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Contents

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Abstracts

A comprehensive longitudinal assessment of overall health after Trikafta in persons with cystic fibrosis: a patient-oriented case study

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Trikafta is a medication that targets faulty cystic-fibrosis-transmembrane-conductance-regulator proteins. The present study is partnering with the Saskatchewan Health Authority (SHA) to explore overall health outcomes of initiating Trikafta in persons with cystic fibrosis (CF). Outcome measures include respiratory, cardiometabolic, fitness, neurophysiology, neuropsychology, gut health, and lifestyle factors at baseline [BL], 1mo-, 3mo-, 6mo-, 9mo-, and 12mo-post medication. The participant and research team member (female, aged 39y) has been integral in developing the research question, and has been engaged throughout the research process. Importantly, chloride sweat-test levels decreased from BL to 3mo (73mmol/L [indicative of CF] to 14mmol/L [CF unlikely]). Data collection and analyses are ongoing; BL, 1mo, and 3mo respiratory, cardiometabolic, fitness, and lifestyle factor data have been analyzed: spirometry results indicate improved lung capacity and function (FVC +8%, FEV_1 +3%, PEF +7%); cardiovascular measures improved (HR -11%, BP -9%sys/-14%dia, MAP -12%, central pulse wave velocity -19%); metabolic and body composition measures changed (fasted blood glucose -25%, resting metabolic rate -10%, WC +4%, body mass +10%, body fat +6%, body fat-free +5%); and fitness improved ($\dot{V}O_{2peak}$ +8%, $\dot{V}_{Epeak}$ +55%), as did self-reported MVPA (+210min/week). Lifestyle factor questionnaires showed decreased stress (-78%), and increased trait physical energy (300%) along with decreased trait physical (-57%) and mental (-20%) fatigue. Sleep quality improved, as did eating patterns and behaviors. The participant has self-reported reduced pain and blockage frequency [related to CF-DIOS] as well as decreased volume and frequency of sinus discharge. Other outcomes collected will be analyzed in the coming weeks. We hope to recruit further participants to explore individual variability in a case series that may inform outcomes of importance for future larger studies.

Stryd critical power is equivalent to the running intensity at critical speed

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The maximal metabolic steady state (MMSS), which is the highest exercise intensity that can be supported entirely by aerobic metabolism, is a useful threshold for exercise training interventions. Both critical speed (CS) and critical power (CP) represent the MMSS, but whether the two thresholds are synonymous in runners is unknown. The purpose of this project was to compare CS to the CP derived from a commercially available running power meter, Stryd. Ten trained runners (7M, 3F; 29±7 years; 59.0±4.2 $ml \cdot kg^{-1} \cdot min^{-1}$ [mean±SD]) participated in this project. Their average running speed and power during time trials performed on separate days on a 400m outdoor track—1200m (286±24 m/min, 332±49 W), 2400m (260±24 m/min, 302±36 W), and 3600-4400m (249±24 m/min, 289±32 W)—were used to calculate CS (233±27 m/min) and CP (271±28 W). On a separate day, when runners were paced at their calculated CS for 800m (233±26 m/min; p=0.64 vs. calculated CS), the measured running power (271±28 W) was not significantly different from the calculated CP (p=0.94), and there was excellent absolute agreement between the two values (ICC=0.96). These results suggest that, in running, speed and power estimates of the MMSS (i.e., CS and CP) are highly similar, indicating that Stryd power provides a valid assessment of running intensity that can be used to guide training. (Supported by the Natural Sciences and Engineering Research Council of Canada (NSERC), NSERC CREATE We-TRAC training program, and Alberta Innovates).

Effect of chronic electronic cigarette use on hemodynamic responses to head up tilt

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Chronic electronic cigarette (EC) use increases resting sympathetic tone but whether this affects hemodynamic

adaptation during an autonomic challenge remains unknown. We tested the hypothesis that chronic EC users will demonstrate abnormal hemodynamic responses to head-up tilt (HUT). Nine EC users (22 ± 1 yrs) and 9 healthy age and sex-matched controls (CTL, 22 ± 1 yrs) underwent HUT without (-CPT) and with cold pressor testing (+CPT). Heart rate (HR; electrocardiogram), systolic blood pressure and stroke volume (SBP and SV; finger cuff photoplethysmography) were measured continuously and were analyzed as the change (Δ) from baseline to HUT. Relative responses were compared using unpaired two-tailed t-test, and data presented as mean ± SEM. There were no significant differences in pre-HUT HR, SBP or SV between EC and CTL during -CPT or +CPT (all $p > .05$). During HUT-CPT, EC demonstrated less increase in HR (EC: Δ+17 ± 1 vs. CTL: Δ+28 ± 3 bpm, $p = 0.01$), less decrease in SBP (EC: Δ-14 ± 2 vs. CTL: Δ-27 ± 5 mmHg, $p = 0.04$), and less decrease in SV (EC: Δ-22 ± 1 vs. CTL: Δ-33 ± 1 mL, $p = 0.04$). With additional sympathetic stimulation during HUT (HUT+CPT), EC again demonstrated less increase in HR (EC: Δ+14 ± 2 vs. CTL: Δ+24 ± 3 bpm, $p = 0.04$) and less decrease in SBP (EC: Δ-11 ± 3 vs. CTL: Δ-19 ± 3 mmHg, $p = 0.04$). There was no difference in SV (EC: Δ-18 ± 0 vs. CTL: Δ-22 ± 1 mL, $p = 0.41$). These data suggest that EC use may affect the acute hemodynamic adaptation to an orthostatic and sympathetic challenge.

Neuromuscular efficiency changes with handedness and forearm position during an upper-body arm-cycling sprint

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Arm-cycling sprinting is a potential exercise modality to improve physical performance in individuals with and without motor impairments. Modifications to the forearm position (i.e., pronated vs supinated) during arm-cycling sprinting, has been shown to modulate performance and fatigue development, however the underlying neuromechanical mechanisms are not well understood. Thus, the aim of this study was to compare the effect of different forearm positions and handedness on bilateral force and muscle electromyography (EMG) during an upper-body Wingate test. EMG and force data were collected from fourteen healthy male participants (mean age ± SD) while performing two, thirty-second upper-body Wingate tests in either a pronated or supinated forearm position. EMG was collected bilaterally from the biceps brachii, triceps brachii, brachial radialis, anterior deltoid, and latissimus dorsi muscles. Crank-pedal forces were also collected bilaterally. A one-way repeated measures ANOVA using Statistical Parametric Mapping (SPM) was conducted for statistical analyses. Our findings show no main effect for handedness and forearm position on EMG activity of the ten muscles ($p > 0.05$). A main effect was observed for handedness and forearm position on bilateral force production ($p < 0.05$). In conclusion, handedness and forearm position during an upper-body sprint leads to changes in neuromuscular efficiency. This research was supported by a NSERC DG (D.C. Button)

Resistance training induces improvements in range of motion: A Systematic Review and Meta-analysis

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Recently it has been suggested that improvements in range of motion (ROM) can be achieved through other activities such as resistance training (RT). The objective of this meta-analytical review was to quantitatively evaluate the effect of RT on ROM compared either to a control condition or stretch training or to a combination of RT and stretch training to stretch training, while assessing moderating variables. Following the systematic search in four databases (PubMed, Scopus, SportDiscus and Web of Science) and reference lists from related reviews; 55 studies with 222 effect sizes were found to be eligible for this meta-analysis. The main meta-analyses revealed that generally, RT (free weights, machines, Pilates) increased ROM (ES=0.73; P=<0.001) with the exception of no significant ROM improvement with RT using only body mass. Although "trained or active people" increased ROM (ES=0.43; P<0.001) "untrained and sedentary" individuals had significantly (P=0.005) higher magnitude of changes in ROM (ES=1.042; P<0.001). No other difference was found. In conclusion, since RT with external loads can improve ROM, additional stretching prior to or after RT may not be necessary to enhance flexibility. This work was partially supported by the Natural Science and Engineering Research Council of Canada

Association of arterial stiffness and changes in brain structure and function in the UK Biobank

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While evidence suggests there is indeed a relationship between arterial stiffness and changes in brain structure and function cross-sectionally, the longitudinal relationship between arterial stiffness and changes in brain structure and function is unclear. Also unclear is whether a regional effect of arterial stiffness on brain structure exists, or if the effect is homogenous across brain regions. Using a healthy cohort of the UK Biobank study ($N = 1858$, mean±SD: 61 ± 7 years), we investigated the longitudinal association between changes in arterial stiffness index (ASI) and brain structure and function (cognitive performance in 6 tests) over 2.5 ± 1 years. We also examined the association between baseline ASI and all structural and functional brain outcomes 8-11 years post-baseline ($N = 630$). Prior to correction, we observed a significant effect of changes in ASI over 2.5 ± 1 years on cortical thickness in 11 brain regions contributing to reductions between 0.0004-0.0024mm annually. Following correction there was no effect of changes in ASI on brain structure or function. Baseline ASI was negatively associated with whole brain grey matter volume 8.5 ± 1.05 ($p = 0.015$) and 11 ± 1.02 ($p = 0.03$)

years later. Our findings suggest that taken with the age, elevations in ASI may have an additive effect to accelerate changes in brain structure. Our findings also suggest the relationship between ASI and reductions in whole brain grey matter volume may require long-term exposure to elevations in arterial stiffness in otherwise healthy older adults.

The Epidemiology of Injury in British Columbian Forrest Firefighters - A pilot study

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Climate change has led to more frequent and intense wildfires which have increased the number of injuries and fatalities sustained by Wildland Firefighters. The last study to examine the epidemiology of injury examined injuries reported from 2003 to 2007. No studies have examined the impacts of climate change on the epidemiology of injury or if injury differs in jurisdictions outside of the United States.

This pilot study will describe the distribution and determinants of physical injuries over the past ten years in the British Columbia Wildfire Service (BCWS). Injury data was obtained from BCWS's Occupational Health and Safety Incident Tracking database from 2013 to 2021. Descriptive statistics were used the analyze pilot data within each year and across years to describe the types and severity of injuries. Pilot data shows that from 2013 to 2021 there was an average of 136.6 reported injuries each year and of these injuries an average of 48.6 injuries resulted in time lost. The most common injury types were either a strain to the lower back (32%) or a sprain to the ankle (28%). Interestingly, in comparison to Britton and colleges', the pilot findings for this research suggest that back injury is much more prevalent in BCWS firefighters.

Cardiovascular implications of acute respiratory muscle unloading at different exercise intensities

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Respiration is accomplished by alterations in intrathoracic pressure (ITP) and has physiological implications on the cardiovascular system. We sought to determine the impact of respiration on cardiovascular function during semi-supine cycle exercise by using a proportional assist ventilator to attenuate ITP changes and the work of breathing (W_b). Thirteen healthy participants (6 females) completed discrete exercise trials at 30%, 60% and 80% peak power (Wmax) with unloaded and spontaneous breathing. Intrathoracic and intraabdominal pressure were measured with balloon catheters placed in the esophagus and stomach. An electrocardiogram measured heart rate (HR) and blood pressure (BP) was determined via finger photoelectric plethysmography. Mean esophageal pressure (Peso) was greater during unloaded relative to spontaneous breathing at all exercise intensities ($p<0.0001$). Esophageal pressure swings per breath (between spontaneous and unloaded breathing) were different at 30%, 60% and 80%; (-3.5±3.4 vs. -6.8±6.4 vs. -11.9±7.9 cmH_2O, respectively ($p=0.01$). However, the decrease in W_b was not different between exercise intensities (52±23 vs. 51±17 vs. 53±14% from spontaneous breathing for 30%, 60%, and 80%Wmax, respectively, all $p>0.05$). No differences in HR or blood pressure were observed at 30% and 60%Wmax between unloaded and spontaneous breathing. At 80%Wmax, HR was lower (160±13 vs. 165±13 bpm, $p<0.0001$) and blood pressure was higher (138±13 vs. 134±14 mmHg, $p=0.0015$) during unloaded breathing. In summary, attenuating ITP had no implications on HR or BP at 30% and 60%Wmax. However, at 80%Wmax, there was a greater increase (less negative) in mean Peso and absolute change in W_b which may be responsible for the reduction in HR and elevation in BP. (Funding: NSERC, CFI)

Fear of falls following an online exercise program for aging adults

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Fear of falling is associated with more falls. Although regular exercisers tend to report low fear of falling, it is unknown if fear of falls can be reduced following a short-term fall prevention exercise program, especially when delivered online. The purposes of this study were to 1 - test if the number of falls in the past and fear of falling are different when participants register for a peer-led exercise program either in person or online and 2 - test changes in fear of falling following a peer-led fall prevention exercise program in person or online. The fall prevention exercise program was offered to adults age 50+. Participants chose to participate in the 12-week program online or in person. Fear of falling was reported using the Fall Efficacy Scale (16-64; 64 being the greatest fear of falling) pre- and post-participation. A total of 85 adults (average age of 69.0) participated in the program offered online (N=44) and in-person (N=41). No significant between-group differences were found in fall rate in the past year. Fear of falling showed no significant differences before and after participation in the program for neither group: online (20.7 ± 5.1 to 21.8 ± 5.5) and in-person (20.6 ± 5.1 to 21.2 ± 5.3). The current work suggests that a 12-week fall prevention exercise program has no significant effect on participants' fear of falling for participants online and in person.

Je veux mes résultats ! Une méthode pour autogénérer des rapports d'évaluation individuels dans un essai de faisabilité d'une intervention centrée sur l'exercice

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Les interventions basées sur l'exercice sont fréquemment étudiées pour comprendre comment améliorer la condition

physique et la santé des gens. Les participants sont généralement curieux à recevoir les résultats de leur participation. Cependant, en raison des ressources limitées et de la nature parfois lente de la méthode scientifique, ces résultats ne sont pas toujours présentés aux participants eux-mêmes. L'objectif de ce projet était de développer une méthode permettant de générer rapidement des rapports individualisés pour les participants à un essai de faisabilité basé sur l'exercice. Des données provenant d'un essai de faisabilité d'une intervention basée sur l'exercice ont servi d'exemple dans ce projet. Le logiciel pour générer le rapport a été développé en utilisant le langage de programmation R et le package rmarkdown (2.1.4). Le logiciel permet d'autogénérer un document individuel pour chaque participant à partir d'une base de données. Le rapport contient tous les résultats de l'individu, ainsi que les moyennes globales de tous les individus du projet. Ces données sont représentées sous forme de tableaux et de graphiques. Le code de ce projet est présenté sur un site Web à partager avec d'autres personnes pour promouvoir cette pratique dans de futurs projets de recherche.

The influence of respiration, neck flexion, and arterial segment on carotid artery longitudinal wall motion

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While carotid artery longitudinal wall motion (CALM) has been highly detailed in cross-sectional studies, there is little evidence to explain the large variability between individuals and population groups. The purpose of this study is to examine how common external factors influence CALM. We hypothesized that (1) CALM will be greater when imaging proximal vs. distal to the heart, (2) neck extension will reduce motion compared to flexion, and (3) inspiration will shift CALM towards the thorax compared to expiration. Twenty-two healthy adults (11 females; aged 22±1.7 years) were recruited. Experiment 1 examined the arterial wall immediately distal to the clavicle and 1 cm proximal to the carotid bifurcation. Experiment 2 involved the neck positioned at 70°, 90°, maximum extension (112±9°) and maximum flexion (51±7°). Experiment 3 measured CALM during 7-sec inspirations, expirations, and breath holds.CALM was greater at proximal vs. distal locations (retrograde, maximal, and radial-axial displacements; all $p < 0.05$). Minimum neck angles had greater motion than maximum neck angles (diastolic and maximum displacements; both $p < 0.05$). There was no difference in CALM from minimum to 70°, 70° to 90°, or 90° to maximum. Retrograde displacement was greater during inspiration vs. during breath hold and expiration, while diastolic displacement was greater during expiration vs. breath hold (all $p < 0.05$). Maximum and radial-axial displacement were reduced during breath hold vs. expiration and inspiration (all $p < 0.05$). When breathing traces were corrected for linear bias, there were no differences between conditions. We recommend the use of consistent techniques including scanning 2-3 cm proximal to the carotid bifurcation, maintenance of a neutral neck angle (70°±10°), and initiation of a breath hold during acquisition. When breath holds are not possible (e.g., retrospective data), it is appropriate to conduct a linear bias correction.

Inspiratory muscle training corrects sympathetic tone during orthostatic challenge in patients with post-acute sequalae of COVID (PASC) and myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS)

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Reduced exercise capacity and orthostatic intolerance may be associated with autonomic dysfunction in PASC and ME/CFS. Hypocapnia could reduce cerebral blood flow and contribute to symptomatology. Inspiratory muscle-training (IMT) is low-exertional and reduces sympathetic tone in heart failure. The current study assesses the effect of IMT on hypocapnia, exercise capacity, and autonomic function during orthostatic challenge in PASC and ME/CFS. Five patients (3ME/CFS, 2PASC) were evaluated before and after 8-weeks of IMT. End-tidal CO_2 (E_TCO_2) was measured using a CO_2 gas-analyzer. Autonomic tone was assessed from heart rate variability during 5-minutes of supine and 5-minutes of 70° head-up tilt (HUT) ECG; exercise capacity was determined from the 6-minute walk test. There was no difference in E_TCO_2 (35.5±11.9 vs 45.6±5.00mmHg) or walk distance (403.6±76.3 vs 438.4±109.0m) pre- and post-IMT. However, 4/5 patients showed increased E_TCO_2 and walk distance after IMT. Low-frequency to high-frequency ratio (LF/HF) during HUT increased before but not after IMT (1.81±1.30 vs 8.69±4.42, $p = 0.028$ and 3.33±1.44 vs 5.85±4.55, $p = 0.36$). Initial results suggest IMT may correct hypocapnia and improve exercise capacity. IMT reduces sympathetic tone during HUT, which is associated with orthostatic intolerance. Further tests are underway to evaluate these changes in a larger sample.

Enhancement of mental health among patients with metabolic syndrome during COVID-19 after following the CHANGE program

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This study intended to evaluate the mental health status of patients with metabolic syndrome (MetS), after participating in the Canadian Health Advanced by Nutrition and Graded Exercise (CHANGE) program for 12 months. A convenience sample of 100 patients completed the program (regular diet and exercise counseling). Beck Depression Inventory (BDI-II), Beck Anxiety Inventory (BAI), IPAC, and the Mediterranean Diet Score (MDS) Questionnaires were employed to assess participants' depression, anxiety, physical activity (PA), and quality of diet respectively. The 6-Minute Walk Test, One-Leg Stance Test, and Grip Strength Test were also used. Anthropometric and blood pressure (BP) measurements were performed by a nurse. Among participants (mean age 58.3±11.0, and 75.4% females), BDI-II and BAI mean scores decreased by 41.6 and 38.9 percentage points respectively

after the 12-month program. Additionally, the study revealed significant reduction in reported participants' alcohol use by 36.5 percentage points, improvement in participants' MetS status (reduction in number of MetS criteria), and significant amelioration in their PA, MDS, physical fittness, BP, and weight mean scores. While the COVID-19 pandemic was accompanied by detrioration of mental health status among several people worldwide, following the CHANGE program could independently promote MetS patients' mental health after adjusting for other covariates.

Impact of lifestyle modification on quality of life in patients with metabolic syndrome

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This study aimed to assess the quality of life (QoL) of patients with metabolic syndrome (MetS), after participating in the Canadian Health Advanced by Nutrition and Graded Exercise (CHANGE) program for 12 months, and to identify determinants of QoL. A convenience sample of 100 patients completed the program (diet and exercise regular counseling). SF-36, IPAC, PACE and the Mediterranean Diet Score (MDS) Questionnaires were employed to assess participants' QoL, physical activity (PA), sedentary behaviors, and quality of diet respectively. The 6-Minute Walk Test, One-Leg Stance Test, and Grip Strength Test were also used. Anthropometric (height, weight, and waist circumference (WC) and blood pressure measurements were performed by a nurse. The participants' mean age was 58.3±11.0, of which 75.4% were females. After the 12-month program, paticipants demonstrated significant reduction in the number of their MetS criteria and significant improvement of physical and mental components of QoL. Moreover, there was significant increase in participants' PA, MDS, and physical fitness mean scores with corresponding significant reduction in sedentary behavior time, blood pressure, and WC measures. Linear regression analysis revealed that age, WC, screen time, PA, and physical fitness were significant individual predictors of QoL. Adopting a healthy lifestyle improves MetS patients' health status.

Influence of sex and age on the relationship between cardiorespiratory fitness and muscle sympathetic nerve activity in healthy adults

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Cardiorespiratory fitness diminishes the risk of cardiovascular disease. Studies investigating whether this is due, in part, to attenuated muscle sympathetic nerve activity (MSNA) have been limited by small cohorts and potential sex-differences. Our aim was to determine with greater precision the influence of sex and age on the relationship between cardiorespiratory fitness and MSNA in healthy adults. Data were assessed from 210 non-medicated normotensive volunteers, 136 males (aged 19-76 yrs) and 74 females (18-74 yrs), in whom resting MSNA (microneurography) and cardiorespiratory fitness (peak oxygen uptake, $\dot{V}O_{2peak}$; incremental exercise test) were evaluated. There was an inverse association between $\dot{V}O_{2peak}$ (range 12.9-73.1 $ml \cdot kg^{-1} \cdot min^{-1}$) and MSNA burst frequency (range 3-65 $bursts \cdot min^{-1}$) across all participants (R^2=0.21, P<0.0001), as well as in male (R^2=0.22, P<0.0001) and female (R^2=0.35, P<0.0001) cohorts. When separated into younger (<50 yrs) and older (≥50 yrs) males and females, there was an inverse relationship between $\dot{V}O_{2peak}$ and burst frequency in younger males (n=71; R^2=0.21, P<0.0001) and older females (n=22; R^2=0.36, P<0.01), but no relationship in older males (n=65; R^2=0.05, P=0.08) or younger females (n=52, R^2=0.03, P=0.19). Similarly, when quantified as percent-predicted $\dot{V}O_{2peak}$ based on age, sex, height, and weight, an inverse relationship described percent-predicted $\dot{V}O_{2peak}$ and burst frequency in younger males (R^2=0.13, P<0.01) and older females (R^2=0.32, P<0.01), but not in older males (R^2=0.02, P=0.33) or younger females (R^2=0.00, P=0.88). Similar patterns were observed when MSNA was assessed using heart rate corrected burst incidence. Age and sex influence the relationship between cardiorespiratory fitness and resting MSNA; inverse relationships are strongest in younger males and older females.

Factors associated with inconvenience during physical activity because of excess skin after bariatric surgery: a multicentric cross-sectional study

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Excess skin (ES) after bariatric surgery can cause inconvenience during physical activity for some individuals, but factors associated with such inconvenience are unknow. The aim of this study was to compare characteristics of individuals who experience inconvenience due to ES during physical activity to those without inconvenience. A multicentric cross-sectional study, including 124 adults (92% women, M_{age} 46.5±9.9 years), was conduced in Gatineau, Quebec City, Montréal, and Sherbrooke (Canada). Participants completed questionnaires 34.2±27.6 months after surgery to assess degree of inconvenience due to ES, social physique anxiety, body esteem, and physical activity. Quantity of ES on abdomen, arms and thighs were objectively measured. Based

on responses to the Sahlgrenska questionnaire, 69 (55%) participants experienced inconvenience due to ES when participating in sports, and 63 (50%) experienced inconvenience due to ES when walking/running quickly. Participants who experienced inconvenience due to ES when participating in sports and/or running/walking quickly reported higher social physique anxiety (p<.001) and lower body esteem (p<.05) compared to those reporting no inconvenience, without any significant difference in physical activity levels between groups. Participants who experienced inconvenience due to ES when running/walking quickly had more abdominal ES (p=.002). Quantity of ES did not differ between participants who experienced inconvenience due to ES when participating in sports versus those reporting no inconvenience. Amount of abdominal ES seems important to determine who may experience inconvenience when running and/or walking quickly. Body-related psychosocial factors seem to be more closely related to inconvenience due to ES during physical activity after bariatric surgery. Causality of these relationships needs to be examined in future studies. Funding support: none

Meeting the Canadian 24-hour movement guideline recommendations according to BMI classes in Canadian adults

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The aim of this study was to describe the proportion of Canadian adults meeting individual and various combinations of the 24-H Guidelines by BMI class, and their association with health indicators. Data from the cross-sectional Canadian Health Measures Survey cycles 1 to 4 (2007-2015, n=10,515 adults aged 18-79 years) were used. Daily time spent in moderate-to-vigorous intensity physical activity (MVPA) and sedentary time were assessed using accelerometry. Sleep duration, recreational screen time, chronic conditions, sociodemographic, general and mental health were self-reported. BMI, waist circumference, blood pressure and aerobic fitness were directly measured. Respondents were classified as meeting 24-H Guidelines when: MVPA ≥150 min/week, sedentary behaviours ≤9h/d of sedentary time and ≤3h/d of recreational screen time, and sleep =7-9h/d [18-64 years] or 7-8h/d [≥ 65 years]. Significantly fewer adults with overweight (6.1%), class I (4.3%), and class II/III obesity (3.9%) met all three 24-H Guidelines compared to those with normal weight (9.5%). Meeting all three or two 24-H Guidelines was generally associated with a lower waist circumference, higher aerobic physical fitness, and self-perceived general health regardless of BMI class. Canadian adults with overweight and obesity are less likely to meet the Canadian 24-H Guidelines. Most of the benefits associated with meeting the Canadian 24-H Guidelines are observed regardless of BMI status. Funding support: none

Effect of β-hydroxybutyrate administration on amyloid precursor protein processing and cognitive performance

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Cell culture and animal studies indicate that the ketone body β-hydroxybutyrate (βHB) can reduce beta-amyloid plaques, however the mechanisms are unknown. Research has demonstrated that βHB promotes the expression of brain-derived neurotrophic factor (BDNF) in the hippocampus of mice and evidence from human studies suggests ketone-induced cognitive improvements. BDNF treatment has been shown to reduce the activity of BACE1, the rate limiting enzyme in the amyloidogenic cascade. We aimed to determine the effect of acute and chronic βHB supplementation on BDNF content and subsequent effects on cognition and amyloidogenic processing in both healthy and obesogenic models. Acute experiment: male lean and diet induced obese C57BL6/J mice were orally gavaged with either 1) Saline (n=10) or 2) βHB (n=10; 3 mg/g b.w.). To examine the effects of acute βHB supplementation on cognition, mice underwent object recognition training prior to the gavage and were tested 4 hours post-gavage. Post-euthanasia, prefrontal cortex and hippocampal samples were dissected to examine BDNF signaling and the amyloidogenic pathway. Chronic experiment: Male C57BL6/J mice were assigned into 1) Chow (n=20) or 2) HFD (n=20) for 4 weeks, after which they were subdivided into either saline or ketone gavage groups (n=10/group) for an additional 4 weeks. Mice underwent similar testing/tissue collection as the acute experiment. Acutely, βHB resulted in a trend towards higher exploration time of the novel object ($p = 0.07$). This was accompanied by altered BACE1 activity in a brain region specific manner and no changes in BDNF content. Chronic βHB resulted a trend towards higher percent exploration time of the novel object ($p = 0.08$) as well, lower BACE1 activity within the HFD group. Chronic βHB had no effect on BDNF content or signaling. Collectively, these studies demonstrate an ability for βHB to modulate BACE activity, however, our data does not demonstrate the involvement of BDNF in the potential cognitive benefits of βHB supplementation. (Funded by NSERC CGS D and a Brock University Explore Grant)

Changes in body mass, physical activity, and dietary intake in Canadian university students during the first year of the COVID-19 pandemic

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This study examined changes in body mass, physical activity, and dietary intake in Canadian university students during the first year (March 2020-March 2021) of the

lockdown/restrictions of the COVID-19 pandemic. Two observational, self-reported recall surveys were conducted online; in September 2020 (T1) and March 2021 (T2). For T1, five hundred ten (99 males, 411 females) students completed the survey and of those one hundred thirty-five (32 males, 103 females) also completed the survey at T2. The surveys included demographic information (age, sex, living arrangements, activity level, etc.), body mass and height, and a series of standardized questionnaires energy, macronutrient, and micronutrient intake as well as energy expenditure. Body mass and body mass index significantly increased in both males and females. Body mass increased on average by 0.91 kg, $t(132) = -2.7$, $p = 0.008$, 95%CI = [0.24, 1.58]. Importantly, a significant change was shown that between T1 and T2 with a greater number of participants identified as overweight (19.8% to 24.4%) than normal weight (61.7% to 54.8%). Body mass change was not associated with changes in physical activity and dietary intake. Females were more likely to decrease At Home Workouts compared to males with no other significant changes detected for type of physical activity in either T1 or T2. Energy intake significantly decreased by ~200 kcals/d. Diet quality also changed in both sexes characterized by negative changes in both macro and micronutrients. Modest weight gain did occur during the pandemic in Canadian university students despite the insignificant changes reported in physical activity and the significant decrease in overall dietary intake, which can be possibly attributed to the changes in diet quality.

