

#1

## TITLE: IMPACTS OF EXERCISE TRAINING ON THE VISCERAL ADIPOSE TISSUE AMONG INDIVIDUALS WITH NORMAL BODY MASS INDEX: A SYSTEMATIC REVIEW

AUTHORS: Fatemeh Bagherpour, MS; Hamid Arazi, PhD

Affiliations: Department of Exercise Physiology, Faculty of Sport Sciences, University of Guilan, Rasht, Iran; Department of Exercise Physiology, Faculty of Sport Sciences, University of Guilan, Rasht, Iran

First author's contact: bagherpour.fl994@gmail.com

**BACKGROUND:** The thin outside fat inside (TOFI) phenotype, an obesity expression, is recognized by a high amount of visceral adipose tissue (VAT) despite average anthropometric measurements such as normal body mass index (BMI). High VAT is a considerable risk of metabolic syndrome. As a beneficial intervention, exercise training can decrease body fat amount. This review aimed to investigate exercise efficiency on VAT in individuals with normal BMI. **METHODS:** Electronic databases were used to detect studies related to exercise training intervention on VAT in normal BMI individuals from 1999 to 2022. Inclusion criteria included acute, four weeks or more; duration intervention of aerobic training (AT), resistance training (RT) or combination training (COM) with adults. Participants BMIs were approximately 26 kg/m<sup>2</sup> or less in studies investigating VAT differences between sedentary and active individuals. Acceptable body assessment measurements in the studies used computed tomography, magnetic resonance imaging, or dual-energy x-ray absorptiometry. **RESULTS:** The primary search resulted in 217 original studies and 11 were included. The most common intervention was AT, using treadmill running, and the most common mode of RT was weight machines. Frequency of training averaged 3 days per week of 30- to 90 minute sessions. AT intensity was demonstrated with the percentage of maximum oxygen consumption (VO<sub>2</sub> max), peak rate of oxygen consumption (VO<sub>2</sub>peak), heart rate reserve (HRR), or maximal heart rate (MHR) in the range of 55% to 120%. The most common range was 60- 70% MHR. The intensity of RT was determined as one-repetition maximum (1-RM), ranging between 60-80% 1RM. One study used interval modality intervention. Seven studies show a significant decrease in VAT values. The most impactful training was AT with two studies using COM also reported benefits. The most common unit of measurement used for VAT was cm<sup>2</sup>. Other studies used varying units such as 1) kg, 2) cm<sup>3</sup>, 3) liter, and 4) percentage of total body fat. The range of significant change in VAT scores was  $-2.5 \pm 7.2$  cm<sup>2</sup> to  $-19.3 \pm 12.7$  cm<sup>2</sup>. Additionally, one study reported significant differences in VAT observed between active and sedentary individuals and one study reported no demonstrated differences using RT. **CONCLUSIONS:** The systematic review suggests exercise training could be a beneficial intervention for improved VAT changes. However, exercise modality should be taken into account alongside acute variables such as volume, intensity, duration, and frequency. Based on findings, AT is the most effective modality and RT as another exercise option needs more investigation.

#2

TITLE: THE EFFECTS OF A SUMMER PROGRAM ON PHYSICAL FITNESS AND HEALTH OUTCOMES IN CHILDREN

AUTHORS: Joseph A. Bonner, MS; Carolina Velasquez, PhD; Natasha Cruz, MS; Alexis Friedman, PhD; Debbiesu Lee, PhD; Arlette C. Perry, PhD

Affiliation: University of Miami, Miami, FL

First author's contact: J.Bonner1@umiami.edu

**BACKGROUND:** High rates of adolescent obesity and its associated co-morbidities have been attributed to a lack of physical activity and unhealthy nutrition habits. This is especially apparent during the summer months, when adolescents are out of school and do not have the structure of the academic year and its planned extracurricular activities. The Translational Health in Nutrition and Kinesiology (THINK) program is a nutrition and exercise science curriculum that is interfaced with social emotional learning (SEL) to enhance to personal health and lifestyle behaviors in middle school youth. The purpose of this study is to determine whether the THINK program could improve physical fitness, nutrition habits, and SEL in a 6-week summer program across a 3 year period. **METHODS/DESIGN:** Participants from the South Miami community were enrolled in the THINK (n =108, 58 males, 50 females, 12.03 +.56 years). The assessments of physical fitness included: cardiorespiratory fitness (CRF) using the Pacer test, flexibility using the Sit & Reach test, power using the Vertical Jump test, agility using the Shuttle Run, and muscular endurance using the Curl-up test. Body composition was analyzed using the Inbody 520 and SEL was measured using the Positive Youth Inventory. Food habits were measured using the Adolescent Food Habits Checklist. Means and standard error values were evaluated for all dependent variables. Paired sample t-tests (SPSS version 27) were performed to determine changes in dependent variables over time. **RESULTS:** Significant improvements in CFF (p<.001), power (p<.006), flexibility (p<.001), agility (p<.001), muscular endurance (p<.001), lean body mass (p<.001) Food Habits (p<.001), and SEL (p=.038) were found. **CONCLUSION:** An integrative and physically active summer program can result in improvements in physical fitness, nutrition habits, and SEL in as little as 6-weeks. The emphasis on physical activities in combination with nutrition, science and SEL in programs such the THINK program may serve as novel approach for improving physical fitness and lifestyle behaviors in middle school adolescents during the summer months. Future studies should include control groups to determine whether these changes occur independent of typical maturation and developmental processes in youth.

