not statistically significant, a trend existed for improved sleep efficiency (92% vs 88%, p=0.1). There was an increase in the number of participants meeting MVPA (53% vs 27%) and sleep recommendations (40% vs 7%), although results were not statistically significant. CONCLUSION: Improvements in MVPA and sleep quality were observed following the 8-week judo program, although statistically significant findings were limited due to the small sample size. Future studies should include larger samples of youth with ASD, over a longer intervention period

### EXERCISE IS MEDICINE-ON CAMPUS OUTCOMES FOR YEAR 1 AT MARYVILLE COLLEGE

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Exercise is Medicine® on Campus (EIM-OC) is an initiative that encourages college faculty, staff, and students to work together to improve the health and well-being of the campus community. To achieve Gold Level recognition, an EIM-OC campus must measure exercise as a vital sign during of every student visit to campus healthcare providers. Purpose: To describe the exercise levels of students visiting healthcare providers on the Maryville College (MC) campus. Methods: A cross-sectional study design was used to measure exercise levels of students at all campus healthcare provider visits during the 2017-2018 school year. Participants were 183 students who visited the campus health center from Sept. 2017 to May 2018 and 64 student athletes who completed physical evaluations in Aug. 2017. Participants reported the days per week and minutes per day spent participating in exercise. Total volume of exercise (min/wk) (mean and standard deviation) was calculated, and frequencies determined the percentage of students who met the recommended 150 min/wk of physical activity. Results: Students who visited the campus health center reported an average of 262.3±261.0 min/wk of exercise, with the highest volume reported in October (321.8±300.8 min/wk; range 0-1200 min/wk) and the lowest volume reported in March (120.6±157.4 min/wk; 0-360 min/wk). Student athletes reported an average of 327.5±164.2 min/wk of exercise. Approximately 59% of students who visited the campus health center and 94% of the athletes achieved the recommended physical activity guidelines. Conclusions: Nearly 40% of student who visited the campus health center did not achieve physical activity guidelines. The EIM-OC referral system for exercise 'prescription' can help connect students with a network of campus exercise opportunities. Funding Source: Maryville College Gibson Fund

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### COMPLIANCE WITH PHYSICAL ACTIVITY GUIDELINES AND ASSOCIATIONS WITH PHYSICAL LITERACY AMONG FUTURE PHYSICAL EDUCATORS

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PURPOSE: To examine the relationship between pre-professional physical educators meeting the U.S. Physical Activity Guidelines and steps per week and physical literacy. METHODS: Twenty-five physical education teacher education (PETE) undergraduate majors (19 males, 6 females, aged 19-24 years) participated in assessments of Physical Literacy using the Canadian Assessment of Physical Literacy and wore GTX3+ accelerometers on their waist for a week. Freedman 1998 cut-points were used for determining moderate-to-vigorous physical activity (MVPA). Descriptive statistics were calculated for all variables. Correlations were calculated to examine the relationships between measured MVPA, measured steps, Physical Literacy, self-reported PA and sedentary time, and physical competence. RESULTS: 16% were compliant with MVPA guidelines, 4% were compliant with both MVPA and 10,000 steps recommendations, 56% met MVPA but were considered low active steps, and 24% did not meet any recommendations. Participants' physical literacy considered below that of a proficient 12-year old. Significant relationships existed between self-reported PA and Physical Competence ( $r=0.40$ ,  $p\leq.05$ ), and MVPA and Physical Literacy ( $r=0.42$ ,  $p\leq.05$ ); however, no other relationships existed. CONCLUSIONS: These findings suggest that while PETE students may meet the minimum guidelines for physical activity, more work needs to be done to address their Physical Literacy.

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### ASSOCIATION OF CARDIOVASCULAR HEALTH TRAJECTORIES AND CARDIORESPIRATORY FITNESS: THE CARDIA STUDY

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Ideal cardiovascular health (CVH) is a composite metric of seven health factors and behaviors. How cardiorespiratory fitness (CRF) is related to CVH is unclear. Purpose: To identify associations of CVH trajectories throughout adulthood with CRF in late-middle age. Methods: CVH components were measured in Black and White adults (N=2723, aged 18-30 yrs. at baseline) in the CARDIA Study at seven in-person examinations over 20 years. Graded treadmill tests at years 0 and 20 were used to measure CRF (minutes duration). CVH was determined by assigning each metric a score of 2 (ideal), 1 (intermediate), or 0 (poor) and summing the scores (range 0-14). Latent class modeling was used to identify subgroups of individuals with similar CVH trajectories from young adulthood to middle age. Multivariable logistic Poisson regression was used to assess the association between 20-year CVH trajectories and race- and sex-specific quartiles of CRF at year 20. Results: Five distinct CVH trajectories were identified: high (n=485), high-moderate (n=666), moderate (n=805), low-moderate (n=603), and low (n=164). Compared to the high trajectory group, odds ratios for low fitness (bottom quartile) at year 20 were 3.2 (95% CI: 1.9-5.2) for high-moderate, 6.6 (4.1-10.7) for moderate, 9.9 (6.1-16.4) for low-moderate, and 14.0 (8.2-24.0) for the low CVH trajectory groups after adjusting for race, sex, education, center, baseline CVH, and baseline CRF. Conclusion: Lower CVH trajectories throughout adulthood are associated with higher odds of low CRF in late-middle age.

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### THE PREVALENCE OF OBESITY AND ITS ASSOCIATION WITH PREVIOUS MUSCULOSKELETAL INJURY IN PROBATION OFFICERS

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Probation officers are responsible for the supervision of criminal offenders released into the community with the high risk of violent and physically demanding interactions. Despite obesity reaching epidemic levels in many public safety occupations, probation officers remain understudied. PURPOSE: The purpose of the current study was to examine the prevalence of obesity and its association with previous musculoskeletal injury in probation officers. METHODS: The current study used data from a survey administered to all North Carolina probation officers in 2015, with 1,323 completing the entire survey (70.9%). The survey included questions on demographics, injury history, physical activity, geographical location of work, and years of employment. Body mass index (BMI) was calculated and classified per the National Heart, Lung, and Blood Institute's guidelines. A logistic regression model estimated the odds ratios (OR) of musculoskeletal injury history within the past year. Predictor variables were age, sex, employment history, geographical location, physical activity within the past month, and BMI classification. RESULTS: The majority (80.8%) of the respondents were classified as overweight or obese (BMI  $\geq 25.0$  kg/m<sup>2</sup>), with 49.9% classified as obese (BMI  $\geq 30$  kg/m<sup>2</sup>) and 9.5% classified as severely obese (BMI  $\geq 40$  kg/m<sup>2</sup>). Multivariable logistic regression modeling suggested that workers categorized as being severely obese (BMI  $\geq 40$  kg/m<sup>2</sup>) were 2.5 times more likely (OR=2.56; 95% CI=1.19-5.51) to sustain a musculoskeletal injury within the past year than their normal weight colleagues. CONCLUSION: Given the prevalence of obesity in our sample of probation officers, and its association with previous musculoskeletal injury, public safety administrators may wish to consider workplace interventions designed to combat obesity. Supported by the North Carolina Department of Public Safety

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### EFFECTS OF SEDENTARY BEHAVIOR ON CORE STRENGTH, FLEXIBILITY, AND POSTURE IN COLLEGE STUDENTS

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Sedentary behavior and physical inactivity has increased with advancements in technology. College students are high utilizers of technology, putting them at risk for negative health consequences. PURPOSE: To evaluate the effects of sedentary behavior and physical activity participation on core strength, flexibility, and posture in college students. METHODS: College students (n=33) completed physical measures and questionnaires of sedentary behavior (SB) and physical activity (PA). Curl-up tests, sit and reach, and plumb line assessments indicated core strength, flexibility, and posture, respectively. Two-way ANOVAs were performed with participants categorized by their posture measures (rounded shoulders; RS, and forward head posture; FHP) on weekday and weekend SB, and PA per week.

**P217** Associations were determined between SB, PA, core strength, flexibility, and body fat percentage by computing Pearson's correlation coefficients. RESULTS: There were no significant differences in SB and PA between postural groups. However, participants with RS and FHP spent an hour more per day being sedentary on average than those with RS alone (RS & FHP: SB weekday, M=3.74 hrs  $\pm$  0.79, SB weekend, M= 3.74 hrs  $\pm$  0.9; RS only: SB weekday, M= 2.62 hrs  $\pm$  0.36, SB weekend, M= 2.77 hrs  $\pm$  0.48). SB was associated with decreased flexibility (SB weekday: r=-0.47, p<0.01; SB weekend: r=-0.48, p<0.01), while PA was associated with lower body fat percentage (r=-0.36, p=0.04) and increased core strength (r=0.51, p<0.01). Furthermore, college students who are sedentary during the week are also sedentary on the weekend (r=0.82, p<0.01). CONCLUSION: Sedentary behavior was associated with negative changes in posture and decreased flexibility among college students.

### GENDER DIFFERENCES IN PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOR INDICIES AMONG PHYSICAL EDUCATION PEDAGOGY UNDERGRADUATE STUDENTS

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PURPOSE: This study examined the gender differences of sedentary behavior (SB) and self-reported and measured physical activity (PA) in undergraduate Physical Education Pedagogy (PEP) students. METHODS: Twenty five (19 males, 6 females, aged 19-26) undergraduate students participated. Participants underwent testing according to the Canadian Assessment of Physical Literacy (CAPL) protocol. Participants also wore an accelerometer for one week to record steps and moderate to vigorous physical activity (MVPA). RESULTS: Significant differences in self-reported sedentary behavior score were observed (0.42  $\pm$  1.07 vs. 2.0  $\pm$  2.19 for males and females respectively; t = -2.420, p  $\leq$  0.05) and self-reported PA score (2.0  $\pm$  0.94 vs. 1.17  $\pm$  0.41 for males and females respectively; t = 2.080, p  $\leq$  0.05). Surprisingly, no gender differences were found in measured MVPA or steps (267.8  $\pm$  128.7 vs. 223.7  $\pm$  82.8 minutes/week and 5472.9  $\pm$  2579.1 vs. 4755.2  $\pm$  2596.5 steps/day for males and females, respectively). CONCLUSIONS: This study indicates females self-report higher levels of sedentary behavior and less physical activity compared to males. Although not statistically significant, males participated in more measured PA. These findings suggest gender differences in physical activity participation exist even among professionals in the field. The implications of these findings are particularly relevant when considering the role these professionals play in modeling physical activity behaviors.

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### WALKING CADENCE DURING MODERATE INTENSITY PHYSICAL ACTIVITY IN PREGNANT WOMEN

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PURPOSE: Three to six metabolic equivalents (METs) has long been considered equivalent to moderate intensity exercise, and further research has indicated that walking cadence (steps/min) of 100 steps/min is approximately three METs. However, all studies establish 100 steps/min as indicative of moderate intensity threshold have been conducted in non-pregnant individuals. The purpose of this study was to determine the walking cadence equivalent to three METs in pregnant women. METHODS: Pregnant women in their second or third trimester (>12 weeks gestation) completed three stages of walking at 0% incline for five minutes each: walking speeds were 2.5, 3.0, and 3.5 miles per hour (mph). Oxygen consumption (VO2) and heart rate (HR) were measured each minute and METs were calculated for each stage. During all stages, walking cadence was evaluated in real-time by an OptoGait gait analysis system. During a fourth stage, where participants walked at a speed that elicited 100 steps/min, VO2 and HR were also collected. RESULTS: Mean cadence increased linearly across the three stages (100.21 $\pm$ 7.94, 108.10 $\pm$ 5.02, and 115.40 $\pm$ 4.17 steps/min), as did METs (2.05 $\pm$ 0.76, 2.49 $\pm$ 1.04, and 3.25 $\pm$ 0.92 METs). The average speed at which women walked at 100 steps/min was 2.65 $\pm$ 0.35 mph, while VO2 was 8.60 $\pm$ 0.57 mL/kg $\cdot$ min, or 2.50 $\pm$ 0.14 METs. CONCLUSIONS: These data indicate that the traditionally used 3 MET cutoff for moderate intensity activity is too high for pregnant women and that a 2.5 MET cutoff is more appropriate for this population. Additionally, the implication that the cadence of 100 steps/min is equivalent to 2.5 METs during pregnancy is important for pregnant women and clinicians who evaluate physical activity levels using a step-based program.

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### VALINE-CATABOLITE, 3-HYDROXYISOBUTERATE ALTERS MYOTUBE METABOLISM AND REDUCES INSULIN SIGNALING

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Recently, circulating branched-chain amino acids (BCAA) have been consistently correlated with severity of insulin resistance. The valine catabolite 3-hydroxyisobuterate (3HIB), was shown to enhance lipid uptake contributing to insulin resistance in skeletal muscle. PURPOSE: This study investigated the effect of 3HIB on skeletal muscle insulin signaling, metabolism, and related gene expression in vitro. METHODS: C2C12 myotubes were treated with 3HIB for up to 48 hours with various concentrations. Metabolic gene expression was measured via qRT-PCR, cell metabolism was measured via O2 consumption (mitochondrial) and extracellular acidification rate (glycolysis), insulin sensitivity was measured using western blot, and lipid content was assessed using lipid-specific staining (each of which were analyzed using either t-test, one-way ANOVA, or MANOVA with correction for pair-wise comparison). RESULTS: 3HIB did not alter expressional indicators of mitochondrial biogenesis, glycolysis, BCAA catabolism, or lipogenesis. Chronic physiological 3HIB treatment significantly increased peak oxygen consumption (p<0.05), while supraphysiological 3HIB treatment suppressed basal and peak mitochondrial and glycolytic metabolism (p<0.05 for each). Both physiological and supraphysiological 3HIB reduced pAkt expression during insulin stimulation (p<0.05). CONCLUSION: 3HIB may reduce insulin sensitivity in vitro, supporting a potential role of 3HIB in the development of insulin resistance.

This work was supported by the HPU Department of Exercise Science.

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### EFFECT OF VALINE ON MYOTUBE METABOLISM AND INSULIN SENSITIVITY

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Increasing population data has consistently demonstrated a correlation between circulating BCAA levels and insulin resistance. The valine catabolite, 3-hydroxyisobutyrate (3HIB), may promote insulin resistance through increased endothelial lipid uptake, however, it is unclear if valine independently causes insulin resistance. **PURPOSE:** This study investigated the effect of valine on muscle metabolism and insulin signaling in vitro. **METHODS:** C2C12 myotubes were treated with varying concentrations of valine for up to 48 hours. Gene expression was measured by qRT-PCR, and mitochondrial and glycolytic metabolism were measured via O<sub>2</sub> consumption and extracellular acidification rate, respectively. Branched-chain-alpha-keto acid dehydrogenase (BCKDH) protein expression was evaluated using western blotting, as was insulin sensitivity (using pAkt expression) following insulin stimulation. Data were analyzed using either t-test, one-way ANOVA, or MANOVA with correction for pair-wise comparison. **RESULTS:** Valine did not affect metabolic gene expression of mitochondrial biogenesis or glycolysis, but significantly reduced basal and peak cell metabolism ( $p < 0.05$ ). Valine also altered BCKDH mRNA expression, yet BCKDH protein content remained unaltered ( $p > 0.05$ ). Additionally, valine treatment had no effect on pAkt expression following both acute and 48-hour treatment ( $p > 0.05$ ). **CONCLUSION:** Valine does not appear to independently alter insulin sensitivity, but may reduce skeletal muscle metabolism.

This work was supported by the HPU Department of Exercise Science.

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### MODEST UPPER BODY LOADING INCREASES MARATHON PACE RUNNING ECONOMY BY 3-4% IN FEMALE RUNNERS

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The effect of modest differences in body mass on running economy (RE) are not well documented. In this study external loads of 1.6 (L), 2.4 (M), and 3.2 kg (H) were added to the torso region of female runners ( $n = 18$ ;  $165 \pm 8$  cm;  $57.2 \pm 6.6$  kg;  $VO_2$  peak =  $46.9 \pm 5.5$  ml/kg/min) using double-layer compression garments with dense, malleable gel inserts to simulate subcutaneous body fat distributed throughout the upper body. RE was evaluated using indirect calorimetry and calculated by averaging the 60-s average values of minutes 3-4 and 4-5 with verification of steady state (difference in  $VO_2 < 0.1$  L/min between minutes) during four running bouts at marathon pace for the 3 load levels and an unloaded state (BL). An increase ( $p < 0.05$ ) in absolute  $VO_2$  (L/min) was exhibited for M ( $2.30 \pm 0.27$ ) and H ( $2.31 \pm 0.26$ ) versus BL ( $2.22 \pm 0.31$ ) but not L ( $2.29 \pm 0.29$ ).  $VO_2$  increased by  $\geq 1.5\%$  over BL for 74% of the L, M, and H loads. There was no difference in RE for any other loading comparisons. Respiratory exchange ratio also differed for BL ( $0.92 \pm 0.03$ ) versus M ( $0.94 \pm 0.03$ ) and H ( $0.95 \pm 0.03$ ), but not L ( $0.93 \pm 0.03$ ). RPE for legs, breathing, and overall were rated higher than BL for all load levels but one comparison (breathing at load M). Only a weak ( $r = 0.24$ ) near significant ( $p = 0.08$ ) relationship was found for change in body mass percentage and change in RE percentage. The prediction equation developed from the data produced a standard error of estimate of 6.7%. The findings from this study suggest that extra upper body mass loading of 1.6-3.2 kg of non-contractile tissue will negatively affect RE in trained women by ~3-4%. However, changes in RE exhibited by the light load differences were not able to be predicted with acceptable levels of error.

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### EFFECTS OF EXTRA SIMULATED, UPPER BODY FAT MASS ON MARATHON PACE RUNNING ECONOMY IN FEMALE RUNNERS

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The effect of modest differences in body mass on running economy (RE) are not well documented. In this study external loads of 1.6 (L), 2.4 (M), and 3.2 kg (H) were added to the torso region of female runners ( $n = 18$ ;  $165 \pm 8$  cm;  $57.2 \pm 6.6$  kg;  $VO_2$  peak =  $46.9 \pm 5.5$  ml/kg/min) using double-layer compression garments with dense, malleable gel inserts to simulate subcutaneous body fat distributed throughout the upper body. RE was evaluated using indirect calorimetry and calculated by averaging the 60-s average values of minutes 3-4 and 4-5 with verification of steady state (difference in  $VO_2 < 0.1$  L/min between minutes) during four running bouts at marathon pace for the 3 load levels and an unloaded state (BL). An increase ( $p < 0.05$ ) in absolute  $VO_2$  (L/min) was exhibited for M ( $2.30 \pm 0.27$ ) and H ( $2.31 \pm 0.26$ ) versus BL ( $2.22 \pm 0.31$ ) but not L ( $2.29 \pm 0.29$ ). There was no difference in RE for any other comparison loading comparisons. Respiratory exchange ratio also differed for BL ( $0.92 \pm 0.03$ ) versus M ( $0.94 \pm 0.03$ ) and H ( $0.95 \pm 0.03$ ), but not L ( $0.93 \pm 0.03$ ). RPE for legs, breathing, and overall were rated higher than BL for all load levels but one comparison (breathing at load M). When data from both sexes were combined, BL RE ( $2.66 \pm 0.54$ ) was lower ( $p < 0.05$ ) versus L ( $2.71 \pm 0.52$ ), M ( $2.73 \pm 0.53$ ), and H ( $2.75 \pm 0.52$  L/min). Male runners exhibited a moderate relationship ( $r = 0.37$ ) between percentage change in absolute  $VO_2$  and increased percent body mass, and a prediction model ( $\Delta VO_2 = 0.88(\Delta\% \text{ body mass}) - 0.92$ ;  $SEE = \pm 2.5\%$ ) was developed. However, all loads except L exhibited a similar increase in RE from BL for female runners, and RE was indistinguishable among loaded trials. Female runners also exhibited marked differences in perceptual responses to extra body mass. Current findings suggest increases in body mass of M or greater likely result in a detectable and potentially important decrease in RE, but a complex relationship exists between changes in body mass and RE.