Adiponectin receptor agonism attenuates fibrosis, inflammation and mitochondrial H_2O_2 emission in diaphragm from the D2.*mdx* mouse model of Duchenne muscular dystrophy

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Adiponectin receptor agonism improves muscle function and inflammation in mouse model of Duchenne muscular dystrophy. The objective of this study was to examine if the slow-release agonist ALY688-SR improves muscle health and mitochondrial bioenergetics by lowering inflammation in D2.*mdx* mice. Mice were treated from 7-28 days of age with 3mg/kg b.w. (low dose; LD), 15mg/kg b.w. (high dose; HD) ALY688-SR or a saline vehicle (VEH) and compared to age-matched wild-types (D2A strain; WT). Fibrosis was increased in diaphragm in VEH vs WT (6.5x) and tibialis anterior (TA; 2.2x) which was partially lowered by both LD and HD (-56.5% to -57.2%, respectively, vs VEH) in diaphragm only. Compared to WT, VEH mitochondrial H_2O_2 emission was increased during a range of oxygen consumption rates (50-56%) and quadriceps (198-813%) and were partially prevented by HD in diaphragm (-3 to -25% vs VEH) and both doses in quadriceps (-32 to -55% vs VEH). Pyruvate-supported respiration, markers of inflammation, serum creatine kinase (muscle damage) and functional testing were not improved with either dosage. Short-term treatment with ALY688-SR in D2.*mdx* mice attenuated early onset fibrosis, inflammation, and indices of mitochondrial stress. The longer-term influence of ALY688-SR on muscle weakness and atrophy remain to be explored.

Limb and inspiratory muscle metaboreflex activation in healthy males and females

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The purpose of this study was to compare activation of the limb (LMA) and inspiratory (IMA) muscle metaboreflex and determine differences on the basis of sex. It was hypothesized that the rise in mean arterial pressure (MAP) would be similar between IMA and LMA and that the increase would be less in females. Young males (M, n=9) and females (F, n=8) completed trials of intermittent handgrip exercise and pressure threshold loading at 60% maximal voluntary contraction, a contraction frequency of 15/min, and a prolonged duty cycle (0.7) to task failure. The increase in MAP was significantly greater in males (M-LMA: $\Delta 31 \pm 12$mmHg; M-IMA: $\Delta 31 \pm 9$) than females (F-LMA: $\Delta 21 \pm 7$ mmHg; F-IMA: $\Delta 13 \pm 7$), regardless of muscle group ($p<0.001$). A greater increase in MAP during LMA than IMA was also observed (LMA: $\Delta 26 \pm 11$ mmHg; IMA: $\Delta 22 \pm 12$) regardless of sex ($p=0.036$). When performing exercise at an absolute workload of 82 cmH_2O or 167 N, the increase in MAP remains elevated in males (LMA: $\Delta 35 \pm 6$ mmHg; IMA: $\Delta 30 \pm 7$) than females (LMA: $\Delta 21 \pm 7$ mmHg; IMA: $\Delta 14 \pm 4$) at the same contraction frequency and duty cycle ($p<0.001$). Results from this study show that when the forearm (LMA) and diaphragm (IMA) perform the same relative or absolute contractions, the blood pressure response is statistically similar. Our findings suggest the sex-based differences in the pressor response to metaboreflex activation is not muscle group-dependent (Funding: NSERC).

Interleukin-6 does not appear to influence the appetite-regulatory hormonal response to an acute bout of moderate-intensity exercise though there was dysregulation in individuals with obesity

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Interleukin-6 (IL-6) is an inflammatory marker that induces appetite inhibitory effects in animal and cell culture models. While exercise and adiposity are known to upregulate IL-6, how these elevated IL-6 concentrations effect appetite regulation is unconfirmed. This study examined the potential role of IL-6 in the appetite-regulatory response to moderate-intensity exercise in sedentary normal weight (NW) and sedentary males living with obesity (OB). Seventeen male participants (9 NW, 8 OB) completed two experimental conditions: 1) non-exercise control (CTRL) and 2) moderate-intensity continuous training (MICT; 60 min, 65% $\dot{V}O_{2max}$). IL-6, acylated ghrelin, peptide tyrosine tyrosine (PYY_{3-36}), and active glucagon-like peptide-1 (GLP-1) were measured fasted,

pre-exercise, 30-, 90-, and 150-min post-exercise. IL-6 concentrations were elevated in OB (P=0.005, η^2=0.419), however MICT responses were similar between groups denoting elevations at 30- and 150-min post-exercise versus CTRL (P<0.008, d>0.57). OB demonstrated suppressed acylated ghrelin concentrations compared to NW (P<0.017, d>0.84) and generated no additional response to MICT (P>0.512, d<0.44). Only NW exhibited time course responses to PYY_{3-36} (P=0.032, η^2=0.559), while neither group nor condition altered active GLP-1 (P>0.316, η^2<0.062). IL-6 does not appear to influence key appetite hormones, though notably OB demonstrated a dysregulation of normal appetite-regulatory responses to exercise. (Supported by NSERC).

A comparison of peak oxygen uptake determined by inert gas rebreathing and a metabolic cart using a randomized crossover design

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Inert gas rebreathing (IGR) permits the non-invasive measurement of cardiac output ($\dot{Q}$). The Innocor (COSMED) device continuously measures oxygen uptake ($\dot{V}O_2$) including during the IGR rebreathing period used to determine ($\dot{Q}$). Under "maximal" exercise conditions, this allows $\dot{V}O_{2peak}$ and $\dot{Q}_{peak}$ to be assessed using a single test to volitional exhaustion. We compared $\dot{V}O_2$ values derived from the Innocor with those from a metabolic cart (Quark CPET, COSMED) during both a constant load test based on $\dot{V}O_{2peak}$ verification phase testing ($\dot{Q}_{CL}$) and a step exercise test ($\dot{Q}_{step}$). Participants [n=34 (19 females); 25±5y] performed each of the $\dot{Q}_{CL}$ and $\dot{Q}_{step}$ protocols on two separate occasions. $\dot{V}O_2$ was measured using the Innocor on one occasion and using the Quark CPET on the other occasion. The order of the trials was randomized. The $\dot{V}O_{2peak}$ measured using the Innocor was lower than for the metabolic cart for both the $\dot{Q}_{CL}$ protocol (2.70±0.74 vs 3.12±0.72 L/min, p<0.01) and the Q_{step} protocol (2.64±0.79 vs 3.12±0.80 L/min, p<0.01). $\dot{V}O_{2peak}$ measured using the Innocor and Quark CPET was positively correlated when combined from the $\dot{Q}_{CL}$ and $\dot{Q}_{step}$ tests (r^2=0.88, p<0.001). Our data suggest that the Innocor may underestimate $\dot{V}O_{2peak}$ by ~20% as compared to the Quark CPET. (Supported by NSERC).

Effects of a 12-week physical activity program on balance and gait stability in ageing adults

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Falls are a leading cause of injury among older adults, however fall risk may be reduced by improving balance and gait stability, which is often achieved through exercise. Increased stride length, cadence, and postural control can be indicative of greater stability and may help to reduce fall risk. The current study sought to investigate whether participation (N=49) in a 12-week fall (2X/week) prevention exercise program increased balance and gait stability in adults aged 50+ (mean age=66; 83% female). Balance measures included postural sway velocity, distance, and frequency as detected by a BTrackS force plate (Balance Tracking Systems Inc.), and gait stability was assessed using cadence and stride length obtained from a Garmin foot pod during a Six-Minute Walk Test. Our results show that cadence improved from pre-test (M=60.05; SD=6.12) to post-test (M=62.25, SD=5.05), p< .01. However no other differences were observed as a result of the program. Based on our findings, it is possible that more specific exercises, or longer periods of exercise, may be needed to improve these outcomes.

Effect of 6 weeks of aerobic exercise training on gross cardiac hypertrophy and lung congestion in rats with experimental heart failure

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Myocardial infarction (MI) is a major precursor to heart failure (HF), which is characterized by cardiac hypertrophy and lung congestion. We hypothesized that exercise training (EX) would lower cardiac hypertrophy and lung congestion in MI-induced HF rats. Male Sprague-Dawley rats underwent either coronary artery ligation (MI to induce experimental HF) or SHAM surgeries. Approximately 10-days post-surgery, MI-EX rats (n=9) performed continuous, progressive treadmill training. MI-SED (n=10) and SHAM (n=8) remained sedentary. Seven weeks following the MI or SHAM surgeries rats underwent $\dot{V}O_2$max testing and were subsequently euthanized. Body (BW), wet heart (HW) and wet lung (LW) weights were assessed. Tibial length (TL) was measured to normalize organ weight to body size. MI-EX rats achieved a faster maximum running speed (28 ± 6 m/min) compared to MI-SED (21 ± 5 m/min) and SHAM rats (18 ± 5 m/min; P=0.004). $\dot{V}O_2$max was not different between groups (P=0.19). HW was significantly greater in MI-SED (1.87 ± 0.24 g) compared to SHAM (1.49 ± 0.28 g; P=0.02) while MI-EX (1.61 ± 0.27 g) was not different from MI-SED (P=0.051) or SHAM (P=0.342). Effect size analysis revealed MI-SED had a large, positive effect on HW and HW/TL ratio (Cohen's d=1.19 and 0.95 vs. SHAM, respectively) and MI-EX had a medium-large negative effect on HW and HW/TL ratio (d=-0.92 and -0.78 vs. MI-SED, respectively). However, mean differences in HW/TL ratio (P=0.14), LW (P=0.26; MI-EX vs. MI-SED d=0.19), LW/BW ratio (P=0.20; MI-EX vs. MI-SED d=0.39), and LW/TL ratio (P=0.59; MI-EX vs. MI-SED d=0.14) were not significant between groups. Exercise training contributes to reduced cardiac hypertrophy, but not lung congestion in MI-induced experimental HF rats.

Sex Differences in Sarcolipin Expression and Muscle Fatiguability in Mice

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Sarcolipin (SLN), a negative regulator of the sarco(endo)plasmic reticulum Ca^{2+} ATPase (SERCA) pump, is a key regulator of muscle metabolism and contractile function. To date, no study has examined potential sex differences in SLN expression or whether the effects of SLN ablation on muscle metabolism and fatiguability are different in male and female mice. Here, soleus muscles were isolated from adult (4-6m) male and female wild type (WT) and SLN knockout (KO) mice and measurements of fibre type composition, fatiguability, and protein expression were made. In WT mice, SLN expression was higher ($p<0.05$) in females compared to males. Fatiguing contractions resulted in greater force loss in males compared to females in WT mice (-81.97 $\pm$ 6.42% vs. -74.02 $\pm$ 5.62%, $p<0.05$) but not in SLNKO mice (-79.74 $\pm$ 2.91% vs. -80.65 $\pm$ 7.21%, $p=0.80$). The improved fatigue resistance in WT females could not be explained by differences in fibre type or protein expression of oxidative metabolism markers (PGC1α, COX1-4), since there were no differences in these parameters observed between WT and KO mice. These results suggest that high levels of SLN expression may promote fatigue resistance in female mice, but further research is required to elucidate the underlying mechanisms.

Sex specific roles of cultural connectedness and social support in meeting physical activity guidelines among First Nations and Métis Peoples in Saskatchewan

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Regular physical activity (PA) improves males and females' health, lowering risks of premature death and improving mental health. While cultural connectedness (CC) and social support (SS) are integral parts of Indigenous cultures, how these health dimensions are related to PA for Indigenous Peoples is unclear. This study aims to determine associations of CC and SS with PA among First Nations and Métis Peoples in Saskatchewan. Métis and First Nations (N=192; 80.7% females; M_{age}=28.9) from the University of Saskatchewan completed questionnaires including Godin Leisure-Time Exercise, Cultural Connectedness Scale and Social Support Index. First Nations sub-group Cree/Nehiyawak (50.8±7.5 vs. 41.75±7.8, p=0.03) and overall Indigenous (48.4±9.7 vs. 42.4±11.0, p=0.046) males meeting Canadian Society for Exercise and Physiology moderate to vigorous PA (MVPA) guidelines reported higher CC scores than those not meeting guidelines. Métis females not meeting MVPA guidelines reported greater community support scores than those meeting guidelines (14.2±2.1 vs. 12.6±2.4, p=0.03). Overall Indigenous males meeting MVPA guidelines reported a higher positive perception of social support than those not meeting MVPA guidelines (18.8±3.3 vs. 15.3±4.3, p=0.03). Métis females meeting MVPA guidelines reported lower community support (12.6±2.4 vs. 14.2±2.1, p=0.03). Among overall Indigenous males and females, CC and SS are associated with PA, with different experiences across sexes and Indigenous identities.

Developing an Exhaustive Tool to Measure School Level Factors that Influence Physical Activity and Sedentary Behaviours

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Children and adolescents are exposed to healthful behaviours (such as physical activity [PA] and sedentary behaviours [SB]) at schools. Unfortunately, schools are limited in their capacity to promote these behaviours, as a comprehensive tool to help them identify and target factors that they can improve has not been developed. This study aimed to fill the gap by conducting a comprehensive search strategy to identify all previous tools and to create one tool that is generalizable. In 2022, a comprehensive search strategy was implemented in seven electronic databases (PubMed; CINAHL; Scopus; SocIndex; SPORTDiscuss; Education Source; ERIC) to identify tools that measured any school (high, middle, and elementary) level factors. After removing duplicates, 1568 records were reviewed by two researchers and evaluated at the title and abstract level. Of the original, list 228 were fully reviewed and 52 publications were used to compile preliminary content for the measurement of school level factors. At this stage, 154 unique themes were identified covering seven main domains: demographics, environments, opportunities, culture, promotion, policies, and accessibility. An expert committee has been formed to review and make recommendations on themes that should or should not be retained. Automatic and personalized reports will accompany the completion of the tool.

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Males and females matched for V̇O2max per fat-free mass are also matched for submaximal exercise thresholds

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Although maximal oxygen uptake ($\dot{V}O_2$max) is typically normalized to body mass (BM), this method does not account for sex differences in body composition. Instead, normalizing $\dot{V}O_2$max to fat-free mass (FFM) is the recommended approach to investigate sex-based differences for variables related to aerobic fitness. We hypothesized that there would be no sex differences in submaximal exercise thresholds when participants were matched for $\dot{V}O_2$max per FFM. In total, 27 healthy, young females (n=12) and males (n=15) completed maximal and submaximal exercise protocols. $\dot{V}O_2$max,

respiratory compensation point (RCP), and gas exchange threshold (GET) were determined using 30W/min (i.e., 1W/2s) cycling ramp incremental protocols. To determine the power output (PO) and $\dot{V}O_2$ at the maximal lactate steady state (MLSS), participants completed two or three 30-minute constant work rate trials to find the highest PO at which blood lactate concentration was stable. When females and males were matched for $\dot{V}O_2$max (mean±SD: 60.2±7.8 vs. 63.1±11.0 mL/kg FFM/min; p=0.45), there were no differences in GET (36.8±8.0 vs. 36.7±8.3 mL/kg FFM/min; p=0.97), RCP (53.1±7.9 vs. 54.0±10.1 mL/kg FFM/min; p=0.81), MLSS PO (3.40±0.52 vs. 3.65±0.81 W/kg FFM; p=0.35), or MLSS $\dot{V}$O2 (49.1±5.7 vs. 50.5±10.6 mL/kg FFM/min; p=0.68). These findings indicate that males and females have similar submaximal exercise thresholds when matched for aerobic fitness based on $\dot{V}O_2$max normalized to FFM. (Supported by the Natural Sciences and Engineering Research Council of Canada (NSERC) and the University of Calgary, Faculty of Kinesiology)

Sex Differences in Sarcolipin Expression and Calcineurin Signalling with Aging

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Sarcolipin (SLN), a small protein inhibitor of the sarco(endo)plasmic reticulum Ca^{2+}-ATPase (SERCA), is dynamically upregulated in atrophic unloading and disease states where it promotes muscle health by activating calcineurin (Cn) and the nuclear translocation of nuclear factor of activated T-cells (NFAT). This study examined whether SLN expression and Cn signalling are altered with aging where reductions to both muscle mass and function are also well established. Here, analyses of SLN expression and Cn signalling were performed on soleus muscles from both male and female young adult (4-6M) and older adult (18+M) mice. Both age and sex were significant factors in SLN expression, wherein SLN content was greater in older animals independent of sex and in females regardless of age ($p<0.05$). Although total Cn expression displayed no differences between groups, Cn signalling, as indicated by the ratio of inactive phosphorylated NFAT to total NFAT, was greater in females and older animals ($p<0.01$) where SLN expression was greatest. Overall, these data add to the growing body of literature suggesting SLN is a key regulator of Cn signalling and points to a potential sexual dimorphism in this signalling pathway.

Reducing exertional dyspnea after acute respiratory muscle loading

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The perception of dyspnea, or breathing discomfort, is influenced by both physiological and psychological factors. We sought to determine if exertional dyspnea perception could be experimentally manipulated by exposing individuals to increased breathing discomfort while exercising. We hypothesized that dyspnea perception during exercise would be lower following an induced dyspnea task (IDT). Fifteen healthy participants (8 females, 7 males) completed two incremental cycle exercise tests on two separate days; starting at 40 watts (W) for females and 60W for males, increasing 20W each minute until volitional exhaustion. Before each increase, dyspnea and leg discomfort were assessed using the modified 0-10 Borg scale and cardiorespiratory parameters were measured with a customized metabolic cart. Following Day 1, participants completed IDT consisting of a 5-minute exercise at 70% peak W with added dead space (500 mL) and increased airway resistance (6.8±2.3 $cmH_2O{\cdot}s^{-1}{\cdot}L^{-1}$ inspiration, 3.8±0.7 $cmH_2O{\cdot}s^{-1}{\cdot}L^{-1}$ expiration). At maximal exercise, there were no differences in oxygen uptake ($\dot{V}O_2$) (47.2±9.9 vs 48.5±8.5 $mL{\cdot}kg^{-1}{\cdot}min^{-1}$), minute ventilation (124±36 vs 131±39 $L{\cdot}min^{-1}$), heart rate (181±9 vs 182±10 bpm), dyspnea (6.1±2.5 vs 5.9±2.6 a.u.) or leg discomfort (6.6±2.3 vs 6.6±2.4 a.u.) between days (all $p>0.05$). However, dyspnea was significantly lower on Day 2 at 60% $\dot{V}O_{2\,max}$ (1.7±1.4 vs 0.9±0.8 a.u, $p<0.001$) and 80% $\dot{V}O_{2\,max}$ (3.3±1.9 vs 2.6±1.7 a.u., $p<0.001$) despite no differences in relevant physiological variables. The onset of perceived dyspnea occurred at a significantly higher intensity on Day 2 than on Day 1 (42±18 vs 50±17%$\dot{V}O_{2\,max}$ respectively, $p = 0.029$). Leg discomfort was not different at any submaximal intensities nor was the onset different between days 1 and 2. In conclusion, exposing healthy individuals to heightened breathing discomfort can alter the perception of dyspnea during subsequent exercise bouts. (Supported by NSERC and CFI).

The effects of 8 weeks of local heat therapy, moderate-intensity exercise training, or combined training on cardiorespiratory fitness, body composition, and muscle strength in young, healthy recreationally active adults

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Repeated exposure to whole-body passive heat stress can improve cardiorespiratory fitness, body composition, and muscle strength in a similar manner to exercise training. However, chronic lower limb heating may be a more feasible and tolerable alternative. This study was a randomized controlled trial comparing the effects of 8 weeks of no intervention (CON), lower limb heat therapy (HEAT), moderate-intensity cycling exercise training (EX), or combined training (HEATEX) in 60 young, healthy recreationally active adults (23±3 years, 30 females). For HEAT, EX, and HEATEX, supervised training occurred 3x/week. Cardiorespiratory fitness was assessed via a $\dot{V}O_2$peak cycling test. Body composition was assessed with whole body densitometry. Muscle strength was assessed with a maximal isometric leg extension protocol. One-way analyses of variance were conducted on the change scores

(dependent variables) from week 0 to 8 to determine if there were differences between groups (independent variable, 4 levels). There were greater increases in the peak power output achieved on the $\dot{V}O_2$peak test in HEATEX compared to CON (Δ+22±12 *vs.* Δ-3±12 W, p=0.005). There were no other differences in change scores for any other variables between groups. A greater training stimulus is likely required to elicit improvements in cardiometabolic outcomes in this population. Clinical Trials NCT04588103. (Funded by NSERC.)

Acute partial sleep deprivation impairs working memory performance in young adults

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A single night of total sleep deprivation impairs cognitive functions like working memory (WM) in young adults. Interestingly, higher levels of cardiorespiratory fitness may buffer against the detrimental effects of sleep deprivation. Currently, it is unclear how partial sleep deprivation (PSD) impacts WM and whether cardiorespiratory fitness moderates this effect. We tested the effect of one night of PSD on WM performance, and the corresponding relationship between cardiorespiratory fitness and WM performance. Twenty-two young adults with normal sleep habits (n=13 females) completed the N-back test of WM following one night of normal sleep (7-9 hours sleep duration) and one night of PSD (3 hours sleep duration). Cardiorespiratory fitness was assessed via an incremental test to exhaustion on a cycle ergometer.To account for learning effects due to repeated cognitive testing, a time-matched control group was collected (n=22). Wefound that 3-back reaction time (RT) significantly worsened after PSD compared to the control group (P=0.038, η_p^2=0.099). Contrary to our hypothesis, V̇O2peak was associated with slower 3-back RT following PSD (P=0.025, r=-0.48). Our data indicate that acute PSD is sufficient to impair WM performance in young adults and that people with higher cardiorespiratory fitness may be more sensitive to these detrimental effects.

One night of partial sleep deprivation does not impact indices of cardiovascular function in young and healthy humans

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Short sleep duration is associated with increased cardiovascular disease (CVD) risk. Cardiovascular dysfunction that precedes CVD may be detectable as impairments in indices such as arterial stiffness, and the effects of acute partial sleep deprivation (PSD) on cardiovascular function have not been fully characterized. The purpose of this study was to examine the acute impact of one night of PSD on indices of cardiovascular function and the degree to which cardiovascular fitness, estimated by V̇O2peak, moderates changes in cardiovascular function after PSD. We measured resting blood pressure and heart rate, heart rate variability, and carotid-femoral pulse wave velocity (cfPWV) in thirty-two young, healthy participants (mean±SD: 21±3 years) after three consecutive nights of normal sleep (NS; 7-9 hours), and after one night of PSD involving three hours of sleep. No differences in hemodynamic parameters were observed between NS and acute PSD (all p > 0.05), except for a 1 mmHg decrease in DBP (NS: 63±6; PSD: 62±5 mmHg, $p = 0.04$). Furthermore, there was no difference in cfPWV (p > 0.05) between sleep conditions. Cardiorespiratory fitness did not moderate any of the aforementioned relationships. We conclude that one night of partial sleep deprivation does not significantly affect central hemodynamics or cfPWV in young and healthy adults.

Cannabis inhalation does not alter carotid-femoral pulse wave velocity or brachial artery reactive hyperemia flow-mediated dilation

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Recreational cannabis use is widespread and typically involves smoke inhalation. Cigarette smoking detrimentally affects both arterial stiffness and vascular endothelial function. Having abstained from recent use, habitual cannabis users demonstrate greater carotid-femoral pulse wave velocity (cfPWV), but similar flow-mediated dilation (FMD) compared to non-users. To date, the acute vascular effects of cannabis have not been characterized. Thus, the purpose of this study was to assess cfPWV and brachial artery FMD following cannabis inhalation. In a randomized order, participants inhaled cannabis under three different conditions: 1) smoked cannabis containing Δ-9-tetrahydrocannabinol (S-THC), 2) vaporized cannabis containing Δ-9-tetrahydrocannabinol (V-THC), and 3) vaporized cannabis containing cannabidiol (V-CBD). Heart rate, blood pressure, cfPWV, and FMD, were measured prior to- and following each cannabis intervention. Mean blood pressure was increased under all conditions (S-THC: Δ6.5±6.5mmHg, V-THC: Δ4.5±4.5mmHg, V-CBD: Δ2.6±3.6mmHg; P=0.00001). Heart rate was increased following both S-THC and V-THC (both P<0.01), but not V-CBD (S-THC: Δ16.5±15.5bpm, V-THC: Δ15.6±15.9bpm, V-CBD: Δ-1.1±4.1bpm). Both cfPWV (S-THC: Δ0.3±0.7m/s, V-THC: Δ0.4±0.7m/s, V-CBD: Δ0.1±0.4m/s; P=0.3) and FMD (S-THC: Δ-0.3±4.4%, V-THC: Δ2.3±5.5%, V-CBD: Δ0.9±3.8%, P=0.08) were unaffected by any cannabis intervention. The present findings suggest that despite hemodynamic perturbations, neither arterial stiffness nor vascular endothelial function are acutely altered by cannabis inhalation.