#3

TITLE: THE ROLE OF THE EXERCISE PROFESSIONAL IN THE SUPERVISED VERSUS TELEREHABILITATION EXERCISE PROGRAMS FOR MULTIPLE SCLEROSIS (STEP FOR MS) TRIAL

AUTHORS: Kathryn A. Born, MS; Whitney Neal, MS; Alexander V. Ng, PhD; Deborah Backus, PT, PhD; Robert W Motl, PhD.

Affiliations: KAB, Marquette University, Milwaukee, WI; WN, University of Alabama Birmingham, Birmingham, AL; AVG, Marquette University, Milwaukee, WI; DB, Shepherd Center, Atlanta, GA; RWM, University of Illinois Chicago, Chicago, IL.

First author's contact: [kathryn.born@marquette.edu](mailto:kathryn.born@marquette.edu)

**BACKGROUND:** The STEP for MS trial was designed and delivered by a team of medical and rehabilitation professionals with a key player being the exercise professional (EP). Our purpose is to showcase the role of the EP and methods for standardized, safe and effective exercise and behavior change intervention. **DESIGN:** Site principal investigators who designed the intervention and implementation plan were physical medicine and rehabilitation doctors, physical therapists and kinesiologists with expertise in MS and exercise programming. The interventional EP were site staff members with varied backgrounds in delivering exercise programming to people with MS. Professional titles include personal trainer, exercise specialist, clinical exercise physiologist, graduate teaching assistant, research associate, clinical integration and research coordinator. Interventionalists had little to no prior experience using the theory-based behavior change strategies employed in the trial. **METHODS:** To accommodate differences in EP backgrounds and expertise, standardized training on behavior change principles and exercise prescription was required. Weekly booster meetings were held via Zoom to discuss participant progress, challenges and identify solutions and modifications to the intervention while maintaining trial fidelity. Supporting materials like exercise training manuals, scripts, newsletters, logbooks and calendars were used by EPs to deliver the intervention. EPs deployed their unique skills and training to provide guidance on exercise program progression, exercise technique modification and behavior change strategies to participants. EPs and participants mutually decided on the trajectory of exercise progression based on experiences during the first 2 standardized weeks. The trajectories differed in the rate of progression with all participants meeting the exercise guidelines of 30 minutes of aerobic exercise and 5-10 strength exercises consisting of 1-2 sets, 10-15 repetitions targeting lower body, upper body, and core musculature 2 days a week, by week 10 of the program. Outcome measures were transcribed by EPs in a research database. **CONCLUSION:** There was a varied skillset among principal investigators and interventionalists in the STEP for MS trial which provided a well-rounded intervention to people with MS. Standardized training, trial-issued supporting materials and weekly booster meetings enabled successful and standardized program implementation across 8 sites.

#4

TITLE: CARDIOPULMONARY RESPONSE TO EXERCISE IN PATIENTS WITH NEUROMUSCULAR DISEASE

AUTHORS: Jeffrey W. Christle, PhD, ACSM CEP; Tina Duong, PhD; Constance de Monts, DPT; Noirin Maire Ni Ghiollagain, BS; Dana Parker, MS; Veronica Stevens, BS; Sally Dunaway Young, DPT; Beth D Kaufman, MD, Whitney Tang, BA; Jacinda Sampson, PhD; Jonathan Myers, PhD; Euan A. Ashley, PhD; John Day, PhD; Matthew T. Wheeler, PhD

Affiliations: Stanford University, Stanford, CA, USA

First author's contact: [christle@stanford.edu](mailto:christle@stanford.edu)