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### THE EFFECTS OF FASTED OR FED STATE ON PHYSIOLOGICAL MEASURES OF AEROBIC PERFORMANCE IN WOMEN

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Previous research examining effects of fasting on exercise suggests fasting before exercising can affect performance. It has been demonstrated that as exercise intensity increases, plasma fatty acid turnover does not increase, and additional energy is obtained through muscle glycogen, blood glucose, and intramuscular triglycerides utilization. **Purpose:** To date, no study has directly examined physiological or psychological effects of fasted versus fed states on maximal aerobic exercise tests in women. **Methods:** 15 female students (age:  $m=20.13$ ;  $SD=1.2$  years; Height:  $m=167.73$ ;  $SD=5.2$ cm; and Weight:  $m=63.41$ ;  $SD=8.6$ kg) completed two testing sessions in either a fasted or fed state. Individuals performed a Modified Bruce incremental treadmill test to exhaustion on two occasions separated by at least 24 hours, once in a fed state and once while fasted. Time at volitional fatigue was recorded as the time to exhaustion. During the test, expired gases were recorded to analyze metabolic indices. Ratings of perceived exertion were measured during each stage using the Borg scale and, post test, individuals were asked to rate their overall feeling of exertion on a visual analog scale. **Results:** No significant difference in scores for:  $VO_{2max}$  fed ( $M=39.53$ ,  $SD=7.74$ ) and  $VO_{2max}$  fasted ( $M=37.4033$ ,  $SD=6.99128$ );  $t=-1.094$ ,  $p=0.293$ , for TEE Fed ( $M=554.93$ ,  $SD=135.51$ ) and TEE Fasted ( $M=538.60$ ,  $SD=106.54$ );  $t=0.924$ ,  $p=0.371$ , for RER Fed ( $M=287.20$ ,  $SD=99.02$ ) and RER Fasted ( $M=319.67$ ,  $SD=129.86$ );  $t=1.121$ ,  $p=0.281$ . for fat utilization fed ( $M=16.39$ ,  $SD=10.09$ ) and fat utilization fasted ( $M=18.09$ ,  $SD=8.18$ );  $t=-0.0564$ ,  $p=.582$ , for VAS fed ( $M=6.5$ ,  $SD=2.12$ ) and VAS fasted ( $M=5.57$ ,  $SD=1.93$ );  $t=-1.731$ ,  $p=.105$ , or for RPE fed ( $M=14.34$ ,  $SD=1.31$ ) and RPE fasted ( $M=13.99$ ,  $SD=1.39$ );  $t=-1.391$ ,  $p=0.186$  were seen. **Conclusions:** Although some studies have reported significant findings to metabolic indices following a fast of 24 hours or greater. The findings of the current study suggest that a 9 hour water fasting protocol is not sufficient to alter physiological or psychological variables in college age women.

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#### LIPID PROFILE AND HBA1C VALUES VARY ACROSS AGE GROUPS IN ACTIVE OLDER ADULTS

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Lipid profile and blood hemoglobin A1c (HbA1c) have been shown to be associated with cardiovascular disease risk in older adults. Purpose: The purpose of this study was to determine if there is a relationship between lipid profile and HbA1c values and age in active older adults. Methods: Blood samples were collected via finger prick from 143 senior citizens from seven local recreation centers. Total, LDL, and HDL cholesterol and triglyceride levels were calculated via CardioChek analyzer. HbA1c was calculated via A1cNow analyzer. Values were then reported and explained to the participants, as well as recorded for data purposes. Values were averaged by age group to look for trends as age increased. Results: Average total cholesterol was 189 mg/dL, 170 mg/dL, 189 mg/dL, 166 mg/dL, and 136 mg/dL for ages 50-59, 60-69, 70-79, 80-89, and 90+ years old, respectively. Average HDL cholesterol was 58 mg/dL, 55 mg/dL, 64 mg/dL, 64 mg/dL, and 71 mg/dL for the above age groups, respectively. Average LDL cholesterol was 103 mg/dL, 86 mg/dL, 85 mg/dL, 79 mg/dL, and 50 mg/dL, respectively. Triglycerides were 137 mg/dL, 139 mg/dL, 118 mg/dL, 140 mg/dL, and 77 mg/dL, respectively. HbA1c values were 5.4%, 6.6%, 5.5%, 5.7% and 6.4%, respectively. Conclusions: Our results reveal no association between lipid profiles and HbA1c values and age, independent of other factors, in active older adults. Supported by Sharon Towers Continuing Care Retirement Center.

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#### RELATIONSHIP BETWEEN MEASURES OF ANXIETY AND CHANGE IN RESTING METABOLIC RATE

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PURPOSE: To investigate the relationship between measures of anxiety and outcomes from two resting metabolic rate (RMR) tests. METHODS: A total of 33 subjects (12 men, 21 women;  $34.8 \pm 11.2$  years) completed two RMR tests within one month. Variables from the tests included RMR (kcal), oxygen consumption (VO<sub>2</sub> in mL/min) and heart rate (HR in bpm). During the first visit, the State-Trait Inventory for Cognitive and Somatic Anxiety was used to assess state (STICSA-Moment) and trait (STICSA-General) anxiety and the Anxiety Sensitivity Index-3 (ASI-3) to evaluate anxiety sensitivity. STICSA-Moment was administered again during the second visit. RMR Variables and STICSA-Moment were compared between visits and Spearman's rank correlation coefficients assessed relationships between outcomes. RESULTS: There was a significant difference in STICSA-Moment scores ( $t = 2.32, p = .027, \Delta$ STICSA-Moment = -1.4, 95% CI = -2.6, -.2) and VO<sub>2</sub> ( $t = 3.51, p = .001, \Delta$ VO<sub>2</sub> = -9.2 mL/min, 95% CI = -15, -3.9) between visits but not for HR ( $t = 1.40, p = .172, \Delta$ HR = -1.6 bpm, 95% CI = -4.0, .7) or RMR ( $t = 1.49, p = .146, \Delta$ RMR = -24 kcal, 95% CI = -58, 9). Significant, moderate correlations were observed between change in STICSA-Moment scores and change in RMR ( $\rho = .437, p = .012$ ) and VO<sub>2</sub> ( $\rho = .428, p = .015$ ), as well as a weak relationship with change in HR that trended towards significance ( $\rho = .323, p = .072$ ). Correlations between RMR variables and outcomes from STICSA-General and ASI-3 were insignificant. CONCLUSIONS: Although the changes were small in magnitude, practitioners and researchers should be aware that RMR and state anxiety may decline after an initial test. Future research should further explore the relationship between state anxiety and RMR results.

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#### CHANGES IN RESTING METABOLIC RATE FROM PREGNANCY TO POSTPARTUM

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PURPOSE: Postpartum weight retention has been shown to have lasting implications including cardiovascular disease, diabetes and obesity. Therefore, the postpartum period is a critical timepoint for a new mother to return to and maintain a healthy body weight. METHODS: Changes in resting metabolic rate of the mother were assessed at 34-36 weeks of gestation and at ~6 months postpartum ( $n = 24$ ). At each visit, fasted participants had a baseline blood draw, followed by metabolic assessments (i.e. resting metabolic rate (RMR) and substrate utilization) taken via indirect calorimetry. At the postpartum visit, the participants were also given surveys to fill out, including the Pittsburgh Quality Sleep Index (PSQI), which determined the quality of sleep for the month prior. RESULTS: RMR was significantly lower in the postpartum group ( $p < 0.001$ ). After accounting for body weight, the difference in RMR between the pregnancy and postpartum groups remained significant ( $p=0.034$ ). Interestingly, relative RMR was significantly higher in the "good sleepers" than the "bad sleepers" during the postpartum period ( $p=0.016$ ). CONCLUSIONS: Resting metabolic rate decreases from pregnancy to postpartum, which could contribute to the prevalence of postpartum weight retention. Improving sleep quality in the postpartum period could be a factor contributing to altered metabolic rate after pregnancy.

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#### RESTING ENERGY EXPENDITURE AND METABOLIC EQUIVALENTS IN YOUTH: IMPACT OF INCONSISTENT OPERATIONAL DEFINITIONS

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Youth metabolic equivalents (METy) express energy expenditure as a multiple of resting energy expenditure (REE). There are different operational definitions for REE, including basal metabolic rate (BMR) or resting metabolic rate (RMR). PURPOSE: To compare METy values expressed as multiples of BMR (METyBMR) versus RMR (METyRMR). METHODS: Data from two studies ( $N = 255, 47.4\%$  male, mean  $\pm$  SD age  $10.2 \pm 1.5$  years) were analyzed. For all participants, BMR was predicted using Schofield's equations, with body mass and height as predictors. RMR was assessed during 30-min supine rest while wearing a portable metabolic unit (Cosmed K4b2). Participants also performed structured tasks ranging from sedentary behaviors (e.g. supine rest) to vigorous activities (e.g. track running). METyBMR and METyRMR were calculated by dividing steady state oxygen consumption by BMR and RMR, respectively. Values were compared using two-way (Activity X METy calculation) analysis of variance on a mixed-effects model. Post-hoc tests were performed with Bonferroni correction, and significance was set to  $p < 0.05$ . RESULTS: There was a significant interaction ( $F(30) = 15.4, p < 0.001$ ) between activity and METy calculation. METyBMR and METyRMR differed significantly for 19 of 31 activities (61.2%), with differences ranging from 0.2 METy for supine rest to 3.1 METy for the Jackie Chan game ( $p < 0.001$ ). The mean for METyBMR was always higher than the mean for METyRMR. CONCLUSIONS: METyBMR and METyRMR are comparable (within 0.5 METy) for sedentary behaviors, but METyBMR becomes progressively higher than METyRMR as intensity increases, reaching differences  $>40\%$ . METyBMR and METyRMR are not interchangeable units, and care is necessary when interpreting and comparing the findings of studies that use METy.

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### RELATIONSHIP BETWEEN EXERCISE CLASS PARTICIPATION AND IMPROVEMENT IN CARDIOVASCULAR HEALTH

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**P229** PURPOSE: To determine the relationship between the frequency of participation in exercise classes and one's improvement in cardiovascular health through use of a diagnostic lipid panel. METHODS: Participants at local recreational/senior centers attended two Health Risk Assessments at baseline and at 3 months. Finger prick testing was used to collect blood samples from n=9 older adults. Total, LDL, and HDL cholesterol levels were calculated via CardioChek PA test system. Participant values were reported and explained to the seniors and recorded for data purposes. These levels were then compared to the frequency of exercise participation to determine the relationship. At both centers, the classes are taught Monday through Friday and consist of aerobic and strength exercises and use body weight, dumbbells, and resistance bands. RESULTS: Data showed total cholesterol levels increased by less in more frequent class participants when compared to less frequent class participants (+14.19% in <2d/wk and +9.00% in >3d/wk). However, HDL levels increased in less frequent class participants (+27.25%) and decreased in more frequent class participants (-8.04% in >3d/wk). There were no major differences in LDL levels between groups. CONCLUSIONS: There was a trend leading to exercise classes positively impacting total cholesterol levels among older adults at local senior/recreational centers in Mecklenburg County. All procedures were approved by the University of North Carolina at Charlotte Institutional Review Board 16-1015. Supported by Sharon Towers Continuing Care Retirement Center.

### PRE-SLEEP CONSUMPTION OF CASEIN PROTEIN ON RESTING METABOLIC RATE AND APPETITE IN PREMENOPAUSAL WOMEN

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**P230** PURPOSE: To determine the acute effects of nighttime pre-sleep consumption of casein protein (CP) and a placebo (PLA) supplement on next-morning measures of resting metabolic rate (RMR) and appetite in sedentary premenopausal women. METHODS: This study was a randomized crossover double-blind placebo-controlled trial. Seven premenopausal (age: 19.9±1.2 yrs, BMI= 23.1±2.6 kg/m<sup>2</sup>) women participated. Subjects had body composition (DXA), RMR (indirect calorimetry), and appetite (visual analog scale; VAS) measured. Subjects consumed either CP (35g, 130 kcal) or PLA (7.2g, 10 kcal) 30 min prior to bed time on two separate occasions separated by 48 hours. RMR and measures of hunger, desire to eat, and satiety were analyzed using Paired T-tests. Significance was accepted at p≤0.05. RESULTS: RMR (CP:1383±162; PLA:1340±159 kcal/day) and relative oxygen consumption (CP:3.41±0.44; PLA 3.36±0.38 ml/kg/min) were not different between CP and PLA. There were also no effects of CP and PLA on measures of appetite (Hunger: CP: 3.8±3.0; PLA: 3.1±2.7 cm; Satiety: CP: 4.1±3.4; PLA: 4.7±2.7 cm; Desire to Eat: CP:3.7±3.4; PLA:2.8±2.1 cm). CONCLUSION: There were no differences in RMR and measures of appetite between CP and PLA. There is growing evidence that a small snack before sleep (150-200 kcal) is not harmful to metabolism or appetite. This study was supported with product by Dymatize Nutrition.

### LAT1 IMMUNOHISTOCHEMICAL ALTERATIONS FOLLOWING TRAINING AND EFFECTS OF LAT1 OVEREXPRESSION IN C2C12 MYOBLASTS AND MYOTUBES

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**P231** Large Neutral Amino Acid Transporter 1 (LAT1) has gained attention due to its potential anabolic properties in skeletal muscle. It has been demonstrated LAT1 transports leucine and is upregulated following resistance training. PURPOSE: To determine alterations in LAT1 following resistance training using immunohistochemistry (IHC), and determine how overexpression of LAT1 in C2C12 myoblasts and myotubes (MYO) affects protein synthesis, via puromycin integration (SUnSET method), and 20S proteasome activity. METHODS: Untrained, college-aged males were separated into a Placebo (PLA, n=10), Leucine (LEU, n=9), or Whey Protein Concentrate (WPC, n=9) group and underwent 12 weeks of resistance training. Skeletal muscle biopsies were obtained prior to and following training. LAT1 was stained using IHC to determine total LAT1, membrane LAT1, and both measurements made relative to fiber count. C2C12 myoblasts were plated and transfected with a LAT1 overexpression plasmid (OvEX) and compared to cells transfected with a scramble overexpression plasmid (CTL). RESULTS: Total LAT1, membrane LAT1, and membrane LAT1/fiber were unaltered following training (p>0.050). Total LAT1/fiber increased following training (p=0.003). LAT1 overexpression in C2C12 MYO increased LAT1 protein (p=0.026), decreased puromycin content (p=0.002), decreased BCKDHa protein (p=0.001), and did not alter 20S proteasome activity (p=0.347). CONCLUSIONS: LAT1 measured via several techniques (IHC, WB, PCR) increases following training; however, may lead to decreases in protein synthesis given that C2C12 MYO overexpressing LAT1 presented decreases in protein synthesis and decreased BCKDHa potentially suggesting increased oxidation of leucine.

### CIRCULATING LACTATE IS ELEVATED IN PREDIABETES PHENOTYPES COMPARED WITH NORMAL GLUCOSE TOLERANT COUNTERPARTS

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**P232** Purpose: Prediabetes can be characterized as impaired fasting glucose (IFG) with or without impaired glucose tolerance (IGT; 2-hr blood glucose). IFG is depicted by impaired liver insulin sensitivity, while IFG+IGT is related to reduced liver and muscle insulin sensitivity. Lactate is a byproduct of non-oxidative glycolysis that may mediate altered glucose regulation. However, whether IFG and/or IFG+IGT have elevated lactate compared to normal glucose tolerant (NGT) controls is unclear. We hypothesized that individuals with IFG and IFG+IGT would have higher lactate levels than NGT controls. Methods: Forty-one obese adults (54.8±2.0yrs; 36.0±1.0kg/m<sup>2</sup>) were screened for NGT, IFG, or IFG+IGT (75g OGTT, ADA criteria) following an overnight fast. Plasma lactate, glucose, and insulin (estimate insulin sensitivity; oral minimal model) were measured during a 120min 75g OGTT. Aerobic fitness (VO<sub>2</sub>peak), substrate oxidation (RER, indirect calorimetry) and body composition (BIA) were also tested. Results: There were no differences in VO<sub>2</sub>peak, body fat or fasting RER across groups. Individuals with IFG+IGT had lower insulin sensitivity compared with IFG and NGT (P<0.01). However, both IFG and IFG+IGT had increased lactate tAUC compared to NGT (P<0.01 and P=0.01, respectively). Increased lactate tAUC correlated with fasting glucose (r=0.33, P=0.03) and reduced VO<sub>2</sub>peak (r=-0.34, P=0.03). Fasting lactate also related to fasting RER (r=0.31, P=0.04). Conclusion: Despite no differences between prediabetes phenotypes, adults with IFG and IFG+IGT have elevated lactates compared to NGT controls. Lactate tAUC directly associates with fasting glucose and fitness, but not insulin sensitivity. These data suggest that fitness may mediate lactate metabolism via the liver. Future work is warranted to determine the mechanism by which lactate influences type 2 diabetes risk.

### IMPACT OF SHORT-TERM EXERCISE TRAINING ON GLUCOSE EFFECTIVENESS BETWEEN PHENOTYPES OF PREDIABETES

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**PURPOSE:** Although exercise improves glucose effectiveness (GE) in adults with type 2 diabetes, the influence of exercise on GE across different phenotypes of prediabetes is unknown. The purpose of this study was to examine the effect of exercise on GE in adults with impaired fasting glucose (IFG) compared with IFG plus impaired glucose tolerance (IFG+IGT). **METHODS:** Female subjects (Age: 59.4±7.2 yrs.; BMI 34.4±1.4 kg/m<sup>2</sup>) were screened for IFG (n=7, FPG: 103.9±2.3 mg/dl; 2-hr glc: 116.7±7.2 mg/dl) and IFG+IGT (n=10 FPG: 99.1±3.5 mg/dl; 2-hr glc: 152.9±11.0 mg/dl) using ADA criteria (120 min 75g OGTT). Subjects underwent 12 bouts of exercise at ~70% of HRpeak for 60 min/d over 2-weeks. A 180 min, 75g OGTT was used to collect glucose and insulin to determine GE via a validated minimal model before and after training. V02peak and body composition (BIA) were also tested. **RESULTS:** Exercise reduced BMI (P<0.05) but had no effect on lean body mass (LBM) or V02peak in both groups. However, adults with IFG+IGT increased GE post-training (within effect; P=0.02), and this rise in GE tended to be greater in those with IFG+IGT when compared with IFG (0.23±0.08 vs. 0.00±0.08 mg/dl per min; P=0.059). Increased GE correlated with decreased glucose incremental AUC180 (R=-0.69, P<0.05) and elevated LBM (R=0.42, P=0.09), but not reduced BMI (r=-0.08, P=0.75) or increased fitness (r=0.02, P=0.95). **CONCLUSION:** Independent of weight loss and fitness, short-term exercise training increases GE in adult women with IFG+IGT but not those with IFG. Together, these data suggest increased GE may relate to improved glucose tolerance through alterations in lean body mass.