Investigating the roles of exercise intensity and biological sex on post-exercise alterations in cardiac function

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Exercise-induced cardiac fatigue (EICF) is the transient reduction in cardiac function following prolonged-strenuous

exercise. Recently, it has been demonstrated that EICF can occur following only 45min of high-intensity exercise, and alterations are more pronounced when using exercising stress-echocardiography. The aim of this investigation was to examine whether sprint-intervals (SIT;6x30s Wingates), or 90min moderate-cycling with sprint-intervals (MIX;90min with 1x30s Wingate every 15min), would cause greater EICF than 90min (CON) or 3h (LONG) moderate-cycling assessed using stress-echocardiography, and to assess sex-differences in EICF. Seventeen (M:9,F:8) active participants underwent 3 cycling sessions in a randomized cross-over design, with stress-echocardiography performed before and after each condition, and at 90min during LONG for the CON timepoint. Following all conditions, measures of left ventricular (LV) systolic (stroke volume, ejection fraction (EF), peak longitudinal strain, isovolumetric contraction time, S') and diastolic (E/A, E', isovolumetric relaxation time, longitudinal strain rate) function were reduced (all $P<0.05$). In the right ventricle (RV), systolic function was reduced (tricuspid annular plane systolic excursion, S', peak strain, and strain rate) following all conditions, and fractional area change was impaired to the greatest degree following SIT (condition x time, $P=0.01$). Females demonstrated lesser alterations in LV EF, elastance, and E' compared to males (time x sex, $P<0.05$). EICF occurs similarly following all cycling loads, which suggests it may be a normal compensation for post-exercise hemodynamic and autonomic milieu; however, males experience greater magnitude alterations than females.

$\dot{V}O_2$max but not pulse wave velocity predicts limb blood flow responses to passive movement during passive heating

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Central artery stiffness and aerobic fitness are modifiable, independent predictors of cardiovascular disease risk; however, their relationship to downstream peripheral vascular function (the location of symptomatic vessel disease) has not been well described in the literature. We tested whether arterial stiffness and aerobic fitness predicted dynamic blood flow responses to passive stimuli (passive movement and external heating) in healthy adults. Sixteen participants (24±3 yrs, 23.0±2.7 $kg{\cdot}m^2$) visited the laboratory on separate occasions to assess carotid-femoral pulse wave velocity (cfPWV) and $\dot{V}O_2$max (cycle ergometer) (visit 1) and blood flow responses to 30 minutes of thigh heating at 38°C and a standard 1-min passive limb movement test (visit 2). Multiple linear regression was used to predict blood flow responses to passive heating (model 1) and passive movement during heating (model 2) with fitness and arterial stiffness after correcting for age and sex. Model R^2 values and standardized Beta coefficients of predictor variables are reported. $\dot{V}O_2$max was a significant predictor of the blood flow response to heating (model $R^2=0.37$; $\dot{V}O_2$max Beta=0.89), the passive limb movement peak flow response ($R^2=0.44$; $\dot{V}O_2$max Beta=1.0), and passive limb movement flow area-under-the-curve ($R^2=0.37$; $\dot{V}O_2$max Beta=0.78); all models and coefficients $P<0.05$. Neither $\dot{V}O_2$max nor cfPWV predicted passive movement responses at rest and cfPWV was not a predictor in dynamic models. These findings emphasize the role of higher aerobic fitness in predicting dynamic blood flow responses in the leg, with fitness being more indicative of whole-body vascular function than aortic stiffness. The disconnect between cfPWV and peripheral function outcomes was not expected and might reflect the upper-end cardiovascular health of the participants, resulting in a ceiling effect on the predictive response. Future studies should consider the full transduction of blood from central to peripheral systems when describing bulk blood flow to the lower limb following external stimuli.

Do gender-related variables predict changes in functional capacity and quality of life in patients with coronary artery disease following cardiovascular rehabilitation?

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Masculine scores from the Bem-Sex Role Inventory (BSRI, a measure of masculine and feminine personality traits) have been shown to predict 6-minute walk test (6MWT) distance and mental health-related quality of life (HR-QoL) at cardiovascular rehabilitation (CR) intake. This study examined if gender-related variables at intake predict changes in 6MWT distance or mental and physical HR-QoL following CR. Patients who underwent coronary revascularization procedures completed the BSRI (scale range: 1-7), a 6MWT, and the Medical Outcomes Study Short Form-36 (to determine physical and mental component summary [PCS and MCS] scores) at CR intake and at 12 weeks follow-up. Marital and occupation status, ethnicity and education level were assessed at intake. The associations between gender-related variables and changes in 6MWT distance, PCS and MCS scores were examined using correlation analyses. A total of 103 participants (91 males, 12 females, 60.8±7.4 years, 82.5% married/common-law, 43.7% working full-time, 82.5% white, and 44.0% with 1-3 years of university/college education) were included. At intake, BSRI masculine scores were 5.6±0.8 for males and 4.9±1.0 for females. BSRI feminine scores were 4.8±0.5 for males and 4.9±0.7 for females. Changes from intake to follow-up were +58.7±53.5 m for 6MWT; +6.2±7.6 points for PCS scores; and 3.2±8.9 points for MCS scores. No significant correlations were found between gender-related variables and changes in the measured outcomes. Our findings demonstrate that intake gender-related variables may not predict the changes in health outcomes following CR, as previously shown with CR intake values. (Supported in part by the Innovations Fund of the Alternate Funding Plan for the Academic Health Sciences Centre of the Ministry of Ontario, and the Heart and Stroke Foundations of Canada)

Characterizing SERCA function in the hippocampal and prefrontal cortex regions of the brain from C57 and D2 *mdx* mice

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Duchenne muscular dystrophy (DMD) is an X-linked muscle wasting disease caused by the loss of dystrophin, and approximately 30% of those affected experience cognitive deficits. Recent evidence has shown that the DBA/2J (D2) *mdx* mouse model of DMD present with cognitive dysfunction and Alzheimer's like pathology with a shift towards amyloid beta production in the hippocampus and prefrontal cortex (PFC). However, the mechanism behind these results remains unknown. Given that proper calcium (Ca^{2+}) homeostasis is vital for cognition and that impairments in sarco(endo)plasmic reticulum Ca^{2+}-ATPase (SERCA) function have been linked with Alzheimer's disease, we sought to characterize SERCA function in the hippocampus and PFC from young (9-10 week old) D2 and C57BL/10 (C57) *mdx* mice and their wild-type (WT) counterparts. Ca^{2+} uptake experiments showed that both *mdx* models have decreased Ca^{2+} uptake ability in the PFC but only D2 *mdx* showed impairments in the hippocampus. While there were no changes in SERCA2 content or any of its protein regulators, D2 *mdx* mice displayed signs of oxidative stress with less heat shock protein 70 expression. Thus, we provide the first evidence of SERCA dysfunction in the *mdx* brain. Future studies should investigate whether enhancing SERCA function can improve cognitive health. (This work was funded by a Canada Research Chair Tier 2 Award to VAF.)

Allometric scaling of performance measures in adolescent ice hockey players

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Allometric scaling of performance data may facilitate comparison between athletes of differing physical characteristics. This may be important for adolescent athletes where variation in growth can produce drastic differences in body proportions within age groups. The purpose of this study was to define the correlation between anthropometric variables and off-ice performance and determine the effect of allometric scaling on the observed correlations in male ice hockey players. Four hundred seven top-level competitive male adolescent ice-hockey players (119 defense, 246 forwards, 42 goalies; 13.9 ± 1.2 yrs., 169.7 ± 9.3 cm, 62.5 ± 11.9 kg) participated in pre-season off-ice fitness testing in the fall of 2017 - 2020. Testing was completed in a combine style including various tests of strength, flexibility, agility and speed; However, only the Wingate anaerobic power test, long jump for distance and the 5-10-5 agility test are included in the present analysis. Pearson correlations were completed between height, weight and performance outcomes before and after scaling procedures. Linear regressions were completed on log-transformed data to determine allometric coefficients, which were then compared against ratio scaling (height, weight) of all performance outcomes. Correlations ranging from $r = 0.238$ to $r = 0.894$ were found between height, weight and performance outcomes prior to scaling ($p < 0.001$). In all cases, allometrically scaled height or weight negated the correlation between anthropometrics and performance whereas normalizing by weight or height did not ($r = 0.291 – 0.926$, $p < 0.001$), with the exception of long jump distance ($r = -0.028$, $p = 0.584$). Allometric scaling of height or weight may be preferred for performance normalization for inter-athlete comparisons in adolescent hockey players, with the exception of the long jump where either method may be appropriate.

Does supplementing with creatine monohydrate decrease time to recovery following concussion in adolescents? - A protocol

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Sport related concussion (SRC), a form of traumatic brain injury (TBI), continues to be highly prevalent for children and adolescents. A SRC causes a cascade of neurometabolic changes which all contribute to clinical symptoms. Murine models demonstrate that TBI impairs mitochondrial function partially due to an influx of calcium ions, while creatine (Cr) can improve calcium homeostasis through increasing adenosine triphosphate (ATP) and in-turn restoring membrane potential. The purpose of this project is to determine if supplementing with Cr following a SRC changes time to recovery, systemic stress and inflammatory biomarkers, and quality of life in adolescent patients. A double-blind, randomized, parallel arm clinical trial design will be utilized. One hundred and twenty participants (15-19 yrs of age) with an acute SRC (<7 days post-injury) will be recruited and consume either placebo (maltodextrin; $n = 60$) or Cr at a dose of 20 g/day for the first seven days followed by 5 g/day afterwards, until participation is concluded once medical clearance to return to full sport- and school activities is received from their treating physician. Weekly research visits will be conducted following clinical appointments to evaluate symptoms (post-concussion symptom scale; version from the Sport Concussion Assessment Tool-5), quality of life inventory (PedsQL), and will provide a saliva sample (2 mL) for cortisol and interleukin-6 analysis. The primary outcome of days to recovery, will be analyzed with Kaplan-Meier survival analysis and log Cox regression model while all other variables will be analyzed with mixed-effect linear models to identify differences between the experimental and placebo group.

The impact of 16-week resistance training performed with elastic bands along with diabetes education on physical function, glycemic control, and frailty status in individuals with type 2 diabetes and frailty: Results from the Band-Frail study

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Patients with type 2 diabetes (T2D) or frailty have a reduced physical function compared to healthy individuals of the same age. Living simultaneously with both conditions (T2D and Frailty) exacerbates an individual's physical function and glycemic control. Resistance training and diabetes education have been shown to improve glycemic control and physical function. However, no studies investigated the impact of resistance training using elastic bands along with diabetes education on physical function, glycemic control, and frailty status in individuals with both T2D and frailty. We hypothesized that performing 16-week of resistance training with elastic bands along with diabetes education would increase physical function, improve glycemic control, and reduce frailty status. Participants (n=54) were included if they were aged 65 yrs old and above, living with T2D (HbA1c $\geq$ 6.5%), and if they were at least pre-frail based on the Fried's Frailty Scale. The primary exposure variable was a 16-week elastic band resistance training program which consisted of 50 minutes of supervised resistance training twice a week and 10-20 minutes of diabetes education with a diabetes educator once a week. Primary outcomes were physical functions, glycemic control, and frailty status measured by the Short Performance Physical Battery (0-12), HbA1c, and Fried's Frailty Scale. The results showed that participating in the band-frail program significantly improved physical function (pre: 7.9 $\pm$ 2.0 vs: post:9.5 $\pm$ 2.0; p<0.01), HbA1c (pre:7.7 $\pm$ 1.5 vs: post:7.4 $\pm$ 1.2; p<0.01) frailty status (pre:1.9 $\pm$ 0.9 vs: post: 1.4 $\pm$ 1.0; p<0.01). These results suggest that participating in the Band-Frail program enhances physical functions, glycemic control, and frailty status in frail individuals with T2D. (Funding: Public Health Agency of Canada- Healthy Senior Pilot Projects)

Optimizing Resistance Training Prescription for Strength: A Systematic Review and Bayesian Network Meta-Analysis

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Skeletal muscle strength is critical for maintaining physical function throughout the lifespan, and resistance training (RT) potently increases skeletal muscle strength. Resistance training prescriptions (RTx) include numerous modifiable variables. Previous pairwise meta-analyses have compared small sample sizes and single prescription variables. The objective of this analysis was to comprehensively compare the impact of unique RTx on muscle strength. Eligible randomized trials included healthy adults ($\geq$18 years), compared at least two of 13 predefined interventions, spanned at least six weeks, and measured muscle strength. Predefined interventions were non-exercising control (CTRL) and 12 unique RTx denoted by a three-letter acronym – XYZ – where X is load (H, $\geq$80% 1-repetition maximum [1RM]; L, <80% 1RM); Y is sets (M, multi-set; S, single-set); and Z is weekly frequency (3, $\geq$3 d/wk; 2, 2 d/wk; 1, 1 d/wk), respectively. Six databases were systematically searched from inception to February 2022. Articles were screened, and data from eligible articles were extracted in duplicate. Standardized mean difference (SMD) was calculated for all comparisons and analyzed with a random-effects Bayesian network meta-analysis using non-informative prior distributions. Surface under the cumulative ranking curve (SUCRA) probabilities were calculated to rank interventions. Analyses were completed in RStudio with the packages escalc and multinma. The initial search retrieved 28732 records, and the quantitative analysis included 178 articles (n = 5097). The mean (95% credible interval) SMD for each RTx versus CTRL was: HM3 = 1.63 (1.40, 1.87), HM2 = 1.66 (1.32, 1.99), HM1 = 1.60 (0.78, 2.43), HS3 = 1.22 (0.70, 1.75), HS2 = 1.20 (0.53, 1.87), HS1 = 0.79 (-1.03, 2.63), LM3 = 0.99 (0.80, 1.17), LM2 = 1.24 (1.00, 1.49), LM1 = 1.04 (0.38, 1.69), LS3 = 0.87 (0.52, 1.23), LS2 = 0.91 (0.45, 1.37), LS1 = 0.75 (-0.28, 1.75). HM2 (85.9%), HM3 (82.6%), and HM1 (62.4%) were most likely to be ranked in the top-three RTx. While lifting heavier loads maximized strength gains, all RTx increased strength compared to no exercise. This analysis robustly supports the conclusion that adults of all ages can achieve strength gains through RT with various training schemes.

Investigating the association between SmartMoms Canada app usage and physical activity, sleep and self-reported psychological health markers in pregnant women

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We assessed the association between SmartMoms Canada (SMC) app usage and physical activity levels, health-related quality of life (HRQoL), depression symptoms, and sleep quality in pregnant women. Pregnant women (12-20 weeks gestation) were recruited to participate in the SmartMoms Canada trial. After installing the app, participants answered questionnaires related to i) physical activity behaviours (Godin Leisure-time Exercise, GLTE), ii) HRQoL (SF-36), iii) prenatal depression (Edinburgh Postnatal Depression Scale, EPDS), and iv) sleep quality (Pittsburgh Sleep Quality Inventory, PSQI). These questionnaires were re-applied at 24-28 and 36-40 weeks gestation. Step count was tracked using a Fitbit® activity tracker and captured on the SmartMoms Canada

server. App usage (min/week) throughout pregnancy was determined with Google Firebase®. Spearman Rank correlations (rho) were performed to associate app usage with the questionnaire data and step count in both mid- and late-pregnancy. Significance was set at $p<0.05$. We identified three large (≥ 0.5) correlations. App usage was positively correlated with GLTE scores at mid- (rho=0.557; p=0.009; n=21) and late-pregnancy (rho=0.635; p=0.036; n=11). SMC usage was also largely associated with vitality (HRQoL domain) at late-pregnancy, although not statistically significant (rho=0.554; p=0.077; n=11).

Higher SMC app usage was associated with greater self-reported physical activity levels and self-perceived vitality in pregnant women. Future studies should examine the effectiveness of mHealth interventions during pregnancy and postpartum. (Funding: Public Health Agency of Canada and the Canadian Institutes of Health Research).

Scoping review on children and youth's outdoor play publications in Canada

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The 2015 Position Statement on Active Outdoor Play galvanized the outdoor play movement in Canada. The Outdoor Play in Canada: 2021 State of the Sector Report provided an update to that statement and outlined key priorities for the sector. This scoping review was part of the State of the Sector Report and aims to answer the question: 'How, and in what context, is children and youth's outdoor play being studied in Canada?'. Articles published after September 2015 in English/French on outdoor play by authors from Canadian institutions or studied Canadian children/youth were included. The electronic search was conducted in March 2021 on MEDLINE, CINAHL, and Scopus. Articles were organized according to the State of the Sector Report priorities. Within each priority, study design and measurement methods were tallied. In total, 275 articles were included. Sample sizes varied from one parent's reflections to 999,951 data points from health databases. The most common priority area was health, wellbeing, and development; the least common were COVID-19 and Indigenous Peoples and Land-based Outdoor Play. Cross-sectional studies were the most common study design, the least common was rapid review. More studies used subjective than objective measurement methods. Across priorities, physical health was the most examined outcome and mental/emotional development the least. A wealth of knowledge has been produced in Canada on outdoor play since the Position Statement on Outdoor Play. An area where further knowledge generation is needed includes the relationship between outdoor play and mental/emotional development among children and youth. (Funding for this project was provided by the Lawson Foundation, the Social Sciences and Humanities Research Council, and an anonymous donor)

Utility and acceptability of an ergometer for aging adults' training in a clinic environment – a pilot study

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It has been shown that exercise during hemodialysis (HD) enhances the treatment's efficiency and patients' functional capacity. However, there is no cheap and accurate cycle ergometer that can be used to optimally prescribe exercise. Then, the objective of this study was to evaluate if a cycle ergometer prototype (EXALT) designed for research in exercise science was safe and acceptable for patients and health professionals in HD.

A total of 13 patients from HD were recruited and perform an aerobic exercise session with the EXALT ergometer. Along with the 13 patients, 4 health professionals evaluated the acceptability and safety of the ergometer. Concerning the ergometer itself, 62% of the patients found it well adapted because of its functionality, its shape and size and comfort, against 23% that do not like its configuration. Regarding the pedaling, only 54% found it comfortable. 69% of them would like to have access to the exercise data. Although 92% of the patients found the screen and font size pleasant, 75% of health professionals found the buttons too small and not easy to use. Regarding safety, 85% of patients and 100% of professionals found it safe to use in HD. For a long-time use, 77% of patients and 75% of professionals would like to use it.Based on this study, we modified the EXALT ergometer to make exercise data accessible along with a WiFi-connected tablet to control the exercise parameters. In conclusion, this study shows that this prototype is suitable and safe to be used for intradialytic exercise.

The effect of a semi-upright body position on the cardiovascular response to submaximal cycling

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The effect of hemodynamic conditions induced by a semi-upright body position on the cardiovascular response to exercise is poorly understood. This study explored the effect of a semi-upright body position during submaximal cycling on cardiac output ($\dot{Q}$), vastus lateralis oxygen saturation (SmO_2), oxygen consumption ($\dot{V}O_2$), and perceived exertion (Borg RPE). Ten healthy individuals (23±4 years, 50% male) completed alternating five-minute bouts of submaximal upright and semi-upright (40° incline) cycling at 50W and 100W. Starting body position was randomly assigned and counterbalanced. $\dot{Q}$, SmO_2, $\dot{V}O_2$ and RPE were assessed at rest and during steady state exercise. Data are Δ from seated rest and reported as mean±SD. There was a main effect of intensity on

$\dot{Q}$, SmO_2, $\dot{V}O_2$ and RPE (all p<0.05). In a semi-upright position, the increase in $\dot{Q}$ (7.3±2.5 vs 5.4±2.1 L/min, p=0.001) and RPE (median, Q1-Q3: 12, 8-12 vs 9, 8-11, p=0.045) and the decrease in SmO_2 (-30±24 vs -20±19%, p=0.010) were greater than upright, while the increase in $\dot{V}O_2$ was attenuated (1.01±0.35 vs 1.17±0.34 L/min, p=0.003). SmO_2 was not predicted by $\dot{Q}$ (all p>0.35) and RPE was not predicted by SmO_2 or $\dot{Q}$ except in the semi-upright position at 50W ($\dot{Q}$, r=0.66, p=0.037). In conclusion, the elevated $\dot{Q}$ during semi-upright cycling does not seem to perfuse active skeletal muscle as SmO_2 is reduced and RPE is increased. This suggests a peripheral perfusion impairment despite an elevation in $\dot{Q}$. Additional work should examine leg blood flow to further explore $\dot{Q}$ distribution in the semi-upright position.

iACTIF: Assessing acceptability and utility of a co-constructed virtual community that promotes social support and healthy lifestyles among cancer patients

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iACTIF is virtual community that promotes social support and access to educational material to promote healthy lifestyles as part of a virtual multimodal group-based prehabilitation program for patient diagnosed with cancer waiting for surgery. This presentation aims at describing the successful co-creation process and providing preliminary results on the acceptability and utility of the virtual community. An expert advisory committee was involved in five co-construction working sessions over the past year to identify the optimal technopedagogical solution, co-develop and test the content and modalities of the virtual platform. A total of 11 informative capsules were developed and delivered. A sample of 25 participant complete questionnaire at study inception (T1), before surgery (T2) and three months after surgery (T3). Preliminary results indicate that 88% of participants found the duration of the teaching component and discussion appropriated, 92% declared the material was easy to understand, 84% were satisfied with the virtual modality, 84% found it easy to connect to the virtual platform and 100% report that supervision of the virtual session by a kinesiologist gave them confidence. Of the 11 thematic content offer, pain management, nutrition, rehabilitation after surgery and muscle strength were the most utile capsules according to participants. Participants reported high sense of belonging to the prehabilitation group as indicated by the Relatedness to Others in Physical Activity Scale (mean(SD) = 4.12 (1.01)).This technopedagogical solution represents a unique opportunity to consolidate, sustain and facilitate accessibility to the prehabilitation material while also fostering patient social interactions and support. (Programme de soutien aux projets technosociaux innovants (no 2021-PSPTI-005), Partenariat-UdeM (no CF00150254)).

Repeatability of expiratory flow limitation during exercise in healthy adults

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Approximately 50% of healthy adults experience expiratory flow limitation (EFL) at or near maximal exercise; however, the repeatability of exercise-induced EFL has not been established in this population. We sought to determine the between-test repeatability of EFL in healthy adults during incremental cycle exercise. We hypothesized that the repeatability of EFL would be 'good' when assessed as a binary variable (*i.e.,* absent or present) but 'poor' when assessed as a continuous variable (*i.e.,* % tidal volume overlap). Nine healthy adults (20-52 y, n=7 males, n=2 females) performed spirometry followed by an incremental cycle exercise test to exhaustion on two separate occasions. Standard cardiorespiratory variables were measured continuously at rest and throughout exercise. EFL was assessed using the tidal flow-volume overlap method. The between-test repeatability of EFL was determined using Cohen's κ for the binary assessment of EFL and intraclass correlation (ICC) for the continuous measures of EFL. During exercise, EFL occurred on at least one occasion in 44% (n=4) of participants. The repeatability of binary assessments of EFL was 'good' at matched levels of minute ventilation ($\dot{V}_E$) during high-intensity exercise (*i.e.,* >75% of maximal oxygen uptake) (κ=0.82, p<0.05) and at peak exercise (κ=0.77, p<0.05). The repeatability of continuous measures of EFL was 'poor' at matched levels of $\dot{V}_E$ during high-intensity exercise (*i.e.,* >75% of maximal oxygen uptake) (ICC=0.50, 95% confidence interval: 0.07–0.78) and at peak exercise (ICC=0.44, 95% confidence interval: -0.30–0.84). Our results suggest that when assessing EFL during exercise in healthy adults, binary assessment provides greater repeatability than continuous measures, which has important implications for studies involving repeated measures of EFL. (Supported by the Natural Sciences and Engineering Research Council of Canada)

Effects of parity status on physical fitness of purple trade members in the Canadian Armed Forces with repetitive strain injury history

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This study aimed to identify physical fitness differences between parous and nulliparous Canadian Armed Forces (CAF) Purple Trade (tri-service) members who have had a repetitive strain injury (RSI) during their military service. From October 2021 and January 2022, data were collected via an online questionnaire and in-person physical fitness assessment. Active-duty, female members of CAF Purple Trades with a history of RSI were included in this study (n=51). Descriptive

analysis, independent-samples t-test, one-way ANCOVA (adjusted by age), and chi-square were used to compare physical fitness results between parous and nulliparous groups. A p-value <0.05 was considered significant. The parous group (n=24) exhibited superior lower back muscular endurance on the Biering-Sorensen test (146.7±63.9 vs. 108.0±46.1seconds, p=0.016) and had lower fat mass percentage (27.8±8.6 vs. 32.2±7.0, p=0.047) compared to nulliparous peers (n=27). Further, 87.5% of parous females were able to surpass 30cm in the sit-and-reach flexibility test compared to 63.0% of the nulliparous group (p=0.045). No other differences in strength, power, or $\dot{V}O_{2max}$ were observed. Differences in lower back endurance and fat mass percentage did not remain when adjusting for age. Parous members of CAF Purple Trades who did not release from service after childbirth or after being injured performed better on lowerback endurance and flexibility tests than their nulliparous counterparts. A higher level of fitness may be required for parous CAF members to continue service after pregnancy and RSI. (This project was funded by the Innovations for Defence Excellence and Security [IDEaS]).

Cross sectional and longitudinal associations between sedentary behaviour and fall related injuries in middle and older aged adults: Results from the CLSA

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The second leading cause of injury related deaths are falls and contribute to high health care costs. Although data suggest that sedentary behavior is associated with health and functional outcomes, very limited evidence suggest that sedentary behaviour contributes to fall related injuries and how a change in sedentary behaviour may impact the risk of falls. This study aimed to 1- investigate the association between sedentary behaviour and fall related injuries and 2- investigate if changes in sedentary behaviour over 18 months impacts the risk of fall related injuries. Participants in this study were from the Canadian Longitudinal Study of Aging (CLSA) which includes a cohort of 51,338 community-dwelling adults between the ages of 45-85 at baseline. The primary outcome was self-reported occurrence of at least one fall-related injury. The exposure variable, sedentary behaviour was derived from the Physical Activity Scale for the Elderly. Logistic regression models were constructed to investigate the association between sedentary behaviour and change in sedentary behaviour with fall related injury while adjusting for the following co-variates: age, sex, number of chronic conditions, moderate to vigorous physical activity, and resistance training. Sedentary behaviour was associated with injurious falls in middle-aged and older adults aged 62.61 ± 10.18 and 48.8% male, independent of age, sex, chronic conditions, and physical activity levels OR (95%CI) of 1.096 (1.047-1.148), particularly for participants who engaged in the highest amount of sedentary activity. However, changes in sedentary behaviour over 18 months period of and follow-up were not associated with fall-related injuries 1.030 (0.972-1.092). In conclusion, although sedentary behaviour is associated with falls related to injury, changes reported in sedentary behaviour over 18 months is not predicting the risk of fall-related injuries among this age group.

Lack of sex differences in the influence of acute local changes in blood pressure on forearm arterial stiffness

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Arterial stiffness assessed with pulse wave velocity (PWV) increases with acute increases in blood pressure (BP) evoked via sympathoexcitation. However, how PWV is impacted by changes in blood pressure elicited without sympathoexcitation, and whether there are sex differences in responses is unknown. Twenty healthy adults participated (10 males aged 21 ± 6 years; 10 females aged 21 ± 7 years). Females were tested in the low estrogen phase of menstrual or oral contraceptive pill (OCP) cycle. Forearm PWV was assessed via applanation tonometry in two trials of both high (arm above heart level (AHL)) and low (arm below heart level (BHL)) forearm blood pressure (FBP). Results are mean ± SD. FBP was significantly higher BHL (94 ± 8 mmHg) compared to AHL (52 ± 9 mmHg) (p<0.001). There was no effect of trial (P=0.133) or sex (P=0.619) on PWV. PWV was higher BHL vs. AHL (P<0.001) (Pooled across sex: BHL 12.8 ± 4.6 m/s vs. AHL 6.6 ± 1.6 m/s). In conclusion, increasing forearm blood pressure without traditional sympathoexcitatory manoeuvres resulted in increased forearm arterial stiffness without any apparent sex differences when females were tested under low estrogen conditions. (Funded by NSERC)

Absolute but not relative exercise duration at $\dot{V}O_{2max}$ changes according to the power output within the severe-intensity domain.