**BACKGROUND:** Standard of care for patients with neuromuscular disease (NMD) includes exercise testing and exercise therapy. The focus of exercise in this group is to respond to muscular skeletal pathologies related to NMD, improve general health and fitness and health related quality of life. Cardiopulmonary exercise testing CPX is the gold standard for assessing cardiorespiratory fitness, but the use of CPX has been limited in NMD, especially for those patients with low mobility. We present our data on peak CPX and submaximal A6MCT exercise testing in patients with NMD and limited mobility. **METHODS:** We prospectively recruited and consented consecutive patients who were performing outpatient physical therapy at the Neuromuscular Clinic at Stanford University Hospital. Patients performed CPX to volitional exhaustion on a total body trainer and/ or A6MCT at highest pace possible for six minutes on an ergometer. Respiratory gas data were collected on a breath-by-breath basis and analyzed after applying a rolling 30 second average filter. Collected data were compared and contrasted between CPX and A6MCT and compared to normative data and controls. **RESULTS:** There were no complications or adverse events during the study, and data quality was adequate for CPX and A6MCT and comparable to controls. Average respiratory exchange ratio (RER) for patients with NMD was  $1.08 \pm 0.16$  and average rating of perceived exertion (RPE) was  $18.4 \pm 2.1$  compared to  $1.16 \pm 0.12$  and  $18.1 \pm 2.0$  for controls. NMD patients on average showed markedly reduced percent predicted VO<sub>2</sub> max ( $55.6 \pm 24.9$  percent predicted) and impaired ventilatory efficiency. **CONCLUSIONS:** Quality exercise testing is possible and worthwhile in patients with NMD and low mobility. Especially CPX may offer strong and standard assessment of CRF which may provide valuable clinical data both specific to NMD and nonspecific to improve outcomes. Although a commonly performed procedure, A6MCT would need more study to illustrate its utility for patients with NMD.

#5

TITLE: EXERCISE HAS NO EFFECT ON KNEE JOINT CREPITUS. A SYSTEMATIC REVIEW AND META-ANALYSIS

AUTHORS: Alexandre Kovats B.ExPhys, AEP; Matthew Jones PhD, AEP; Adrian Ram B.ExPhys, AEP; Darryl Ser Foong Ho B.Med; Alexandra Azzi, B.MedSc(Hons); Jeanette Thom PhD

Affiliations: School of Health Sciences, Faculty of Medicine and Health, University of New South Wales; Sydney, Australia

First author's contact: a.kovats@student.unsw.edu.au

CATEGORY: Musculoskeletal

**BACKGROUND:** Noise emanating from the knee upon movement (crepitus) is one of the primary symptoms of knee osteoarthritis (OA). Exercise and education are key components of evidence-based guideline recommendations for prevention and treatment of OA. However, there is limited evidence if these approaches alter knee crepitus. Exercise professionals are faced with client concerns of crepitus during exercise; providing reassurance to the contrary may help exercise adherence. Thus, we aimed to determine if knee crepitus improves with exercise or education, either alone or combined, in healthy individuals or in people with early or established OA. **METHODS/DESIGN:** We conducted a systematic review and meta-analysis. Electronic databases (CINAHL, Embase, PsycINFO, PubMed, and SportDISCUS) were searched from inception to 1 July 2022 for studies of adults (>18 years) with OA or reporting knee crepitus who undertook exercise or education compared to control. Risk of bias was appraised using the Cochrane Risk of Bias tool (v2). Data was analysed using a random-effects meta-analysis. **RESULTS:** 12 studies were included, with data from seven contributing to the meta-analysis. All included studies measured crepitus using the KOOS subscale following varying supervised and unsupervised exercise interventions (aquatic, resistance (weights, body weight, theraband), stretching, circuit, aerobic (cycle, treadmill, arm crank)) for 30-60 minutes at moderate to vigorous intensity, 3-7 days/week over 12-52 weeks. Across 379 participants (n=201 exercise, n=184 control, 82% female), mean crepitus at baseline was 2.0 on a 5-point scale. There was no difference in the effect of exercise compared to control on crepitus (MD: 0.01; 95% CI -0.023, 0.021). The remaining five studies, excluded from the meta-analysis due to exercising controls, had similar characteristics. Risk of bias ranged from low to high, with bias introduced due to issues with randomization, reporting of results, noted deviations from intended interventions and missing outcome data. **CONCLUSIONS:** Based on studies with mixed risk of bias, knee crepitus is unlikely to change in individuals with established OA following exercise. Thus, Exercise Physiologists can provide reassurance to people who are concerned about their noisy joints that exercise should not exacerbate symptoms.