### mitoRACE: IN VIVO ASSESSMENT OF MITOCHONDRIAL FUNCTION USING MULTIPHOTON NADH FLUORESCENCE

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The evaluation of mitochondrial function is critical to the study of energy metabolism in health and disease. However, there are currently limited methodologies that provide direct assessments of mitochondrial oxidative phosphorylation in vivo. Here we describe a novel technique for evaluating mitochondrial function in vivo using reduced nicotinamide adenine dinucleotide (NADH) autofluorescence which provides a direct, spatially-resolved assessment of oxidative phosphorylation. **Methods:** Skeletal muscle redox kinetics were evaluated in vivo by imaging NADH fluorescence in the mouse tibialis anterior muscle using multiphoton microscopy with real-time 3D motion tracking. NADH serves as the primary electron donor of the mitochondrial electron transport chain (ETC). At rest, the mitochondrial NADH pool is the net result of both production by citric acid cycle dehydrogenases and utilization by the ETC (complex I). To evaluate flux through the ETC, NADH utilization was rapidly inhibited via superfusion of an ETC inhibitor, sodium cyanide, resulting in an instantaneous increase in mitochondrial NADH that is proportional to the preceding rate of utilization. Thus, flux through the ETC was quantified as the rate of change in NADH fluorescence immediately following superfusion of sodium cyanide. Mitochondrial flux was assessed in the basal, uncoupled, post-exercise, and fasted metabolic states. Mitochondria were uncoupled via superfusion of 10 μM FCCP, and mitochondrial membrane potential was evaluated using tetramethylrhodamine (TMRM) fluorescence. **Results:** At rest, skeletal muscle NADH pools were 75.15±2.97% reduced. Basal mitochondrial flux was 74.58±3.4 μM NADH sec<sup>-1</sup>. Uncoupling resulted in a complete dissipation of mitochondrial membrane potential and a 3.3 fold increase in mitochondrial flux (243.3±16.48 μM NADH sec<sup>-1</sup>), whereas exercise resulted in a 7.8 fold increase in mitochondrial flux (570.0±53.1 μM NADH sec<sup>-1</sup>). Fasting was associated with a 40% decline in basal flux (45.2±4.79 μM NADH sec<sup>-1</sup>). **Conclusions:** The Mitochondrial Redox After Cyanide Experiment (mitoRACE) can provide a direct, spatially-resolved assessment of mitochondrial oxidative phosphorylation in vivo with potential to evaluate changes in mitochondrial flux associated with alterations in metabolic status and pathology.

### AGREEMENT BETWEEN ENERGY EXPENDITURE ASSESSMENTS DURING EXERCISE BY METABOLIC CHAMBERS AND CART

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**Purpose:** Whole room indirect calorimeters (WRIC) assess energy expenditure (EE) during near-free living conditions and are appealing since a canopy, face mask, or mouthpiece that might impact subject comfort is not required. Studies comparing EE obtained by WRIC and traditional metabolic carts (MC) during exercise are limited. **Methods:** Fourteen participants (37.4±15.9 yrs, 24.3±2.4 kg/m<sup>2</sup>, 9 males) completed three trials within one week. EE was assessed using a randomly assigned indirect calorimeter (Large WRIC, Small WRIC, Parvo TrueOne 2400) during three ~10 min steady state work bouts on a cycle ergometer. Intensities ranged from 0.75-2.25W/kg and 0.50-1.50W/kg for males and females, respectively. EE assessments were compared using Bland-Altman analysis and repeated measures ANOVA. **Results:** A maximum bias of 0.53±0.08 kcal/min was observed between the Large WRIC and MC at the highest intensity, and a minimum bias of 0.10 ± 0.03 kcal/min was observed between the Small WRIC and MC at the lowest intensity. On average, the relative error was 6.3% and 4.5% between the MC and the large and small WRIC, respectively. No significant difference (p > 0.05) was observed between the indirect calorimeters for each intensity. **Conclusions:** WRICs provide a versatile means to assess EE during longer duration exercise trials. However, a smaller WRIC may be better suited for higher intensity exercise given its slightly better agreement with MC.

### IN-SEASON CHANGES OF COUNTERMOVEMENT JUMP PERFORMANCE IN DIVISION II FEMALE VOLLEYBALL ATHLETES

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**Purpose:** The purpose of this study was to evaluate countermovement jump (CMJ) performance throughout the course of a competitive season in collegiate volleyball athletes. **Methods:** A total of 11 athletes performed two maximal effort CMJ trials each week for 11 weeks. A total of three testing sessions at the pre-season, mid-season and post-season of the regular season were utilized for analysis. Jumps were performed on two PASCO Force Platforms (PS-2142) at a sampling frequency of 1,000 Hz. Force-time data was collected in PASCO Capstone software and subsequently analyzed in LabVIEW software calculating the following variables: peak power (PP), jump height (JH), net impulse (NI), time to takeoff (TTT), RSI-modified (RSImod), relative peak power (RelPP), and body mass (BM). A one-way repeated measures ANOVA was performed to assess differences between pre-season, mid-season and post-season testing sessions for all of the variables mentioned previously. The weekly total of time spent were calculated for practice, time spent with the Strength and Conditioning staff and competitions for pre-season, weeks 2-5 (mid-season) and weeks 6-10 (post-season). **Results:** Statistically significant improvements (p < 0.05) were observed for the following variables: PP (6.6%), JH (12.5%), NI (6.6%), RSImod (16.4%), and RelPP (6.6%) from pre-season to post-season testing sessions with the exception of body mass and time to takeoff (p > 0.05). **Conclusion:** An effective in-season resistance training program in conjunction with implementation of appropriate fatigue management strategies may likely result in enhancement of CMJ performance in female collegiate volleyball athletes.

**ERGOGENIC, PERCEPTUAL AND METABOLIC RESPONSES TO PALM COOLING**

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**P237** Subjects (n = 14) did three rowing ergometer workouts of up to eight two-minute stages separated by 45-60 second rests. Ergogenic, perceptual and metabolic responses to workouts may be aided by intermittent palm cooling. Purpose: Subjects received one of the following treatments per workout in a randomized sequence: no palm cooling (No PC), intermittent palm cooling during workouts (PC EX), or palm cooling applied intermittently during workouts and post-exercise recovery (PC EX & POST). Methods: Palm cooling entailed intermittent cold (8-11o C) against the palmar surface of subject's hands and totaled 11 ½ (PC EX) and 21 ½ (PC EX & POST) minutes. Workouts began with ten minutes of rest in which pre-exercise data were obtained, followed by a ten-minute low-intensity warm-up and the workout, and concluded with a 20-minute post-exercise recovery period. Perceptual and metabolic data were obtained before (pre), during (mid) and post (at 5, 10, 15 and 20 minutes) workout. The volume of work done at each stage, blood lactate concentrations ([BLA-]), and RPE values were collected and used for analysis. Work volume was examined with a one-way (workout) ANOVA. [BLA-] and RPE were each examined with three-way (gender, workout, time) ANOVAs, with repeated measures for workout and time. Results: A trend (p = 0.14) for work volume differences exist as follows: No PC < PC EX, PC EX & POST. [BLA-] saw a significant time effect, with the following inter-time differences: 5-post, mid, 10-post > 15-post, 20-post > pre. RPE results yielded non-significant differences. Conclusions: Our results are preliminary. Continued data collection, with updated results, are ongoing. Nonetheless our work volume results, with a trend towards higher values with concurrent palm cooling, may eventually support claims of an ergogenic effect from this treatment. Yet our [BLA-] results only produced a time effect and, along with RPE, no inter-workout differences. Our results imply variables unrelated to perceptual and metabolic factors may be responsible for the trend of higher work volumes produced by palm cooling.

**ELECTROLYTES ADDED TO A CARBOHYDRATE-BASED DRINK: EFFECT ON EXERCISE DONE AGAINST PROGRESSIVELY HIGHER WORKLOADS**

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**P238** Aerobic exercise with progressively higher workload stages done in succession challenges a person's cardiorespiratory system as their VO2 max is estimated. Higher heart rates (HR) during such exercise lowers a person's estimated VO2 max. Adding electrolytes to a carbohydrate-based drink may raise VO2 max values if ingested before exercise. Purpose: Compare the merits of added electrolytes, in two otherwise similar beverages, when consumed before VO2 max tests that entail progressively higher workload stages. Methods: In a randomized double-blind study, subjects (13 men, 21 women) did two cycle ergometer workouts to estimate their VO2 max. Workouts were preceded by intake of a 2% sucrose solution, one of which was an electrolyte-rich (500 mg of vitamin C, 1 mg of B-12, 100 mg of Mg+2, 400 mg of K+, 200 mg of Na+, 1 µg of Cr) beverage, while the other was devoid of added electrolytes and served as a placebo. HR were recorded before, four times during, and after workouts. Ratings of perceived exertion (RPE) were provided at the end of workouts. HR were compared with a three-way (gender, treatment, time) ANOVA, with repeated measures for treatment and time. Estimated VO2 max and RPE were assessed with two-way (gender, treatment) ANCOVAs, with repeated measures for treatment. Body mass and body fat percentage were each examined as covariates. Scheffe's served as our post-hoc and a = 0.05 denoted significance. Results: There were significant inter-time differences for HR. RPE and VO2 max each had inter-gender differences. Yet there were no inter-treatment differences. Conclusions: Little research exists on the ergogenic effects on electrolyte formulations added to carbohydrate beverages, yet our results concur with studies that also saw a lack of inter-treatment differences.

**COMPARISON OF FUNCTIONAL TESTS OF LEG POWER IN COLLEGIATE ATHLETES**

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**P239** PURPOSE: In the field of sports medicine, functional tests, such as the single leg hop for distance (SLHD) and single leg vertical jump (SLVJ), are often used to determine an athlete's return to competition. Little is known regarding the agreement of the data obtained from the functional tests and the Keiser Air420. Thus, the purpose of this study was to compare the results of the Keiser leg press to those of the SLHD and SLVJ in WFU athletes. METHODS: Data were obtained from 71 (36 males and 35 females) healthy student-athletes at WFU. After a warmup, each subject performed the SLHD and SLVJ (cm) and the Keiser leg press (W/kg) in random order with a 5-minute rest period between each test. The relationship between tests was examined with Pearson Correlation Coefficients. RESULTS: The means for the Keiser, SLHD, and SLVJ tests (listed right and left, respectively) were 15.3±3.7 W/kg and 14.9±3.6 W/kg, 171.1±28.6 cm and 173.2±28.9 cm, 36.0±7.4 cm and 35.9±8.0 cm, respectively. All three measures of leg power were highly correlated with each other (r > 0.70). The SLVJ and Keiser scores (right leg r=0.82, left leg r=0.83) had a slightly higher correlation than the SLHD and Keiser scores (right leg r =0.71, left leg r =0.75). CONCLUSIONS: As suggested by the observed relationships, both the SLHD and SLVJ data correlate significantly with leg peak power results obtained from the Keiser Air420 in healthy, collegiate athletes. Thus, this study suggests low-tech/low-cost functional tests like the SLHD and SLVJ appear to be appropriate for evaluating leg power and return to competition in this population.

**NO EFFECT OF STARTING HEIGHT ON REBOUND VERTICAL JUMP**

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**P240** Improving power and work outputs are areas of interest within athletics and are reinforced by the plethora of training modalities used for such purposes. For example, plyometric exercises are specifically geared towards increasing power production by utilizing the stretch-shortening cycle. However, it has yet to be determined how different starting heights of depth jumps (DJ) affect rebound jump height. PURPOSE: Measuring rebound jump height between different depth jump starting heights was the purpose of this study. METHODS: College students were recruited for this study (m = 11, f = 3; age: 22.00±1.4 y, height: 166.52±48.88 cm, mass: 82.39±12.68 kg) and were prepped using reflective markers on their ASIS and PSIS, bilaterally, which allowed for vertical jump height measurements. After a specific warm-up, subjects were instructed to perform three maximal DJs from five different heights: 30 cm (DJ30), 45 cm (DJ45), 60 cm (DJ60), 76 cm (DJ76), and 91 cm (DJ91). RESULTS: A repeated measures ANOVA revealed no significant differences in rebound jumps between starting heights (DJ30: 52.67±0.10293 cm; DJ45 = 53.46±0.10298 cm; DJ60 = 52.94±0.10574 cm; DJ76 = 53.13±0.09875 cm; DJ91 = 51.02±0.10063 cm). CONCLUSIONS: No significant differences were found between starting heights. A potential avenue for future research would be to investigate the effects of a depth jump training intervention from different starting heights on vertical jump performance.

### EXAMINING THE LEARNING EFFECT ON AN ISOKINETIC FATIGUE TEST PROTOCOL

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**P241** When performing repeated repetitions of a task, the body becomes familiar with the task and can become more efficient. This is known as the learning effect and can alter performance. **PURPOSE:** To examine the learning effect when fatigue testing without familiarization. **METHODS:** 22 masters-aged [53±5 years), competitive female cyclists completed 3 separate 50-repetition knee flexion/extension tests on a Biodex isokinetic dynamometer, separated by one-week with no familiarization. **RESULTS:** No differences [Wilks  $\Lambda > .05$ ] existed between trials, indicating no learning effect was associated with the tests for any variable: a) peak torque (T1 50.7±10.4 N·m; T2 53.0±11.5 N·m; T3 56.6±11.0 N·m), b) relative peak torque (T1 36.2 ± 6.7 N·m/kg; T2 37.9 ± 7.5 N·m/kg; T3 39.2 ± 7.3 N·m/kg), c) torque generated at 30° (T1 27.1 ± 10.0 N·m; T2 26.4 ± 10.2 N·m; T3 26.6 ± 9.4 N·m), d) torque generated at 0.18 s (T1 45.7 ± 9.0 N·m; T2 47.4 ± 10.1 N·m; T3 50.1 ± 9.0 N·m), e) relative work completed (T1 50.2 ± 9.7 J/kg; T2 50.5 ± 9.0 J/kg; T3 51.5 ± 10.9J/kg), or f) total work completed (T1 2548.4 ± 524.4 J; T2 2544.8 ± 516.0 J; T3 2615.3 ± 579.3 J). **CONCLUSIONS:** No learning effect was seen with the isokinetic knee extension/flexion fatigue protocol in masters-aged, female cyclists. Therefore, these findings would suggest that previous experience in isokinetic muscular fatigue testing does not alter subsequent performance.

### TEST-RETEST RELIABILITY OF AN ISOKINETIC FATIGUE TEST

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**P242** By performing muscular testing, such as an isokinetic fatigue test, it is possible to assess anaerobic capacity and measure how muscles perform when isolated. This might also identify weak points and which movements might be related to compensation. However, test-retest reliability is key to obtaining consistent results of muscular function. **PURPOSE:** To establish isokinetic fatigue test-retest reliability when testing without familiarization. **METHODS:** 22 masters (53±5 years), competitive female cyclists completed 2 separate 50-repetition knee extension tests (T1 and T2) on a Biodex isokinetic dynamometer, separated by one-week with no familiarization. **RESULTS:** Test-retest reliability (intra-class correlation coefficients; ICC), were calculated between T1&T2 scores for fatigue index (T1 38.8±9.5%; T2 43.7±6.9%), time to peak torque (T1 280.5±59.8ms; T2 284.1±69ms) average power (T1 99.0±19.4W; T2 100.5±20.6W), and average peak torque (T1 36.6±6.3N·m; T2 37.5±7.1N·m). ICCs between trials exhibited excellent reliability (.93–.97) for all variables except time to peak torque (ICC=.35) and fatigue index (ICC=.65). **CONCLUSIONS:** There was strong test-retest reliability for strength and power measurements in masters female cyclists during an isokinetic knee extension fatigue test. However, the test was unreliable for its purpose in determining rate of fatigue. Practitioners should seek other forms of knee extension fatigue measurement.

### DWELL TIMES FROM A HIGH-SPEED EXERCISE INTERVENTION AS A CORRELATE TO CALCANEAL ACCRETION

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**P243** Thirty workouts on a gravity-independent high-speed resistive exercise device (Impulse Training Systems, Newnan GA) evoked significant gains in calcaneal bone mineral content (BMC; +29%) and density (BMD; +33%) [1]. Dwell times are transitions between the end of the eccentric phase, and the start of the next repetition's concentric phase which produce force exertion that leads to eventual muscle shortening, but have yet to evoke visible changes in sled movement direction. Dwell time durations are on the order of milliseconds for this device. **Purpose:** Examine dwell times as a correlate to the calcaneal accretion from a high-speed exercise intervention. **Methods:** We tabulated dwell times for the hip extension exercise as part of the 1st and 12th workouts done by subjects (n = 13) of the recent study [1]. We used dwell times from the 12th hip extension workout, and the delta (difference) in dwell times between the 1st and 12th hip extension workouts, as two predictor variables. They attempted to predict the variance in delta calcaneal BMC and BMD values achieved after 30 workouts. DEXA scans quantified calcaneal BMC and BMD values with region of interest software. Pearson Product Moment Correlation coefficients quantified our correlations. **Results:** With a 0.05 alpha, 12th workout dwell times correlated with significant amounts of delta calcaneal BMC (r = -0.48) and delta calcaneal BMD (r = -0.47) variance. Delta dwell times correlated with even greater amounts of delta calcaneal BMC (r = -0.64) and delta calcaneal BMD (r = -0.63) variance. Negative correlations infer shorter dwell times yielded greater calcaneal gains. **Conclusions:** Since brief dwell times are achieved with repetitions done on the device, this hardware warrants continued inquiry to abate calcaneal BMC and BMD losses seen in microgravity and ambulatory models. [1] Caruso JF et al. Int J Sports Med 39: 791-801, 2018

### COMPARING PHYSICAL FITNESS IN CAREER VS. VOLUNTARY FIREFIGHTERS

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**P244** **Purpose:** The purpose of this study was to assess the potential similarities and differences in health and physical fitness profile between career fire fighters and volunteer fire fighters. **Methods:** The research protocol consisted of a health and physical fitness assessment testing the 5 components of health-related fitness (body composition, cardiovascular fitness, muscular strength, muscular endurance, and flexibility) using previously published and accepted protocols. The participant population consisted of career fire fighters (CFF) who were all members of the Bowling Green Fire Department in Bowling Green, KY and voluntary fire fighters (VFF) were all members of the Warren County Fire Department (Warren County, KY). The total sample size consisted of 140 fire fighters comprised of 121 CFF and 18 VF. **Results:** An independent t-test showed evidence of a significant difference between groups for the following variables: fat mass (p = 0.002), body fat percentage (p < 0.0005), push-ups completed (p = 0.023), plank time (p < 0.0005), and absolute grip strength (p = 0.029). There were not shown to be any significant differences between groups for the following variables: age (p = 0.299), body mass (p = 0.161), fat-free mass (p = 0.292), flexibility (p = 0.097), or relative grip strength (p = 0.934). **Conclusion:** In regards to the physical fitness testing of the current sample, the VFF had a significantly worse health and fitness profile across a number of variables compared to the CFF. Despite the financial and commitment status of volunteer firefighting departments, they perform an equally dangerous and important job as firefighters of professional/career firefighting departments and more attention should be directed at developing the fitness and performance of these firefighters as well.