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Exercising within the severe-intensity domain drives oxygen uptake ($\dot{V}O_2$) to its maximum. However, it is unclear how long $\dot{V}O_{2max}$ may be sustained at different power outputs (PO) within this domain before task failure ensues. Such information is important because maximizing exercise duration at $\dot{V}O_{2max}$ is considered an important component of a successful high intensity training program. This study quantified the duration for which $\dot{V}O_{2max}$ could be sustained before task failure at discrete POs within the severe-intensity domain. Seven

recreationally trained males (age: 28±9 years) performed a ramp-incremental test (30 W·min^{-1}) to volitional exhaustion to measure $\dot{V}O_{2max}$ and peak PO (PO_{peak}) and four time to exhaustion (TTE) trials at POs corresponding to 70, 80, 90, and 100% of PO_{peak}. During the TTE trials, $\dot{V}O_2$ was continuously recorded and $\dot{V}O_{2max}$ was considered attained when $\dot{V}O_2$ was equal to, or exceeded, 95% of the ramp-identified $\dot{V}O_{2max}$. For each trial, the duration at $\dot{V}O_{2max}$ was computed in seconds and relative to the total TTE duration (%). The $\dot{V}O_{2max}$ and PO_{peak} were 4.17±0.54 L·min^{-1} and 381±45 W, respectively. During the TTE trials, the duration at $\dot{V}O_{2max}$ differed across POs (P=0.021). Compared to 80%PO_{peak} (187±112 s), duration at $\dot{V}O_{2max}$ was shorter at 90%PO_{peak} (73±57 s; P=0.042) and 100%PO_{peak} (37±33 s; P=0.027) but not different from 70%PO_{peak} (241±139 s; P=0.881). However, for the trials at 70, 90, and 100% of PO_{peak}, the durations at $\dot{V}O_{2max}$ were not different from each other (P>0.05). In addition, there was no difference amongst POs when considering the duration at $\dot{V}O_{2max}$ relative to the TTE (P=0.167); 32±19, 41±12, 27±15, and 22±17% for 70, 80, 90, and 100%PO_{peak}, respectively.

Although the PO within the severe-intensity domain influences the duration at $\dot{V}O_{2max}$, the duration expressed as a percent of the TTE remains similar within this range of intensity. These findings have important implications for the planning and implementation of high intensity exercise programs.

Effects of face masks on the multiple dimensions and neurophysiological mechanisms of exertional dyspnea

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Despite consistent evidence that face masks (FMs) increase dyspnea (i.e., breathlessness), no studies have examined the multidimensional components of dyspnea or the physiological mechanisms of dyspnea with FMs. In a randomized cross-over design, sixteen healthy individuals (n=9 females, 25±3 y) completed three testing sessions separated by ≥48 h. Each visit included maximal incremental cycling where visit 1 was for familiarization purposes and visits 2 & 3 were randomized to either FM or control. Dyspnea intensity and unpleasantness were assessed using the 0-10 Borg scale and the Multidimensional Dyspnea Profile (MDP) was administered immediately following exercise. Crural diaphragmatic electromyography (EMG_{di}) and esophageal pressure (P_{eso}) were measured via a specialized catheter to estimate neural respiratory drive and respiratory muscle effort, respectively. Dyspnea unpleasantness was significantly greater with the FM at the highest equivalent submaximal work rate (HESWR) (2.5±2.0 vs. 1.5±1.5 Borg 0-10 units, P=0.01) and at peak exercise (7.8±2.1 vs. 5.9±3.4 Borg 0-10 units, P=0.01) with no differences in dyspnea intensity ratings throughout exercise compared to control. There were significant increases in the sensory quality of "smothering/air hunger" (P=0.01) and the emotional response of "anxiousness" (P=0.04) in the FM condition. There were also significant increases in EMG_{di} (P=0.001) and esophageal pressure (P=0.006) with FMs at the HESWR. FMs negatively impact the affective domain of exertional dyspnea, which may be explained by increases in neural respiratory drive and respiratory muscle effort requirements during exercise.

Examination of adipose tissue morphology and metabolism with low-dose lithium and creatine supplementation

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Neutraceutical approaches to enhancing energy expenditure (EE) and adipose browning may provide a method of preventing or reducing obesity. GSK3 has been identified as a negative regulator of UCP1. We have previously observed lithium, an inhibitor of GSK3, to increase UCP1 content and cellular respiration in 3T3-L1 adipocytes (0.5mM) and mice treated with 10mg/kg/day have increased EE, UCP1 and white adipose (WAT) multilocular phenotype. Creatine metabolism is emerging as a critical regulator of WAT, and we have previously observed increased mitochondrial markers with creatine monohydrate supplementation. This study aimed to investigate the impact of supplemental lithium, creatine and the combination on EE and adipose tissue form and function. Male and female Sprague-Dawley rats were divided into four experimental groups for 6 weeks: (1) control, (2) lithium-supplemented (200 mg/L), (3) creatine-supplemented (5 g/L), (4) dual-supplemented (n=8 per group). All interventions increased EE and reduced body mass in males but not females. In males, brown adipose (BAT) UCP1 was unaltered with lithium however several mitochondrial and lipolytic markers were increased as well as inhibitory GSK3 serine9 phosphorylation. Creatine increased BAT UCP1 but had no effect on WAT thermogenic markers and reduced WAT mitochondrial and lipolytic markers. In the gonadal WAT depot, lithium shifted the relative frequency of smaller to larger adipocytes and reduced mitochondrial markers however, the dual supplementation group had increased lipolytic markers. In females, lithium increased BAT UCP1 but reduced lipolytic and mitochondrial markers. Inguinal WAT saw reduced lipolytic and mitochondrial markers with lithium. Lithium increases markers of BAT thermogenesis which likely contributes to the increased EE and reduced body weight in males however the female data is less conclusive. WAT markers appear dysregulated with lithium in both sexes and should be further explored as well as the ability of creatine supplementation to mitigate this effect.

Different ramp incremental slopes elicit similar $\dot{V}O_{2max}$ and neuromuscular fatigue development despite differences in peak power output

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Manipulating the slope of a ramp incremental test (RI) does not impact the maximal oxygen uptake ($\dot{V}O_{2max}$), but it affects peak power output (PPO). Although exercise-induced metabolic disturbance is the fulcrum of neuromuscular fatigue (NMF) development, it remains unknown whether different PPOs elicited by different RI slopes would affect the development of NMF. Eleven males and ten females performed three different RI tests on separate occasions and in randomized order, as follows: 1) RI slope of 15 W/min (RI_{15}); 2) 30 W/min (RI_{30}); and 3) 45 W/min (RI_{45}). NMF was characterized by isometric maximal voluntary contractions (IMVC) and femoral nerve electrical stimulation of knee extensors to measure maximal voluntary activation (VA) and resting twitch (Qtw) at baseline and 30 s after the exercise. Oxygen uptake ($\dot{V}O_2$) was continuously measured during the ramps. As expected, $\dot{V}O_{2max}$ was not different between RI_{15}, RI_{30}, and RI_{45} tests (3.32±0.81, 3.28±0.86 and 3.26±0.84 L/min, respectively; $p>0.05$). PPO was progressively greater (RI_{15}, 272±74; RI_{30}, 304±77; and RI_{45}, 337±85 W; $p<0.05$) and time was progressively shorter (RI_{15}, 16.8±5.0 min; RI_{30}, 9.5±2.6 min; and RI_{45}, 7.1±1.9 min; $p<0.05$) as the RI slope increased. NMF profiles were not different between RI_{15}, RI_{30}, and RI_{45}, as the IMVC (-23±14%, -23±10% and -25±9%, respectively; $p>0.05$), VA (-2±7%, -1±8% and 2 ± 10%, respectively; $p>0.05$) and Qtw (-47±14%, -47±14% and -49±14%, respectively; $p>0.05$) showed the same decline from pre- to post-exercise. This study indicates that the metabolic rate rather than the mechanical power associated with task failure during a RI test is what determines the amplitude and etiology of NMF. (Dr. Juan M. Murias' work is supported by the Natural Sciences and Engineering Research Council of Canada (RGPIN-2016-03698) and the Heart & Stroke Foundation of Canada (1047725).

Determining the flow of the cardiovascular circuit: the role of the heart versus peripheral blood vessel control in driving the increase in blood flow during exercise

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At exercise onset, increases in muscle blood flow and cardiac output (CO) are coordinated to ensure arterial blood pressure (MAP) is protected. Whether this reflects constraint of vasodilation to match cardiac activation, or CO being driven by vasodilation-mediated venous return is unclear. We tested the hypothesis that excess vasodilation at exercise onset would result in a greater increase in CO and the maintenance of MAP, supporting peripheral vasodilation as the driver for early cardiovascular circuit flow increase at exercise onset. In 8 participants (4F), excess vasodilation was created by a 5-min single-leg blood flow occlusion that was released at the onset of exercise. Beat-by-beat responses for CO and MAP were recorded using finger photoplethysmography and total vascular conductance (TVC) was calculated. 5-second averages across the first 20 seconds following exercise onset with excess vasodilation were compared to the normal exercise onset response. With excess vasodilation, TVC was significantly greater than normal after 7.5 seconds of exercise whereas CO was not significantly greater until 12.5 seconds. MAP dropped significantly in the first 7.5 seconds but was restored by 12.5 seconds. Thus, excess vasodilation is not translated into an immediately matched increase in CO, which resulted in early hypotension. However, the restoration of MAP appears to reflect a delayed increase in CO suggesting a delayed translation of peripheral flow into a venous return.

Participating in 12 weeks of the Saskatchewan Health Authority's Diabetes Wellness Series: a preliminary look at cardiometabolic health and fitness

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The Saskatchewan Health Authority's (SHA) innovative and progressive Diabetes Wellness Series (DWS) incorporates both exercise (aerobic and resistance) and education (e.g., nutrition, mental health, stress, etc.) twice weekly. A larger study, in collaboration with the SHA, aims to assess the program's feasibility, and evaluate how it might improve gut health, appetite regulation, cardiometabolic health, and fitness. The objectives of the present study are two-fold: (1) compare baseline cardiometabolic health of persons with type 2 diabetes (T2D) to healthy controls, and (2) evaluate 12-weeks adherence to DWS on cardiometabolic health and fitness among persons with T2D. Three individuals with T2D (2 male; 1 female) and ten healthy controls (9 male; 1 female) participated: age 71±6y vs. 61±5y; BP 116±2/61±8mmhg vs. 124±8/74±7mmHg; central pulse wave velocity (cPWV) 11.2±3m/s vs. 8.6±2m/s; fasted blood glucose 5.5±0.9mmol/L vs. 4.4±0.2mmol/L; BMI 38.3±2kg/m^2 vs. 23.7±2kg/m^2; WC 116±13cm vs. 85±9cm; body fat 38±6% vs. 18±4%; body fat-free 62±6% vs. 82±4%. The three persons with T2D completed 12-weeks of DWS; small or negligible improvements were found: cPWV (-7%), fasted blood glucose (-9%), BMI (-1%), WC (-1%), body fat (-2%), body fat-free (+1.4%). Aerobic fitness assessed via a graded cycle-ergometer exercise test revealed improvements: peak power output (+13%), $\dot{V}_{Epeak}$ (+20%), and absolute and relative $\dot{V}O_{2peak}$ (+9% and +6%, respectively); likely due, in part, to increased test duration (+19%), and participants pushing themselves harder (HR_{peak} +18%; $RPE_{central}$ +20%, $RPE_{peripheral}$ +3%). Greater improvements may be seen after 12 more weeks of exercise (continued intervention group). Analyses of additional outcomes are ongoing (gut microbiota, appetite regulation, and lifestyle

factors [e.g., sleep, perceived stress, mental health, quality of life, eating behaviours, etc.]), and further participants are being recruited. The DWS should continue to be promoted as we gain insight into its effectiveness.

Validation study of online physical function testing for older adults

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Physical function is a strong predictor of independence, institutionalization, and premature mortality and it is traditionally assessed in a clinic or lab environment. However, the pandemic raised the need to conduct physical function tests using online tools. Therefore, the aim of this study was to determine the validity of common physical function tests conducted online in older adults compared to gold standard in-person testing. Thirty-eight community-dwelling older adults were randomized to an online or in-person setting to test physical functions, including gait speed, one-leg stance balance, 30-second chair stands, and 2-minute steps. We calculated the average intraclass correlation coefficients (ICC) between the two settings, and we created Bland-Altman plots to test proportional bias via linear regression. Besides the one-leg stance balance with eyes closed (ICC = 0.509, p-value =.028), the two settings showed excellent agreement for all tests (average ICC ranging from 0.865 to 0.935, all p-values <0.001). Bland-Altman plots did not show proportional bias. In conclusion, physical function testing for older adults living in the community is valid when performed online.

Peripheral adaptations in high-performance handcycling

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Few studies have described the physiological profile of well-trained handcyclists, but $\dot{V}O_2$max and thresholds have been described as the predominant physiological determinants of performance. The objective of this study was to better understand the central (cardiac output) and peripheral (muscles ability to extract and use oxygen) physiological determinants of performance in well-trained handcyclists. Given the size of the active muscle masses, it was hypothesized that peripheral cardiovascular adaptations to training may be more important than the central $\dot{V}O_2$ adaptations. $\dot{V}O_2$max, cardiac output (thoracic impedance) and changes in muscle O_2 saturation (SmO_2, % from baseline) of the biceps (BB), triceps (TB), anterior deltoid (AD), and forearm extensor (FE) muscles were assessed via portable near-infrared spectroscopy monitors (Moxy monitor) on five well trained handcyclists (2 men and 3 women). Two testing sessions included a maximal 30-second power test (Wingate) followed by an incremental $\dot{V}O_2$max test and a 20-minute time-trial performed on an arm ergometer. The BB reached the highest levels of desaturation (SmO_2min, change from baseline of 30±7.0%), followed by FE (33±3.7%), AD (39±1.9%) and TB (43±1.9%). Maximal aerobic power (MAP in W/kg) negatively correlated with maximal desaturation of all muscles averaged during the time-trial (R = -0.78 [-0.96, -0.06], p = 0.12), and during the incremental test (R = -0.70 [-0.95, 0.13], p = 0.19), and during the Wingate (R = -0.62 [-0.94, 0.28], p = 0.26). In addition, MAP positively correlated with $\dot{V}O_2$max (ml/kg/min) (R = 0.90 [-0.13, 1.0], p = 0.04). Maximal cardiac output was measured successfully in one male and one female athlete, as 23.6 and 17.2 L/min respectively. These results suggest that other than $\dot{V}O_2$max, peripheral cardiovascular adaptations measured by near-infrared spectroscopy also contribute to success in this sport.

Associations between puberty status and relative age on sport dropout during adolescence

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Among same-age teens, those who are relatively less-mature (e.g., less physically developed) and those who are relatively younger (e.g., born later in the year) might be at greater risk of sport dropout. To assess this, we aimed to 1) describe longitudinal dropout, re-engagement, and uptake patterns in organized/unorganized and team/individual sports during adolescence; and 2) estimate associations between puberty status, relative age, and sport dropout. We used longitudinal data from 781 (56% girls, age 10-13 years at study baseline) participants of the MATCH study. Participants self-reported puberty status, birthdate, and involvement in 36 different sports every four months from 2011-2018. We calculated the incidence of dropout, re-engagement, and uptake in organized/unorganized and team/individual sports from grade 6 until grade 12. We used Cox proportional hazard models controlling for socioeconomic status and rurality to estimate associations of puberty status and relative age on organized/unorganized and team/individual sport dropout. Results show declines in sport participation from grade 6 to grade 12. Re-engagement and uptake were higher for individual than team sports, and higher for unorganized than organized sports. More mature girls were more likely to drop-out of organized sports than girls of the same age with average-puberty status (Hazard Ratio, 95% confidence interval: 1.81, 1.12-2.91). Boys born in the 2nd and 3rd quarters of the year were less likely to drop-out of unorganized sports than boys born in the 4th quarter (0.38, 0.18-0.79 and 0.43, 0.20-0.94, respectively). This study highlights that puberty and relative age may help predict organized/unorganized

sport dropout according to participants' gender, but may not be important for predicting team/individual sport dropout.

Using blood volume estimations to investigate the relationship between transient central volume reduction and hormonal response during BFR exercise

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There is growing evidence of remarkable improvements in aerobic capacity with blood flow restriction (BFR) training. While early evidence suggests peripheral adaptations may not be responsible for the observed aerobic improvements, our laboratory has demonstrated post-BFR hormonal changes associated with fluid retention, implying adaptations may be related to blood volume or maximal cardiac output. We developed a novel variation of the carbon monoxide (CO) rebreathe technique to investigate whether the amount of blood trapped in the lower extremities during occluded exercise is related to the hormonal response following BFR exercise. Seventeen volunteers (5F/12M) completed occluded exercise (3min walk,1min stand), with CO-rebreathe procedures performed to estimate both the total blood volume and the blood volume trapped in the legs following this stimulus. Plasma renin and copeptin levels were measured separately before and after a similar BFR walking protocol (19min). Whole body blood volume was 6076±1265mL, while the average volume of blood "trapped" in the legs following BFR exercise was 1609±484mL (15.1-42.5% of whole-body blood volume). Preliminary results suggest that relative volume of blood partitioned in the legs during BFR exercise does not predict increases in renin (19.0±9.3 to 42.6±24.5ng/L; r=0.41) or copeptin (6.7±3.2 to 41.0±31.8pmol/L; r=0.15) with BFR exercise (both, $p>0.1$). We conclude that relative volume reduction in central circulation via blood "trapping" during BFR walking varies greatly between individuals, but it does not appear to predict the acute BFR-induced increases in hormones regulating fluid homeostasis.

The Lost Season; Effect of COVID-19 Closures on Varsity Athlete Fitness

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The purpose of this mixed-method study was to determine the effects of COVID-19 pandemic shutdown(s) on varsity athlete fitness during the 2020-2021 season. Fitness testing data was collected on 8 varsity teams in the fall of 2021 and participants were sixty-nine varsity athletes (51 female, 18 male) who had baseline data from the 2019 preseason and follow-up data from the fall 2022 varsity fitness testing. The mean eligibility year in 2021 and 2019 was 3.87 and 1.87 respectively. There was no significant difference in weight (73.8 – 72.8 kg), grip strength (89.0 – 87.9 kg), mid-thigh pull (124.0 – 115.5 kg), vertical jump (52.2 – 50.6 cm), agility (11.2 – 11.2 sec) or 20 meter shuttle run score (9.7 – 9.7 stage). Significant changes ($p= 0.05$) were found in long jump (214.9 – 204.3 cm) and 20 m sprint time (3.52 – 3.41 sec). The athletes also filled out a survey on their training activities over the 2020-2021 season. When asked about their perceived fitness level 39% of athletes perceived their fitness got worse, 33.3% felt their fitness was better, and 27.5% felt there was no change. Data from open-ended responses revealed three themes related to the effects of the pandemic shutdown on fitness: (1) lack of motivation, (2) lack of resources, and (3) feelings of loss of strength and loss of sport specific skills. In conclusion, with the help of strength and conditioning coaches, most athletes were able to maintain some of their overall fitness; however, there was still a significant loss in muscular power and sprint speed.

Differences in experiences and motives for physical activity led to identification of four distinct profiles of physical activity participation during adolescence

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While adolescence is often marked by declining physical activity participation, some individuals manage to maintain active lifestyles. This qualitative description study aimed to better understand longitudinal physical activity experiences among initially active adolescents, to describe distinct physical activity profiles, and explore characteristics and experiences unique to each profile. From the 929 MATCH study participants, a purposely selected sample of 23 physically active participants were interviewed once a year for six years. Verbatim transcripts were inductively and deductively coded to characterize each participant's personal physical activity experiences. Following individual-level analyses, profiles were identified based on similarity of longitudinal experiences. Four distinct profiles captured participants' physical activity experiences throughout adolescence: Independents (i.e., progressively seek activities that cater to their need for autonomy); Multitaskers (i.e., participate in many different physical activities as an integral part of their lifestyle); Specialists (i.e., aspire to be among the best at one physical activity and invested at an early age); Undecided (i.e., taking part in physical activity is a means to occupy free time or something they do socially). The exploration of longitudinal physical activity experiences demonstrated distinct profiles that may be targets for tailored interventions, theory development, and participation models. These findings could advance initiatives aimed at promoting sustained physical activity throughout adolescence. (The MATCH study is supported by the Social Sciences and Humanities Research Council (435-2020-0809; 435-2016-0888), the New Brunswick Health Research (20130729) and Sport Canada through the joint Sport Participation Research Initiative (862-2010-0001;862-2014-0002).)

A comparison study of the muscle activation of the medial and lateral head of the gastrocnemius muscle during isometric plantar flexion

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The gastrocnemius is an important muscle in daily activity such as gait and balance. The muscle is comprised of two heads and literature has suggested that each head of the gastrocnemius functions differently; however, research has failed to conclusively identify these variations. The purpose of this research was to examine the lateral and medial gastrocnemius muscle during ramped isometric plantarflexion contractions. Surface electromyography (sEMG) and strength were compared between male runners (n=10), female runners (n=10), male non-runners (n=10) and female non-runners (n=10). Participants completed 24 ramped isometric contractions ranging from low to maximal intensity while muscle activity from the gastrocnemius was recorded. Results indicated that there was a significant difference in the sEMG amplitude between the medial and lateral gastrocnemius for all groups during low, moderate, high and maximal intensities ($p<0.05$). Understanding the contribution of each gastrocnemius head is significant for studies of the lower limb in addition to the development of training protocols. In this exploratory study, we found differences between the medial and lateral head of the gastrocnemius during isometric plantar flexion of varying intensities suggesting that these two heads do display different characteristics and with training, the lateral gastrocnemius can be recruited to a greater extent during high intensity contractions. (Natural Science and Engineering Research Council).

Evaluating a 2-year follow-up: Benefits of an Exercise Program for People Living with Cancer

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The survival rate of cancer patients has been increasing, demonstrating a need for initiatives that improve the quality of life of people living with cancer. Exercise is known to help with short-term outcomes, but less is known about the long-term outcomes. This current study used administrative data of patients who participated in a 12-week supervised, community-based exercise program to determine whether exercise as an adjunctive therapy during their cancer journey had a positive impact on health outcomes. The outcomes investigated included the number of hospitalizations, the length of hospital stays and the number of physician service claims. The patients were followed for one and two years following the completion of the program and their outcomes were compared to matched cohort (sex, ± 5 years old, ± 2 admissions to the hospital in the year prior to program). The results are currently under embargo, but generally speaking the participants who participated in the exercise program showed reduced risk on all studied outcomes over the 2-year follow-up. This study highlights potential benefits associated with participation in a community-based exercise program during a patient's cancer journey both over short- and long-term periods.

Coupling of $\dot{V}_E$ and $\dot{V}CO_2$ kinetics: insights from multiple exercise transition below the estimated lactate threshold.

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During a step-change in exercise power output (PO), ventilation ($\dot{V}_E$) increases with a similar time course to the rate of carbon dioxide delivery to the lungs ($\dot{V}CO_2$). We compared $\dot{V}_E$ and $\dot{V}CO_2$ kinetics from ten independent exercise transitions performed. Thirteen males completed 3-5 repetitions of Δ40W step-transitions initiated from 20, 40, 60, 80, 100, and 120 W on a cycle ergometer. The Δ40W step transitions to 60, 80, 100, and 120 W were preceded by 6 min of 20 W cycling. $\dot{V}CO_2$, oxygen uptake, $\dot{V}O_2$, and $\dot{V}_E$ were measured by mass spectrometry and volume turbine. The rapidity of their dynamic responses was modelled and characterized by the time constant parameter (τ). Overall, $\dot{V}CO_2$ kinetics were consistently slower than $\dot{V}O_2$ kinetics (by ~45s) and $\tau\dot{V}CO_2$ rose progressively with increasing baseline PO and with heightened ΔPO from a common baseline. Compared to $\tau\dot{V}CO_2$, $\tau\dot{V}_E$ was on average slightly greater (by ~4 s). There was no interaction between $\tau\dot{V}CO_2$ and $\tau\dot{V}_E$ in either the variable baseline ($p=0.49$) and constant baseline ($p=0.56$) conditions indicating that each changed in unison. These data indicate that within the moderate-intensity domain, both the temporal- and amplitude-based characteristics of $\dot{V}_E$ kinetics are inextricably linked to those of $\dot{V}CO_2$. (Sponsored by NSERC).

Tideglusib restores diastolic function and reduces oxidative/nitrosative damage in the hearts of young D2-*mdx* mice

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Duchenne muscular dystrophy (DMD) is a muscle wasting disorder leading to premature death due to cardiorespiratory failure. Affected cardiac muscles display high levels of reactive oxygen/nitrogen species (RONS) and dysfunction of the sarcoplasmic reticulum calcium (Ca^{2+})-ATPase (SERCA) pump. SERCA regulates myocardial relaxation by storing cytosolic Ca^{2+} for subsequent contractions. SERCA dysfunction can cause Ca^{2+} overload, contributing to RONS production and cardiomyocyte apoptosis. Glycogen synthase kinase-3β (GSK3β) has been implicated in DMD and negatively regulates SERCA and antioxidant functions. Here, we aimed to preserve cardiac function in the D2-*mdx* mouse by inhibiting GSK3β with Tideglusib to reduce RONS and preserve SERCA function. D2-*mdx* and healthy wild-type mice were treated with

Tideglusib or vehicle for 4 weeks. At endpoint, cardiac function was assessed. Hearts were collected to measure fibrosis, SERCA function, and expression of SERCA, its regulators, GSK3β and RONS. Only vehicle-treated *mdx* mice showed diastolic dysfunction. Tideglusib reduced total GSK3β content in *mdx* mice. All *mdx* mice had significantly impaired Ca^{2+} uptake and ATPase activity. Vehicle-treated *mdx* mice had higher levels of RONS and fibrosis in most areas of the heart however, both were reduced with Tideglusib. Thus, GSK3β inhibition preserved diastolic function and prevented myocardial RONS production in D2-*mdx* mice. (SIH is funded by a QEII-GSST award. This work is also supported by a NSERC Discovery grant and Canada Research Chair Tier 2 to VAF.)