#6

TITLE: GLUCOSE INTOLERANCE PREDICTS CARDIORESPIRATORY FITNESS IN A HEALTHY POPULATION

AUTHORS: Joshua Labadah, MPhil; Jehu Narh Apafllo, MS; Gabriel Narvaez, BS; Victoria Rocha; Ali Mossayebi, MS; Ana Pedroza Villegas; Sudip Bajpeyi, PhD

Affiliations: Metabolic, Exercise and Nutrition Research Laboratory, The University of Texas at El Paso, El Paso Texas

First author's contact: Minerlab@utep.edu

**BACKGROUND:** Aerobic capacity or maximum oxygen consumption rate (VO<sub>2</sub>max) is accepted as the single best indicator of cardiorespiratory fitness. VO<sub>2</sub>max is also an indicator of metabolic health and known as an all-cause mortality predictor. It is well established that glucose intolerance and insulin resistance in patients with diabetes is associated with decline in cardiorespiratory fitness. However, it is not clear if glucose intolerance is associated with poorer cardiorespiratory fitness in a population without diabetes. Therefore, the purpose of this study was to assess if glucose intolerance measured by oral glucose tolerance test (OGTT) is associated with cardiorespiratory fitness in a population without diabetes. **METHODS:** Fifty one (30 males and 21 females) predominantly Mexican-American adults without diabetes (Age  $26.1 \pm 5.3$  years; BMI  $26.7 \pm 4.2$  kg/m<sup>2</sup>; fasting blood glucose  $92.1 \pm 10.0$  mg/dL) from the border region of El Paso, TX participated in this study. VO<sub>2</sub>max was assessed using a standardized graded exercise test protocol on a treadmill with Parvomedics metabolic cart. Glucose tolerance was measured by a 3-hour OGTT performed after a 12-hour overnight fast. Blood glucose measured at fasting and every 30 minutes after the ingestion of 75g of glucose drink during OGTT and glucose area under the curve was determined to assess glucose tolerance. Pearson correlation analysis was performed at 0.05 significance level. **RESULTS:** Glucose intolerance measured by glucose area under the curve was negatively correlated with VO<sub>2</sub>max ( $r = -0.40$ ,  $p = 0.006$ ). Additionally, blood glucose level during OGTT test at 120 min ( $r = -0.43$ ,  $p = 0.003$ ), 150 min ( $r = -0.36$ ,  $p = 0.014$ ), and 180 min ( $r = -0.32$ ,  $p = 0.048$ ) were also negatively associated with VO<sub>2</sub>max. However, fasting blood glucose was not associated with VO<sub>2</sub>max ( $r = -0.09$ ,  $p = 0.56$ ). **CONCLUSION:** Poorer cardiorespiratory fitness is indicated by greater glucose intolerance and a greater surge of glucose level during an OGTT, but not fasting blood glucose in a population without diabetes.

#7

## TITLE: VERTICAL JUMPING CAPACITY AND CARDIAC ADAPTATIONS: IS THERE A LINK IN SOCCER PLAYERS?

AUTHORS: Vassilios Panoutsakopoulos, PhD; Nikolaos Koutlianos, PhD; Zacharias Papadakis, PhD, FACSM, ACSM EP; Evangelia Kouidi PhD

Affiliations: VP, Biomechanics Laboratory, School Of Physical Education And Sports Science At Thessaloniki, Aristotle University Of Thessaloniki, Greece; NK, Laboratory of Sports Medicine, School of Physical Education and Sports Science at Thessaloniki, Aristotle University of Thessaloniki, Greece; ZP, Human Performance Laboratory, Department of Health Promotion and Clinical Practice, College of Health and Wellness, Barry University, Miami Shores, FL; EK, Laboratory of Sports Medicine, School of Physical Education and Sports Science at Thessaloniki, Aristotle University of Thessaloniki, Greece

First author's contact: bpanouts@phed.auth.gr

**BACKGROUND:** Athletes' cardiac screening is challenging. The distinction between abnormal and normal is further hindered by the fact that cardiac adaptations differ between endurance and power athletes. Soccer performance depends on both cardiovascular and musculoskeletal systems. Most of the studies are focused on cardiac and aerobic adaptations related to left ventricular hypertrophy (LVH), but there is lack of studies examining musculoskeletal and anaerobic adaptations that elicit cardiac remodeling. The aim of this study was to examine whether the anaerobic jumping performance, as evaluated by vertical jump parameters achieved at a repetitive jump test (RVJ), was related to the left ventricular mass index (LVMI) in Greek soccer players. **METHODS/DESIGN:** Elite male professional players ( $N = 19$ , age =  $25.7 \pm 4.6$  yrs) participated in this study as part of their annual physical and physiological performance screening. The participants performed a RVJ test consisted of 15 continuous maximal effort countermovement jumps. Echocardiography measurements of left ventricular mass (LVM) and body surface area (BSA) were used to calculate the LVMI as  $LVM/BSA$  in  $g/m^2$ . LVMI value of  $115 g/m^2$  is considered to be a cut-off value for LVH and two groups were additionally formed: group A with  $LVMI \geq 115 g/m^2$  ( $n = 11$ ) and group B with  $LVMI < 115 g/m^2$  ( $n = 8$ ). Independent samples T-test was used to examine the maximum jump height ( $JH_{max}$ ) difference between the groups. Pearson's correlation analysis was run to check the relationship between LVMI raw values and  $JH_{max}$ . Statistical analysis was performed using the R-based Jamovi software (version: 2.3.3.0), with the level of significance set at  $\alpha = 0.05$ . **RESULTS:** LVMI raw values were  $143.14 \pm 18.06 g/m^2$  and  $108.22 \pm 9.66 g/m^2$  in groups A and B, respectively. Group A had significantly lower  $JH_{max}$  compared to Group B ( $0.29 \pm 0.04 m$  vs  $0.35 \pm 0.04 m$ , respectively;  $t_{17} = -3.39$ ,  $p = 0.003$ , Hedges'  $g = 1.43$ : large effect size). In the total sample, LVMI raw values correlated significantly with  $JH_{max}$  ( $r = -0.53$ ,  $p = 0.020$ ). **CONCLUSIONS:** Soccer players with  $LVMI \geq 115 g/m^2$  values had lower RVJ performance compared to those with  $LVMI < 115 g/m^2$ . Resistance training, which is common in soccer, leads to cardiac anatomic adaptations such as LVH. The utility of the RVJ performance as a prognostic component for cardiac remodeling is weak. Even though soccer is a mixed type sport, aerobic adaptations are still the key prognostic elements for LVH.