### COMPARISON OF THE HEART RATE VARIABILITY AND VENTILATORY THRESHOLDS DURING TREADMILL EXERCISE

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**P245** **PURPOSE:** To examine whether the heart rate variability threshold (HRVT) occurs at a similar exercise intensity to the ventilatory threshold (VT) during treadmill exercise. **METHODS:** Twelve fit, college-aged men [age = 20.6  $\pm$  0.7; maximal oxygen consumption (VO<sub>2</sub>) = 52.1  $\pm$  6.6 mL.kg<sup>-1</sup>.min<sup>-1</sup>] completed a maximal treadmill test. Heart rate variability (HRV) data was obtained via Polar RS800CX and analyzed with Kubios HRV software. VT was determined visually by experienced researchers using the V-slope and ventilatory equivalencies methods. HRVT was also determined visually using the standard deviation of instantaneous beat-to-beat variability (SD1) HRV measure dropping below 3 milliseconds. Paired sample t-tests, intraclass correlation coefficient (ICC) and Bland-Altman analyses were done to assess agreement between HRVT and VT. **RESULTS:** The HRVT trended to occur at a lower VO<sub>2</sub> compared to the VT (2.0  $\pm$  0.6 vs. 2.5  $\pm$  0.7, P = 0.066, 22.2% difference), and a lower percent of VO<sub>2</sub>max (48.7  $\pm$  11.6 vs 59.6  $\pm$  13.6, P = 0.06). ICC between the HRVT and VT was 0.54 (P = 0.11). Bland-Altman analysis trended towards disagreement (P = 0.07) but did not reach significance. **CONCLUSIONS:** Previous reports in less fit subjects have suggested that the HRVT and VT occur at similar exercise intensities on different exercise modalities. Results from the current study suggest that the HRVT, which marks complete parasympathetic withdrawal, may be occurring prior to the ventilatory changes that occur in response to increased blood lactate, decreased muscle pH, and increased carbon dioxide production associated with the VT in these higher fit subjects. Future research with a greater sample size and a broader range of fitness levels is needed to further elucidate this relationship before the HRVT can be considered a surrogate marker for the VT.

### EFFECT OF INSTABILITY ON CORE MUSCLE ACTIVATION IN A SIDE BRIDGE

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**P246** Training the musculature of the core continues to be perceived as an essential component in conditioning and rehabilitation settings. A popular way to train the core is through the use of instability devices, such as the Swiss ball or suspension trainer. However, there is limited research on the effects of these devices on core muscle activation. Purpose: To compare core muscle activity during side bridge variations with and without instability devices through electromyography (EMG) recording of the rectus abdominis, external oblique, erector spinae, and latissimus dorsi muscles. Methods: A total of 39 participants (22 men, 17 women) performed three variations of a side bridge in a randomized order: on the floor, with feet elevated on a Swiss ball, and with feet suspended in a TRX suspension trainer. Each bridge variation was held for 5 seconds and repeated three times. Prior to performing the side bridges, participants completed a maximal voluntary isometric contraction (MVIC) for all four muscles, for EMG normalization. Root mean square values for each side bridge were reported as a percentage of MVIC. Results: Significantly higher muscle activation occurred with the use of the instability devices. Mean  $\pm$  SD %MVIC was significantly higher on the ball and TRX when compared to the floor in the rectus abdominis (Floor: 21.7 $\pm$ 11.8; Ball: 29.7 $\pm$ 15.6, p = 0.001; TRX: 31.7 $\pm$ 18.5, p < 0.001) external oblique (Floor: 32.9 $\pm$ 13.6; Ball: 40.1 $\pm$ 24.4, p = 0.032; TRX: 38.0 $\pm$ 18.5, p = 0.035), and latissimus dorsi (Floor: 7.0 $\pm$ 4.5; Ball: 12.2 $\pm$ 9.1, p < 0.001; TRX: 12.2 $\pm$ 7.3, p < 0.001). Conclusion: It was concluded that instability devices may be beneficial in training the core musculature as shown by higher muscle activation. Higher muscle activation may indicate a greater dependence on the selected muscles when completing these types of activities.

### LOCATION OF LOW-FREQUENCY ELECTRICAL STIMULATION DOES NOT EFFECT RECOVERY FOLLOWING LOWER-BODY EXERCISE

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**P247** Recovery refers to the restoration of the physiological and psychological processes. Enhancing recovery should reduce fatigue and improve performance. **PURPOSE:** The purpose of this study was to examine the effect of electrode placement of low-frequency electrical stimulation (LFES) training recovery. **METHODS:** Eleven recreationally-trained college-age subjects (age = 22  $\pm$  2.0 yrs, height = 176.4  $\pm$  3.7 cm, weight = 72.3  $\pm$  13.9 kg) participated in this repeated-measures design study. This study consisted of 4 trials with 1 week between each trial. Trial 1 established a 10RM leg extension. The following 3 trials included 1 bout of 3 sets to failure of leg extensions using the 10RM weight with 30 two-foot ankle hops between sets. After the exercise bout, subjects were exposed to 15-min of a recovery treatment. LFES to the quadriceps only, LFES to the calves only, or passive recovery (counterbalanced). Each trial, participants completed baseline and post-recovery assessments of perceived recovery (RPR), perceived muscle pain (RMP), and countermovement jump (CMJ). **RESULTS:** There were no statistically significant differences in change from baseline to post measurement of RPR, RMP, or CMJ between recovery treatments (p > 0.05). **CONCLUSION:** There was no difference in recovery between the electrode placement of the quadriceps or calves. LFES did not enhance recovery relative to passive recovery. There was trend toward statistical significance for RMP (p = 0.059, Cohen's d = 0.71) between LFES of the calves and passive recovery.

### EFFECTS OF AN 8 WEEK UPPER BODY RESISTANCE TRAINING PROGRAM ON AEROBIC CAPACITY IN UNTRAINED FEMALES

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**P248** Strengthening the upper body could result in a possible connection to improving biomechanics of running which could lead to better running form and therefore more efficient oxygen utilization. **PURPOSE:** VO<sub>2</sub>peak and 1RM in untrained females were compared before and after an eight week upper body strength training plan to determine the effect of upper body strength training on overall running performance. **METHODS:** Twelve untrained college females completed a VO<sub>2</sub>peak and 1RM bench press test. The subjects were randomly split in to two groups of six. Both groups maintained their normal aerobic exercise routine with the exception of the treatment group, who completed an upper body strength training protocol twice a week for eight weeks. VO<sub>2</sub>peak and 1RM were then reassessed immediately following the eight week period. **RESULTS:** A one-way repeated measure ANOVA determined no statistically significant changes due to the exercise intervention in VO<sub>2</sub>peak, RER max, HRmax, final time to exhaustion, and 1RM bench press over time, F(5, 6) = .540, p = .742, partial  $\omega^2$  = .310. **CONCLUSION:** Although not statistically significant, a slight overall increase in VO<sub>2</sub>peak in the treatment group was observed, while no change in the VO<sub>2</sub>peak of the control group occurred. Upper body resistance training alone will not impact aerobic capacity dramatically in untrained athletes. Resistance training may, however, be beneficial in competitive athletes where even a slight difference in performance could be the difference between winning and losing.

**IDENTIFYING THE CRITICAL RESISTANCE FOR THE DEADLIFT**

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Critical power (CP) is defined as the highest power output that can be maintained without fatigue during cycle ergometry. Purpose. This study: 1) determined if the mathematical model used to derive CP could be used to identify the critical resistance (CR) for the deadlift; and 2) compared the predicted and actual repetitions to failure at 50, 60, 70, and 80% one-repetition maximum (1RM). Methods. Twelve subjects (weight:  $76.63 \pm 15.46$  kg) completed 1RM testing for the deadlift followed by 4 visits to determine the number of repetitions to failure at 50, 60, 70, and 80% 1RM. The CR was calculated as the slope of the line of the total work completed (repetitions x weight [kg] x distance [m]) versus the total distance (m) the barbell traveled. The actual and predicted repetitions to failure were determined from the CR model and were compared using paired samples t-tests and Pearson's correlation coefficients. Results. The mean  $\pm$  SD for the weight and repetitions completed at CR was  $56 \pm 11$  kg ( $40 \pm 5\%$  of 1RM;  $r^2 = 0.956 \pm 0.039$ ) and  $49 \pm 14$  repetitions, respectively. The actual repetitions to failure were significantly less than predicted at 50% ( $p < 0.001$ ) and 80% 1RM ( $p < 0.001$ ) and greater at 60% ( $p = 0.004$ ), but there was no difference at 70% 1RM ( $p = 0.084$ ). The actual versus predicted repetitions to failure were significantly related for all 4 percentages of 1RM ( $r = 0.719 - 0.983$ ;  $p < 0.05$ ). Conclusions. The total work versus distance relationship can be used to identify the CR for the deadlift, however, this model does not accurately predict repetitions to failure at resistances that are greater than CR.

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**COMPARISON OF THE CRITICAL HEART RATE TO HEART RATES AT CRITICAL VELOCITY AND VENTILATORY THRESHOLD**

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Purpose: This study compared the critical heart rate (CHR), the heart rate (HR) at the critical velocity (CVHR), and the HR at the ventilatory threshold (VTHR). Methods: Ten subjects (Mean  $\pm$  SD: Age  $23 \pm 3$  yrs) completed a graded exercise treadmill test (GXT), where  $\dot{V}O_2$ , minute ventilation rate ( $\dot{V}E$ ), and HR were recorded. The VT was determined from the  $\dot{V}E$  versus  $\dot{V}O_2$  and the VTHR was estimated from linear regression of the HR versus  $\dot{V}O_2$  from the GXT. The CV was determined from the linear regression of the total distance (TD) versus time to exhaustion (TLim) for 4 treadmill runs at various intensities. The CVHR was estimated from linear regression of the HR versus velocity from the GXT. The CHR was determined from the total heart beats (HBlim) versus TLim from 4 treadmill runs at various intensities. Statistical analyses included a one-way repeated measures ANOVA ( $p < 0.05$ ), Bonferroni corrected pairwise comparisons and bivariate regression. Results: There was no significant difference ( $p = 0.298$ ) between the CHR ( $175 \pm 5$  b $\cdot$ min $^{-1}$ ) and CVHR ( $172 \pm 6$  b $\cdot$ min $^{-1}$ ), but the VTHR ( $167 \pm 6$  b $\cdot$ min $^{-1}$ ) was significantly lower than the CHR ( $p = 0.015$ ) and CVHR ( $p = 0.048$ ). The CVHR was significantly related to the VTHR ( $r = 0.64$ ) and the CHR ( $r = 0.68$ ), but the VTHR was not related to the CHR ( $r = 0.42$ ). Conclusions: These findings suggested the CHR and CVHR are similar, but reflect a higher threshold than the VTHR. The CHR and CVHR may provide an estimate of the highest heart rate that can be maintained for an extended period of time ( $> 30$  min) and demarcate the heavy from severe exercise intensity domains.

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**DIFFERENCES IN 1-REPETITION MAXIMUM BENCH PRESS WITH AND WITHOUT LOAD KNOWLEDGE**

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During the completion of a 1-repetition maximum (1RM) test, participants must concentrate on various aspects of the lift, including technique, bar path, load, etc. Without knowledge of the external load, alterations in performance of the lift can occur (e.g., repetitions to failure). However, no study has yet to examine these variations at a maximal load. PURPOSE: The purpose was to determine differences in a 1RM bench press for males and females participants with a known and unknown load. METHODS: Twenty resistance-trained (10 males and 10 females) participants completed two trials of a 1RM bench press. One trial used a known external load. A second trial was performed with the external load blocked from view from the participant (unknown). For each individual, both trials were completed within a 48-96 hour period. RESULTS: No statistical mean differences were observed between 1RM values for the known ( $130 \pm 20.6$  kg) versus unknown ( $127.7 \pm 20.3$  kg) condition for males ( $p = 0.70$ , Cohen's  $d = 0.11$ , ICC = 0.99). Females also demonstrated no statistical mean difference between known ( $55.2 \pm 14.2$  kg) and unknown ( $54.8 \pm 14.5$  kg) ( $p = 0.64$ , Cohen's  $d = 0.03$ , ICC = 0.99) 1RM bench press values. CONCLUSIONS: Results indicate that no statistical differences for a 1RM bench press between males and females for known and unknown loads exist. The body may experience a physiological set point during maximum effort, thereby not allowing an individual to surpass this limit, regardless of external feedback (i.e., load knowledge) at this intensity.

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**EFFECTS OF A 6-WEEK FITNESS PROGRAM ON FIREFIGHTER RECRUITS: A CASE STUDY**

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Firefighting is a physically demanding job that requires adequate strength, mobility, and cardiorespiratory fitness. Supervised physical training can help recruits build the necessary strength, endurance, and mobility to meet the job demands. PURPOSE: To evaluate the effectiveness of a supervised 6-week training program in improving fitness components and retention rates of recruits in a rural setting. METHODS: Four firefighter (FF) recruits from a rural setting ( $23.0 \pm 1.7$ yr) were put through a 6-week (27 sessions at 5 times/week) physical fitness program. The FF submaximal  $\dot{V}O_{2max}$ , dominant handgrip strength (DHS), submaximal repetition maximal (3RM) on the back squat (S), bench press (BP) and deadlift (D), and mobility (FMS) were measured pre and post-training. Nonparametric Wilcoxon-Signed rank test were used to analyze all pre- to post-training data. RESULTS: While not statistically significant, perhaps due to small sample size, a positive improvement in all performance variables:  $\dot{V}O_{2max}$  (~24% improvement,  $p = 0.08$ ); DHS (~6%,  $p = 0.07$ ); 3RM-S (~15%,  $p = 0.12$ ); BP (~10%,  $p = 0.09$ ); and D (~16%,  $p = 0.07$ ) post training. CONCLUSION: These results support having a trained exercise specialist to implement programs with the recruit training to bring about fitness improvements and increase retention.

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**EFFECTS OF CAFFEINE ON TENNIS SERVE ACCURACY**

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**P253** PURPOSE: This study examined the effects of caffeine on tennis serve accuracy. METHODS: Division II tennis athletes (n = 10) completed two serve trials (double-blind, counterbalanced) following ingestion of 6 mg/kg of caffeine or matched placebo. During each trial, participants completed 48 serves divided into 3 sets with 2 serves per 8 different targets in which the serve had to land in the service box to be counted as good. Following each 2 serves per target format, participants completed a shuttle run sprint. Number of serves taken and shuttle sprint times were recorded for each target. Separate 2 (trial) x 8 (target) repeated measures analysis of variances (ANOVAs) were used for distance delta, and necessary tries for each of the 3 sets. A 2 (treatment) x 3 (set) repeated measures ANOVA was used for shuttle run times. RESULTS: While results were not significant, the treatment main effect approached significance (p = 0.07) in set 2 for the delta of distances when comparing caffeine (96.2 cm ± 19.8) versus placebo (107.1 cm ± 16.3). Post-trial surveys revealed subjective responses approached significance with greater feelings of stomach distress (p = 0.08) and nervousness (p = 0.13) following caffeine and elevated feeling of fatigue (p = 0.19) following placebo. CONCLUSION: Therefore, with no impairment in serve accuracy coupled with some evidence of reduced fatigue, results suggest caffeine may benefit tennis athletes. Extending the understanding of the effects of caffeine on tennis serve accuracy and performance could benefit overall match performance, with the potential of improving the match outcome in extended playtime

**EVALUATING PHYSICAL ACTIVITY IN A LOCAL AFTERSCHOOL PROGRAM: COMPARISON TO ESTABLISHED NATIONAL GUIDELINES**

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**P254** As pressures of academic performance continue to supersede attention on physical development in elementary school settings, the demand for physical activity (PA) programming within the context of afterschool program (ASP) curriculum has increased. As a result, guidelines have been established to encourage at least 30 minutes of moderate-to-vigorous PA (or the equivalent of 4,600 steps) among students enrolled in ASP's. Purpose: To investigate the efficacy of a local ASP in promoting PA participation among youth. Methods: Children enrolled in a local ASP were recruited to participate in this study. Participants were assigned an Omron HJ-151 pedometer to record engagement in PA while at the ASP. A four-day assessment period was used to ensure the attainment of a reliable estimate of PA. Using a single-sample t-test, mean daily step counts were compared to established PA guidelines for ASP's to determine if local programming was sufficient for encouraging recommended levels of PA. Results: Participants (n = 36; boys = 17, girls = 19) spent 128 + 29 mins at the ASP each day, accumulating an average of 2,676 + 1,632 daily steps. This level of PA was significantly lower than established ASP recommendations,  $t(35) = -7.07, p < .00$ . Conclusions: Participants did not achieve the recommended level of PA while engaged in programming at the local ASP. These findings serve as a preliminary benchmark for ASP staff to examine the efficacy of programming for encouraging engagement in health-producing levels of PA.

**GENDER DIFFERENCES CONCERNING PHYSICAL ACTIVITY BELIEFS AND PRACTICES AMONG FOURTH GRADERS**

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**P255** Gender differences concerning physical activity (PA) begin in elementary school. Males, 12-17 years old, spend more time in PA than females of the same age and we previously showed that females in college had less self-confidence in their abilities to increase PA and improve physical fitness. Purpose: Therefore, the purpose of this study was to identify gender differences in PA beliefs and practices among elementary school students. Methods: Forty public school fourth grade students (18 male and 22 female) completed a proctored survey to assess their PA beliefs and practices as well as the Virginia state-administered FitnessGram. The 14-question survey, answered on a Likert scale, asked students about their PA beliefs, knowledge, self-confidence, and practices. The FitnessGram test included the 20-meter PACER, sit-and-reach, trunk lift, curl-ups and flexed arm hang, or curl-up scores between genders. However, girls performed better on the trunk lift and sit-and-reach (p < 0.05). Conclusion: While girls reported more self-efficacy in their abilities to improve PA and fitness when compared to boys, FitnessGram results indicate that the girls' confidence cannot be explained by differences in cardiorespiratory or muscular fitness. Our data suggest that reductions in females' PA self-confidence occur during middle and high school. Future research is needed to determine how these changes contribute to gender discrepancies in time spent in PA.