Public persuasion in a pandemic — what's said, and what's unsaid

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Public health messaging and behaviour change strategies are an integral part of the management of the global pandemic. The objective of this project was to analyse the Covid-19 (C-19) GNB public health messaging using natural language processing (NLP). NLP is a branch of artificial intelligence that uses computational techniques for analyzing naturally occurring texts to perform linguistic analysis, including lexicon-based sentiment analysis (LBSA). Overall, it is expected that the sentiment of the public health messaging is positive, and that public health relied on a multicomponent approach to behaviour change in response to the C-19 pandemic. One hundred and fifty-two GNB press conference videos were scraped from the GNB YouTube page using the R language (4.1.0), the packages 'tuber'(0.9.9) and 'youtubecaption'(1.0.0) to access the transcripts and video statistics for each video. The web scraping was performed on September 28th, 2021. NLP was performed using 'tidytext'(0.3.2) and 'Syuzhet'(1.0.6). LBSA indicates an overall positive sentiment derived from the video transcripts. Word frequency count analyses indicated limited evidence of public health strategies that promoted behaviour change, education, or risk stratification. GNB public health messaging during the C-19 pandemic is primarily positive in sentiment with limited evidence of a multicomponent approach to promote behaviour change.

Ketone monoester co-ingestion with protein increases circulating β-hydroxybutyrate and alters mTOR translocation and colocalization in human skeletal muscle compared to protein intake alone

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Ketone bodies (e.g., β-hydroxybutyrate (β-HB)) are lipid-derived molecules whose production is amplified during fasting, starvation, and carbohydrate restriction (e.g., a "ketogenic diet"). Orally ingested ketone supplements can induce hyperketonemia within minutes to concentrations observed with prolonged fasting (~4-5 mM) without the need for dietary restriction. Along with serving as a source of energy for peripheral tissues, ketone bodies may possess anabolic effects in skeletal muscle. For example, ketone bodies can potentiate the increase in anabolic signaling via mTORC1 and protein synthesis in leucine-stimulated myotubes. The current study investigated the effects of elevated β-HB, via ingestion (0.36 g/kg body weight) of the ketone monoester (R)-3-hydroxybutyl (R)-3-hydroxybutyrate, alone (KET) and when co-ingested with 10 g protein (KET+PRO) on acute mTOR translocation and colocalization in human skeletal muscle. KET and KET+PRO treatments were compared to protein ingestion (10 g) alone (PRO). In a parallel group design, 36 healthy young men (24.2±4.1 y) consumed either KET, PRO, or KET+PRO treatments. Muscle biopsies were obtained before, and at 120- and 300-min after treatment ingestion to assess protein colocalization and translocation of key anabolic signaling molecules via immunofluorescence microscopy. mTOR- wheat germ agglutinin (WGA: cell periphery marker) colocalization was greater at 120- and 300-min in the postprandial period vs. fasted conditions (Time: $P=0.003$). mTOR-Ras homolog enriched in brain (Rheb: positive regulator of mTOR) colocalization was greater (Interaction: $P<0.0001$) in PRO (12.3%) and KET+PRO (11.9%) vs. KET at 120-min. Further, KET+PRO was greater vs. KET (10.9%) and PRO (13.7%) at 300-min after treatment ingestion. Tuberous sclerosis 2 (TSC2: negative regulator of mTOR)-Rheb colocalization decreased (Interaction: $P<0.0001$) in PRO (16%), KET (19.2%), and KET+PRO (18.2%) at 120-min. This decrease was sustained at 300-min only in KET+PRO (19.1%). Ketone monoester co-ingestion with protein (KET+PRO) maintains mTOR in closer proximity to its direct activator Rheb while concomitantly decreasing TSC2-Rheb colocalization compared to isolated protein intake (PRO) in human skeletal muscle.

Exercise during two weeks of head-down bed rest prevents reduction in cardiorespiratory fitness in older adults (BROA)

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Cardiorespiratory fitness declines with age, and this decline may be accelerated by periods of inactivity and bed rest, such as during hospitalization. Recovery of fitness is possible, but the time course in older adults is unknown. Furthermore, the effectiveness of exercise to prevent deconditioning during bed rest needs to be evaluated in older adults. Therefore, the purpose of this study was to investigate if a multimodal exercise intervention protects older adults' fitness during two weeks of head-down bed rest (HDBR), as well as explore how cardiorespiratory fitness recovers following periods of severe inactivity. Twenty-two older adults (11 women, 59±3 years) completed two weeks of strict 6° head-down bed

rest (HDBR). Half of the participants performed ~1 hour of total daily exercise, including high-intensity interval cycling, aerobic cycling, and upper- and lower-body resistance training, whilst the other participants served as inactive controls. Step-incremental cycling tests to exhaustion were conducted prior to HDBR and at 3 times during the recovery phase (day 1 or 2, 6, and 4 weeks) to access peak oxygen uptake ($\dot{V}O_2$). Peak $\dot{V}O_2$ was reduced in the control group throughout the first 6 days of recovery, but did return to pre-HDBR levels by the 4 week recovery time point (interaction: p=0.002). In the exercise group, peak $\dot{V}O_2$ was no different at any time point during recovery from pre-HDBR. Ventilatory threshold $\dot{V}O_2$ (interaction: p=0.002) and submaximal heart rate (interaction: p=0.055) responses mirrored the changes in peak $\dot{V}O_2$ in each respective group. Our results suggest that ~1 hour of daily exercise was effective at protecting older adults' cardiorespiratory fitness. However, two weeks of HDBR without exercise countermeasures caused substantial reductions in cardiorespiratory fitness, which recovered within 4 weeks of resuming daily activities. These findings have important implications for translational medicine, and highlight the importance of physical activity in older adults. (Supported by Canadian Institutes for Health Research and Canadian Space Agency).

Blood-flow restricted resistance exercise induced myokine secretion is correlated with changes in muscle strength but not fat free mass

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Myokines are proteins released from skeletal muscle following contraction and are postulated to contribute to skeletal muscle hypertrophy. The objective of this study was to identify correlations between full-body blood-flow restricted resistance exercise (BFR-RE) induced myokine secretion and changes in strength and fat free mass (FFM) in response to a 12-week strength training program. Fifteen untrained males completed a full-body BFR-RE before and following a 12-week strength training program. Blood samples were collected at rest, immediately after, and at 3, 6, 24 and 48 hours of recovery following BFR-RE sessions. Blood plasma was analyzed for interleukin-4 (IL-4), IL-6, IL-7, leukemia inhibitory factor (LIF) and irisin which are proposed contributors to muscle hypertrophy. Area under the curve (AUC) was calculated for each myokine and the relationship between AUC and percent change in average strength, FFM and strength per kg FFM were evaluated with a Pearson correlation. Change in average strength over the 12-week strength training program was correlated with the AUC of LIF in the untrained state (r=-0.524; p=0.045), while the change in FFM was not correlated with any biochemical variable in the untrained or trained condition. Furthermore, the change in strength per kg FFM was correlated with the AUC of IL-4 (r=0.537; p=0.039), IL-6 (r=0.525; p=0.044) and LIF (r=-0.548; p=0.035) in the untrained condition. The secretion of multiple myokines in response to BFR-RE may influence strength adaptations and changes in strength per kg FFM but are not correlated with changes in FFM associated with a 12-week strength training program. (Funding support: University Collaborative Research Program and Faculty of Science Collaborative Grant- University of Manitoba)

Sex-differences in action potential amplitude and heterogeneity in the biceps brachii at short, medium, and long muscle lengths after eccentric quasi-isometric loading: preliminary results

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Eccentric quasi-isometric (EQI) loading is a novel, low-velocity resistance exercise method utilising isometric and eccentric muscle actions to volitional fatigue. It is postulated that musculotendinous adaptations to EQIs are likely to be driven by mechanical and hormonal mechanisms; however, neuromuscular responses may be relevant when considering that total volume will be a function of muscle fatiguability. Although the contributing mechanisms are known to be muscle, task, and intensity specific, females are more fatigue resistant than males, and differences in motor-unit recruitment strategies may contribute to sex-differences in muscle fatigue. This preliminary analysis examined sex-differences in high-density surface electromyography (HD-sEMG) amplitude and spatial distribution variability in the biceps brachii at short, medium, and long muscle lengths after a unilateral EQI elbow extension protocol. Ten resistance-trained individuals (4 male, 6 female) performed unilateral maximal isometric contractions at 120°, 90°, and 60° of elbow flexion, before and after 4 EQIs, while HD-sEMG was collected from the biceps brachii. Mann-Whitney U tests were used to compare sex with pre-post change scores for root mean square and coefficient of variation. Preliminary analysis suggests no significant sex-differences (p > .05). With large inter-individual variability, an adequately powered sample is needed for meaningful interpretations of any sex-differences.

Evidence that the ventilatory threshold is an anchor for the perception of effort

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The purpose of this study was to compare rating of perceived exertion (RPE) at the ventilatory threshold during incremental and prolonged running, cycling, and upper

body exercise. The working hypothesis was that the RPE at the ventilatory threshold would not be different across the three exercise modes, which would reinforce the assertion that the ventilatory threshold serves as an anchor for the perception of effort.. Participants were nine women (age, 22 ± 1 yr; height, 162 ± 6 cm; weight, 63 ± 7 kg) and eleven men (age, 22 ± 2 y; height, 178 ± 7 cm; weight, 78 ± 8 kg). They completed incremental tests using running, cycling, and upper body exercise, to determine the ventilatory threshold and RPE associated with that threshold, for each mode. Then they performed 20-min constant-power tests at the ventilatory threshold for each mode. The ventilatory threshold was identified at 9.4 ± 0.7 km·h−1 in running, 135 ± 24 W in cycling, and 46 ± 5 W in upper body exercise. In the incremental tests, RPE at the ventilatory threshold did not differ across the three exercise modes: 11.9 ± 1.4, 12.1 ± 1.6, and 12.0 ± 1.7, respectively, despite differences in metabolic demand. In addition, during 20 min of exercise at the ventilatory threshold, RPE did not differ across the three modes: 12.1 ± 1.6, 12.2 ± 1.6, and 12.2 ± 1.6, respectively. These finding support the contention that the ventilatory threshold serves as an anchor for the perception of effort. This RPE is also suitable for use in exercise prescription when the target intensity is the upper end of the moderate exercise intensity domain.

The mathematical relationship between peak post-exercise blood lactate concentration and the glycolytic contribution in exercise

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Often, the glycolytic contribution is estimated by multiplying the increase in blood lactate concentration elicited by exercise by a conversion factor, usually 3.3 (or 3) mL·kg^{-1} per mM. The purpose of the present study was to directly determine the value of this conversion factor. Six women (age, 23±1 yr; $\dot{V}O_{2max}$, 40±6 mL·kg^{-1}·min^{-1}) and eight men (age, 23±2 yr; $\dot{V}O_{2max}$, 43±7 mL·kg^{-1}·min^{-1}) volunteered to participate. They performed two severe-intensity, cycle ergometer exercise tests at 189±29 W, to exhaustion, one in hypoxia (F_IO_2 = 10.8±0.6%) and one in normoxia. $\dot{V}O_2$ was measured throughout both tests and blood lactate concentration was measured before and 4 min, 5 min, and 6 min after exercise. The total anaerobic contribution, quantified by the maximal accumulated oxygen deficit, was calculated using methods based on the assumption that exhausting exercise lasting ∼4 min or ∼10 min elicits the same (maximal) contribution. The phosphocreatine contribution was the area under the curve of the fast phase of the $\dot{V}O_2$ in recovery. The glycolytic contribution was the difference between the total anaerobic contribution and the phosphocreatine contribution. The ratio between the glycolytic contribution (in mL·kg^{-1}) and the increase in lactate concentration (in mM) yielded an oxygen equivalent of peak lactate of 3.4±0.3 mL·kg^{-1} per mM. The results provide support for the use of a common conversion factor to calculate the glycolytic contribution from peak post-exercise blood lactate concentrations.

The Effects of Muscle Specific GSK3 Genetic Knockdown on Voluntary Wheel Running in Female C57BL/6 Mice

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Regular exercise improves muscle performance and overall health by increasing lean mass and favourably altering whole-body metabolism. Available literature suggests that the inhibition of glycogen synthase kinase-3 (GSK3) may mirror these effects and that exercise naturally inhibits GSK3. Thus, the effects of regular exercise may be mediated, in part, through GSK3 inhibition. We partially knocked down GSK3 in skeletal muscle to determine whether GSK3 inhibition could mimic and/or amplify the effects of regular exercise. Female GSK3^{floxed} (control) and GSK3 muscle knockdown (GSK3^{mKD}) mice were randomly placed into a sedentary or voluntary wheel running group (VWR) for 7 weeks (n=6 per group). VWR enhanced whole-body and soleus fatigue resistance as well as glucose homeostasis in GSK3^{floxed} and GSK3^{mKD} mice. In the soleus, VWR increased muscle force production to a greater extent in GSK3^{mKD} mice. In the EDL, there was no effect of VWR on muscle force production, however, GSK3^{mKD} mice produced more force than GSK3^{floxed} mice. This increase in force production was primarily due to increased muscle cross-sectional area. In conclusion, partial GSK3 knockdown increased muscle size and force production. Future studies will examine the role of biological sex testing the effects of partial GSK3 knockdown and VWR in male mice.

Cohort Profile: The Manitoba Tomorrow Project (MTP)

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The Manitoba Tomorrow Project (MTP) is a prospective cohort study created as part of The Canadian Partnership for Tomorrow's Health (CanPath). Together, they serve as a platform for evaluating the effect of genetics, lifestyle behaviours, and other risk factors on cancer and chronic diseases. To date, over 11,000 Manitoba residents aged 30-74 years have been recruited and 6,358 have completed the baseline questionnaire. Participants consent to long-term active and passive follow-up through recontact and linkage with administrative databases. The questionnaire asks about health history, medication use, and physical activity levels among other lifestyle

and socioeconomic factors. Of those participants with returned questionnaires, 99.4% have agreed to provide biosamples and have physical measurements assessed, including venous blood, urine, height, weight, body composition and blood pressure. Moreover, 76.4% reside in Winnipeg, 10.9% have a history of cancer, and 63.9% have been diagnosed with at least one chronic condition. Participants reported engaging in 198.3 ± 399.3 minutes of moderate physical activity per week, with 33.8% reporting no physical activity and 7.06 ± 3.23 hours of daily sitting. Based on self-reported height and weight, male and female participants have a body mass index of 28.3 ± 6.6 kg/m^2 and 27.5 ± 8.2 kg/m^2, respectively. Like the other Canadian regional cohorts, the MTP will be a valuable resource for researchers attempting to investigate the risk factors and causes of cancer and chronic diseases. (Funding Support: Canadian Partnership Against Cancer)

Increasing training intensity fails to improve responder status in people living with prediabetes or type 2 diabetes mellitus: The INTENSITY Trial

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Some individuals living with prediabetes or type 2 diabetes mellitus (T2DM) who engage in exercise training will not experience the anticipated improvements in glycemic control, referred to as non-responders. Some studies suggest that exercise training performed at higher intensity may lead to improvements in responder status. However, it is unclear if increasing exercise intensity for non-responders with prediabetes or T2DM would enhance their responder status. The purpose of this randomized trial was to explore if increasing exercise intensity can change the status of non-responders based on glycated hemoglobin (HbA1c). Participants (n=50) completed 16 weeks of aerobic exercise training at an intensity of 4.5 metabolic equivalents (METs) for 150 minutes per week. Participants were then categorized as responders, non-responders or 'unclear' based on their 90% confidence interval laying above, below, or crossing a 0.3% reduction in HbA1c. Participants were randomized to a maintained (4.5 METs; n = 23) or increased (6.0 METs; n = 26) intensity group for an additional 12 weeks. Two (4.1%) participants were categorized as responders, four (8.2%) as non-responders, and 43 (87.7%) as unclear following the first 16 weeks of exercise training. Two participants experienced an improvement in status – from unclear or non-responder to responder – as a result of increasing exercise intensity, and one by maintaining exercise intensity. Our results suggest that neither increasing nor maintaining exercise intensity appear to consistently improve the responder status for people living with prediabetes or T2DM. (Funding: Heart and Stroke New Brunswick, Diabetes Action Canada, New Brunswick Health Research Foundation)

Differences in the magnitude of muscle atrophy but similar declines in muscle strength between the elbow flexors and extensors in response to 14-days of upper-limb immobilization in young women

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Musculoskeletal injuries lead to periods of disuse (e.g., limb immobilization) during which rapid declines in skeletal muscle size and strength occur. However, the susceptibility to disuse atrophy can markedly differ between individual muscles. Currently, the susceptibility of different muscle groups of the upper arm to disuse atrophy is unclear. The aim of the present study was to assess the magnitude of skeletal muscle atrophy in the elbow flexors and extensors in response to 14-days of unilateral arm immobilization in young women. It was hypothesized that the immobilized elbow flexors would experience a greater decline in muscle size and strength than the immobilized elbow extensors, and the magnitude of the decline in muscle strength would exceed the magnitude of decline in muscle size following immobilization. Twelve young women (20.6±2.1 years) underwent 14-days of immobilization of the non-dominant (left) upper-arm via an elbow brace and sling. The contralateral non-immobilized arm served as the internal control. Upper-arm muscle size and strength of both the elbow flexors and extensors were assessed in both arms via magnetic resonance imaging (MRI) and BioDex dynamometry at baseline (day 0) and after immobilization to quantify the degree of muscle atrophy and strength loss. There were no significant changes in any of the dependent variables of interest in the non-immobilized arm. Muscle cross-sectional area (CSA) and volume of the elbow flexors was unchanged in the immobilized arm. However, there were significant declines in elbow extensor CSA (-2.85±2.87%, P=0.018) and volume (-2.54±2.52%, P=0.043). The relative decline in elbow extensor CSA and volume was greater than that of the elbow flexors (-2.85±2.87% vs. -0.3±2.3%, P=0.025; -2.54±2.52% vs. -1.15±2.36%, P=0.021). Immobilization resulted in a decline in both elbow flexor (-20.7±18.4%, P=0.008) and elbow extensor (-19.9±15.7%, P=0.021) strength; however, the decline in strength was similar between muscle groups (P=0.838). Findings from this study demonstrate that the elbow flexor and extensor muscles are similar in their susceptibility to disuse-induced strength loss but differ in their susceptibility to disuse atrophy, with greater disuse atrophy observed in the elbow extensors compared to the elbow flexors.

The impact of blood flow restriction on vastus lateralis tissue oxygenation during low-intensity aerobic exercise

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This study examined the impact of blood flow restriction (BFR) on vastus lateralis tissue oxygenation during low-intensity aerobic exercise in healthy males. Near-infrared spectroscopy (NIRS; NIRO-200) was used to estimate local concentrations of total [Hb_{tot}], oxygenated [HbO_2], and deoxygenated [HHb] haemoglobin of the vastus lateralis during 20-minutes of low-intensity treadmill walking (~64%HR_{Max}) during BFR and non-BFR conditions (KAATSU-Nano). Seventeen healthy males were studied (23±0.4 years; 25±0.6 kg/m^2). Data from the final 15 minutes of exercise were analyzed and reported as change (Δ) from a seated baseline. Two-way repeated-measures ANOVAs examined condition and time effects on NIRS-derived measures. [Hb_{tot}] and [HHb] were greater during BFR compared to non-BFR from minutes 5 to 20 of exercise (both $p<0.05$). [HbO_2] did not differ between conditions ($p>0.05$). [Hb_{tot}] increased from minutes 5 to 20 of exercise during BFR (min 5: 0.37±8.13μM; min 20: 8.98±4.94μM) and non-BFR (min 5: -6.54±4.76μM; min 20: 4.38±5.54μM). [HHb] decreased from minutes 5 to 20 of exercise during BFR (min 5: 5.69±4.99μM; min 20: 3.70±4.82μM) and non-BFR (min 5: -0.87±2.82μM; min 20: -2.63±3.65μM). [HbO_2] increased from minutes 5 to 20 of exercise during BFR (min 5: -5.33±4.64μM; min 20: 5.37±3.26μM) and non-BFR (min 5: -5.72±4.59μM; min 20: 7.08±4.38μM). There was no condition by time interaction for any variable (all $p>0.05$). These findings suggest that total and deoxygenated haemoglobin concentrations were greater during BFR throughout the duration of low-intensity aerobic exercise.

MLN does Not Alter SERCA1a Apparent Coupling Ratio

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The sarco(endo)plasmic reticulum Ca^{2+}-ATPases (SERCAs) are responsible for inducing muscle relaxation and are integral to the maintenance of intracellular calcium (Ca^{2+}) homeostasis. As such, their activity is modulated by multiple regulatory proteins. Recently, a myriad of new SERCA regulatory proteins have been discovered in both muscle and non-muscle cell types. Of these, myoregulin (MLN) is expressed in mammalian skeletal muscle and has emerged as a key regulator of Ca^{2+} homeostasis and muscle contractility. In this study, we investigated whether MLN can uncouple Ca^{2+} transport from ATP hydrolysis by SERCAs (altering SERCAs' apparent coupling ratio). To that end, HEK-293 cells were transfected with cDNA encoding SERCA1a alone or with SERCA1a and MLN and both Ca^{2+} uptake and Ca^{2+}-ATPase activity were measured on crude cell homogenate prepared from the transfected cells. Ca^{2+}-dependent SERCA activity was assessed over Ca^{2+} concentrations ranging from pCa 6.85 to 4.80 in the presence and absence of the Ca^{2+} ionophore A23187 using a spectrophotometric plate reader assay. SERCA-mediated Ca^{2+} uptake was measured in the presence and absence of the precipitating anion, oxalate, using the fluorescent dye Indo-1 and a spectrofluorometer plate reader assay. SERCA coupling ratio was calculated by dividing Ca^{2+} uptake by Ca^{2+}-ATPase rates across different pCa values. In both the presence ($p < 0.03$) and absence ($p < 0.05$) of ionophore, MLN significantly depressed the maximal rate of ATP consumption (V_{MAX}) and SERCA1a's Ca^{2+} affinity, with this effect being more pronounced in the presence of ionophore. Similarly, MLN significantly reduced SERCA1a Ca^{2+} uptake in both conditions ($p < 0.04$ with oxalate and $p < 0.05$ without oxalate), with a greater effect in the presence of oxalate. These results indicate that MLN does not affect the Ca^{2+}/ATP coupling ratio of SERCA1a pumps under both maximal (presence of ionophore/oxalate) and physiological (absence of ionophore/oxalate) conditions.

An evaluation of the effectiveness of exercise training-based cardiac rehabilitation to improve aerobic fitness

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In individuals with heart disease, improving aerobic capacity (as measured by peak oxygen uptake [$\dot{V}O_{2peak}$]) reduces mortality and improves prognosis. For this reason, exercise training-based cardiac rehabilitation (CR) is considered standard of care in the management of heart disease. With the objective of evaluating effectiveness of contemporary training practices, this study quantified changes in $\dot{V}O_{2peak}$ before and after completion of a CR program. We retrospectively analyzed 251 patients (65±11 years; 71 females) referred to St. Joseph's CR and Secondary Prevention program (London, Ontario) between January 2017 and September 2019, who completed a symptom-limited cardiopulmonary exercise test before and after 6 months of guideline-recommended exercise training (frequency: 3-5 days/week; intensity: 40-85% of heart rate reserve; time: 20-40 minutes/session; type: walking). Participant's $\dot{V}O_{2peak}$ was computed from breath-by-breath data as the highest 20-second rolling average and expressed in absolute (mL·min^{-1}) and

relative (mL·kg^{-1}·min^{-1}) terms. Using a pragmatic minimal detectable change in $\dot{V}O_{2peak}$ of 100 mL·min^{-1}, patients were classified as "positive responders" ($\Delta\dot{V}O_{2peak} \geq 100$ mL·min^{-1}), "non-responders" ($\Delta\dot{V}O_{2peak}$ between -100 and 100 mL·min^{-1}), or "negative responders" ($\Delta\dot{V}O_{2peak} \leq -100$ mL·min^{-1}). Overall, group mean $\dot{V}O_{2peak}$ increased ($p<0.001$) by ~11% from 1510±630 mL·min^{-1} (18.0±6.5 mL·kg^{-1}·min^{-1}) at intake to 1640±660 mL·min^{-1} (19.3±7.0 mL·kg^{-1}·min^{-1}) at exit; 165 (66%) patients displayed a positive change in absolute $\dot{V}O_{2peak}$ and 86 (34%) displayed a negative change. Of the 251 patients, 128 (51%) were classified as "positive responders", 86 (34%) as "non-responders", and 37 (15%) as "negative responders". Therefore, nearly half of patients may not have received the risk-reducing benefits that accompany improvements in aerobic fitness following exercise training-based CR. Future work should investigate whether exercise prescription is sufficiently tailored to stimulate improvements at the individual level.

The impact of exercise on cardiotoxicity in pediatric and adolescent cancer survivors: A scoping review

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Cardiotoxic chemotherapies and chest-directed radiation put childhood and adolescent cancer survivors at a high risk of developing cardiovascular diseases. Currently, pharmacological therapies to manage long-term cardiotoxicity have limitations, thus necessitating complementary therapies to reduce the risk of cardiac damage. It is widely reported that exercise is cardioprotective. Regarding cardiotoxicity, exercise increases cardiomyocyte production and cardiovascular capacity and reduces cardiomyocyte death, apoptosis and oxidative stress, and cardiometabolic risk profiles. While preclinical trials have demonstrated the cardioprotective properties of exercise for cancer patients, relatively few have been conducted in clinical populations. Thus, a scoping review was conducted to map out the clinical research regarding the design and effects of exercise-based interventions for preventing and managing cancer treatment-related cardiac dysfunction in childhood and adolescent cancer survivors. The Joanna's Briggs Institute methodology was used to identify relevant literature, screen the literature, and extract relevant data. 4616 studies were screened, and the results from 6 reports were extracted. The frequency, intensity, time, and type of exercise programs varied across all reviewed studies. The results of the reviewed studies indicate that exercise positively affects cardiac function across numerous indices of heart health, suggesting that any type and amount of exercise may help mitigate the cardiotoxic effects of treatment in childhood and adolescent cancer survivors. This scoping review also confirmed that few clinical studies employ exercise interventions for childhood and adolescent cancer survivors, highlighting the need for more research in this area.

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Potential benefits of online-delivery circuit training for men living with obesity

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While most resources for obesity management are targeting women, men are more likely to develop obesity related diseases compared with women. The objective of this study was to examine adherence to the both components of weekly physical activity (PA) guidelines (muscle strengthening and aerobic activities) for men living with obesity 46 weeks after being offered a 12-week online muscle-strengthening circuit program, compared with a control group. Sixty men (Age: 41.7 years; Body fat 35.4%) were randomly assigned to the intervention group (N=30) or the control group (N=30) for 12 weeks, from which 19 participants completed the study in each group. Adherence to the weekly PA guidelines was captured at baseline, after 12, 24, and 46 weeks after being enrolled in the program using a heart-rate tracker (Fitbit charge 3) and an exercise log. More participants in the intervention group adhered to the PA guidelines compared to the control group 46 weeks after being involved in the exercise program (intervention 36.8% vs control 5.3%, p=0.021). The proposed program increased adherence to PA guidelines after 46 weeks for men living with obesity.