#8

TITLE: EXERCISE IMPROVES HEART RATE RECOVERY GREATER THAN STANDARD CARE IN TYPE 2 DIABETES

AUTHORS: James Shadiow, MS; Ryan Perkins, PhD; Corey Mazo, MS; Edwin R. Miranda, PhD; Jacob M. Haus, PhD

Affiliations: Human Bioenergetics Laboratory, School of Kinesiology, University of Michigan, Ann Arbor, Michigan

First author's contact: [jshadiow@umich.edu](mailto:jshadiow@umich.edu)

**INTRODUCTION:** An attenuated heart rate recovery (HRR) immediately after exercise is considered an index of autonomic imbalance and is a predictor of all cause mortality in patients with type 2 diabetes (T2D). Because autonomic dysfunction in T2D patients has shown to be reversible with glycemic control, weight loss, and fitness gain, we investigated the effect of a 12 week aerobic exercise (AE) intervention compared to standard care on HRR in patients with T2D. **METHODS:** T2D patients (n=32) were randomized to a 12-week AE intervention (n=19) or standard of care (n=13). The AE intervention consisted of supervised exercise training for 1h/day 5/wk for 12 weeks at 80% VO<sub>2</sub>peak. All subjects completed body composition analysis (DEXA), oral glucose tolerance test (OGTT), and maximal exercise testing before and after the study period. HRR was measured every minute for 10 minutes after cessation of maximal exercise testing. **RESULTS:** Baseline HRR 1-minute values were negatively associated with ASCVD Risk ( $\rho = 0.623$ ;  $p = 0.002$ ) and positively associated with VO<sub>2</sub>peak ( $\rho = 0.361$ ;  $p = 0.042$ ). Body weight was unchanged in both control ( $p = 0.989$ ) and AE group ( $p = 0.248$ ) after the study period. Following AE training intervention, VO<sub>2</sub>peak increased by  $7.4 \pm 1.9\%$  ( $p < 0.001$ ), glucose metabolism, as measured by OGTT area under the curve (AUC), improved by  $11.6 \pm 6.0\%$  ( $p = 0.040$ ), and HRR 1-minute increased by  $10.4 \pm 6.1\%$  ( $p = 0.234$ ). The control group showed no significant changes as VO<sub>2</sub>peak increased by  $0.7 \pm 2.6\%$  ( $p = 0.826$ ), AUC improved by  $3.1 \pm 3.5\%$  ( $p = 0.585$ ), and HRR 1-minute increased  $3.9 \pm 9.0\%$  ( $p = 0.915$ ). Baseline HRR predicted change in HRR after the study period in the control group ( $\rho = -0.817$ ;  $p = 0.002$ ) but not in the AE group ( $\rho = -0.054$ ,  $p = 0.860$ ). Upon controlling for baseline HRR, AE group possessed a significantly higher post intervention HRR 1-minute value than control by 28.5% ( $p = 0.036$ ). We found the AE group also had higher HRR values than control during the post-intervention 10-minute recovery resulting in a main effect of group ( $p < 0.001$ ). **CONCLUSIONS:** T2D patients with higher HRR, only receiving standard of care, are more susceptible to chronic detriments in HRR indicative of gradual autonomic function loss. To our knowledge these are the first data showing regular moderate-vigorous intensity exercise, which improved glycemic control and fitness gain independent of weight loss, outperforms standard of care alone for greater HRR.