**MAXIMUM PUSH-UP PERFORMANCE IS STRONGLY RELATED TO REGULAR EXERCISE AND PROPER SLEEP**

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**P256** Purpose: To compare lifestyle behaviors in exercise and sleep across performance categories for a maximal push-up test. Methods: A sample of 107 subjects (46 females and 61 males, 32.6 ± 12.9 years, 171.6 ± 10.3 cm, 78.0 ± 16.9 kg) completed the Physical Activity as a Vital Sign form, Pittsburgh Sleep Quality Index (PSQI) survey, and a maximal push-up test to volitional exhaustion. Participants were categorized for maximal push-up performance using normative values by age and sex. Three categories of push-up performance were created: high performer (HP; ≥ 65th percentile), moderate performer (MP; 36-64th percentile), and low performer (LP; ≤ 35th percentile). Results: Only five participants were classified as LP, 19 classified as MP, and 83 participants were classified as HP. The HP group participated in more days of physical activity (4.3 ± 1.7 days) and more days of resistance training (2.6 ± 1.8 days) than the LP group (3.2 ± 2.4 days physical activity, 0.6 ± 1.3 days resistance training), p < 0.05. The LP group had significantly more body mass (95.0 ± 10.4 kg), higher resting heart rate (88.0 ± 9.0 bpm), and higher Global PSQI score (7.0 ± 2.9), indicating poorer sleep quality and quantity, than the two other groups, p < 0.05. Conclusion: These results indicate that an individual's maximum push-up test results are significantly related to weekly exercise, resistance training, and good sleep quality and quantity. These data align with previous research suggesting that participating in one healthy behavior often results in engaging in more healthy behaviors leading to better overall health and fitness.

### ACTIVE COMMUTING AND WEIGHT-RELATED HEALTH STATUS IN ELEMENTARY SCHOOL-AGED YOUTH: A PRELIMINARY INVESTIGATION

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Compelling evidence exists to support the benefits of active commuting (AC) as a means to increase physical activity participation and promote a healthy body weight in adults and adolescents. While AC encourages engagement in physical activity among elementary-school aged youth, the relationship between AC and health outcomes in young children is unclear. Purpose: To explore the relationship between AC and weight-related health status in elementary school-aged youth. Methods: Data from 17 public elementary schools, representing 734 students (age =  $7.34 + 1.77$  years; boys = 369, girls = 365) was collected from the 2016-2017 Roanoke Valley Community Healthy Living Index. Chi-square analysis was used to examine the relationship between self-reported commuting style (active vs. non-active) and BMI for-age category (underweight, healthy weight, overweight, obese), determined from objective measures of height and weight. Results: Among our sample, 12% of youth reported AC to school. The relationship between commuting style and weight-related health status was not significant,  $X^2(3, N = 734) = 0.62, p = .89$ , Cramer's  $V = 0.03$ . Conclusions: Our results expand upon previous findings by illustrating a lack of a relationship between AC and healthy body weight in youth. Future authors should consider replicating this work in school districts with existing policies supporting AC.

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### VALIDITY AND RELIABILITY OF A PLYOMETRIC PUSHUP UPPER BODY POWER TEST

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Measurements of power are important in athletic populations. Lower body power is often measured using vertical jump. However, there is currently no validated, self-contained upper body power test equivalent. PURPOSE: To test the validity and test-retest reliability of a plyometric pushup (PPU) upper body power test to the medicine ball put (MBP) test. METHODS: Data from 45 Division-I collegiate cheerleaders was used for analysis. Participants completed two trials of both the PPU and MBP tests in a counterbalanced condition, with the best trial included for analysis. Performance of the PPU was calculated using a switch mat. Due to the violation of normality (via skewness and kurtosis), a nonparametric Spearman rho correlation was run to determine the relationship between PPU and MBP. Interclass correlations (ICC) and Cronbach's alphas were generated to determine test-retest reliability of the PPU. RESULTS: A significant, positive, moderate correlation ( $r = 0.50; p < 0.01$ ) was revealed between the tests. Additionally, the PPU test was found to have high test-retest reliability (PPU1:  $8.8 \pm 2.8$ in, PPU2:  $9.2 \pm 2.7$ in) (ICC = 0.86;  $\alpha = 0.93$ ). CONCLUSIONS: The data revealed the PPU may be used as a practical, self-contained method of determining upper body power in this population. However, given the moderate relationship between the PPU and MBP test in this population, caution should be taken before implementing the PPU test as an exclusive measure of upper body power.

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### DOES MOTOR MUSCLE ENGAGEMENT COMPLEXITY AFFECT LEARNING OF YOGA POSES?

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Gesture analysis for yoga training may be useful for development of home and clinic based yoga therapy (YT) for hard to reach populations. Purpose: We are developing an exergame that provides assessment tools that scores performance of student yoga postures and provides improvement metrics. Research goal to test algorithms measuring basic physiologic parameters in computer video exergame to assess yoga skill acquisition in targeted populations as means to promote healthy physical activity and promote wellness by providing feedback. Methods: Convenience sample of 20 adult students in a college yoga course, male and female, were recorded by a Microsoft Kinect attached to a PC while following a yoga instructor. Three yoga sessions (pre-test, mid-way and a post-test) were captured during the regularly scheduled yoga class which met twice weekly for 75 minutes, over a 10-week period. Results: Gesture analysis of these sessions were compared to yoga poses captured from yoga instructors using machine intelligence software to score student learning of 5 poses. Using repeated measures ANOVA, three poses showed significant learning acquisition over the course sessions. For example, Mountain sensitivity went from 0.78 (initial) to 0.87 (final session), while the expert's test clips scored 0.94. We sought to determine if different poses scored better based on the musculoskeleton complexity of that pose. Using literature values of estimated standard muscle masses and identity of muscle engagements in the yoga poses, we ranked the yoga poses by total muscle mass engaged. Initial t-test analysis suggests that our sample size is too small to show correlation. Conclusions: Many innovative information technology apps use gestures as input. We explored gesture analysis for incorporation into exergames for personalized medical intervention using yoga as therapy with remote physiology measurements.

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### GRIP STRENGTH COMPARED TO HEALTHY LIFESTYLE BEHAVIORS

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Grip strength is used to assess muscular strength and has been shown to predict morbidity and mortality, but little information is available associating healthy lifestyle and this metric. Purpose: To compare lifestyle behaviors in physical activity and sleep across performance categories for relative grip strength (RGS). Methods: A sample of 107 subjects (46 females and 61 males;  $32.6 \pm 12.9$  years,  $171.6 \pm 10.3$  cm,  $78.0 \pm 16.9$  kg) completed the Physical Activity as a Vital Sign form, Pittsburgh Sleep Quality Index (PSQI) survey, and a test for handgrip strength using a handgrip dynamometer. The highest value from each arm was summed and divided by body mass to calculate RGS. Participants were categorized using RGS normative values by age and sex: high performer (HP:  $\geq 65$ th percentile), moderate performer (MP: 36-64th percentile), and low performer (LP:  $\leq 35$ th percentile). Characteristics among groups were compared using a Kruskal-Wallis test. Results: There were 63 participants classified in the LP group, 26 in the MP group, and 18 in the HP group. Analyses revealed that the LP group ( $81.6 \pm 18.2$  kg) was significantly heavier ( $p > 0.05$ ) than the HP group ( $78.7 \pm 9.2$  kg), but there were no significant differences between RGS group and physical activity or sleep quality. Conclusion: The results from this study indicate that several participants have less than optimal RGS. Further, these results conflict with previous literature linking RGS to healthy lifestyle behaviors. This is surprising as RGS has been used as a predictor of morbidity and mortality, and would therefore be expected to be linked with healthy lifestyle behaviors.

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### RELATIONSHIP AMONG STABILITY GROUPINGS BETWEEN THREE DIFFERENT STABILITY TESTS

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Many movement assessments exist to assess an individual's stability and injury susceptibility. PURPOSE: To assess whether three different stability assessments, single-leg squat (SLS), functional movement screen (FMS), and the closed kinetic chain upper extremity stability test (CKCUEST), provide the same stability groupings among an athletic population. METHODS: Twelve participants ( $22.6 \pm 2.4$  yrs,  $175.2 \pm 10.2$  cm,  $71.3 \pm 10.9$  kg) were randomly assigned testing order of the SLS, FMS, and CKCUEST. Based on testing performance, participants were assigned as stable or unstable. The stability group cut off was average knee valgus below  $15^\circ$  in SLS; total FMS score above 13; and CKCUEST above 20. SLS testing required the participant to perform 3 repetitions, bilaterally. For the SLS, knee valgus was analyzed by Dartfish. The FMS required participants to complete 7 exercises (overhead squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, trunk stability push-up, and rotary stability) and a score of 0-3 was assigned for each exercise, and a total FMS score was calculated. The CKCUEST required participants to maintain a push up position with hands 36 inches apart and proceeded to complete as many opposite hand touches in 15 seconds as possible. The CKCUEST was performed 3 times, with the final score an average composite. RESULTS: Kendall's concordance coefficient indicated a significant moderate association between the SLS, FMS, and CKCUEST ( $W = 0.30$ ,  $\chi^2 = 10.83$ ,  $p = 0.013$ ). CONCLUSION: The association seen within the results indicates that the SLS, CKCUEST, and FMS share similar stability groupings within an athletic population. However, the moderate level of association should cause clinicians, coaches, and trainers to be cautious when considering using these tests interchangeably.

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### RELIABILITY, BIAS, AND REPEATABILITY OF POWER OUTPUT DURING SQUATS USING A FLYWHEEL RESISTANCE TRAINING DEVICE

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Flywheel Resistance Training (FRT) provides quantifiable power output data, but the quality of these measures during complex movements, such as the squat has not been explored. Purpose: To determine the reliability, test-retest bias, and reproducibility of power output during FRT squats. Methods: Nineteen resistance trained subjects ( $23.2 \pm 3.4$  y) completed two bouts of FRT consisting of 3 sets of 5 maximal effort repetitions with varying inertial loads (0.050, 0.075, and 0.100 kg\*m<sup>2</sup>). Peak concentric and eccentric power (W) were recorded via mobile app. Test-retest reliability was assessed by intraclass correlations (ICC). A paired-sample T-Test was used to determine test-retest bias. Finally, the coefficient of repeatability (CR) was calculated. Results: Reliability (ICC) of peak concentric power (0.84 to 0.95,  $p < 0.001$ ) and peak eccentric power (0.91 to 0.96,  $p < 0.001$ ) ranged from good to excellent for each inertial load. We noted no significant differences between trials in peak concentric or peak eccentric power output at any inertial load ( $p = 0.245$  to 0.965). We noted large CRs for peak concentric (40.7 to 88.7%) and eccentric power (36.3 to 67.7%). Conclusion: FRT squats produce reliable, unbiased, but not repeatable, data for peak concentric and peak eccentric power. Multiple testing sessions may be necessary to obtain accurate measures of peak power output with this modality.

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### RELATIONSHIP BETWEEN VERT VARIABLES AND FATIGUE IN DIVISION I VOLLEYBALL ATHLETES

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VERT is a movement sensor that tracks various kinematic and kinetic activities of athletes and could serve as a device to measure fatigue over the course of a season. Purpose: To examine the relationship between VERT variables and fatigue over the course of a collegiate volleyball (VB) season. Methods: 22 Division I VB athletes participated in the study and were divided based upon their usual roll (front row, back row) on the team. VERT sensors were worn on a belt placed posteriorly near the L4-L5 junction. 15 different kinematic and kinetic variables were collected from VERT and averaged weekly. Maximum vertical jump heights (VJH) were recorded using a jump mat. Data were collected over a season. Pearson correlations were run between the front and back row athletes and VERT to assess the relationship between VERT variables and VJH for the following week. Results: For the front row, there was a significant relationship between average VERT jump height and VJH for the following week ( $r = .713$ ,  $p = .047$ ). For the back row, there were no VERT variables, that correlated significantly to VJH for the following week. Conclusion: Average jump height measured from VERT was related to fatigue as measured by VJH in front row VB athletes and may be tracked to gain insight into the physiological stress on these athletes. However, jumping metrics may not be valuable for tracking fatigue for back row VB athletes.

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### NO CORRELATION BETWEEN CVD RISK FACTORS AND FITNESS VARIABLES IN FIREFIGHTERS

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Firefighting is a stressful job that requires an adequate level of physical fitness to perform many job-related tasks. However, the job is also associated with a large amount of sedentary time. Without additional exercise, this sedentary time could lead to increased risk of cardiovascular disease. PURPOSE: The purpose of this study was to examine the relationship between measures of physical fitness and cardiovascular risk factors in firefighters. METHODS: Eighty firefighters, aged 21-60 years old, voluntarily participated in the study. Participants completed physical fitness testing consisting of YMCA Sub Maximal Cycle test, upper and lower body muscular endurance testing, hand grip strength, vertical jump, and sit-and-reach. Participants were also measured for variables associated with risk factors of cardiovascular disease, including age, systolic and diastolic blood pressure, resting heart rate, obesity (body fat percentage, BMI, waist-hip ratio), blood lipid profile (total cholesterol, HDL levels, LDL levels, triglycerides), and fasted blood glucose levels. RESULTS: No significant correlations were found between any markers of physical fitness (VO<sub>2</sub>Max, muscular strength, muscular endurance, and flexibility) and cardiovascular disease risk factors (RHR, BP, body composition, blood lipid profile, fasting glucose). CONCLUSIONS: The present study found no significant correlations between measures of physical fitness and cardiovascular disease risk factors. This was potentially due, in part, to the wide variability in fitness levels between participants in various age groups.

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**THE IMPACT OF VOLUME-MATCHED, HEAVY VS MODERATE WEIGHT RESISTANCE TRAINING ON INFLAMMATION AND MUSCULAR DAMAGE**

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Background: It is well documented that resistance exercise training improves muscular strength and hypertrophy. Heavy loads greater than 65% of 1 repetition maximum (1RM) are typically required for optimal induction of muscular hypertrophy. Heavy loads tend to induce greater muscular damage and repair, resulting in enhanced muscular hypertrophy. However, there is little information comparing intensities of hypertrophy inducing resistance loads on muscular damage and inflammatory response. The purpose of this study was to compare heavy vs moderate hypertrophying loads on markers of post exercise muscular inflammation and damage. Methods: 11 resistance-trained, college-aged males were recruited for this study. Participants were asked to complete 3 data collection sessions, each 1 week apart. During session 1, a baseline venous blood draw was collected, followed by evaluation of 1RM barbell squat. With sessions 2 and 3, participant performed volume-matched barbell squats at 2 different intensities using a counter-balanced design: 5 sets of 5 reps at 85% (High) or 3 sets of 11 reps at 67% (Low). Blood draws were taken 1 hour post-exercise for sessions 2 and 3. Plasma was isolated and evaluated via ELISA assay. Results: There were no significant changes ( $p < .05$ ) in plasma C-Reactive Protein (CRP) for any of the 3 time points (358.78+180.32, 454.52+520.68, 322.01+188.02 ng/mL for Baseline, High, Low, respectively). Myoglobin, a marker of muscular damage, is awaiting analysis. Conclusions: Current results suggest that the utilized volume of hypertrophying resistance training, at either load, does not induce detectable changes in inflammation in the plasma.

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**TRACKING HBA1C FOR REPEAT PARTICIPANTS ACROSS MECKLENBURG COUNTY: A 15-MONTH STUDY**

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PURPOSE: To determine the risk for diabetes in older adults that participates in weekly physical activity programs. METHODS: Blood samples were collected via finger prick from N=16 older adults from seven local recreation/senior centers. HbA1c was calculated via A1cNow test system. Values were reported and explained to participants, as well as recorded for data purposes. RESULTS: Over a 6 month period there was an average decrease of HbA1C levels by a 3.2% for repeat participants. Over a 15-month period there was a 6.4% decrease in HbA1C levels. In Round 1 HbA1C levels averaged 6.2, in Round 5 the levels averaged 6.0, and in Round 6 the levels averaged 5.8 There was a continuous decrease in risk for diabetes and pre diabetes in repeat participants. CONCLUSIONS: These results determine that through consistent physical activity HbA1C levels can improve, decreasing the risk of diabetes. All procedures were supported by Sharon Towers Continuing Care Retirement Center.

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**THE EFFECT OF DUAL TASKING ON EXECUTIVE FUNCTION AND GAIT DURING TREADMILL DESK WALKING**

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PURPOSE: The purpose of this study was to investigate the effects of dual tasking on set speed and preferred speed during treadmill desk walking on executive function and gait. METHODS: College aged males and females participated in this study. In a within groups counterbalanced study design, participants completed three trials: sitting (ST) at a desk, set speed (SS) at 1.4 mph on a treadmill desk, or preferred walking speed (PS) on a treadmill desk. Participants completed a battery of cognitive tests including the Tower of London (ToL) and Eriksen Flanker (EF) test. Gait parameters were measured during the treadmill desk sessions. RESULTS: There were no significant differences between baseline gait measurements and PS ( $p=0.54$ ) or SS ( $p=0.26$ ) during the EF test nor were the accuracy scores different between the ST ( $p=0.24$ ), PS ( $p=0.18$ ), or SS ( $p=0.46$ ) trails. Gait parameters during the ToL test were not different in the PS ( $p=0.90$ ) or ST ( $p=0.36$ ) walking trials compared to baseline walking however the ToL performance time was significantly different while walking at PS in the 4-move ( $p=0.05$ ) and 5-move ( $p=0.04$ ) section. CONCLUSION: No effects of dual tasking were observed at a set treadmill desk speed compared to a baseline, single task condition. During preferred speed treadmill desk walking, cognitive performance was impaired during the ToL, a complex test involving multiple domains of executive function. These results indicate cognitive resources might be allocated to maintain gait parameters at the impairment of cognitive function while walking on a treadmill desk.

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**BLOOD PRESSURE CHANGES AT BETTE RAE THOMAS RECREATION CENTER HEALTH ASSESSMENTS**

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PURPOSE: To determine the change over time in systolic blood pressure for older adults that attended multiple health assessments. METHODS: Blood pressure was screened using an Omron automated blood pressure monitor. The appropriate cuff size was chosen based on the circumference of the bicep and was placed around the arm above the elbow crease. Participants sat resting for approximately five minutes against the back of a chair, with feet flat on the ground, and the palm up. While the cuff was inflating, and deflating participants remained quiet and relaxed. Values were recorded, and average percent change was calculated for those that attended two or more assessments. RESULTS: There were a total of 37 participants assessed. The average percent change in systolic blood pressure for those that attended two assessments was 6.7%. Those that attended three assessments had an average percent change of 2.8%. Those that attended four assessments had an average percent change of -3.6%. CONCLUSIONS: Participants that attended health assessments regularly were more likely to have improved systolic blood pressure readings over time. All procedures were approved by the University of North Carolina at Charlotte Institutional Review Board 16-1015.

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Supported by Sharon Towers Continuing Care Retirement Center.