Effect of acute isometric handgrip exercise on vascular function in children and emerging adults with congenital heart disease

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Whether acute isometric handgrip (IHG) exercise improves endothelial function in patients with congenital heart disease (CHD) remains unknown. The effect of acute IHG exercise on brachial artery endothelial function was examined in children and emerging adults with CHD. We tested the hypothesis that acute IHG exercise would increase flow-mediated dilation (FMD). Subjects with CHD (n = 21, age; 13 ± 4 yrs, BMI; 21 ± 4 kg/m^2, 12 males) completed four bouts

of 2 min IHG exercise (30% maximum voluntary contraction) with 1 min rest between bouts. The right brachial artery was imaged with Duplex ultrasound. Baseline (3.3 ± 0.5, vs. 3.3 ± 0.6 mm, $p = 0.73$) and peak diameter (3.4 ± 0.5, vs. 3.5 ± 0.5 mm, $p = 0.57$) during the FMD test were not significantly different from pre- to post-IHG exercise. FMD (4.8 ± 3.2, vs. 6.1 ± 4.6%, $p = 0.31$) and normalized FMD to shear rate area under the curve (0.18 ± 0.14, vs. 0.24 ± 0.24 a.u., $p = 0.29$) were not significantly different from pre- to post-IHG exercise. The IHG protocol increased normalized FMD response from pre- to post-IHG in 11/21 participants (responders; 0.10 ± 0.12, vs. 0.36 ± 0.28 a.u., Cohens $d = 1.2$). Among the remaining 10 participants (non-responders), the IHG protocol reduced normalized FMD (0.26 ± 0.11, vs. 0.11 ± 0.07 a.u., Cohens $d = 1.6$) from pre- to post-IHG. Of note, pre-IHG normalized FMD was lower in responders vs. non-responders (0.10 ± 0.12, vs. 0.26 ± 0.11 a.u., $p < 0.00$). In patients with CHD, acute IHG exercise improved FMD responses in those with poorer basal vessel reactivity. (Funding: Saskatchewan Health Research Foundation).

Brain Health and the Role of Exercise in Late-Life Cognitive Reserve: A Narrative Review

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Many recent studies focus on the effects of exercise on cognitive and mental health in older adults. Depression and cognitive decline are highly prevalent in the aging populations and exercise can be an accessible option for treatment and prevention. Exercise also encounters the benefits of a non-pharmacological intervention with high importance in the aging population. Data suggests that older adults who meet the physical activity guidelines have 20% risk reduction for cognitive decline and dementia. Nevertheless, existing exercise recommendation have not shown to increase the prevalence of a physically active lifestyle among elderly persons. Educating older adults and healthcare professionals on the neurological benefits of exercise is an integral part of prevention and treatment strategies. The aim of this narrative review is to present the neuroprotective mechanisms of exercise for brain health. We searched MEDLINE, MEDLINE RCTs, PsycINFO, and EMBASE from inception. Studies exploring the impact of exercise on neuroanatomy, neurophysiology, neurovascular and cognitive functions in the aging population were reviewed and evaluated. Exercise affects brain function and anatomy in various pathways. Scientific evidence from previous studies have demonstrated that exercise increases cerebral blood flow and neuronal metabolism, which in turn increases oxygen extraction, and glucose utilization in the brain. This process initiates a cascade of events which promotes neuronal health, involving enhancement of neurotrophic factors such as Brain Derived Neurotrophic Factor (BDNF), Insulin-Growth-Factor-1 (IGF-1) and more which are of high importance in cognitive function. Moreover, exercise enhances secretion of neurotransmitters, including dopamine, norepinephrine, and serotonin which have a major role in attention and in management of anxiety and mood symptoms. There are also neurophysiological and neuro-anatomical changes, as shown by neuroimaging studies, such as increased metabolism and volume of the hippocampus, and improved connectivity and density of the white and grey matter. These changes are significantly important in the aging brain and for cognitive reserve. Exercise modifies brain function and promotes brain health in various pathways. It is vital in maintaining late life brain health, mental health and preventing cognitive decline. Education of the neuroprotective mechanisms of exercise may assist in promoting physical activity in the aging population. There was no funding of any kind and no financial support to this research project.

The Paradox of Physical Activity Health Recommendations: Healthy and Irrational

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Past studies show the various health benefits of physical activity (PA). Moreover, inactivity is a significant health risk factor. However, 60-85% of the world's population still lead a sedentary lifestyle. Thus, efficient implementation strategies of PA guidelines are urgently needed. This review demonstrates the challenges in promotion of PA and explore Behavioral Economics (B/E) concepts involved. We conducted an integrated review that merges the health benefits of PA, epidemiology of inactivity and related consequences, and relevant concepts from B/E describing the challenges in decision-making. We searched scientific publications in healthcare and economics search engines, including MEDLINE, EMBASE, Research Library, ScienceDirect, and Scopus. Epidemiological data for the prevalence of sedentary lifestyle and its consequences was evaluated. This review identifies critical factors in decision making. We demonstrate cognitive biases that explain the common automatic preference for sedentary behavior, and the perceived "irrationality" of PA. Key principles in B/E are presented, such as: "optimism bias": the assurance that our present behavior will probably not have a negative result in the future. "Present bias": a basic preference for immediate profit while neglecting delayed future gratification, making the long-term benefits of exercise transparent. "Loss aversion": the discomfort of loss is more dominant than the comfort of the benefit: exercise is perceived as an immediate loss - it is effortful and involves discomfort, while the future health benefits are non-existent at present. Additionally, "status quo bias": the clear preference to avoid (behavior) change. We created an intervention for PA promotion that integrates these challenges in decision making. The innovative program will provide PA advocates with effective tools for applying PA guidelines. Health recommendations

for PA may be perceived as "irrational". Establishing a new approach to promoting PA guidelines is required to reduce the high prevalence of inactivity. Addressing the automatic preference of inactivity resulting from cognitive biases and other factors in decision making is essential. There was no funding of any kind and no financial support to this research project.

Bone Turnover Markers and Osteokines in Adolescent Female Athletes of High-impact and Low-impact Sports Compared with Non-athletic Controls

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This study examined differences in resting concentrations of markers of bone formation and resorption and osteokines between female adolescent (12-16 years) swimmers, soccer players and non-athletic controls. Resting, morning blood samples were obtained after an overnight fast from 20 swimmers, 20 soccer players and 20 non-athletic controls, matched for age. Carboxyl-terminal crosslinking telopeptide of type I collagen (CTX), amino-terminal propeptide of type I collagen (P1NP), total osteocalcin (OC), sclerostin, osteoprotegerin (OPG), and receptor activator of nuclear factor kappa B ligand (RANKL) were analyzed in serum. After controlling for percent body fat there were no significant differences between swimmers and non-athletic controls in any of the measured markers. In contrast, soccer players had significantly higher P1NP (89.5 $\pm$ 25.6 ng·ml^{-1}), OC (57.6 $\pm$ 22.9 ng·ml^{-1}) and OPG (1052.5 $\pm$ 612.6 pg·ml^{-1}) compared to both, swimmers (P1NP: 66.5 $\pm$ 20.9 ng·ml^{-1}; OC: 24.9 $\pm$ 12.5 ng·ml^{-1}; OPG: 275.2 $\pm$ 83.8 pg·ml^{-1}) and controls (P1NP: 58.5 $\pm$ 16.2 ng·ml^{-1}; OC: 23.2 $\pm$ 11.9 ng·ml^{-1}; OPG: 265.4 $\pm$ 97.6 pg·ml^{-1}), with no differences in CTX, sclerostin and RANKL. These results suggest that bone formation is higher in adolescent females engaged in high-impact sports like soccer compared to swimmers and controls.

The sleep of elite water polo players during a competition week: A comparison of men and women

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The aim of the study was to compare sleep patterns between elite men and women water polo players. Ten men (age: 23.4 $\pm$2.6 years) and seventeen women (age: 21.59 $\pm$4.7 years) water polo players had their nocturnal sleep measured using actigraphy across a competition week, including 5 training days, 1 match day, and 1 day of rest. Sleep quantity and quality were determined by recording time in and out of bed (hh:mm), total time in bed and total sleep time (min), sleep efficiency (%), and wake time after sleep onset (WASO, min). Differences in sleep outcomes between genders were examined using linear mixed-effects models. The significance level was set at $p \leq 0.05$. Analysis showed that women went earlier to bed than men (13:21$\pm$1:34 h:mm vs. 13:57$\pm$1:37 h:mm, p=0.03), but no differences were detected between genders in terms of waking up (p=0.57). Despite that the total time in bed was similar between genders (p=0.22), women attained greater time asleep (432$\pm$95 min vs. 404$\pm$78 min, p=0.03), exhibited higher sleep efficiency (92.3$\pm$4.34% vs. 90.12$\pm$5.31%, p=0.00) and less WASO (32.23$\pm$19.14 min vs. 40.52$\pm$ 23.14 min. p=0.02) compared to men. The present data corroborates previous observations in general population suggesting that women sleep longer compared to men.

The effect of calcaneal tendon stiffness on dynamic rates of torque and velocity development

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Rapid generation of muscular torque facilitates locomotion, balance corrections, and other daily activities. Intrinsic tendinous properties (e.g., stiffness) influence musculoskeletal torque transmission. However, these associations have only been assessed isometrically (i.e., no joint rotation) which is less relevant to naturalistic movements. The purpose was to investigate the effect of calcaneal tendon stiffness on the dynamic rates of torque (RTD) and velocity (RVD) development in plantar flexor muscles. Young adult males (n=13) and females (n=2) performed prone isometric and isotonic maximal voluntary contractions (MVC) of the plantar flexors. Ultrasound imaging was used to quantify tendon cross-sectional area and elongation during isometric ramped MVCs, and Young's (elastic) modulus was calculated as a measure of tendon stiffness. Maximal voluntary and electrically evoked (300 Hz) isotonic contractions, at 20% MVC load, were evaluated for RTD (0-150 ms) and RVD (0-150 ms) through a 25° ankle joint range of motion. Young's modulus was not correlated with dynamic RTD (voluntary: r=0.39, p=0.14; evoked: r=0.16, p=0.58) nor RVD (voluntary: r=0.26, p=0.35; evoked: r=0.47, p=0.08). These non-significant relationships would indicate that calcaneal tendon stiffness is not a primary determinant of RTD nor RVD during isotonic contractions. Elucidating determinants of dynamic RTD and RVD may help optimize neuromuscular functionality. (Supported by NSERC)

Embedding a Clinical Exercise Physiologist into a collaborative family practice to improve physical activity levels and functional outcomes

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Primary care providers lack time, training, and confidence in performing physical activity counselling in clinical

practice. Clinical Exercise Physiologists (CEPs) can provide physical activity counselling in collaborative care practices to improve physical activity levels and health- and fitness-related patient outcomes. This pilot quality assurance evaluation embedded a CEP into two primary care collaborative practices (PCCP): PCCP1 for 19 months (September 2020-March 2022), and PCCP2 for seven months (September 2021-March 2022). Out of 534 scheduled appointments (30/month average), 36.5% were intakes, 40.6% were follow-ups, 13.9% were rescheduled, and 9% didn't show. 195 patients completed an initial assessment (mean age: 64 years, 76% female, resting heart rate: 73bpm, resting blood pressure: 126/74 mmHg). For those that completed a follow-up assessment (n=47 PCCP1, n=15 PCCP2) there were significant improvements in moderate-to-vigorous physical activity (+55%), resistance training (3-fold), reduced sedentary behaviour (-13%), improved lower-body strength (30-second chair stand, +23%) and single-leg balance (+31%), and 16 out of 45 participants improved their frailty score (35%). These improvements in health- and fitness-related patient outcomes are associated with a reduced risk of falls and significant annual healthcare savings, making the integration of CEPs into PCCPs a cost-effective strategy for the prevention, treatment, and management of chronic disease. (Funding support from the Nova Scotia Department of Health and Wellness)

Online exercise programs for older adults: what is offered and what are the potential benefits – a scoping review

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Physical activity and exercise are vital aspects of healthy aging, yet older adults are the least physically active demographic. While internet use is not as popular among older adults compared to other age groups, the COVID-19 pandemic has increased the proportion of older adults using the internet regularly. Online exercise programs provide a unique opportunity to improve accessibility to exercise for older adults. This review aimed to assess the current literature on live, supervised, online exercise programs for older adults, determine gaps in the literature, and report on previous findings to understand if online delivery of exercise programs can be a feasible option in the future. A total of 12 articles were included, totalling 668 participants (average 56 participants/study, mean age: 68 years, 68% female). The average intervention was 15 weeks long with 35 total training sessions. The findings of this review indicate that online exercise programs for older adults are feasible and well-accepted by participants. This review also found that online exercise programs can be as effective as in-person exercise programs in improving physical function outcomes. The current literature lacks congruency, and more research is needed to determine the specific benefits of online exercise programs for older adults.

The muscle metaboreflex during dynamic exercise: contribution to ventilation and cardiovascular regulation in males and females

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The skeletal muscle metaboreflex plays a significant role regulating blood flow during exercise. The cardiovascular response to the metaboreflex is observed with static and rhythmic forearm contractions, and attenuated in females. We sought to isolate the metaboreflex following heavy exercise, and quantify its contributions to ventilation and cardiovascular control in males and females. Healthy (24±4 y) males (n=9) and females (n=7) completed standardized pulmonary function and an incremental cycle test to exhaustion. Participants then completed two, randomized, 6-min bouts of intense cycle exercise (84±7%$\dot{V}O_2$max). One bout was immediately followed with post-exercise occlusion (PECO) (220 mmHg, 3-min) of the legs and one followed by passive recovery. The heart rate response to PECO compared to control was greater in males (+30±3 bpm) compared to females (+21± 7 bpm, p=0.01). Mean arterial pressure response to PECO was statically similar between in males (+18±5 mmHg) and females (10±4 mmHg, p=0.08). PECO elicited similar ventilation in males (+11±7 L/min) compared to females (+6± 3 L/min, p=0.108). We found that the metaboreflex contribution to the cardiovascular control was greater in males during dynamic exercise, however, the contribution to ventilation is similar between sexes. (Funding: NSERC)

Muscle metaboreflex activation following static exercise is attenuated by eccentric exercise induced muscle weakness

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It is assumed that static exercise at the same relative intensity (% of maximal voluntary contraction; MVC) evokes similar increases in blood pressure (BP), yet our lab has shown that MVC is positively correlated to static exercise and post-exercise circulatory occlusion (PECO) BP responses, indicating that a higher absolute workload is associated with larger BP responses due to greater metaboreflex activation. Whether absolute force is causally linked to the magnitude of the BP response remains to be established. We aimed to determine whether acutely reducing MVC attenuates BP responses to static knee extensor (KE) exercise and PECO 24 hours after a bout of eccentric KE exercise. Continuous BP, heart rate (HR), muscle oxygenation (NIRS), and vastus lateralis electromyography (EMG) were recorded in 16 young healthy males (n=10)

and females (n=6) during 2 minutes of static KE (80° of knee flexion) at 20% MVC, followed by 2 minutes of PECO while subjects were seated on a HumacNORM dynamometer. Subjects then performed 300 maximal effort eccentric knee extensions (60° range of motion, 50°/s). Subjects performed the same experimental protocol 4 weeks later as an internal control to attenuate eccentric exercise induced muscle weakness via the repeated bout effect. The change from baseline for each variable was calculated in the last 30s of KE exercise and PECO. Eccentric exercise caused a reduction in MVC in all subjects (156.2±37.0 vs. 119.0±28.3 Nm [mean±SD], $P<0.0001$). Systolic BP responses to exercise were unchanged during static KE exercise 24 hrs after eccentric exercise (34±16 vs. 33±14 ΔmmHg, $P=0.9$), but were attenuated during PECO (17±11 vs. 11±9 ΔmmHg, $P=0.004$). EMG responses to static exercise were similar before and after eccentric exercise ($P>0.99$). Changes in deoxygenated hemoglobin during exercise were attenuated following eccentric exercise (-24.9±26.9 vs -15.7±26.7%, $P=0.001$). Following the repeated bout effect, eccentric exercise caused less muscle weakness (-22±14 vs. -10±11% of baseline MVC, $P=0.02$), and all hemodynamic, EMG, and oxygenation responses were similar compared to control values. In conclusion, BP responses to metaboreflex activation, but not voluntary exercise, were reduced following eccentric exercise-induced reductions in MVC.

Nutrition knowledge associated with dietary adequacy in powerlifters

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Athletes in weight categories often restrict dietary intakes before competition, which may be detrimental to health and performance. Our purpose was to assess the effect of nutrition knowledge (NK), sex, and time (off-season versus pre-competition) on dietary adequacy in powerlifters. Twenty-three powerlifters (10 females; 30.7±11.2y) completed questionnaires to assess NK and dietary adequacy. Athletes with higher NK consumed more fruits and nuts and less vitamin B2, B3, and coffee and tea across all time-points ($p<0.05$) with a greater number (73%) above the RDA for vitamin D compared to those with lower NK (50%) ($p<0.05$). Males with higher NK consumed less alcohol and vitamin A than those with lower NK ($p<0.05$). Although NK was associated with lower intakes of certain vitamins most intakes remained above RDAs. Females with higher NK consumed less sugar and beverage calories than those with lower NK ($p<0.05$). Intake of alcohol and carbohydrate decreased, and meat calories increased from off-season to pre-competition ($p<0.05$). Males increased B-vitamins, whereas females decreased B-vitamins and sugar consumption approaching competition ($p<0.05$). Males increased water consumption versus females approaching competition (sex x time, $p<0.05$). Higher NK predicts a greater intake of foods and nutrients important for health and performance. Female powerlifters should pay close attention to intake of B-vitamins and water before competitions when many are cutting weight.

Comparison of two ovulation tests to improve predicted timing of the late follicular phase for menstrual cycle research

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To examine the impact of estrogen changes during the menstrual cycle it is desirable to perform assessments during the estrogen peak, just prior to ovulation, in the late follicular (LF) phase. Standard ovulation tests (SOT) identify the luteinizing hormone (LH) surge (indicative of ovulation) and only confirm that ovulation occurred after LF testing. The Clearblue Advanced Ovulation Test (AOT) detects a rise in estrogen before the LH surge. We hypothesized that using the AOT to schedule LF testing between the rise in estrogen and LH would decrease the LF_{visit}:ovulation interval vs. the SOT. 21 naturally menstruating females (22±4 years) participated in an early follicular (EF) and LF visit. LF visit scheduling employed an AOT (n=10) or SOT (n=11). Saliva samples were analyzed for estradiol. There was no difference in the LF_{visit}:ovulation interval between tests (AOT=2.7±2.2 days, SOT=2.5±1.7 days; p=0.859). Estradiol increased from the EF to LF phase, regardless of ovulation test used (phase $p<0.001$, test p=0.528, interaction p=0.099), and Δestradiol was negatively correlated with LF_{visit}:ovulation interval (r= -0.380, p=0.080). Using the AOT did not decrease the time between the LF visit and ovulation. Future studies should explore different methods to better identify the estrogen peak. (Funded by NSERC)

Short-term Resistance Exercise Training Attenuates Muscle Damage and Alters Transcription of Muscle Extracellular Matrix Regulators in Response to 300 Eccentric Contraction in Young Adults

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Unaccustomed resistance exercise training (RET) results in large non-specific translational and transcriptional responses which becomes more refined with continuing training, while previous eccentric (ECC) exercise confers protection from damage in subsequent similar bouts. It was hypothesized that these two phenomena may share a common mechanism involving remodeling of the extracellular matrix (ECM). Healthy young adults (6 female, 10 males; 20.94± 4.14 years) performed 6 sessions of unilateral RET with the contralateral leg acting as a control prior to 2 bilateral bouts (B1, B2) of 300 eccentric knee extensions separated by 21 days. Bilateral muscle biopsies were obtained before and 48-hours after each bout. Muscle damage assessed as the area under the curve for isometric force loss over 72-hours following ECC, was attenuated in B1 by RET (33%±4.76, p=0.035) and not observed in either group after B2. ECC elevated expression of Transforming Growth Factor-Beta (*TGFβ*, p=0.018) and Collagen Type IV (*COL4A1*, p=0.027) only in the RET leg after

each bout, while Matrix Metalloproteinase-2 (*MMP2)* mRNA increased after ECC only in the control leg (p=0.049). These results collectively suggest that short-term RET modifies that transcriptional response of ECM regulators to bouts of high volume ECC exercise which may partially underpin the observed attenuation of ECC induced muscle damage by prior RET. Further analysis is required to determine if altered transcription of ECM regulators is also reflected at the protein level.

The impact of an acute bout of prolonged sitting on popliteal endothelium-dependent and independent vasodilation

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Prolonged, uninterrupted sitting reduces popliteal blood flow-induced shear stress, resulting in diminished endothelium-dependent flow-mediated dilation (FMD) responses. It is currently unknown whether endothelium-independent vasodilatory mechanisms (i.e., reduced vascular smooth muscle sensitivity to exogenous nitric oxide) are also involved. The objective of this study was to determine the impact of prolonged sitting on nitroglycerin-mediated dilation (NMD, endothelium-independent dilation). Resting popliteal blood flow, relative FMD (%), and NMD (%) were assessed via duplex ultrasonography before and after a 2-h bout of sitting in 10 young, healthy adults (6 females; 22±2 yr). The FMD/NMD ratio was also calculated. The relationships between sitting-induced changes in blood flow versus FMD and NMD responses were assessed via Pearson correlations. Prolonged sitting attenuated resting popliteal blood flow (52±19 to 32±14 mL/min, $P < 0.001$), relative FMD (5.0±2.6% to 2.5±2.9%; $P = 0.002$) and NMD (8.2±4.0% to 5.3±3.1%; $P = 0.002$). The sitting-induced decline in popliteal blood flow was correlated to reductions in NMD (R=0.73, $P = 0.02$), but not FMD ($R = 0.09$, $P = 0.98$). The FMD/NMD ratio was unchanged in response to sitting (0.67±0.33 to 0.53±0.36, P=0.37). Our findings demonstrate that popliteal smooth muscle sensitivity to exogenous nitric oxide was impaired after prolonged sitting. Thus, both vascular endothelium and smooth muscle dysfunction occur in response to an acute prolonged bout of sitting.

Assessing corticospinal excitability during maximal effort repeated arm cycling sprints

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The purpose of this study was to assess corticospinal excitability projecting to the biceps brachii during maximal effort repeated arm cycling sprints. Twelve recreationally active participants (10 males, 2 females; age, 26.4±5.8 years) completed five, 17-22 second maximal effort arm cycling sprints on an arm cycle ergometer against a resistance equivalent to 5% of their bodyweight with 90 seconds of rest between sprints. While sprinting, participants received three stimuli via transcranial magnetic stimulation (TMS), transmastoid electrical stimulation (TMES), and peripheral nerve stimulation (PNS) at Erb's point. TMS, TMES, and PNS were measures of corticospinal, spinal, and peripheral excitability, respectively. Prior to and following the sprint protocol, active motor thresholds (AMT) for TMS and TMES, and the maximum compound muscle action potential (M_{max}) for PNS were obtained during submaximal arm cycling at 60rpm and a constant resistance of 0.5kg. All stimulations were evoked when the dominant arm was in full elbow extension. From sprint one to five, there was a ~37% decrease in both mean power output and total work (p<0.001), indicating neuromuscular fatigue development throughout the sprint protocol. During the sprints, no changes in corticospinal, spinal, or peripheral excitability (p>0.05 for all comparisons) were detected. However, at post-sprinting, the stimulation intensity required to elicit AMT for TMES was 4.6% lower (124.17± 30.08 mA) than at pre-sprinting (134.0±31.5 mA; p=0.005), suggesting that the motoneurone pool may be more excitable following the fatiguing sprint protocol. Moreover, M_{max} amplitudes were greater at post-sprinting (14.27±4.402 mA) compared to pre-sprinting (12.73±3.973 mA; p=0.0013), despite the same stimulation intensity being used at both timepoints. Taken together, these findings suggest that: 1) no changes in corticospinal pathway excitability were evident during the sprinting, and 2) alterations at the motoneuronal and/or peripheral level may occur following sprinting. (Supported by NSERC).

Could a family history of type 2 diabetes affect substrate oxidation during submaximal exercise?

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Individuals with a family history (FH+) of type 2 diabetes (TD2) present metabolic alterations such as insulin resistance and metabolic inflexibility. These have never been studied in a context of physiological response to exercise. The aim of the study is to determine if a FH+ of T2D influences exercise metabolism and substrate oxidation during an acute submaximal exercise test in FH+ postmenopausal women. Healthy inactive women aged between 60 and 75 years old were divided in two groups (Control: n=9; FH+: n=10). Participants ingested 50 mg of ^{13}C-palmitate tracer before a submaximal incremental exercise test during which respiratory gas exchange was measured (total fat oxidation) and breath and blood samples were collected for ^{13}C. The ratio of expired $^{13}CO_2$:$^{12}CO_2$ was measured in breath samples (isotopic-ratio mass spectrometry) to estimate exogenous fat oxidation. The oxidation of ^{13}C-palmitate was similar between groups, as were the palmitate tracer values in blood samples. Substrate

oxidation of glucose and fat measured with gas exchange and plasmatic concentrations of glucose, lactate, free fatty acids and glycerol were similar between groups. These results suggest that FH+ of T2D does not alter substrate metabolism and oxidation during submaximal exercise in postmenopausal women and confirm that moderate aerobic exercise remains efficient to prevent metabolic disorders in this population.

Characterization of the kinetic responses of $\dot{V}O_{2p}$, blood flow, and muscle deoxygenation by exercise intensity domain

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A step increase in external work rate (WR) requires an immediate increase in energy production. This energy production is ultimately met by O_2 utilization (which can be measured at the pulmonary level; $\dot{V}O_{2p}$), which requires an adequate supply of blood flow (BF) to the muscle. However, the adjustment of both $\dot{V}O_{2p}$ and BF to a new WR is not instantaneous, but instead increases exponentially to a new 'steady-state,' with the rate of this adjustment quantified by the time constant ($\tau\dot{V}O_{2p}$; τBF). However, the relationship between the dynamics of muscle O_2 utilization and muscle BF for transitions from light-intensity into the different domains of exercise intensity has not been established. This study examined the interaction amongst $\dot{V}O_{2p}$, BF, and muscle deoxygenation (deoxy[Hb+Mb]; a surrogate measure of O_2 extraction) to transitions into three intensity domains: moderate (MOD); heavy (HVY); and very heavy (VH). Six healthy, young men (29 $\pm$ 3 yrs; mean $\pm$ SD) performed 4-6 repetitions of alternate-leg knee-extension exercise from a light-intensity (3 W) baseline to: MOD (32 $\pm$ 8 W); HVY (54 W); and VH (66 W) WRs, with each transition lasting 8 min. $\dot{V}O_{2p}$ was measured breath-by-breath using mass spectrometry and a volume turbine; BF was calculated from vessel diameter and blood velocity measured continuously at the femoral artery using pulsed-wave Doppler ultrasound; and deoxy[Hb+Mb] was measured by near-infrared spectroscopy. Like transitions were ensemble-averaged together and the phase II component for each variable was modeled using a monoexponential least squares regression analysis. $\tau\dot{V}O_{2p}$ was larger in VH (43 $\pm$ 9 s) than MOD (30 $\pm$ 10 s; $p < 0.05$), while τBF was larger in both HVY (30 $\pm$ 11 s) and VH (31 $\pm$ 11 s) than MOD (21 $\pm$ 9 s; $p < 0.05$). The end-exercise ratio of BF-to-$\dot{V}O_{2p}$ (ΔBF/$\Delta\dot{V}O_{2p}$) was larger in MOD (6.6 $\pm$ 0.9) than HVY (5.3 $\pm$ 1.0) and VH (4.8 $\pm$ 0.9; $p < 0.05$). The mean response time (MRT) for deoxy[Hb+Mb] was larger in MOD (24 $\pm$ 3 s) than HVY (21 $\pm$ 1 s) and VH (18 $\pm$ 3; $p < 0.05$). These findings show that compared to MOD, transitions into HVY and VH are associated with slower $\dot{V}O_{2p}$ and BF responses but faster O_2 extraction, likely in compensation for a truncated BF-to-$\dot{V}O_{2p}$ with higher WRs associated with the HVY and VH intensity domains of exercise. (Supported by NSERC)

Isometric handgrip exercise increases middle cerebral artery blood velocity in children with congenital heart disease

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Patients with congenital heart disease (CHD) incur neurological deficits which can be linked to decreased cerebral perfusion. Isometric handgrip exercise (IHG) has been shown to increase indices of cerebral perfusion in healthy individuals; therefore, it may be a feasible exercise modality to increase cerebral perfusion in patients with CHD. This study tested the hypothesis that IHG would increase middle cerebral artery blood velocity (MCAv) similarly in contralateral and ipsilateral hemispheres of patients with CHD and healthy, age- and sex-matched controls. Patients with CHD (n=9 (4F, 5M); age=12$\pm$4y) and healthy controls (n=9 (4F, 5M); age=12$\pm$4y) completed 4 rounds of 2 min of IHG performed at 30% maximum voluntary contraction with each round of IHG separated by 1 min of recovery. During IHG, MCAv increased similarly in control and CHD groups in both contralateral (control=11$\pm$5cm/s vs. CHD=13$\pm$5cm/s; p=0.378) and ipsilateral (control=13$\pm$7cm/s vs. CHD=13$\pm$4cm/s; p=0.927) hemispheres. The relative magnitude of MCAv increase during IHG was also similar between control and CHD groups in both contralateral (control=18$\pm$8% vs. CHD=17$\pm$4%; p=0.800) and ipsilateral (control=20$\pm$12% vs. CHD=17$\pm$9%; p=0.944) hemispheres. These preliminary findings indicate that IHG may be a useful exercise modality to increase cerebral perfusion. Whether this can potentially improve neurological function in patients with CHD requires investigation.