#9

TITLE: IMPROVEMENTS AFTER PATIENT-SPECIFIC ADAPTIVE DYNAMIC CYCLING IN PARKINSON'S DISEASE

AUTHORS: Brittany Smith, MS, ACSM CEP; Younguk Kim, PhD, ACSM EP; Jessica Smith Ricketts, MS, ACSM EP; Angela L. Ridgel, PhD, ACSM EP, FACSM

Affiliations: Kent State University, Kent, OH

First author's contact: bsmit258@kent.edu

**BACKGROUND:** Parkinson's disease (PD) is a progressive neurological disorder characterized by symptoms of bradykinesia, tremor, and muscle rigidity. Previous studies have shown that high cadence dynamic cycling promotes significant improvement in PD motor symptoms. This improvement is attributed to a higher entropy (variability) of cadence during dynamic cycling. However, it is not clear how entropy of cadence and level of effort can be utilized to develop individualized exercise prescriptions for individuals with PD, as well as how patient specific adaptive dynamic cycling impacts motor function and mobility in individuals with PD.

Therefore, the purpose of this study was to develop an individualized exercise paradigm by manipulating entropy of cadence and level of effort and also examine the effects on motor function and mobility in PD. **METHODS/DESIGN:** 11 individuals diagnosed with idiopathic PD were randomized into either the patient-specific adaptive dynamic cycling (PSADC) or an active control (AC) group. The dynamic cycle resistance settings were optimized for each individual in the PSADC group, while settings remained constant in the AC group. Each group completed 12 sessions over the course of 4 weeks. Motor function and mobility were measured at baseline and after 12 exercise sessions using the clinical and Kinesia One Unified Parkinson's Disease Rating Scale Motor III (UPDRS Motor III) and the Timed Up and Go (TUG). The UPDRS Motor III is the gold standard measurement of PD symptom severity. TUG is a mobility assessment that is highly correlated to overall functional mobility. Outcome measures were compared using repeated measures ANOVA, as well as paired samples and independent samples t-tests.

**RESULTS:** Individuals in the PSADC group saw significant improvements UPDRS Motor III score (Pre: 43.33, Post: 36.67;  $p=0.040$ ), Kinesia One UPDRS Motor III score (Pre: 25.142, Post 23.833;  $p = 0.017$ ), and TUG completion time (Pre: 12.37s, Post: 9.99s;  $p=0.036$ ) from baseline to follow up. Individuals in the AC group did not significantly improve motor function (Pre: 28.60, Post: 29.60) or mobility (Pre: 11.23s, Post: 10.85s). **CONCLUSIONS:** PSADC is associated with significant improvements in motor function and mobility in individuals with PD. Future studies will consider developing machine learning or artificial intelligence algorithms to provide accurate and valid exercise prescriptions to be utilized in the clinical rehabilitation for individuals with PD.

#10

TITLE: PREDICTED MAX HEART RATE SHOULD NOT BE USED FOR PATIENTS IN CARDIAC REHABILITATION

AUTHORS: Katherina Steenson, MS; Steven J. Keteyian, PhD; Crystal Grimshaw, MS; Noah Mandel, MS; Clinton A. Brawner, PhD, ACSM CEP

Affiliations: Henry Ford Hospital and Medical Group

First author's contact: [ksteens1@hfhs.org](mailto:ksteens1@hfhs.org)

**BACKGROUND:** A maximal exercise test is often not available for patients in cardiac rehabilitation (CR) and many programs determine a target heart rate (THR) using equations to estimate maximum heart rate (HR<sub>max</sub>). The purpose of this study was to describe the % of patients in which a THR based on an estimated HR<sub>max</sub> would result in a heart rate (HR) that is consistent with guidelines (i.e., 50%-80% HR reserve) in patients with heart disease (HD) on beta-blockade therapy. **METHODS:** This was a secondary analysis of the iATTEND study; a randomized trial of facility-based only CR vs. hybrid CR. Subjects included in the present analysis had a history of myocardial infarction, coronary revascularization procedure, or heart failure; beta-blockade therapy; and sinus rhythm. Exclusion criteria were heart transplant, atrial fibrillation, implanted pacemaker, and exercise-induced ischemia. Measured HR reserve (maximum - rest) was determined from a symptom-limited maximal exercise test with gas exchange performed on a treadmill. Estimated HR<sub>max</sub> was determined using (a) 220 age and (b) a published equation based on patients with HD with beta-blockade (HD BB;  $164 - 0.72 \times \text{age}$ ). % measured HR reserve associated with 60% and 85% estimated HR<sub>max</sub> using each equation was compared to guideline recommended intensity of 50%-80% measured HR reserve. Paired sample t-tests were used to compare measured HR<sub>max</sub> to the 2 estimates of HR<sub>max</sub>. **RESULTS:** Among 166 subjects (68% male; age =  $59 \pm 11$  yr [mean  $\pm$  SD]) measured HR<sub>max</sub> was  $133 \pm 21$  min<sup>-1</sup>. Compared to measured, estimated HR<sub>max</sub> using 220-age was significantly higher ( $161 \pm 11$  min<sup>-1</sup>;  $p < .001$ ) and estimated HR<sub>max</sub> using HD-BB was significantly lower ( $121 \pm 8$  min<sup>-1</sup>;  $p < .001$ ). At 60% of 220-age, 19% of subjects would have been provided a THR that was consistent with guidelines; 72% would have been too low. At 60% of HD-BB, 1% of subjects would have been provided a THR that was consistent with guidelines; 99% would have been too low. At 85% of 220-age, 16% of subjects would have been provided a THR that was consistent with guidelines; 84% would have been too high. At 85% of HD-BB, 36% of subjects would have been provided a THR that was consistent with guidelines; 15% would have been too high. **CONCLUSION:** THR based on % estimated HR<sub>max</sub> from 220-age and HD-BB do not provide an exercise training HR target that is consistent with guideline recommendations, thus should not be used to prescribe an exercise intensity in patients with HD on BB therapy.