### PHYSIOLOGICAL DEMANDS OF HARD SHOE AND SOFT SHOE IRISH DANCING: A PILOT STUDY

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Purpose: Irish Step Dance is a form of dance characterized by maintaining an upright posture and primarily moving the lower extremities with two different shoe styles. Soft shoe (SS) dance requires light and delicate movements, while hard shoe (HS) dance requires forceful and powerful movements. Irish dance competition pieces can last 30-60 seconds and performance pieces can last 10 minutes. The purpose of this study was to characterize the cardiorespiratory demands of female recreational Irish dancers. Methods: Seven female dancers (35.8±9.6 y; 166.6±7.5 cm; 79.1±13.1 kg) volunteered for HR monitoring during three separate 45 min classes (n=16 measurements). Classes consisted of a mixture of HS and SS dancing. Three female dancers (28.0±13.9 y; 168.7±1.2 cm; 76.5±15.2 kg) volunteered for VO<sub>2</sub> testing. Dancers completed a three minute reel and treble reel dances while wearing soft and hard shoes. Steady-state data were analyzed from the last 30 sec of the three minute dance test. The order of testing was randomized and the same piece of music was used for all dances. Results: The mean HR for a class session was 128±14 bpm (69.7±9.3 %HRmax). The mean maximal HR achieved in class was 184±10 bpm (93.9±8.7 %HRmax). There was no significant (p<0.05) difference in VO<sub>2</sub> (HS 23.33±7.51 ml/kg/min; SS 23.57±6.17 ml/kg/min), R-value (HS 1.31±0.05; SS 1.31±0.12), HR (HS 184.7±8.7 bpm; SS 185.0±2.0 bpm), or %HRmax (HS 96.3±3.2 %HRmax; SS 94.5±3.7 %HRmax) for HS and SS dance. Conclusions: The class data suggest that Irish dance classes are a moderate intensity activity with vigorous intensity intervals. Hard shoe and soft shoe Irish dance are physiologically demanding aerobic activities with anaerobic contribution. Despite differences in dance style these data suggest that there is no difference between the metabolic demands of HS and SS Irish dancing.

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### THE EFFECTS OF STRETCHING ON BLOOD LACTATE CONCENTRATION AFTER ANAEROBIC EXERCISE

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Blood lactate (BLa) concentration is believed to be one of the contributing factors of muscular fatigue and muscle soreness when lactate is converted into lactic acid. Because of these decrements associated with BLa accumulation during exercise, multiple methods to remove BLa have been investigated. However, the results on the effects of stretching remain inconclusive. Although BLa returns to resting levels within 30-60 minutes after exercise, the primary focus of this study was to further explore the effects of stretching on BLa recovery. PURPOSE: This study aimed to assess the benefits of stretching on BLa levels (mmol/L) after performing a maximal anaerobic exercise compared to sitting down after the same anaerobic maximal exercise. METHODS: After measuring descriptive data (age, ht., wt., age), 15 subjects (age 22 + 1 years; ht. 1.76 + 0.09 m; wt. 83 + 15 kg) performed a Wingate Cycle Ergometer Test, on two separate occasions, followed by two different 10-minute protocols in counterbalanced order: sitting or (active and passive) stretching. BLa levels were measured before and after performing the Wingate test and then 10 minutes after the test. RESULTS: The difference in BLa levels before (p = 0.815) and after (p = 0.212) exercise were similar and showed no significant difference (p < 0.05). However, there was a statistically significant difference in BLa levels between the two post 10-minute protocols (p = 0.002). CONCLUSIONS: The current results indicate that stretching after a maximal bout of anaerobic exercise can be statistically significant in lowering BLa accumulation.

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### DOES THE 30-DAY PUSH-UP CHALLENGE BUILD UPPER BODY MUSCLE STRENGTH?

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Thirty days of push-ups may increase upper body muscular strength. Purpose: The purpose of the study was to examine relevance of the 30-day push-up challenge in building muscle strength and lean muscle mass. Anecdotal evidence found on YouTube suggests this type of activity will build lean muscle mass and improve muscular strength. To date, no research studies have experimentally verified any physiological or anatomical changes to strength and body composition following a 30-day push-up challenge. Participants of the study performed 100 push-ups a day in a specified time-period (30 minutes for females and 15 minutes for males). Methods: Six (n=6) college age students volunteered for the study and study was approved by the Institutional Review Board at Truett McConnell University. Body composition analysis (BCA) were assessed using the InBody 770 (Seoul, Korea). A baseline measurement of muscle strength was performed by the 1-repetition maximum (1-RM) bench press. Participants underwent a familiarization session of proper bench press form then were monitored and spotted during the 1-RM using a York half-rack (York, PA). Participants underwent proper push-up form familiarization prior to 30-day challenge. After 30 days, five (n=5) study participants performed post-tests on BCA and 1-RM bench press. Results: Initial measurements for push-up group (PG) [mean +/- SD %BF: 23.5% +/- 8.91%; 1-RM of 56.45 kg +/- 30.16 kg]. Only one participant withdrew from the study due to a shoulder injury. Post-test results for the PG (n=5) [mean +/-SD %BF: 25.3 % +/- 7.00 %; 1-RM of 59.54 kg +/- 37.25 kg]. A paired t-test was conducted and no significant difference was found between before and after completing the 30-day push-up challenge in %BF and 1-RM. Conclusions: These results suggest that the push-up challenge does not improve upper-body muscle strength significantly within 30 days.

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### COMPARISON OF MODALITIES ON LACTATE CLEARANCE FOLLOWING EXHAUSTIVE ANAEROBIC EXERCISE: A CASE STUDY

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Although researchers have established that elevated lactate circulating in the plasma increases muscle fatigue, gaps in current research studies exist in determining what recovery modalities are most efficient in clearing lactate. PURPOSE: Three common modalities were compared on their effect on blood lactate clearance following repeated Wingate anaerobic bike tests (WAnT). METHODS: One female anaerobic athlete completed 3 trials of 2 sets of 2 consecutive WAnTs using 2 different modalities for lactate clearance between the 2 test sets. The intervention modalities included 10 minutes of electrical muscle stimulation (ESTIM), ice therapy, and an aerobic cooldown. The exercise and intervention procedure included a 5 minute warm-up, two WAnTs, the 10 min modality intervention, and then two more WAnTs. Capillary blood lactate was measured pre exercise, after the first 2 WAnTs, post modality intervention, and after the second 2 WAnTs. RESULTS: The treadmill active recovery led to a 29% post treatment decrease and 27% overall decrease in blood lactate from pre to post WAnT tests, while ice therapy led to a 31% post intervention increase and overall 28% increase. ESTIM led to an 11% post intervention increase and 6% overall decrease. CONCLUSIONS: An aerobic cool-down was observed to be most beneficial for clearing lactate after anaerobic exercise. Physiologically, an increase in blood flow from active recovery and ESTIM carries lactate to the heart and liver, decreasing its accumulation in blood plasma. This information can be especially important for anaerobic athletes who have multiple competitions per day and must clear lactate efficiently to perform optimally.

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### NUTRITIONAL ADVICE OF CERTIFIED FITNESS PROFESSIONALS

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Certified fitness professionals (CFP) influence their clients' overall health by offering advice on positive lifestyle changes, such as eating habits. However, little is known on the frequency and depth of advice given by CFP. **PURPOSE:** To investigate the nutritional advice, education, and background of CFP in the United States. **METHODS:** A researcher designed questionnaire included questions on the nutritional advice, types of advice given, nutrition background, continued nutritional education and demographics of CFP. Both descriptive and inferential data analysis were used in this cross sectional study design. **RESULTS:** A total of 119 females completed the survey, average age was  $48.0 \pm 12.0$  years, average years of experience of  $14.7 \pm 10.1$  years, and ~81% (97/119) had at least a Bachelor's degree. It was found that 89.9% of the CFP provide nutritional advice, with the majority administering advice weekly. The most common mode of advice was verbal (90.6%) and handouts (37.5%). Over half of the participants reported they received nutrition knowledge from self-studying using the internet. There was no significant difference ( $p < 0.05$ ) between CFP education and nutritional advice. **CONCLUSIONS:** CFP are being using as nutritional resource by fitness clients and participants. Higher education and the fitness industry need to prepare CFP for addressing clients' general nutrition inquiries in the field.

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### ACCURACY OF THE BRZYCKI FORMULA FOR PREDICTING 1RM VALUES WITH EXPLOSIVE LINEAR LEG PRESS TRAINING

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The one repetition max (1RM) is considered the gold standard for the assessment of maximum strength. Currently this method is used to prescribe strength training programs for individuals. Purpose: The purpose of this experiment was to examine the relationship between actual 1RM values and predicted 1RM values for explosive linear leg press training. Methods: Seven female softball players ( $19.3 \pm 0.74$  yrs.;  $73.15 \pm 24.88$  kg;  $164.7 \pm 7.58$  cm) participated in the study. Participants performed a 1RM test and the next week completed a set of explosive repetitions to failure at 80% of the max loaded weight of their 1RM (plus sled weight of 76kg). Each participant was instructed to lower the weight in a controlled manner until 90 degrees of flexion. At flexion they were told to explosively push as hard and as fast as possible, avoiding full knee extension. The number of repetitions to failure were used in the Brzycki formula to predict their 1RMs. Results: The actual 1RMs ranged from 167.3 kg to 341.8 kg and predicted 1RMs from 162.7 kg to 331.5 kg. The predicted 1RMs were strongly associated to the actual 1RMs ( $r = 0.961$ ,  $p < 0.001$ ). There were no significant differences found between the actual 1RM and the predicted 1RM ( $t = 0.196$ ,  $p = 0.848$ ). Conclusion: These results indicate predicting 1RM from repetitions to failure with explosive training on a linear leg press are highly correlated to the actual 1RM. In addition, prediction of 1RM values could be used to efficiently increase weight load for athletes participating in an explosive training regimen.

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### PHYSIOLOGICAL ADAPTATIONS PRE AND POST THROUGH HIKING IN YOUNG HEALTHY MALE SUBJECT: A CASE STUDY

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**PURPOSE:** Backpacking and hiking are common outdoor activities during the spring and summer months in the US. The present case study utilized traditional physiological assessments to investigate the adaptations in cardiopulmonary fitness pre and immediately post completion of through hiking the Pacific Crest Trail (PCT; 2,659 mi). We postulated that maximal aerobic capacity (VO2 peak) would not differ pre vs. post hike and that submaximal exercise efficiency would improve. **METHODS:** One young healthy male subject (26 years old) underwent basic anthropometric measures, resting hemodynamics, resting metabolic expenditure, bone densitometry (DEXA) and cardiopulmonary exercise testing (Bruce treadmill protocol) pre and post through hiking of the PCT. During the exercise test, oxygen uptake (VO2) was measured on a breath-by-breath basis, heart rate (HR) was measured continuously, and the first (VT1) and second (VT2) ventilatory thresholds were identified using the V-slope and the ventilatory equivalent method. The through hike was completed in 140 days and pre and post laboratory visits were conducted within one and a half weeks of starting and completing the trail. **RESULTS:** The pre and post peak exercise time was 15 mins and 45 seconds and 16 mins. VO2 peak pre and post hike was 52.5 and 52.6 mL/min/kg, respectively, and peak HR pre and post hike was 198 and 189 bpm. VT1 was obtained later during the test (time = 7:30 vs. 8:45) and at a higher VO2 pre vs. post hike (VO2 = 32.7 mL/kg/min vs. 31.1 mL/kg/min). **CONCLUSIONS:** Hiking the PCT improved cardiopulmonary efficiency as shown by a higher VO2 at VT1 and a lower heart rate at peak exercise. Moreover, ventilatory responses were more uniform post hike. This assessment could be easily performed with a larger sample of through hikers and future investigations could assess cardiovascular efficiency and fatigue pre, during, and post hike.

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### FIREFIGHTER TURNOUT SUIT WEIGHT INFLUENCES SIMULATED EXERCISE PERFORMANCE

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**PURPOSE:** To investigate how structural firefighter protective ensemble weight influences rate of perceived exertion (RPE) during firefighter simulated exercise (FFSE). **METHODS:** 10 active firefighters (age:  $33 \pm 6$  years, Ht:  $178.2 \pm 3.1$  cm, Wt:  $78.6 \pm 16.7$  kg) were asked to wear, in random order, two ensembles: 1) a single layer (SL) outer shell (2.45 kg) and 2) a traditional turnout suit (4.57 kg). On each laboratory visit, the firefighters performed the FFSE that consisted of two rounds of a 15.24m hose advance, a 15.24m weighted (40.83 kg) carry, sledge hammer exercise, a 15.24m tire flip, a 15.24m dummy drag, rope pull, and unweighted stair climb, with a 1-minute rest period between rounds. The FFSE included a 5-minute acclimation period in the ensemble, a warm up (10 pushups, 10 squats, 20 jumping jacks). Subjects were asked to complete the FFSE as fast as possible. The traditional turnout suit consisted of an outer shell, moisture barrier, and thermal barrier typically found in most turnout suits. The Borg rating of perceived exertion scale was asked immediately at the end of each round of FFSE and ensemble weights were measured pre-FFSE. **RESULTS:** The SL resulted in lower average RPE for round 1 (SL:  $12.8 \pm 1.7$  vs. Traditional:  $13.8 \pm 1.7$ ;  $p = 0.05$ ) and round 2 (SL:  $14.2 \pm 1.6$  vs. Traditional:  $16.2 \pm 2.3$ ,  $p = 0.01$ ) than the traditional turnout. In addition, round 2 of the FFSE was completed significantly faster than the traditional turnout suit (SL:  $262.8 \pm 55.7$  vs. Traditional:  $293.4 \pm 64.9$  sec;  $p = 0.02$ ). **CONCLUSIONS:** The weight of the turnout suit increases RPE, which appears to influence performance for FFSE.

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Supported by Fire-Dex, LLC.

### RELIABILITY OF THE GEORGE JOGGING TEST TO PREDICT VO2MAX

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**P277** PURPOSE: Although the George submaximal treadmill jogging test is a relatively accurate predictor of cardiorespiratory fitness, there's limited research available on its reliability. This study assessed the reliability of the George treadmill jogging test in healthy young adults, as well as determined the smallest change between repeated measurements that's likely to represent a real change in fitness levels. METHODS: Twenty-three subjects (15 females, 8 males;  $23.6 \pm 5.0$  yrs) completed the study. Participants initially walked at a brisk pace for 3 min, at which point they chose a jogging speed from 4.3-7.5 mph if male or 4.3-6.5 mph if female. Heart rate (HR) was collected using a Polar chest-strap monitor, and recordings were taken every 30 sec until a steady-state was achieved, as determined by 2 consecutive HRs within  $\pm 3$  bpm. Each participant completed 3 separate visits, and steady-state HRs from each visit were used estimate VO2max with a published regression equation. Intra-class correlation coefficients (ICC) were used to examine reliability in predicted VO2max values between visits 1 and 2, and between visits 2 and 3. Minimal detectable change values at a 90% confidence interval (MDC90) were calculated with the following formula:  $1.65 \times SD \times \sqrt{2[1 - ICC]}$ . RESULTS: Predicted VO2max values were 42.6 (6.2), 42.9 (6.6), and 43.1 (6.4) ml/kg/min for visits 1, 2, and 3, respectively. A high degree of reliability was observed between visits 1 and 2 (ICC=0.971), and between visits 2 and 3 (ICC=0.983), and the corresponding MDC90 values were 2.49 and 1.98 ml/kg/min. CONCLUSIONS: The George jogging test is a reliable method to assess maximal oxygen consumption. In practical terms, a change of at least 2.0-2.5 ml/kg/min between repeated measurements is needed to be confident that a real change in fitness has occurred.

### DECREASED ERROR WITH HIGHER WRIST POSITION OF OPTICAL HEART RATE MONITORING DEVICES DURING EXERCISE

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**P278** Purpose: To measure the validity of two popular wrist-worn heart rate monitors, 10 recreationally active participants performed an aerobic and resistance exercise protocol. Methods: The exercise consisted of stationary cycling for nine minutes, walking, jogging, and running on a treadmill for three minutes each, and lastly 15 body-weight resistance exercises using a TRX suspension trainer. Participants wore two Apple Watch series 2 (AWS2) devices on the left wrist and two Fitbit Charge HR 2 (FBC2) devices on the right wrist. Heart rate measures were compared to a Polar H7 chest strap. Mean Absolute Percentage Error (MAPE) was used to determine the validity of each heart rate monitor. Results: During stationary cycling AWS2 indicated MAPE values of 2.1% and 2.8% for high and low wrist positions, respectively, compared to 7.3% and 10.9% for FBC2. During treadmill activity AWS2 yielded MAPE of 5.1% and 5.6% for high and low positions, compared to 6.1% and 5.1% for FBC2. During suspension exercise AWS2 recorded MAPE of 7.9% and 9.4% for high and low positions, compared to 11.5% and 13.2% for FBC2. Conclusions: Both devices worn at a higher wrist position outperformed their lower counterpart across the exercise protocol. AWS2 yielded more accurate heart rate measures compared to the FBC2.

### EFFECTS OF AN UNDULATING PERIODIZATION PROGRAM FOR TACTICAL ATHLETES

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**P279** Strength and conditioning programs typically follow linear periodization (LP) schemes to cycle around seasonal changes in competition. Tactical athletes (TA), including police, fire, emergency medical services and military, often struggle to implement programs of linear periodization due to the inconsistent daily jobs requirements. PURPOSE: To determine changes in performance of TA following an exercise program utilizing a non-linear, formally referred to as an undulating periodization (UP) model. METHODS: A retrospective analysis was performed in order to assess changes of 13 male and female TA ( $43.7 \pm 9.2$  yrs,  $173.1 \pm 10.6$  cm,  $105.5 \pm 22.8$  kg). Measures included body fat mass (BFM), skeletal muscle mass (SMM), 300 yard shuttle (300S), Functional Movement Screen (FMS), average handgrip strength (AHS), plank duration (PD), rope pull (RP), and 30 second bike ride for caloric expenditure (BM). Paired sample t-tests were conducted to examine significance with an alpha level set a priori to  $P \leq 0.05$ . RESULTS: There were significant decreases in BFM ( $2.9 \text{ kg} \pm 1.3 \text{ kg}$ ,  $p = .00$ ) and in 300S times ( $41.1 \pm 16.2 \text{ sec}$ ,  $p = .00$ ). Significant increases were discovered in SMM ( $1.1 \pm 0.0 \text{ kg}$ ,  $p = .00$ ), FMS ( $3.6 \pm 2$ ,  $p = .00$ ), AHS ( $11.1 \pm 2 \text{ kg}$ ,  $p = .01$ ), PD ( $34.4 \pm 5.6 \text{ sec}$ ,  $p = .00$ ), RP ( $.9 \pm 1 \text{ m}$ ,  $p = .01$ ) and BM ( $3.8 \pm 1.3 \text{ cal}$ ,  $p = .01$ ). CONCLUSION: The results indicate improvements in performance measures following an UP program, indicating further need to understand different periodization schemes in TA.