Day-to-day variability of hyperoxic, hypoxic, and hypercapnic chemosensitivity during exercise

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The central and peripheral chemoreceptors work together to maintain an ideal carbon dioxide (CO2) and oxygen (O2) arterial partial pressure at rest and during exercise. However, less is known about the day-to-day reproducibility of the ventilatory response to hyperoxia, hypoxia, and hypercapnia (together stimulating central and peripheral chemoreceptors) during exercise. We sought to determine the repeatability of transient hyperoxic and hypercapnic chemosensitivity along with steady-state hypoxia and hypercapnia using end-tidal forcing during exercise. Seven participants completed 3 testing days: Day 1 was a maximal exercise test and Day 2 and 3 consisted of three 15-minute exercise bouts, under three separate conditions, at 30% of peak power out-

put. The three conditions were as follows: (i) room air, (ii) hypercapnia consisting of a peripheral (2 breaths of 10% CO2 repeated 5 times) and combined chemosensor stimulus (steady-state hypercapnia at +3 and +6 mmHg from baseline), (iii) Oxygen sensing consisting of transient hyperoxia (2 breaths of 100% O2 repeated 3 times) and steady-state hypoxia (arterial oxygen saturation ~80%). The order of conditions was randomized between participants but maintained between day 2 and 3. The decline in ventilation from hyperoxia (-17%±4 vs. -20%±5%) and the increase from hypoxia (+25±16 vs. +24±16 L/min) were not different for day 2 and 3, respectively ($p>0.05$). The oxyhemoglobin saturation (83±3 vs 82±2%) and end-tidal CO2 (43±4 vs. 45±5 mmHg) during hypoxia were not different between days ($p>0.05$). Likewise, the peripheral chemosensor (1.15±0.3 vs. 1.04±0.5L/min∗mmHg) and combined ventilatory response to hypercapnia (+3: 5.7±7.9 vs. 3.4±6.3 L/min; +6: 15.3±9.6 vs. 9.7±6.1 L/min) were also not significantly different for day 2 and 3, respectively ($p>0.05$). During stead-state hypercapnia, end-tidal CO2, was within ±1 mmHg and not different between days, ($p>0.05$). Lastly, during all hypercapnic conditions, end-tidal O2 was within ±10 mmHg ($p>0.05$). In conclusion, the peripheral and central chemosensors ventilatory response to O2 and CO2 are reproducible between days. (Funding: NSERC, CFI)

Characterizing the effects of voluntary wheel running on cardiac SERCA function in ovariectomized mice

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In the heart, SERCA2a actively transports Ca2+ into the sarcoplasmic reticulum to facilitate muscle relaxation. Phospholamban (PLN) is an allosteric inhibitor of SERCA. Changes to the PLN:SERCA2a ratio disrupts Ca2+ homeostasis and subsequently cardiac contractility. Ovariectomized (OVX) rodents have reduced SERCA activity and content levels and an increased PLN:SERCA2a ratio. A previous study found that forced treadmill running in OVX rats restored SERCA activity and the PLN:SERCA2a ratio. This study aimed to investigate whether voluntary wheel running (VWR) would produce similar effects on cardiac SERCA function in OVX mice. Female mice were divided into the following groups for 8 weeks: SHAM; OVX; SHAM+VWR; OVX+VWR (n=10/group). SERCA function was measured using SERCA activity and Ca2+ uptake assays. Protein content was determined via western blot analysis. With a two-way ANOVA, we found statistical interactions for total Ca2+ uptake, maximal SERCA activity, and SERCA2a content where VWR appeared to increase these parameters in SHAM mice but not in OVX mice. A significant main effect of OVX also indicates that the PLN:SERCA2a ratio is higher in OVX cardiac muscles compared with SHAM. These findings suggest that estrogen deprivation may negate the beneficial effects of voluntary aerobic exercise on cardiac SERCA function.

The reproducibility of repeated ski sprint performance using the Concept2 SkiErg in Nordic skiers and non-skier athletes

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Repeated ski sprint performance using the Concept2 SkiErg is a modality of exercise that may be used to investigate the effect of an experimental intervention on whole-body exercise performance; however, the reproducibility of this task and therefore, ability to detect small but meaning changes in performance in different athletic populations has not been investigated. On four separated days, eight varsity Nordic skiers and seven non-skier varsity athletes completed a repeated sprint protocol on a SkiErg consisting of four sets of 4 x 30 second maximal sprints with 15 seconds recovery between sprints and 5 minutes recovery between sets. The reproducibility of the average power output, heart rate, cadence and distance during each set was assessed using an interclass correlation coefficient (ICC; 2,1), using a two-way fixed effects model. ICC across the four repeated sprint protocols for skiers vs non-skiers was 0.99 vs 0.97, 0.90 vs 0.89, 0.93 vs 0.71, and 0.93 vs 0.72 for power output, heart rate, cadence and distance, respectively. Data from this study suggest that repeated ski sprint performance on a SkiErg is substantially reliable across all athletic populations; however, varsity Nordic skiers demonstrate higher estimates of reproducibility across all sets compared to non-skier athletes.

Acute ketone monoester supplementation increases the oxygen cost of submaximal exercise in endurance-trained adults

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Nutritional ketosis induced by acute ketone monoester supplementation (KE) affects exercise responses. There are limited and equivocal data regarding the effect of KE on exercise economy. We probed this issue by combining data from two separate studies from our lab that used the same supplementation and exercise protocol. Analysis included 27 endurance-trained adults (17 males, 10 females; $\dot{V}O_{2peak}$: 58±8 ml/kg/min, mean±SD). In a randomized, crossover, and double-blinded manner, participants ingested either 0.6 g/kg body mass KE or a ketone-free placebo. After, they rested for 30 minutes and then cycled at a constant workload that elicited ventilatory threshold 1 (~70% $\dot{V}O_{2peak}$) for 30 minutes. Venous [β-hydroxybutyrate], the major circulating ketone body, was higher during exercise after KE vs placebo ingestion (3.6±1.0 vs 0.2±0.2 mM, $p<0.0001$). Steady-state $\dot{V}O_2$ was 41[12-70] ml/min (mean[95% CI]) higher during exercise after KE vs placebo ingestion (2933±725 vs 2892±722 ml/min, $p=0.01$, $d_z=0.54$, 77% post-hoc power). Exercise heart rate ($p<0.0001$, $d_z=1.2$) and minute

ventilation (p<0.0001, d_z=1.3) were also higher after KE vs placebo. We conclude that ingestion of a large bolus dose of KE increased the oxygen cost of submaximal cycling and thereby impaired exercise economy. This effect was associated with a higher cardiorespiratory stress after KE ingestion. (Supported by NSERC).

Intense interval exercise induces lactate accumulation and a greater suppression of acylated ghrelin compared to submaximal exercise in middle-aged adults

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Exercise-induced appetite suppression is well demonstrated in young adults (18-25 y). This study examined the effect of submaximal, near maximal, and supramaximal intensity exercise on appetite regulation in middle-aged adults. Nine participants (6 female; age: 45±10 y) completed 4 experimental sessions: 1) no-exercise control (CTRL); 2) moderate-intensity continuous training (MICT; 30 min, 65% $\dot{V}O_{2max}$); 3) high-intensity interval training (HIIT; 10 x 1 min efforts, 90% heart rate maximum, 1 min recovery); and 4) sprint interval training (SIT; 8 x 15 s "all-out" efforts, 2 min recovery). Acylated ghrelin, glucagon-like peptide-1 (GLP-1), peptide tyrosine tyrosine (PYY), and subjective appetite perceptions were measured pre-exercise, 0-, 30-, and 90-min post-exercise. Energy intake was recorded the day before and day of each experimental session. Acylated ghrelin was suppressed (P<0.001, η_p^2=0.474) by HIIT (0-min, and 30-min post-exercise; P<0.091, d>1.84) and SIT (0-min, 30-min, and 90-min post-exercise; P<0.037, d>1.72) compared to CTRL, and SIT suppressed concentrations compared to MICT (0-min, and 30-min post-exercise; P<0.91, d>1.19). There were no effects of exercise on PYY (P=0.126, η_p^2=0.200), GLP-1 (P=0.219, η_p^2=0.175), appetite perceptions (P=0.150, η_p^2=0.196), or energy intake (P=0.587, η_p^2=0.076). Intense interval exercise suppresses acylated ghrelin, though little effect on anorexigenic hormones, overall appetite, or free-living energy intake.

Shorter high-intensity cycling intervals mitigate neuromuscular fatigue responses at work-matched level but not task failure

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The duration of work and recovery phases, which can modulate metabolic perturbations during high intensity interval training (HIIT), determine exercise performance. This study aimed to characterize neuromuscular, perceptual, and cardiorespiratory responses to work-to-rest matched HIIT protocols differing in work duration. Twelve healthy individuals (6 females, 26.1 ± 5.3 years) completed a ramp incremental test to determine peak power output (PPO). Then, in three randomized visits, participants completed three cycling protocols to task failure at 90% of PPO: (i) 3:3 min work-to-passive rest ratio HIIT ($HIIT_{3min}$); (ii) 1:1 min work-to-passive rest ratio HIIT ($HIIT_{1min}$); and (iii) constant load (CL). Interpolated twitch technique, including a high-frequency doublet femoral nerve stimulation superimposed on the maximum voluntary contraction (MVC) followed by a 100 Db, a low-frequency doublet (10Db), and a single twitch (evoked every 3 s after the MVC), were performed at baseline, every 6 min of work, and task-failure. Perceptual and cardiorespiratory responses were recorded every 3 minutes and constantly across the exercises, respectively. The work completed during $HIIT_{1min}$ (8447 ± 5124 KJ) was considerably greater than $HIIT_{3min}$ (1930 ± 712 KJ) and CL (1076 ± 356) (P<0.001). At work-matched, $HIIT_{1min}$ resulted in a lesser decline in MVC and twitch force compared to $HIIT_{3min}$ and CL (P<0.001). No differences in voluntary activation were found at the work matched time point (P>0.540). At work-matched, Perceived effort, pain, and dyspnea were least in $HIIT_{1min}$ and less in $HIIT_{3min}$ compared to CL (P<0.001). At task failure, $HIIT_{1min}$ resulted in less voluntary activation than $HIIT_{3min}$ (P=0.010) and CL (P=0.043), while all other neuromuscular and perceptual responses were not different. Overall, the mitigated physiological and perceptual responses during shorter work periods ($HIIT_{1min}$) enhance exercise tolerance in comparison to longer work intervals at the same intensity ($HIIT_{3min}$, CL).

Males and females demonstrate similar neuromuscular fatigue exercising near the critical torque

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Critical torque (CT) is the asymptote of the hyperbolic relationship between intermittent isometric knee torque and muscle contraction time to task failure. We hypothesized that indices of neuromuscular fatigue, characterized by reduced central activation (central fatigue) and diminished muscle contractile function (peripheral fatigue), would be similar for males and females performing small muscle mass exercise near the CT. Twelve females (age: 25±5 y, $\dot{V}O_2$max: 57.3±7 mL·kg FFM^{-1}·min^{-1}) and 12 males (age: 27±6 yr, $\dot{V}O_2$max: 57.1±8.1 mL·kg FFM^{-1}·min^{-1}), matched for aerobic fitness, completed 3-4 intermittent isometric knee extension trials to task failure to determine CT and the work capacity above CT (W'). The relative CT (males vs. females: 37.8±7.8% vs. 41.9±8.7%; p=0.255) and W' (26.4±6.6 Nms·Nm^{-1} vs. 27.5±10.9 Nms·Nm^{-1}; p=0.769) were not significantly different between sexes. Peripheral and central fatigue were observed after 30 min of exercise 10% below CT (p<0.05 for all variables); however, males and females demonstrated similar declines in maximum voluntary contraction (-23.9±16.0% vs. -25.4±12.7%; p=0.835), potentiated twitch force (-23.9±15.8% vs. -30.2±18.9%; p=0.381), low-frequency fatigue (-21.4±12.5% vs. -23.9±8.5; p=0.621), and voluntary activation (-9.2±14.1% vs. -7.7±11.5%; p=0.663). Results were similar for exercise performed above the CT. Overall, the similar neuromuscular fatigue in response to small muscle mass

exercise suggests the absence of a sex difference. (Supported by the Natural Sciences and Engineering Research Council of Canada (NSERC) and the University of Calgary, Faculty of Kinesiology)

Does perceived caloric and nutrient intake influence the acute effect of beverage consumption on cardiovascular function?

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This study explored how endothelial function is altered by consuming a high-fat/sugar beverage with high displayed calories, fat, and sugar compared to the same beverage presented as low in calories, fat, and sugar. Twenty-five, young (21±2 years), healthy, food-stress/shame prone women completed 3 conditions on different days: milkshake consumption (540 Cal, 80g sugar, 14g fat) when given correct nutritional information (milkshake condition), incorrect information (100 Cal, 3g sugar, 4g fat; nutrishake condition), and water consumption (control condition). Pre- and post-beverage we assessed: 1) Endothelial function (60- and 90-min post) via a standard brachial artery reactive hyperemia flow-mediated dilation (FMD) test, and; 2) Perceived beverage healthiness and harm. The milkshake was perceived to be less healthy (milkshake: 1.4±0.6 vs. nutrishake: 3.4±0.6, $p<0.001$) and more harmful (milkshake: 2.4±1.0 vs. nutrishake: 1.7±0.6, $p<0.001$) than the "nutrishake". %FMD significantly decreased after the milkshake condition (pre: 7.4±3.3; post-60min: 4.9±2.9; post-90min: 4.5±3.1, $p<0.001$) but not the nutrishake (pre: 5.7±2.2; post-60min: 5.5±2.6; post-90min: 5.0±2.4, $p=0.43$) or control conditions (pre: 7.0±2.6; post-60min: 6.6±4.1; post-90min: 6.0±3.2, $p=0.29$). A high-fat/sugar milkshake only impacted endothelial function when presented as high in fat, sugar, and calories. This suggests that perceived nutritional information of high-fat/sugar beverages may contribute to their negative impact on endothelial function. (Supported by a Natural Sciences and Engineering Research Council of Canada (NSERC) discovery grant)

High-intensity exercise with a lower-extremity robotic exoskeleton improves memory and gait in people with Parkinson's disease

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High-intensity exercise holds considerable promise as a breakthrough intervention for people with Parkinson's disease (PwPD). The grand challenge is how to deliver such interventions to PwPD whose condition makes it difficult for them to participate in such interventions. Lower-extremity robotic exoskeletons offer a potential solution to improve exercise engagement and enable PwPD to exercise at sufficient intensity. To test this hypothesis we conducted a parallel, open-label, randomized controlled trial of 8 weeks (2x per week) of progressive functional exercise (aerobic, resistance, walking, stairs, etc.) with or without wearing a lower extremity powered exoskeleton. Actigraphy was employed to measure movement intensity during all exercise sessions. The exoskeleton group had significant improvements in memory and gait endurance compared to the group that exercised without the device and the waitlist control group. The improvements in memory and gait were correlated with the exercise intensity levels achieved during the interventions, and only the exoskeleton group was able to achieve progressive intensity-levels that exceeded the high-intensity threshold for PwPD. Our study suggests that PwPD who can achieve high-intensity functional exercise may activate proangiogenic and neurotrophic mechanisms that promote global functional improvements in physical and cognitive health. Facilitating high-intensity exercise with advanced rehabilitation technology is warranted for improving memory and gait endurance in PwPD and other neurological diseases (supported by funding from Centre for Aging + Brain Health Innovation).

State anxiety, depression, and physical activity in university students during the COVID-19 pandemic

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Since the COVID-19 pandemic was declared, university students have faced stressors that may have strained their psychological health. This study examined the associations between state depression, anxiety, and physical activity (PA) among university students during the COVID-19 pandemic. Full-time undergraduate students completed an online survey in the fall of 2021, which included the Depression Anxiety Stress Scale-42 (DASS-42) and the International Physical Activity Questionnaire long-form (IPAQ-L). One-way ANOVAs determined whether state anxiety or depression scores differed between degree programs and linear regressions examined associations between PA and state anxiety/depression. Overall, participants (n=689) showed moderate state anxiety (12.12±8.74) and depression (17.03±11.79) levels. Mean state anxiety and depression scores differed by degree program ($F(10,678)=3.14$; $p<0.01$ & $F(10,678)=2.73$, $p<0.01$). Tukey's post-hoc tests revealed that Bachelor of Forensic Science students had higher state anxiety than Bachelor of Science students ($p=0.03$), and Bachelor of Education students had higher state depression than Bachelor of Kinesiology students ($p=0.02$). Students had a mean PA level of 5239.76±8367.62 MET-min/week, and PA level did not differ by program of study. PA could not predict the variability in state anxiety or depression scores ($p=0.38$). While our study found that PA is not associated with undergraduate students' state anxiety/depression, anxiety/depression of moderate severity is prevalent among university students underscoring the importance of supporting psychological health.

Cardiovascular risk factors in individuals with and without osteoarthritis using the Canadian Longitudinal Study on Aging

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Osteoarthritis (OA) is a prevalent musculoskeletal condition characterized by the progressive degradation of the cartilage and bone, and is comorbid with cardiovascular disease (CVD), particularly in the older demographic. CVD risk factors have been found to be elevated in individuals with OA, suggesting shared etiology and disease mechanisms. Methods to quantify CVD risk, such are carotid intima-media thickness (cIMT), the Framingham risk score (FRS), and the InterHeart risk score (IHRS), can provide valuable insight into potential preclinical changes in individuals with OA that drive the increase in CVD comorbidity. This study examined CVD risk factors, surrogate measures of CVD (cIMT, FRS, and IHRS), and nonspecific risk factors (e.g., frailty, social disadvantage) in individuals with OA compared to an age- and sex-matched cohort of individuals without OA. Unadjusted and multivariate adjusted odds ratios (OR) of developing CVD at 3-year follow-up in individuals with and without OA were studied, with additional models examining differences between weight-bearing and non-weight bearing OA. Odds of CVD at 3-year follow-up were significantly elevated in individuals with OA before ($p<0.001$, OR:1.70) and after ($p<0.001$, OR: 1.67-1.70) adjusting for other CVD risk factors. There were no significant differences between sites of OA ($p = 0.24$-0.75, OR: 0.69-0.71). The elevated risk of CVD individuals with OA suggests possible interactions and synergistic effects of risk factors increase CVD risk beyond independent influences. (Supported by MIRA)

Meeting the New Canadian 24-Hour Movement Guidelines is Associated with Frailty Status across Adulthood: A Cross-Sectional Study

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Meeting the criteria of the Canadian 24-Hour Movement Guidelines (24HMG) reduces the risk of chronic conditions and premature mortality. However, the association between meeting the 24HMG and frailty across adulthood is unknown. We hypothesized that greater adherence to the 24HMG would be associated with lower frailty in adults and older adults. This cross-sectional study included 2739 participants aged 20 years and above from the 2005-2006 National Health and Nutrition Examination Survey. Since an interaction term for age was found to be significant, the analyses were stratified by age groups: 20-64 ($n = 2025$) and 65+ ($n = 714$). The primary exposure variable was adherence to the 24HMG criteria based on established cut offs for time spent in moderate to vigorous physical activity, light physical activity, sedentary time, recreational screen time, sleep, and resistance training. The primary outcome variable was frailty measured using a 46-item frailty index. Multiple linear regression adjusted for known covariates was used to test the relationship between the exposure and outcome variables. In the younger age group, meeting just 1 of 6 elements of the recommendation was associated with lower frailty ($\beta = -0.144$ (95% C.I. = -0.252 to -0.035); $P < 0.01$); meeting 5-6 elements of the guideline was associated with a further reduction in frailty ($\beta = -0.439$ (95% C.I. = -0.551 to -0.328); $P = < 0.01$). In the older age group, meeting 2 of 6 elements of the guideline was associated with lower frailty ($\beta = -0.111$ (95% C.I. = -0.193 to -0.029); $P < 0.01$); meeting 5-6 element of the recommendation was associated with a further reduction in frailty ($\beta = -0.322$ (95% C.I. = -0.490 to -0.154); $P < 0.01$). We conclude that greater adherence to the 24HMG is associated with lower frailty across adulthood. (This project received funding from the New Brunswick Health Research Foundation)

Gene Expression Time Course for Regulators of Mitochondrial Biogenesis in Young Healthy Men

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It is unknown if the expression of key regulatory genes of mitochondrial biogenesis (PGC1α, NRF1, COXIV, COXI, TFAM, ND4) follow unique time courses following exercise, or if these time courses are influenced by exercise intensity. Thus, we investigated the mRNA expression of select regulators of mitochondrial biogenesis at 5 time points after low- (LO) and high-intensity (HI) exercise. Recreationally active men ($n=13$, age=23.2±3.0 yrs) performed an incremental $\dot{V}O_2$max test on cycle ergometer to determine peak work rate (Wpeak). Subsequently, participants reported to the lab on 2 separate occasions and performed either HI (8 x 1 min at 100% Wpeak) or LO (11 x 1 min at 73% of Wpeak) in random order. Skeletal muscle biopsies were obtained from the vastus lateralis as it follows: pre-exercise, 1h post, 3h post, 6h post, 9h post, 12h post. qPCR was performed on samples from each exercise session. Significant differences between HI and LO were observed for physiological outcomes ($n=13$) with heart rate ($p <0.01$), blood lactate ($p <0.01$), and RPE ($p <0.01$) all being higher after HI. mRNA analysis ($n=7$) revealed that PGC-1α mRNA expression at 3HR and 6HR of HI exercise was significantly different from pre-exercise ($p <0.01$). Significant effects of session ($p = 0.96$) or an interaction effect ($p = 0.27$) were not observed for PGC-1α. No significant effects of time ($p > 0.05$), session ($p > 0.05$) or time X session interactions ($p > 0.05$) were observed for mRNA expression of NRF1, COXIV, COXI, TFAM and ND4. We are currently analyzing gene expression data from 5 additional participants, but preliminary findings indicate that most of the genes we investigated (PGC-1α being the exception) are not induced by either HI or LO.

The relationship between critical power and respiratory compensation point: equivalence or coincidence?

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Critical power (CP) and respiratory compensation point (RCP) frequently occur at the same metabolic intensity (i.e., oxygen uptake [$\dot{V}O_2$]), yet their equivalence has been questioned. This study aimed to investigate whether different pedal cadences (60 vs 100 rpm) affect the correspondence between CP and RCP when expressed in $\dot{V}O_2$ and work rate (WR). Ten healthy adults (3 females, 24±2 yrs [mean±SD]) performed the following exercise protocols on a cycle ergometer at both 60 and 100 rpm: i) a "step-ramp-step" protocol to identify the $\dot{V}O_2$ and WR corresponding to RCP; ii) 4-5 constant power output trials for CP identification; and iii) a 30-min bout of exercise at CP to determine its associated $\dot{V}O_2$ value. During each trial, pulmonary gas exchange was measured breath-by-breath (Quark CPET, COSMED, Rome, Italy). The $\dot{V}O_2$ and WR associated with CP and RCP were compared within and between cadence-specific conditions by 2-way repeated measures ANOVA. In the 60-rpm condition, the $\dot{V}O_2$ and WR associated with CP (2816±705 mL/min and 200±54 W) were not different from RCP (2791±628 mL/min and 197±59 W; p=0.672 and p=0.557, respectively). At 100 rpm, the $\dot{V}O_2$ and WR associated with CP (2894±707 mL/min and 191±54) were not different from RCP (2823±636 mL/min and 183±52 W; p=0.305 and p=0.072, respectively). The WR at CP and RCP were lower at 100 vs 60 rpm (p=0.005) but not different within cadence-specific conditions (p=0.174), whereas the $\dot{V}O_2$ values associated with these two variables were not different both within- (p=0.382) and between- (p=0.131) cadences. Data confirm that CP and RCP: i) occur at an identical metabolic intensity and WR; ii) change in unison with an intervention that modifies the WR at which each occurs. The close relationship between the CP and RCP suggests a mechanistic link between these two manifestations of the heavy-to-severe intensity domain boundary.

A modified Nordic Curl intervention does not influence rate of hamstring injuries or time lost due to injury in Canadian football players: A retrospective review

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The Nordic Curl is commonly implemented as part of a preventative injury program, especially in sprinting-based sports. However, there is limited research investigating the implementation of the modified Nordic Curl (mNC) which involves performing both the eccentric and concentric phases of the exercise. Therefore, the purpose of this study was to determine if a mNC intervention reduces the rate of hamstring injuries and time lost due to injury in a single professional Canadian football team. The mNC intervention was implemented post practice for 4 consecutive seasons. The intervention period was compared to the prior four years of hamstring injury data in three categories: 1) overall rate of hamstring injuries; 2) average on-field days lost due to injury; and 3) comparison of total hamstring injuries per timeframe of the season (preseason, and weeks 1-6, 7-12 and 13-18). The records of 906 players were reviewed with a total of 74 hamstring injuries included in the analyses. No significant differences were found for total number of injuries (no mNC: 11.75±4.93; mNC: 6.75±2.63; $p = 0.123$), time lost due to hamstring injury (no mNC: 28.54±4.53 days; mNC: 31.18±6.22 days; p=0.517) or number of injuries per timeframe of season (p-value range 0.2 – 0.69). However, a large effect size was observed for total hamstring injuries (Hedges $g = 1.27$) and the timeframe comparison of weeks one through six (point biserial $r = 0.41$). The results suggest the mNC does not significantly affect hamstring injury rates, time lost due to injury or specific timeframes within the competitive season.