#11

TITLE: ASYMPTOMATIC DYSREFLEXIA AFTER POSTURAL CHANGES IN AN INCOMPLETE SPINAL CORD INJURY: CONSIDERATIONS FOR EXERCISE PHYSIOLOGISTS

AUTHORS: Addie Wanner, BS; Camilo Castillo, MD; Rachel Torres, MS; Daniela Terson de Paleville, PhD

Affiliations: AW, University of Louisville; CC, University of Louisville, UofL Health & Frazier Rehab Institute; RT, University of Louisville; DT, University of Louisville

First author's contact: [addie.wanner@louisville.edu](mailto:addie.wanner@louisville.edu)

**BACKGROUND:** Autonomic dysreflexia (AD) is a potentially life threatening hypertensive syndrome prevalent among patients with chronic spinal cord injuries (SCI) at spinal segment T6 or above. AD is due to the loss of supraspinal control over sympathetic preganglionic neurons and is triggered by noxious stimuli below the level of injury. The treatment of AD is multifaceted, from conservative management to topical and oral antihypertensive medications. Understanding AD's rapid onset and severity are extremely important for exercise physiologists working with patients with SCI. **CASE PRESENTATION:** A 67-year old male with chronic motor incomplete cervical SCI (i.e., ASIA C4 C) and persistent orthostatic hypotension (OH) was enrolled in a study to determine the effects of biofeedback on blood pressure (BP) modulation when an episode of asymptomatic AD occurred. Baseline and resting BP were recorded at 122/82, with a resting mean arterial pressure (MAP) of 96. The BP was continuously monitored using a telemetric device (Caretaker, Charlottesville, VA). Upon positional changes required to measure OH with a tilt table, the participant showed an antagonist response with a sudden increase in BP consistent with AD symptoms, reaching a maximum level of 199/121. The participant was asymptomatic during the AD episode. **CASE MANAGEMENT/OUTCOME:** BP returned to baseline levels after the participant was transferred back to a seated position in the wheelchair without using other measurements or medications. The titl test was modified with the participant positioned in a semi supine position (30° incline) and then tilted to approximately 45and remained in this position for 3 minutes. **DISCUSSION:** AD is prevalent among people with cervical or upper thoracic SCI, and often the episodes are asymptomatic. As a part of the training routine, many patients with SCI are placed in a supine position for passive stretching and exercising. We are presenting data on this episode of asymptomatic AD due to postural changes to bring awareness to exercise physiologists of this life threatening condition. Trainers should carefully check for signs of AD in this population and measure BP often during the training sessions if a continuous assessment of BP is unavailable. Seated is recommended over a supine or semi-supine position. This could be accomplished by using physical therapy wedge cushions to maintain blood pressure homeostasis.

#12

**TITLE: PATIENT PERSPECTIVES ON THEIR CREAKY KNEES AND THE ROLE OF EXERCISE IN KNEE HEALTH**

**AUTHORS:** Jeanette Thom PhD; Alexandre Kovats B.ExPhys, AEP; Elise Drum; Matthew Jones PhD, AEP; Sarah Dennis PhD, Kathryn Mills PhD; Justine Naylor PhD.