### COMPARISON OF MAXIMAL AEROBIC CAPACITY BETWEEN THE TREADMILL AND CONCEPT2 SKIERG

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**P280** The Concept2 SkiErg is quite popular, is widely used in gyms, laboratories, and rehabilitation centers, and provides a low impact and total body cardiovascular and muscular endurance workout. Due to these benefits, the SkiErg could be an alternative max or peak graded exercise test (GXT) mode. PURPOSE: To compare treadmill (TM) VO2max values vs. those elicited from a SkiErg (SE) GXT. METHODS: Descriptive data (Ht., Wt., BF%, age) was measured for 15 averagely fit college-age males. In a counterbalanced order and separated by 72 hours of rest, each subject completed 2 GXT protocols to the point of volitional exhaustion on a TM and SE. Max or peak values for VO2, HR, VE, and RER were compared between TM and SE using a Paired-Samples t-Test with significant differences at  $p < 0.05$ . Peak RPE was compared using a Wilcoxon Signed Rank Test. RESULTS: TM was significantly greater than SE in regard to mean VO2max ( $49.7 \pm 4.6$  vs  $43.9 \pm 3.8$  ml/kg/min,  $p < 0.01$ ), HR ( $191 \pm 13$  vs  $187 \pm 11$  bpm,  $p = 0.017$ ), and RPE ( $19.9 \pm 2.3$  vs  $18.6 \pm 1.2$ ,  $p = 0.046$ ). TM was not significantly greater than SE regarding RER ( $1.2 \pm 0.0$  vs  $1.2 \pm 0.0$ ,  $p = 0.721$ ). VE was not significantly greater in SE vs. TM ( $148.7 \pm 20.3$  vs  $146.1 \pm 17.2$  L/min,  $p = 0.520$ ). CONCLUSIONS: The TM appears to yield higher max values for VO2, HR, RER, and RPE compared to SE, while SE elicited a higher max VE value in college males. Future studies should assess how populations with higher fitness levels, gender, or protocol variations may impact peak VO2 values during a peak SE GXT.

### RELATIONSHIP BETWEEN RELATIVE LOAD AND PEAK POWER, AVERAGE FORCE, AND VELOCITY DURING FLYWHEEL RESISTANCE TRAINING

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Flywheel Resistance Training (FRT) is often used to measure and/or increase power output but the effects of relative inertial load are unknown. Purpose: To determine the relationship between relative inertial load (%1RM\*m<sup>2</sup>) and peak concentric, eccentric power, average force and velocity. Methods: Twenty recreationally active ( $\geq 2$  resistance exercise bouts per week), subjects (10 M, 10 F) completed 2 bouts of resistance exercise using a FRT device (Excentric kbox 4 Pro) separated by at least one week. Each session consisted of 3 sets of 4 exercises (squat, bent-over row, Romanian deadlift, and biceps curl) with varying moments of inertia (0.050, 0.075, and 0.100 kg/m<sup>2</sup>, respectively) in random order. Each set consisted of 5 maximal effort repetitions with 3-minute recovery between sets. Results: As relative inertial load increases a decline can be seen in peak concentric and eccentric power. Unlike traditional weight training where there is a stable power output from ~40-80% (depending on exercise) a steady decline is seen in peak concentric and eccentric power in FRT. A decline in average force and velocity as inertial load increases is also seen across all four lifts: squat, RDL, bent over row, and biceps curl. Conclusions: We see that power decreases with increasing relative inertial load which could be driven by decreases in force and/or velocity. Based on the flywheel mechanics, we believe that velocity may be the main contributing factor for this decrease.

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### COMPARISON OF PRE-STRETCH AND REACTIVE STRENGTH BETWEEN MEN AND WOMEN DURING BENCH PRESS

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Pre-stretch augmentation (PAI) and reactive strength (RSI) indices have been used to assess the stretch-shortening cycle (SSC) contribution to vertical jumping. Quantification of SSC contribution to upper extremity (UE) function largely remains unknown. Furthermore, based on differences in muscle-tendon properties, the effect is likely different between men and women. Purpose: To compare UE PAI and RSI indices between men and women. Methods: 20 men (26 $\pm$ 2.4 yrs) and 17 women (21.4 $\pm$ 2.6 yrs) with >6 months of UE resistance training completed 3 bench press trials using 2 styles, pure concentric (PC) and rebound (RB) (no pause between eccentric and concentric), using 75% of their one repetition maximum. Concentric phase vertical average force (AF) and power (AP) were computed from barbell kinematic data and used to calculate PAI index [(RB-PC)/PC\*100] and RSI (RB-PC). Results: Except for one man and woman, participants demonstrated greater AF and AP for RB compared to PC. Men (.49 $\pm$ .38) had significantly higher (P=.004, d=.75) AF PAI than the women (.27 $\pm$ .17). There was no significant (P=.068, d=.64) sex difference for AP PAI. Men (AF:3.9 $\pm$ 2.9, AP:129.0 $\pm$ 56.7) demonstrated significantly higher RSI for both AF (P<.001, d=1.5) and AP (P<.001, d=2.3) than women (AF:.76 $\pm$ .54, AP :29.6 $\pm$ 18.1, Conclusion: The sex differences were dissimilar between the indices as indicated by the effect sizes. Whereas the AP RSI sex difference was larger than AF, AF PAI was larger than AP.

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### BASEBALL PITCHING MUSCLE ACTIVITY & KINEMATIC COMPARISON BETWEEN WIND-UP AND STRETCH FASTBALLS

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Background: Baseball pitching is considered one of the most intense aspects within the game of baseball, as well as the most complicated dynamic throwing task in all of sports. The kinematics of baseball pitching have been comprehensively investigated in an attempt to distinguish ideal mechanics in terms of pitching performance. However, the relationship between pitching kinematics and electromyography have been under investigated. Purpose: The purpose of this research study was to compare the upper extremity muscle activation patterns, lower extremity muscle activation patterns (mean & peak) and kinematic variables associated with the fastball pitch when pitching from the wind-up and stretch. Methods: Twelve skilled (NCAA level) pitchers participated in this study. Six surface electromyography (EMG) electrodes were placed on the stride leg biceps femoris, medial gastrocnemius, ipsilateral lower trapezius, upper trapezius, triceps brachii and biceps brachii. A paired T-test (fastball by type of delivery) statistical analysis were performed (p < 0.05). The pitch was broken into: foot contact (FC), maximal external rotation (MER), ball release (BR) and maximal internal rotation (MIR). Six pairwise comparisons were significant (p  $\leq$  .01) for the biceps brachii. Eight pairwise comparisons were significant (p  $\leq$  .01) for the triceps brachii, upper trapezius, lower trapezius, biceps femoris and gastrocnemius. The pitch phases of significance differed between the muscle groups. Four pairwise comparisons were significant (p  $\leq$  .01) for elbow flexion-extension and shoulder internal & external rotation. No significance were found for elbow angular velocity. Conclusions: Mean & peak muscle activity as well as kinematics have a significant difference based on the pitch thrown and the delivery of the pitch (wind-up and fastball)

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### EFFECTS OF $\beta$ -ALANINE ON PERFORMANCE, COGNITION, MOOD, ENDOCRINE FUNCTION, AND INFLAMMATION IN SIMULATED MILITARY OPERATIONS

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Sustained military operations (SUSOPs) involve physical exertion, psychological stress, sleep deprivation, and underfeeding. Together, these factors can decrease physical and cognitive performance.  $\beta$ -alanine (BA) is an amino acid that combines with L-histidine in tissue to produce carnosine, which increases buffering capacity and reduces oxidative stress. BA may also increase brain-derived neurotrophic factor (BDNF) levels, resulting in improved cognition and reduced anxiety. Purpose: The purpose of this study was to examine the effects of BA on physical performance, cognition, endocrine function, inflammation, and mood during a 24-h simulated SUSOP. Methods: Nineteen males were randomized to one of two groups: BA or placebo (PLA) (12g/day) for 14-days preceding a 24-h SUSOP. During the SUSOP, subjects endured combat-specific tasks. Physical performance, cognition, mood, endocrine function, and inflammation were assessed upon arrival (0H), 12 (12H), and 24-h after arrival (24H). A two-way repeated-measures analysis of variance was used to determine group differences in dependent variables over time. Results: Visual reaction time (RT) was slower at 24H compared to 0H for PLA only (p=0.035), and PLA missed more RT stimuli at 12H compared to BA (p=0.048). Litter carry and 1-km run times increased at 24H compared to 0H in both groups (p<0.05), however PLA had a longer 1-km time compared to BA at 24H (p=0.050). PLA experienced increases in soreness and fatigue at 12H compared to 0H (p<0.05), which was not observed in BA. Increases in inflammatory and endocrine markers were observed, with no differences between groups. No changes in motor RT, visual tracking ability, jump power, or pull-ups were observed between groups or time points. Conclusions: BA maintains some aspects of physical performance, cognition, and mood during SUSOPs, with no effects on endocrine function or inflammation.

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### USING THE GAD-7 TO COMPARE EFFECTS OF RESISTANCE TRAINING ON STUDENTS AT RISK OF ANXIETY

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The Mental Health America self-screening Anxiety Test (GAD-7) is a commonly used tool for assessing anxiety in individuals. Resistance training has been demonstrated to decrease levels of anxiety. PURPOSE: To compare levels of anxiety as measured on the GAD-7 within sedentary students before and after either four weeks of resistance training or normal activity. METHODS: 12 participants took the GAD-7 and were matched for anxiety level and placed into either a control or resistance trained group. The experimental group exercised two muscle groups three times a week for four weeks. Participants initially lifted 60% of their 1RM in the and increased to 70% of their 1RM by the conclusion of the study. The control group maintained their daily routine. At the completion of four weeks, both groups completed the GAD-7. RESULTS: A mixed model analysis using exercise vs control group and pre-score as fixed effects and subject intercepts as random effects, as well as, by-subject random slopes for the effect of post-score revealed no significant difference in in post test score based on group ( $F=1.045$ ,  $p=0.336$ ), pre-score ( $F=1.254$ ,  $p=0.0295$ ) or group\*pre-score ( $F=0.249$ ,  $p=0.631$ ). CONCLUSIONS: Although the levels of anxiety decreased in the participants that performed the resistance training, more research is needed to determine exercise is a factor when reporting anxiety on the GAD-7.

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### NITRATES AND EXERCISE CAPACITY IN WELL TRAINED MIDDLE TO OLDER AGED ADULTS

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Dietary nitrates ( $\text{NO}_3^-$ ), through their conversion to nitrite ( $\text{NO}_2^-$ ) and nitric oxide, have been shown to increase exercise capacity in healthy younger adults and older diseased patients. Nitrates effect in well trained middle to older aged adults has not been studied. Purpose: To examine the effects of dietary  $\text{NO}_3^-$  on submaximal constant workrate exercise time (CWET) in well trained middle to older aged adults. Method: Subjects ( $n=14$ ,  $\text{VO}_2 \text{ max} = 51.3 \pm 5.5 \text{ ml/kg/min}$ ) were assigned in a randomized, blinded, crossover design to receive one of two treatments (high  $\text{NO}_3^-$  beverage then placebo or placebo then high  $\text{NO}_3^-$  beverage). Results: Nitrate consumption increased  $\text{NO}_2^-$  levels significantly in all subjects ( $p<.01$ ). CWET at 75% of the subject's maximal work capacity was not significantly different ( $p=.26$ ) when comparing the high  $\text{NO}_3^-$  versus the placebo trial ( $1142 \pm 155$  vs  $1064 \pm 132$  sec, respectively). However, CWET was extremely variable between the two conditions with 6 subjects showing a 20% or greater improvement in exercise time with the high  $\text{NO}_3^-$  beverage ( $21.8 - 55.1\%$ ) and 2 subjects showing a 20% or greater decrement in exercise time with the high  $\text{NO}_3^-$  beverage ( $23.9 - 40.1\%$ ). Interestingly, the 2 subjects showing the decrement in performance with the high  $\text{NO}_3^-$  beverage were both on levothyroxine for hypothyroidism. Blood pressure, heart rate, oxygen consumption and rating of perceived exertion were not significantly different between the two trials. These results indicate that  $\text{NO}_3^-$  supplementation increases plasma  $\text{NO}_2^-$  levels; however, it has non-significant, albeit highly variable, effects on exercise performance in middle to older aged well trained adults.

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### QUANTIFICATION OF GRFx AND GRFy FOR SKILLED VERSUS RECREATIONAL BASEBALL HITTING

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PURPOSE: Successfully hitting a baseball requires the hitter to properly use ground reaction forces (GRFs) in all three directions during every at bat. The normal pattern of the GRFs during the baseball swing and the importance of the timing of those same GRFs have been identified, but have never compared how athletes across various competition levels differ. Therefore, the purpose of this study is to investigate how the peak GRFx, and GRFy, and timing to GRFx, and GRFy for the lead and trail legs vary between athletes who have played at the collegiate level and those who have not. METHODS: Currently active baseball athletes were recruited and separated into two groups, recreational ( $n = 6$ ) and skilled ( $n = 6$ ), based on if they were currently competing at the NCAA level. Each athlete performed three swinging trials while standing on two force platforms sampling at 1000 Hz. Peak GRFx, and GRFy normalized to bodyweight, and time to peak GRFx, and GRFy in milliseconds before ball contact were calculated for the lead and trail legs using Visual3D software. Values were averaged for each respective group and compared using independent samples t-test ( $p \leq 0.05$ ). RESULTS: The skilled group demonstrated significantly lower peak negative GRFy in the trail leg at  $p = 0.02$ . CONCLUSION: The negative GRFy seen for both the skilled and recreational group in the trail leg would work to rotate the pelvis and trunk toward the pitched ball. It is believed that the skilled hitters in this study had lower GRFy in the lead leg due to controlling their transverse pelvis rotation. More control over the transverse pelvis rotation would help to ensure that the hitter does not let their hips get out in front of the ball. Lack of significance for other variables tested could be explained by the acquired skill of both groups.

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### CITRULLINE-MALATE DOES NOT ENHANCE PERFORMANCE OR ALTER COORDINATION VARIABILITY DURING ANAEROBIC CYCLING

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Citrulline-malate (CM) supplementation has been previously reported to have positive effects on submaximal resistance exercise performance. Purpose: The effect of acute CM supplementation on anaerobic cycling performance in recreationally trained males was investigated. Methods: Twenty-three recreationally trained males completed randomized, double-blind trials consuming CM (12 grams dextrose + 8 grams CM) or a placebo (PLA) (12 grams dextrose). Participants performed a 30 second (s) Wingate cycling test sixty minutes after supplement consumption. Kinematic data was collected through a single Basler Scout camera (120 Hz) and analyzed through a custom MATLAB program (The Mathworks, Inc., Natick, MA, USA) to determine the sagittal plane CRP mean and deviation phase (DP) of the thigh-shank (TS) and shank-foot (SF). Paired t-tests examined the differences between PLA and CM trials for mean watts, peak watts, fatigue index (%), TS DP (degrees), and SF DP (degrees) for the total test interval and the following time periods: Period 1: 0-10 seconds, Period 2: 10-20 seconds, Period 3: 20-30 seconds. Results: For sustained relative power, a significant effect was observed for time within the trials ( $p < .001$ ); however, no significant differences were observed between CM or PLA trials for mean watts (PLA:  $586.1 \pm 87.7$ ; CM:  $588.0 \pm 93.0$ ), peak watts (PLA:  $773.0 \pm 136.7$ ; CM:  $786.7 \pm 133.0$ ), and fatigue index (PLA:  $12.9 \pm 6.4$ ; CM:  $14.3 \pm 7.2$ ). Likewise, no significant differences were observed in the TS DP (PLA:  $98.6 \pm 33.5$ ; CM:  $94.7 \pm 38.0$ ) or SF DP (PLA:  $22.3 \pm 9.1$ ; CM:  $23.3 \pm 11.3$ ). Conclusions: Despite previously reported benefits of CM on strength performance, the present study suggests that there is no benefit of CM supplementation on anaerobic cycling performance.

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#### **DARK CHOCOLATE SUPPLEMENTATION ELEVATES RESTING ENERGY EXPENDITURE IN EXERCISE TRAINED FEMALES**

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**P289** PURPOSE: To investigate the influence of dark chocolate supplementation on resting and exercise metabolism. METHODS: Using a randomized, double-blind design 18 exercise trained female subjects were assigned to a 30 day supplementation with either 20-g per day of 70% dark chocolate (DC) (n=9) or a calorically matched white chocolate (WC) (n=9). Prior to supplementation (PRE), subjects underwent indirect calorimetry assessment for resting energy expenditure (REE) followed by an assessment of exercise energy expenditure consisting of cycling for 20 min, 10 min at 50 watts (EEE-50) and 10 min at 100 watts (EEE-100). Upon completion of the 30 day supplementation, subjects repeated the assessment for REE, EEE-50, and EEE-100. All data are presented as mean (SE). RESULTS: Pre supplementation REE (DC 1454 (51), WC 1565 (48) kcal per day), EEE-50 (DC 4.86 (0.11), WC 4.61 (0.18) kcal/min), and EEE-100 (DC 7.07 (0.15), WC 6.77 (0.18) kcal/min) were not significantly different between groups ( $p > 0.05$ ). Post supplementation REE was significantly increased by 9% in the DC group (DC 138 (39), WC -29 (18) kcal per day,  $p=0.001$ ). Neither EEE-50 (DC 4.49 (0.19), WC 4.48 (0.11) kcal/min.), nor EEE-100 (DC 6.50 (0.20), WC 6.65 (0.14) kcal/min) were significantly different between groups ( $p > 0.05$ ). CONCLUSION: These results indicate that in athletic female subjects, DC supplementation significantly increases REE by 9%, but doesn't significantly influence exercise energy expenditure.

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

#### **RACIAL AND ETHNIC DIFFERENCES IN 24 HOUR URINARY HYDRATION MARKERS**

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**P290** Prior literature has investigated racial/ethnic differences in hydration status based on fluid intake and spot urine samples, however, no literature has examined differences in hydration status amongst different racial/ethnic sub-populations using 24 h urinary hydration measures. Purpose: To examine 24 h urinary hydration markers in men and women from varying racial and ethnic backgrounds. Methods: Thirteen men (African American (AA), n=2; Caucasian (CA), n=8) and women (AA, n=1, CA, n=3) (mean $\pm$ -SD; age, 24 $\pm$ -4y; height, 173.4 $\pm$ -16.5cm; body mass, 75.1 $\pm$ -12.2kg; body fat, 18.6 $\pm$ -10.3%) provided a 24 h urine sample across 7 consecutive days for assessment of urine volume (UVOL), urine osmolality (UOSM), and urine specific gravity (USG). Differences in 24 h hydration status between race/ethnicity were assessed using linear mixed effects models with associated Bonferroni post hoc analyses. Results: Across 7 days, mean UVOL, UOSM, and USG was 1.81 $\pm$ -0.83 L, 550 $\pm$ 258 mOsm/kg, and 1.015 AU, respectively. UVOL was significantly reduced in AA (0.61 $\pm$ -0.020 L) compared to CA (2.03 $\pm$ -0.70 L) ( $p<0.05$ ). Likewise, UOSM and USG were significantly elevated in AA compared to CA (mean difference [95% CI]; 502 [395, 608] mOsm/kg; 0.013 [0.010, 0.016] AU) ( $p<0.05$ ). Conclusion: Based on 24 h urinary hydration markers, African Americans were inadequately hydrated compared to Caucasians over the course of 7 consecutive days. Future research examining 24-hour hydration status coupled with fluid intake behaviors across other races/ethnicities is warranted to develop targeted approaches for improved day-to-day hydration.