**Affiliations:** JMT, University of Sydney, Sydney; AK, University of New South Wales (UNSW) Sydney; ED, UNSW Sydney; MJ, UNSW Sydney; SD, University of Sydney, Sydney; KM, Macquarie University, Sydney; JN, South Western Sydney Local Health District, Sydney

First author's contact: [jeanette.thom@sydney.edu.au](mailto:jeanette.thom@sydney.edu.au)

**BACKGROUND:** Osteoarthritis (OA) is highly prevalent worldwide, carrying a significant disease burden. Evidence-based guidelines recommend exercise as a key first-line treatment modality and has been found to aid in prevention of developing OA. However, people still appear to be unsure about undertaking exercise to improve their knee health and this may occur before they have been diagnosed with OA. Knee crepitus may be cause people to negatively modify their exercise behaviours due to concerns of joint degeneration, though this is yet to be fully explored. Thus, the overarching objective of this study is to identify attitudes and beliefs of individuals with knee crepitus. More specifically, we aim to investigate if people have concerns about their crepitus and if they respond to these concerns through behavioural modification and to identify their beliefs regarding the role of exercise in knee health.

**METHODS:** Adult participants who had knee crepitus, with or without OA, took part in either an online individual semi-structured interview or focus groups to explore their beliefs regarding their crepitus and what effect this may have had on their exercise behaviours. Content analysis from interview transcripts was conducted using an inductive approach (NVivo software).

**RESULTS:** Twenty-four participants volunteered to be interviewed (mean age 49 years, range 21-69 years, 67% female). Three main themes emerged regarding attitudes and behaviours 1) crepitus, 2) exercise and 3) health professional engagement. A key concern was what crepitus meant and whether it would lead to development of OA. Participants said that crepitus varied in type. Most participants had not ceased exercise but had modified their movement due to crepitus and associated symptoms, with some having increased intentional strength training to try alleviating it. For those already with OA or other symptoms, crepitus was of less concern than symptoms such as pain. Participants agreed that more understanding about the processes causing crepitus and what exercise was safe for knee health would be beneficial. **CONCLUSIONS:** Crepitus does not appear to be a major concern for people who experience it. However, it is a factor that influences exercise behaviours, as is pain. If health professionals could address these concerns by providing greater education and targeted exercise, people with crepitus might be more confident in exercising for the benefit of their joints and overall health.

#13

## TITLE: GUIDED BREATHING EXERCISE MODULATES BLOOD PRESSURE FOR PEOPLE WITH SPINAL CORD INJURY

AUTHORS: Rachel Torres, MS; Camilo Castillo, MD; Addie Wanner, BS; Kaden Kozlowski; Daniela Terson de Paleville, PhD

Affiliations: RT, Interdisciplinary Program in Translational Neuroscience; CC, Division of Physical Medicine and Rehabilitation; KK, DTdP, Health and Sports Sciences; University of Louisville, Louisville, KY, USA

First author's contact: [rachel.torres@louisville.edu](mailto:rachel.torres@louisville.edu)

**BACKGROUND:** People with Spinal Cord Injury (SCI) often suffer from autonomic dysfunction, including orthostatic intolerance. These effects can be similar to those that astronauts experience while exposed to microgravity. To improve post-flight orthostatic intolerance, and other symptoms of autonomic dysfunction, scientists at NASA designed a biofeedback protocol, Autogenic Feedback Training Exercise (AFTE). AFTE combines specific autogenic exercises (e.g., self-suggestion of warmth in the hands) with biofeedback of multiple physiological responses (i.e., blood pressure [BP], heart rate, body temperature, breathing rate). We modified this protocol by adding guided breathing exercises and immersive virtual reality (VR) and tested it among people with and without SCI. The study aims to determine if AFTE is viable for improving autonomic dysfunction in individuals with SCI. We hypothesize that participants with SCI will improve symptoms of orthostatic hypotension and be able to modulate BP toward normotensive values after eight sessions of AFTE. **METHODS/DESIGN:** A convenience sample of five (n=5) participants with chronic cervical SCI: two women (body weight 90+/-13Kg, height 164+/-2Cm, age 48+/-18), three men (body weight 96+/-37, height 180+/-5Kg, age 40+/-28) and four (n=4) participants without SCI: two women (body weight 57+/-9 Kg, height 164+/-9 Cm, age 22+/-1) and two men (body weight 78 Kg +/-18, height 182 cm +/-5, age 27+/-2) participated in the study. Training consisted of eight 3-minute cycles of alternating relaxing then stimulating breathing, interoception (i.e., noticing inner body sensation), and VR. The relaxing breathing to lower BP consisted of making the “mmm” sound with three long nasal exhales to lower blood pressure. The stimulating breathing to raise BP consisted of three series of ten quick nasal exhales. After each of the eight cycles, participants were given feedback on whether they met their goal of increasing or decreasing MAP 5 mmHg during stimulation or relaxation cycles respectively. Training was performed twice a week for five weeks. **RESULTS:** Participants successfully modulated their BP during the breathing exercise portion of the training. Participants reported they were able to use the technique at home after training was completed. **CONCLUSIONS:** Guided breathing exercises could provide a readily available method of BP modification without side effects, potentially enabling more exercise compliance for people with SCI.