#### **SOURCES OF NUTRITION INFORMATION AND KNOWLEDGE FOR ULTRA-RUNNERS (SNIKR STUDY)**

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**P291** PURPOSE: Ultra-marathon events (i.e., >42.2-km) continue to grow in popularity; however, little research exists on the typical dietary intake of ultramarathon participants, or the sources of information which influence their habits and beliefs. The objectives of this study were to characterize the acquisition of nutrition information among ultra-endurance athletes, and to determine the relationship between the use of different sources of information and nutritional knowledge (relative to current evidence-based recommendations). METHODS: Participants (n=196) were adults who had completed an ultramarathon at least once in the past 2 years. Measures included: a demographic questionnaire; the Sources of Nutrition Information (SONI) questionnaire, which included 7 major sources of nutrition information, as well as their credibility, accessibility, frequency, interest; and the General Nutrition Knowledge Questionnaire -Revised (GNKQ-R). Repeated measures ANOVA was used to analyze differences between items on the SONI scale. Spearman rank correlation was used to test for a relationship between sources of information and GNKQ-R score. RESULTS: 18% self-identified as vegan/vegetarian, 6% paleo/ketogenic, 20% traditional American diet, 54% "healthy" and 12% "other". Peer reviewed literature was reported as the most frequently used (mean score=1.64,  $p<0.001$ ), credible (3.02,  $p<0.001$ ), and interesting (2.62,  $p=0.002$ ). Social media was the most accessible (2.81,  $p<0.001$ ), but the least credible (1.87,  $p<0.001$ ). A modest, significant correlation ( $r=0.185$ ,  $p = 0.015$ ) exists between use of peer-reviewed literature and nutrition knowledge. CONCLUSIONS: Ultrarunners report high usage of peer-reviewed literature for nutrition information, which is related with improved nutritional knowledge. Because of its accessibility, social media may be a promising tool to provide nutrition information to this population.

#### **NITRATES DO NOT IMPROVE TISSUE OXYGENATION INDEX: A NIRS ANALYSIS**

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**P292** Dietary nitrate (NO<sub>3</sub><sup>-</sup>) has been shown to increase blood flow and tissue oxygenation through its reduction to nitrite (NO<sub>2</sub><sup>-</sup>) then nitric oxide (NO) in healthy younger adults and diseased older adults. The effect of dietary NO<sub>3</sub><sup>-</sup> on tissue oxygenation has not been studied in healthy middle to older aged adults. Purpose: To evaluate the effects of dietary NO<sub>3</sub><sup>-</sup> on the tissue oxygenation index (TOI) in healthy middle to older aged adults at rest and during exercise. Methods: Subjects (n = 11) were assigned to either a high NO<sub>3</sub><sup>-</sup> then a low NO<sub>3</sub><sup>-</sup> beverage, or low NO<sub>3</sub><sup>-</sup> then high NO<sub>3</sub><sup>-</sup> beverage. Near-infrared spectroscopy (NIRS) was used to measure the TOI at rest and at 50% and 75% of the subject's maximal work capacity. Results: Nitrite levels in the blood were significantly increased following dietary nitrate intake ( $p < .03$ ). However, no significant differences in the TOI were found when comparing the low and high NO<sub>3</sub><sup>-</sup> trials at rest (64.7  $\pm$  2.2 vs 62.5  $\pm$  1.6 %, respectively,  $p = .348$ ), 50% of maximal work capacity (58.6  $\pm$  2.5 vs 57.5  $\pm$  1.7 %, respectively,  $p = .669$ ), or 75% of maximal work capacity (56.5  $\pm$  2.5 vs 54.8  $\pm$  2.0 %, respectively,  $p = .553$ ). Additionally, no significant differences ( $p > .05$ ) were found when comparing changes in the TOI from rest to exercise between the high and low NO<sub>3</sub><sup>-</sup> trials. Conclusion: These results indicate that despite the significantly increased nitrite concentrations, there are no significant differences in tissue oxygenation levels in healthy middle aged adults at rest or during exercise when comparing high and low NO<sub>3</sub><sup>-</sup> beverages.

### NEIGHBORHOOD ACCESS TO HEALTHY FOODS AND WEIGHT-RELATED HEALTH STATUS IN ELEMENTARY SCHOOL-AGED YOUTH

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Investigators have recently begun to explore the impact of perceptions of neighborhood-level access to healthy living resources on healthy behaviors and health outcomes. While a positive association has been observed between perceptions of access to healthy foods and healthy eating behaviors, the relationship with weight-related health status is less clear. Moreover, authors have yet to consider these relationships in youth. Purpose: The purpose of this study was to examine the relationship between perceptions of access to healthy foods and weight-related health status in youth. Methods: Data from 17 public elementary schools, representing 735 students (age 7.3 +/- 1.8 years; girls = 361, boys = 374) were collected from the 2016-2017 Roanoke Valley Community Healthy Living Index. Correlation analysis was used to examine relationships between perceptions of access to healthy foods and BMI-for-age z-scores. Results: A significant negative correlation was found between perceived access to healthy foods and weight-related health status in youth,  $r(733) = -0.10$ ,  $p < 0.01$ . Conclusions: Our findings expand upon previous studies by considering the impact of perceived access to healthy foods on youth health outcomes. Specifically, as perceptions of access to healthy foods increased, BMI-for-age declined among elementary school-aged youth. To explore this question further, future studies should consider the relationship between perceptions of access to healthy foods on nutrition-related beliefs and behaviors among elementary school-aged youth.

### ACUTE EFFECTS OF CAFFEINE INGESTION ON VELOCITY AND POWER OUTPUT DURING RESISTANCE EXERCISE

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PURPOSE: The purpose of this study was to examine the acute effects of caffeine (CAFF) supplementation on velocity and power output during bench press and back squat exercises. METHODS: Resistance-trained males who consume less than 300 mg of CAFF daily were recruited for this study. In a within groups counterbalanced study design, participants were supplemented with 6 mg·kg<sup>-1</sup> CAFF or placebo (PL, gluten-free cornstarch) 60 minutes prior to exercise. Participants completed three sets of 1 repetition with maximum explosive intent at 80% of their one repetition maximum (1RM) for bench press and back squat exercises. Two-minute rest periods were given between each repetition. During the exercise, a liner position transducer was used to measure power and velocity of the barbell movement. Each trial was separated by a 72-hour washout period. RESULTS: Mean velocity ( $p = 0.027$ ; ES=1.04) and mean power ( $p=0.008$ ; ES=0.24) were greater over the three repetitions during bench press exercise with CAFF versus PL. Furthermore, mean velocity ( $p=0.005$ ; ES=1.06) and mean power ( $p=0.020$ ; ES=0.71) values were higher over the three repetitions for back squat exercise with CAFF versus PL. CONCLUSION: This study suggests that CAFF ingestion imposes ergogenic benefits by increasing both velocity and power during upper and lower body multi-joint resistance exercises.

### LONG-TERM EFFICACY OF CONVERTING NITRATE IN BEETROOT JUICE TO PLASMA NITRITE

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Beets contain high concentrations of dietary nitrate (NO<sub>3</sub>), which converts to nitrite (NO<sub>2</sub>) and then nitric oxide (NO) in the body. Benefits of short-term dietary nitrate consumption include decreased vascular stiffness, reduced blood pressure, and improved exercise performance. The effect of long-term consumption of beetroot juice on plasma nitrite is not known. Purpose: Investigate the long-term effects of beetroot juice on the efficacy of converting dietary NO<sub>3</sub> to plasma NO<sub>2</sub>. Healthy participants (10 female and 3 male; mean age=56 years) were randomized to consume beetroot juice with NO<sub>3</sub> (400 mg NO<sub>3</sub>) (BRJ+) and without NO<sub>3</sub> (BRJ-). All participants consumed their designated beetroot juice once daily for 12 weeks. On 7 occasions throughout with higher plasma NO<sub>3</sub> and NO<sub>2</sub> for the BRJ+ vs BRJ- groups. Additionally, following an overnight fast, plasma NO<sub>3</sub> and NO<sub>2</sub> were higher in BRJ+ as compared to BRJ-. For the BRJ+ group, % change for plasma nitrite from pre to post ranged week to week from +154% to +396%, which may be a reflection of the impact of diet on the conversion, and a reflection of oral microbiome and gut environment. Since beetroot juice raises NO<sub>3</sub> and NO<sub>2</sub> with chronic consumption, more long-term studies should be conducted to examine health benefits of sustained beetroot juice intake.

### INFLUENCE OF MODIFIED STARCHES ON MENTAL PERFORMANCE AND PHYSICAL ENDURANCE FOLLOWING EXHAUSTIVE EXERCISE

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Slow-releasing carbohydrates may delay the effects of fatigue after exhaustive exercise. Purpose: Observe the influence that hydrothermally modified starches (HMS) and traditional maltodextrin (MAL) supplements had on physical endurance and mental performance following exhaustive exercise. Methods: Male participants completed a VO<sub>2</sub> max and two days of cycling sessions using a Velotron ergometer. Cycling sessions were performed at 70% of the VO<sub>2</sub> max workload for 150 minutes. Supplements were consumed 30 minutes prior to cycling and during exercise at the 120-minute mark (1 g CHO/kg body weight). Brain activity was measured using a Neuroscan 64-channel Electroencephalogram (EEG) cap. Go-no-Go and N-back tasks were performed before and after cycling bouts. Blood glucose, lactate, ketones, cortisone, and urine specific gravity were measured before, during, and after cycling. Heart rate (HR), VO<sub>2</sub>, and Rate of Perceived Exertion (RPE) were recorded in 15-minute intervals. Results: Ketones increased significantly more for HMS than MAL from pre to post cycling measurements ( $p < .05$ ). Glucose spikes occurred for MAL. HR increased over time during MAL use. Reaction times for Go-no-Go and N-back were faster for HMS post exercise. Event Related Potential (ERP) differences were present in both mental tasks following exhaustive exercise. Conclusion: HMS supplementation decreased the impact of cognitive and physical fatigue post exercise.

**PACING STRATEGY ADHERENCE DURING AN ENDURANCE CYCLING EVENT**HA Yoder<sup>1,2</sup>, CL Keeter<sup>2</sup>, NM Sauls<sup>2</sup>, CX Muñoz<sup>3</sup>, JE Wingo<sup>1</sup>, EC Johnson<sup>2</sup>, and LE Armstrong<sup>4</sup>.<sup>1</sup>University of Alabama, Tuscaloosa, AL; <sup>2</sup>University of Wyoming, Laramie, WY; <sup>3</sup>University of Hartford, West Hartford, CT; <sup>4</sup>University of Connecticut, Storrs, CT

Purpose: To evaluate pacing strategy adherence and performance during a 161 km road-cycling event. Methods: Cyclists (n=19; 54±7 y, 87±7 kg, 178±7 cm) competing in the event with GPS systems provided researchers with race data. Pre-race, subjects completed a questionnaire indicating goals and pacing strategy. Pacing strategies were “even” (maintain constant effort; n=6, “positive” (start fast and slow at the end; n=6) or “variable” (increase or decrease pace in response to external factors; n=7). One-way ANOVAs compared groups’ anthropometrics and goal times. A one-way ANOVA for coefficient of variation of velocity and regression analysis for velocity over distance were completed to determine if strategy was adhered to. One-way ANOVAs compared groups finish times and percent time off goal times to evaluate performance. Results: There were no significant differences in goal times (P=0.21). Groups were not different for coefficient of variation of velocity (P=0.28). Regression analysis signified a difference between distance and velocity in all groups (P<0.01). “Positive” demonstrated an inverse relationship between mileage and velocity (P=0.02, R<sup>2</sup>=0.08). There was no difference in finish time (P=0.34) or percent off goal time (P=0.39) for all groups. Conclusions: Finish time, goal time, or percent off of goal time are not influenced by pacing strategy.

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**RECREATIONAL RUNNERS LACK HYDRATION KNOWLEDGE AND PLACE LITTLE IMPORTANCE ON FLUID REPLACEMENT GUIDELINES**B.A. Davis<sup>1</sup>, R.S. Farley<sup>2</sup>, J.M. Coons<sup>2</sup>, D.K. Fuller<sup>2</sup>, E.K. O’Neal<sup>3</sup>, J.L. Caputo<sup>2</sup>. <sup>1</sup>Kentucky Wesleyan College, Owensboro, KY; <sup>2</sup>Middle Tennessee State University, Murfreesboro, TN; <sup>3</sup>University of North Alabama, Florence, AL

Purpose: Evaluate the hydration knowledge of recreational runners and determine the primary information sources used to develop their hydration strategies. Methods: A survey was administered online using Qualtrics software (N = 162). Runners: 1) reported training volume, race experience and times, and supervised training; 2) answered multiple choice questions on ACSM (American College of Sports Medicine) and NATA (National Athletic Trainer’s Association) hydration guidelines; and 3) rated the importance of sources of information used in developing hydration strategies. A weighted z-score calculated from training volume, race times, and race experience (VPE) was used to place runners into tertiles. Results: Hydration knowledge scores for low, moderate, and high VPE groups were 41 ± 18, 44 ± 13, and 33 ± 21, respectively, with the moderate group having greater knowledge than the high group (p = 0.005). The majority of runners incorrectly answered questions on body weight loss and distance running performance, day-to-day body weight fluctuations, use of body weight change to determine post-exercise fluid needs, and volume of fluid needed to achieve recovery from dehydration. Advice from other runners was rated most important (p < 0.001) with little importance placed on information from ACSM and NATA guidelines. Conclusions: A deficit exists among recreational runners in hydration knowledge. This knowledge gap may be due to hydration advice from sources such as peer runners, websites, and fitness magazines versus ACSM and NATA guidelines. Improved dissemination of professional organization guidelines is warranted.

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**EFFECTS OF ACUTE BEETROOT JUICE SUPPLEMENTATION ON BENCH PRESS POWER, VELOCITY, AND VOLUME**

Mary Page Martin, Tyler Williams, Rebecca Rogers, Christopher Ballmann; Dept. of Kinesiology, Samford University, Birmingham, AL

PURPOSE: The purpose of this study was to examine the effects of acute beetroot juice (BRJ) supplementation on power, velocity, and repetitions to failure (RTF) during the bench press exercise. METHODS: Resistance-trained male and female participants were recruited for this study. In a within-groups counterbalanced study design, participants were supplemented with either 70 ml of BRJ or placebo (Black-currant juice; PL) two hours before exercise. During each exercise trial, participants began by completing 2 sets × 2 repetitions of bench press at 70% 1-RM with maximum explosive intent. Power and velocity of barbell movement was measured using a linear position transducer. Participants then completed 3 sets to concentric muscular failure at 70% 1-RM separated by 2 minutes of rest between each set. Maximum mean power, velocity, and total RTF were analyzed. RESULTS: Velocity of barbell movement was significantly higher with BRJ when compared to PL (p=0.011). Total RTF was significantly increased with BRJ versus PL (p=0.001). However, power of barbell movement was unaffected (p=0.12) CONCLUSION: Results indicate that acute BRJ supplementation positively impacts both velocity and RTF in bench press exercise.

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Time/Day	Lobby	Conference	Ochs	Kelley	Walker	Rose	Roberts	Amphitheater	Chattanooga Ballroom	Ballroom	Kinsey	Littleton	Frierson	Crabtree	Game Room
15-Feb		Concierge							1,2,3,4	Foyer					
11:00 AM											Board Meeting				
12:00 PM											11:00-1:00				
1:00 PM	Registration											AV Meeting			
2:00 PM	Student Help Desk				PC2	PC1						1:00-1:45			
3:00 PM	1:00-6:00 pm				PC3										
4:00 PM		Exhibits	TP1-TP6	O1-O8	S1	S2	T1	T2		Student Awards					
5:00 PM		4:00-6:30 pm	4:00-5:30	4:00-6:00	S3	S4	T3	T4		D1-D8, M1-M8, U1-U8					
6:00 PM										P1-P48					
7:00 PM									Keynote	4:00-6:00					
8:00 PM									7:30-9:00						
9:00 PM	SEACSM Social														
10:00 PM	9:00-10:30														
Time/Day	Lobby	Conference	Ochs	Kelley	Walker	Rose	Roberts	Amphitheater	Chattanooga Ballroom	Ballroom	Kinsey	Littleton	Freirson	Crabtree	Game Room
16-Feb		Concierge							1,2,3,4	Foyer					
6:00 AM									Emily Haymes B-fast						
7:00 AM									6:45-7:45						
8:00 AM	Registration	Exhibits	TP7-TP12	O9-O16	S5	S6	T5	T6		Posters					
9:00 AM	Student Help Desk	8:00-6:00 pm	8:00-9:30	8:00-10:00	S7	T7	T8	T9		P49-P120					
10:00 AM	8:00-5:00 pm								ACSM Pres. Address	8:00-9:30					
11:00 AM									Clinical Crossover						
12:00 PM				Minority Health			Biomechanics	Clinical Track						Past Pres. Lunch	
1:00 PM				Interest Group			Interest Group	12:30-5:45	Basic Science					12:00-1:00	
2:00 PM				12:30-1:15			12:30-1:15		1:15-2:15						
2:30 PM			TP13-TP18	O18-O24	S8	S9	T10			Posters					
3:00 PM			2:30-4:00	2:30-4:30						P121-P192					
3:30 PM					S10	T11	T12			2:30-4:00					
4:00 PM															
4:30 PM									Student Bowl						
5:00 PM									4:30-6:00						
6:00 PM						Grad Fair	Grad Fair								Clinical Reception
7:00 PM						6:15-7:45	6:15-7:45								6:30-7:15
8:00 PM															
Time/Day	Lobby	Conference	Ochs	Kelley	Walker	Rose	Roberts	Amphitheater	Chattanooga Ballroom	Ballroom	Kinsey	Littleton	Freirson	Crabtree	Game Room
17-Feb		Concierge							1,2,3,4	Foyer					
7:00 AM	Run meet at 6:30							Clinical Track						Yoga	
8:00 AM		Exhibits	TP19-TP24	O25-O32	T13	T14		7:30-12:45		Posters				6:45-7:45	
9:00 AM		8:00-12:00 pm	8:00-9:30	8:00-10:00	T15	T16	S11			P193-P264 8:00-9:25					
9:30 AM										Posters					
10:00 AM										P265-P336 9:30-11:00					
11:00 AM							Montoye								
12:00 PM							Lecture								
1:00 PM									Luncheon						
2:00 PM									12:00-2:00						
											Board Meeting				
											2:00-4:00				

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