The effects of dead space loading on the physiological mechanisms of sex differences in exertional dyspnea

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Some studies suggest that females experience greater ventilatory limitations and dyspnea relative to males during exercise. However, previous studies rarely matched groups for relative fitness or experimentally manipulated the ventilatory response to evaluate these differences. This study sought to examine the mechanisms of dyspnea in males and females of similar relative fitness by stressing the respiratory system during exercise using external dead space loading (DSL). DSL stresses the respiratory system by requiring a greater ventilation for a given exercise intensity. Thirty participants (15F vs.15M; $\dot{V}O_2$: 108±22 vs. 112±16%predicted, p>0.05) completed maximal incremental cycling with and without DSL (15% of forced vital capacity) in a blinded and randomized cross-over design. Dyspnea was measured using the 0-10 Borg scale. A combined multipair electrode esophageal balloon catheter was used to determine the work of breathing (W_b) and diaphragm electromyography (EMGdi). Average DSL was 586±72ml for females and 846±108ml for males. Dyspnea was significantly higher in females than males during both conditions at the highest equivalent submaximal work rate (HESWR) of 100 W (Control: 2.1±1.0 vs. 0.9±1.0 Borg units, p=0.002; DSL: 2.5±1.4 vs. 1.2±1.3 Borg units, p=0.009). Males had higher dyspnea at peak exercise (Control: 7.5±2.0 vs. 8.8±1.3 Borg units, p=0.02; DSL: 8.1±1.6 vs. 9.2±1.3 Borg units, p=0.02). Females and

males were both able to significantly increase tidal volume at peak exercise with DSL by 89±76 and 172±174 ml, respectively (both p<0.05). There was no sex difference in W_b at the HESWR (p>0.05), whereas the W_b was significantly greater in males at peak exercise in both conditions (Control: 246±129 vs. 486±172 J/min, p<0.001; DSL: 292±139 vs. 518±128 J/min, p<0.001). There was no sex difference in EMGdi at the HESWR or peak exercise with DSL (p>0.05); however, EMGdi was significantly higher in females during control at the HESWR (24±6 vs. 18±7%max, p=0.01). Higher dyspnea at submaximal exercise in females is likely related to increases in EMGdi to perform the same absolute work rate, at least during control exercise. In contrast, the higher dyspnea at peak exercise in males may be explained by the higher absolute W_b in both conditions.

Maternal physical activity during gestation alters APP processing in offspring in an age-specific manner

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Maternal exercise is beneficial for offspring brain development. Amyloid precursor protein (APP) influences neurogenesis and synaptic plasticity. APP cleavage can produce soluble APP alpha (sAPPa) fragments implicated in the proliferation of neural progenitor cells and neuronal network development. Our study aimed to investigate developmental differences in APP processing in active or sedentary offspring of dams who were either inactive or exposed to voluntary wheel running (RUN) throughout gestation and if RUN effects were altered in dams on a high fat diet (HFD). Female Wistar rats (7-8 weeks old) were fed a normal chow diet (ND) or HFD and randomized into RUN or sedentary (SED) conditions. Dams returned to SED conditions post-parturition. Postweaning, offspring were kept on a ND and separated into pupSED or pupRUN for 6 or 18 weeks. In-utero exposure to maternal RUN was associated with increased sAPPa/sAPPb ratio and BACE1 in offspring prefrontal cortex at 6, but not 18 weeks, of age. The pupRUN group had a trend for higher mature BDNF and a greater content of neuronal nuclear protein (NeuN) at 18 weeks of age if their mothers were exercised. NeuN is exclusive to mature neurons implying that exercised pups of mothers who exercised could be primed to have more neuron maturation potentially influenced by the increased sAPPa/sAPPb ratio seen earlier in development.

Effects of aerobic exercise training on internal carotid artery blood flow during orthostatic stress in rats with experimental myocardial infarction

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Myocardial infarction (MI) commonly predates heart failure (HF), which is associated with cerebral hypoperfusion during orthostatic stress. This may be preventable with exercise training (EX). This study tested the hypothesis that six weeks of EX would improve cerebral perfusion during orthostatic stress in rats with experimental MI. Male Sprague Dawley rats underwent left anterior descending coronary artery ligation to induce experimental MI. Subsequently, rats were divided into sedentary (SED; n=5) or EX (n=5) groups. EX began approximately 10-days post-ligation and consisted of continuous, progressive treadmill running three times per week. Seven weeks following ligation, internal carotid artery blood flow (CarBF; perivascular flow probe) and mean arterial pressure (MAP; arterial catheter line) were assessed in a supine position during neutral (0º) and for 10-s during head-up tilt (HUT; +20º). MAP and CarBF were not different between groups during baseline or HUT (p≥0.472). Compared to baseline, MAP decreased during HUT in both groups (p<0.001). Compared to baseline, CarBF decreased in SED (baseline 6.7±2.3 mL/min vs. HUT 5.9±2.4 mL/min; p=0.02), but not EX rats (baseline 6.8±1.5 mL/min vs. HUT 6.7±1.6 mL/min; p=0.81). Furthermore, %change in MAP was not different (p=0.482), but %change in CarBF was less in EX vs. SED rats (EX -1.4±6.5% vs. SED -14.0±8.6%; p=0.05). These preliminary findings indicate EX improves cerebral perfusion during orthostatic stress in rats with experimental MI. (Heart & Stroke Foundation, NSERC)

The impact of 16-week resistance training performed with elastic bands along with diabetes education on quality of life in frail older adults living with type 2 diabetes: A sub analysis of the Band-Frail study

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The prevalence of Type 2 Diabetes (T2D) and frailty is constantly increasing worldwide. T2D and frailty have been associated with physical limitations and less autonomy, reducing quality of life. Although regular strength training using specialized equipment along with diabetes education improve quality of life of people with T2D and frailty, no studies have yet investigated the impact of resistance training using elastic bands, an accessible option for communities, along with diabetes education. It was hypothesized that participation in a 16-week program of elastic band resistance training and diabetes education would improve quality of life measured using the Short Form 36 Item Health Survey (SF-36). Participants (n = 54) were included if they were aged 65 years old and above, living with T2D (HbA1c ≥ 6.5%), and if they were pre-frail based on Fried's Frailty Scale. Each session consisted of 50 minutes of supervised resistant training using elastic bands twice a week along with 10-20 minutes of diabetes education with a diabetes educator once a week. A significant improvement was observed in the role functioning – physical (pre: 39.4 ± 40.5 post: 56.2 ± 41.8; p = 0.005), energy/fatigue (pre: 49.8 ± 22.7 post: 54.6 ± 17.6; p = 0.045) and health change (pre:47.7 ± 22.9 post: 60.6 ± 23.6; p=0.002) domains of the SF-36, while no significant improvements were observed on any of the other domains (p > 0.05). Therefore,

participating in the Band-Frail program improved most domains of self-reported health. Therefore, it is suggested that using elastic bands as the only equipment along with diabetes education can improve quality of life. (Funding: Public Health Agency of Canada- Healthy Senior Pilot Projects)

Improved fitness from community exercise programs led by a Certified Exercise Physiologist

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Health care providers have identified that an important facilitator to promoting physical activity through health care, is having community exercise programs run by '*qualified*' exercise professionals to refer their patients with medical conditions to. The Centre of Lifestyle Studies (COLS) at Acadia University runs nine community exercise programs led by Canadian Society for Exercise Physiology Clinical Exercise Physiologists (CSEP-CEP). One such program is 'Active for Life' (AFL), for older adults with a range of medical conditions. From September 2020 to March 2022, COLS delivered 14 AFL sessions (9 in-person, n=105; 5 virtually, n=133) and collected program evaluation data on 218 participants (F=179; M=39; age 71.1 ± 7.0 years). At baseline, participants were somewhat active (aerobic moderate-to-vigorous physical activity [MVPA] = 135 ± 153 min / week; Resistance Training [RT] = 1.2 ± 1.7 sessions / week). Paired data (n=60, MVPA, RT; n=156 other) showed significant (all p<0.05) improvements in MVPA (38%), RT (110%), 30 sec sit-to-stand (11%), Single-leg balance (7%), 2 min Aerobic Step test (13%), and 44/156 (28%) improved their Clinical Frailty Scale Score. The AFL program demonstrates significant fitness outcomes that can have potential cost-saving impact when related to reduced risk of falls and improved health. (Funding support from the Nova Scotia Department of Health and Wellness)

The effect of acute isometric handgrip exercise on cognition in young adults

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Acute isometric handgrip exercise (IHG) may be a novel strategy to protect brain health by lowering blood pressure and enhancing cognition; however, the effect of IHG on cognition is poorly understood. We tested the hypothesis that acute IHG would improve reaction time (RT) and working memory in young adults. In a randomized-crossover design, eight participants (n=4 female; age=22.3±2.3 years; BMI=22.1±2.2kg/m^2) completed IHG or time-matched control condition on separate days. IHG was four sets of 2-min unilateral squeezing at 25% maximum voluntary contraction separated by 3-min rest (20-min total). The control condition watched a nature documentary for 20-min. Hemodynamics were assessed throughout. Simple RT, choice RT, and working memory were assessed via the 4-Choice RT, Corsi Block, and N-Back Tests, respectively at baseline and 5-min after each intervention. Preliminary results show that IHG significantly increased mean arterial pressure (Δ+30 mmHg; P<0.001; η^2=0.324) and heart rate (Δ+16 bpm; P=0.002; η^2=0.289) during IHG compared to baseline but returned to resting levels within 5-min of recovery. Contrary to our hypothesis, IHG did not improve RT or working memory performance in our preliminary sample. Early findings suggest that acute IHG does not improve cognition in young adults despite sympathoexcitation indicated by a significant hemodynamic response.

Sex differences in reflex sympathetic responses to dynamic leg exercise in healthy middle-age

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Mild dynamic exercise elicits sympatho-inhibition in healthy middle-age. We hypothesized that the specific reflex mechanisms responsible for this net response would differ between men and women. We studied healthy, medication-free men (7) and post-menopausal women (10), aged 58±3 and 55±3 years (mean±SE); measured heart rate (HR), blood pressure (BP) and fibular muscle sympathetic nerve activity (MSNA; microneurography) at rest and during upright 1-leg cycling (2 min each unloaded and 30-40% of $\dot{V}O_{2peak}$) under 3 conditions: 1) post-exercise circulatory occlusion (PECO)(muscle metaboreflex activation); 2) supine posture (cardio-pulmonary baroreflex activation); 3) while upright breathing hyperoxic air (32% O_2: inhibit arterial chemoreceptor). Baseline HR, BP and MSNA burst frequency (BF) were similar but MSNA burst incidence (BI) lower in women (P=0.008). Exercise-induced HR, MSNA BF and BI responses were similar across conditions although the BI response was shifted down in women. BI differed significantly between men and women during upright cycling only (main effect P=0.05), reflecting lower resting BI in women (P=0.02). BI decreased in an intensity dependent manner (P<0.001), with similar metaboreflex effect (P=0.04 vs loaded cycle). The sympathoinhibitory response during mild dynamic leg exercise is similar in men and women but arising from a lower resting baseline in women. There was no significant difference in reflex contributions to this sympathetic inhibition. (*Funded by the Heart and Stroke Foundation of Canada and CIHR*)

Local Ischemic Preconditioning Improves Anaerobic Arm Cycling Performance in Athletes

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Ischemic preconditioning (IPC) is a vascular manipulation technique that involves brief repeated episodes of limb ischemia and reperfusion before exercise. IPC has been reported to improve exercise performance, however, the effects on arm exercise are equivocal. This study investigated the effects of IPC on supramaximal intensity arm cycling performance in upper body trained athletes. Nine (n = 5 male;

n = 4 female) competitive watersport athletes underwent a familiarization trial followed by three experimental conditions: (i) no IPC (CON), (ii) IPC (4 x 5 min at individual occlusion pressures), and (iii) placebo (PLA; 4 x 5 min at 40 mmHg). Participants completed a 45 s all-out sprint on a mechanically braked arm cycle ergometer. Muscle oxygenation, cardiorespiratory, and blood lactate responses were measured to assess the influence of treatments on physiological responses to exercise. IPC increased mean power and peak blood lactate concentrations compared to CON and PLA and increased peak heart rate compared to CON but not PLA. Both IPC and PLA augmented the change in tissue saturation of the dominant arm compared to CON. While IPC improved arm cycling performance compared to other conditions, physiological measurements in this study provide little mechanistic explanation for the ergogenic effect.

The association of injury and eating behaviour in university athletes

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Athletes have a greater risk of developing disordered eating (DE) behaviours than non-athletes. Literature suggests that DE is associated with injury in female athletes; however, these associations are understudied in both female and male athletes. Our objective was to examine the association between DE and injuries in varsity athletes. In this cross-sectional study, varsity athletes completed an anonymous online survey. The survey included questions regarding demographics, injury occurrence, and the Disordered Eating Screen for Athletes (DESA-6; a score of ≥ 3 is indicative of DE). Athletes were categorized by DE status and injury occurrence; a Chi-Square test was performed to assess the relationship between these variables. Musculoskeletal injury frequency was compared between DE and non-DE groups using an unpaired t-test. Fifty-six varsity athletes (N=37 females, 66.1%) with a mean age of 20.1±1.3 years participated in this study. DE was not associated with injury occurrence (p=0.73) and musculoskeletal frequency did not differ between DE and non-DE groups (p=0.70). However, both injury and DE were prevalent as 75% of participants reported injuries and 34% had positive DESA-6 scores. These findings highlight the need to address DE and injuries in athletes and could encourage the implementation of strategies to reduce their prevalence in sport.

A comparison of drop-out rates from cardiac rehabilitation between older and younger adults and across different exercise modalities

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Older adults (OA) ($\geq$65 years) are at the greatest risk of cardiovascular disease (CVD); however, the prevalence of CVD in younger adults (YA) (<65 years) is growing. This study compared overall drop-out rates of OA vs. YA randomized to 3 exercise modalities (i.e. AIT, moderate-intensity continuous training [MICT], and Nordic walking [NW]-based cardiac rehabilitation (CR)), and drop-out rates across exercise modalities within each age group.

Participants were randomized into (1) AIT (4 × 4 minutes of high-intensity at 85–95% peak heart rate [HR]peak interspersed with 3 minutes of low-intensity at 60–70% HRpeak), (2) MICT (HRs within resting HR +20-40 bpm) or, (3) NW (walking with Nordic poles, HRs within resting HR +20-40 bpm). Drop-out rates from randomization to the completion of the 12-week intervention were recorded. Descriptive statistics and χ^2 analyses were used to determine the proportion of drop-outs between age groups and across exercise modalities.

A total of 90 (84.4% male) OA (n: AIT=31, MICT=30, NW=29) and 40 (85.0% male) YA (n: AIT=12, MICT=14, NW=14) participated. Drop-out rates from CR were higher in OA (n=18, 20.0%) vs. YA (n=4, 10.0%; p=0.003). Within OA, drop-out rates were greater in MICT (23.3 vs.12.9%, p=0.004) and NW (24.1 vs. 12.9%, p=0.003) when compared to AIT. No differences in drop-out rates across the exercise groups were observed within YA.

Overall drop-out rates were highest among OA; a higher proportion of OA dropped-out of MICT and NW vs. AIT, the latter showed a 7% lower dropout in OA than typically seen in CR (~20%). These findings have important implications for age specific considerations and preferences in CR exercise training modalities.

Respiratory and skeletal muscle contributions to exertional tolerance in patients with dyspnea of uncertain etiology

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In patients with dyspnea of uncertain etiology, right heart catheterization can assess cardiopulmonary pressures and heart function as means to explain symptom burden. Exercise may be employed to reveal latent abnormalities in the cardiopulmonary circuit that are absent at rest. Exertional tolerance in this cohort is poorly described as concomitant respiratory and peripheral skeletal muscle assessments are rarely examined in a clinical setting. The purpose of this study was to explore respiratory and skeletal muscle contributions to dyspnea in patients referred for right heart catheterization. Seven patients (61±15 years, 71% male) completed one, six-minute stage (26±10 W) of submaximal semi-upright cycling during right heart catheterization. In addition, patients were outfitted with a facemask ($\dot{V}O_2$ Master Analyzer) and a skeletal muscle oxygen monitor (Moxy Monitor System) on the vastus lateralis. Exercise tolerance

was assessed using a modified 10-point Borg dyspnea scale. All measures were recorded at rest and during exercise at steady state. Only one patient presented with pulmonary hypertension during exercise (total pulmonary resistance >3 WU) and the remaining patients had normal hemodynamics. When examining the change from rest to exercise corrected for differences in work rate, dyspnea demonstrated a negative correlation with minute ventilation (r=-0.44), and a positive correlation with both skeletal muscle oxygen desaturation (r=0.48), and cardiac output (r=0.62). Of note, cardiac output and skeletal muscle desaturation were significantly correlated (r=0.86, p=0.029), suggesting a potential peripheral oxygen diffusion limitation in this cohort. Considering normal exercise cardiopulmonary hemodynamics, dyspnea in this cohort may be explained by a blunted ventilatory response and impaired peripheral oxygen diffusion.

Physical activity level and functional capacity of individuals referred to physiotherapy services before receiving bariatric surgery

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Bariatric surgery aims, amongst other things, to help people regain their functional ability and activities of daily living. To evaluate these services, it is important to have a baseline measure of functional capacity and physical activity levels before persons receive bariatric surgery. We hypothesize that participants who will receive physiotherapy services and bariatric surgery will not meet the minimum recommended levels of physical activity and the functional capacity measure will reflect this. In a feasibility study for a randomized controlled trial, a secondary analysis of preliminary data was performed with baseline measures of physical activity level (7-day accelerometer) and functional capacity (6MWT). Forty-six participants (46.7±11.9 years, 51.5±8.3 kg/m2) were enrolled in this project. Accelerometry measurements indicated that on average, participants took 4558±2647 steps per day, 63.7±34 minutes in step time per day, spent 684±138 minutes per day in a sedentary position, and slept 528±85 minutes per day. For the six-minute walk test, participants walked an average of 375±105 meters. Participants in this study who present for physiotherapy services as part of their preparation for bariatric surgery do not meet recommended guidelines for activity (eg, 8000 to 10000 steps per day) and functional capacity (eg, 400 to 600m 6MWT). (Funding support was provided by the programme de subvention DUO CFMNB & Vitalité)

Blood flow restriction during aerobic training has no impact on muscle but improves exercise performance during blood flow restricted condition

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We have previously demonstrated that gravity-induced blood flow restriction (BFR) decreases muscle oxygenation and augmented post exercise increases in muscle gene expression despite no difference in muscle activation. Thus, we examined the effect of gravity-induced blood flow restricted (BFR) aerobic exercise (AE) on whole body and muscle adaptations to two weeks of exercise training. 19 participants (13 female; 20.9 ± 2.3 years; WRmax 133.9 ± 31.6 W) completed 7 work-matched supervised 30-minute training session over 2 weeks on a cycle ergometer either with their legs below (CTL) or above their heart (BFR). Muscle biopsies were taken before and after the intervention and time to fatigue during incremental cycling tests in the CTL and BFR position was assessed before and after training. No significant effect of time, group, and interaction was observed in PGC-1α, OXPHOS protein, LRP130, and NRF2. Intriguingly, BFR but not CTL resulted in improved performance (time to fatigue) during the incremental test in the BFR position ($p<0.001$). No effect of training was observed during the incremental test in the CTL position in either group ($p=0.412$). In conclusion, two weeks of gravity-induced BFR did not augment muscle markers of mitochondrial content but does appear to improve exercise performance in the BFR position. The mechanisms underlying this latter effect are currently unclear but represent an intriguing area for future study. (NSERC)

A cranberry extract and HIIT, but not resistance training, prevent declines in skeletal muscle mitochondrial function

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Westernized diets have been associated with reduced muscular function caused by chronic inflammation leading to impaired mitochondrial health. Mitochondria are responsible for oxidative phosphorylation and the majority of ATP

production in muscle cells. The objective of this study was to investigate the effect of the cranberry-derived A-type proanthocyanidin (PAC-1), a polyphenol and antioxidant, combined with either high-intensity interval training (HIIT) or resistance training (RT) on mitochondrial respiration in skeletal muscle of rodents. Mice aged 3-4 months (N=8/group; 6 groups) were fed either a regular chow (Control), a high-fat diet (HFD), or a high-fat diet enriched with PAC-1 (200 mg/day/kg of body mass) (PAC). Mice were put on their respective diets and underwent three HIIT or RT sessions per week for a period of 4 weeks. Vastus lateralis muscle was then collected and tested for mitochondrial respiration using high-resolution respirometry. In animals that completed the HIIT protocol, State 3 respiration (Control: 134.42 pmol/s∗mg +/- 42.34; HFD: 93.42 pmol/s∗mg +/- 32.67; PAC: 134.25 pmol/s∗g +/- 25.65; P=0.033) was significantly reduced in HFD compared with Control and PAC. No difference in state 3 respiration was observed between the groups that completed the RT protocol. Our results show that PAC-1 can offset the impairments on mitochondrial function caused by a high-fat diet in animals performing HIIT, but not RT. Further analysis is needed to understand the mechanisms involved.

Voluntary activation of the knee extensors during isometric and isotonic shortening contractions

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The interpolated twitch technique is used to evaluate voluntary activation (VA), but has primarily been applied to isometric contractions. Our purpose was to compare VA during isometric and isotonic shortening contractions. Five young adults (n=1 female) performed maximal and submaximal isometric (55° joint angle) and isotonic (70° range of motion) knee extension contractions on a dynamometer (HUMAC NORM) modified with a plate-loaded pulley device. Isotonic shortening contractions were loaded to 30% isometric maximal voluntary contraction (MVC) torque. Doublet (150 Hz) muscle belly stimulations were performed during voluntary isometric (torque plateau) and isotonic (55° joint angle) contractions and during rest at the same joint position (isometric) or passive velocity in which the interpolated doublet occurred (isotonic). VA was evaluated as the ratio between the interpolated and resting doublet for isometric torque and isotonic power (torque∗velocity). Increasing isometric MVC (20-80%) during the interpolated doublet resulted in a linear correlation with VA (r=0.97). Doublet torque decreased with increasing passive shortening velocity in a rectangular-hyperbola function (r=0.95). Increasing isotonic shortening power during the interpolated doublet resulted in a linear correlation with VA (r=0.91). These data indicate that VA can be adequately assessed in relation to power output during isotonic shortening contractions. (Supported by NSERC).

An unconventional classroom: the effect of mandatory hours in the high school weight room on student participation in resistance training activities

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Amassing muscle early is imperative to health and performance; however, resistance training (RT) participation rates are low in youth, particularly in girls. Requiring RT as part of Physical Education (PE) classes may help to increase engagement. We compared RT participation between girls and boys at schools that do (intervention) and do not (control) require RT as part of the Grade 11/12 PE curriculum. We collected the physical activity logbooks of 139 students at the end of term, and extracted the minutes associated with any RT participation (e.g. “strength workout”, “weights”). After subtracting the required 6 hours of RT from each student’s tally at the intervention school, we analyzed total RT time using a two-way ANOVA with school and sex as the independent variables. Students at the intervention school ($n = 82$) reported more RT than students at the control school (1196.5 ± 1293.9 vs. 795.7 ± 1171.7 minutes; $p = 0.03$). Girls reported about 1/3 less RT time compared to boys (851.2 ± 1014.5 vs. 1292.4 ± 1511.7 minutes; $p = 0.01$). There was no significant interaction between school and sex. Requiring RT as part of PE may facilitate increased participation in RT, but girls still do not participate as much as boys. (Funding provided by the Manitoba Medical Services Foundation)

Impact of motivators and barriers to exercise on attaining to physical activity and sedentary time guidelines among Canadian undergraduate students

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Canadian physical activity guidelines (PAG) suggest engaging in ≥150 min/week of moderate-vigorous intensity physical activity and sedentary time guidelines (STG) recommend ≤8 hours/day of sedentary time. Half of post-secondary students do not meet PAGs or STGs. This study aimed to: 1) determine the most cited motivators and barriers to exercise among undergraduate students, and 2) identify which motivators/barriers were predictive of meeting PAGs and STGs. 341 respondents (279 females, 22.5±4.3 years, 53% met PAG, 49% met STG) completed an online survey regarding undergraduate student lifestyle behaviors. Improved physical health (74% of respondents), mental health (67%), physical appearance (60%), and athletic performance (28%) were the most common motivators. School obligations (68%), time

commitment (58%), job obligations (32%), and lack of available fitness classes (26%) were the most common barriers. Students citing improved athletic performance (OR=1.94, P=0.019) were more likely to adhere to PAGs, while those who selected physical health (OR=0.56, P=0.034) and physical appearance (OR=0.46, P=0.001) as motivators were less likely to meet PAGs. Students who cited school obligations as a barrier were less likely (OR=0.59, P=0.029) to meet STGs. The motivators and barriers identified provide a foundation for University-lead initiatives aimed at promoting healthy physical behaviors among undergraduate students. Strategies that address and re-frame students' appearance-based motivations for exercise may be particularly useful in helping more students achieve national activity recommendations.

The Cardiorespiratory Response to Upper or Lower Body Metaboreflex Activation in Women and the Influence of Oral Contraceptives

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Women do not increase ventilation ($\dot{V}_E$) during post-exercise circulatory occlusion (PECO) of the forearm (i.e., post-handgrip exercise), potentially due to insufficient metabolite accumulation due to smaller muscle size compared to men. Interestingly, oral contraceptive (OC) users display a greater $\dot{V}_E$ response during forearm PECO compared to naturally cycling women (non-OC users (NOC)). The purpose of this study is to investigate the role of muscle size by also performing PECO in the leg (i.e., post plantar flexion). OC (n=7) and NOC (n=16) were recruited to participate in 2 randomized trials, consisting of 2mins isometric exercise (arm ~40%MVC; leg ~80%MVC) followed by 3mins PECO in the forearm and lower leg, respectively. Cardiorespiratory variables (HR, MAP, $\dot{V}_E$) were continuously measured. During PECO, 1) HR did not increase from baseline regardless of OC use or limb (all $p>0.1$), 2) MAP increased from baseline in both OC and NOC (all $p<0.001$), equally between groups ($p=0.368$), regardless of limb ($p=0.288$), and 3) $\dot{V}_E$ did not increase from baseline, regardless of OC use or limb (all $p>0.5$). Since there was no difference in cardiorespiratory response between arm and leg metaboreflex, it is unlikely that muscle size accounts for the lack of ventilatory response in women.

Impact of vitamin D supplementation on statin-associated muscle symptoms

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Vitamin D supplementation has been proposed to reduce the frequently reported statin-associated muscle symptoms (SAMS). The purpose of this study was to evaluate the potential benefits of this supplement in a randomized controlled trial. Men (n=23) and women (n=15) (50.5 ± 7.7 years [mean ± SD]) in primary cardiovascular prevention, self-reporting or not SAMS, were recruited. Following 2 months of statin withdrawal, patients were randomized to supplementation (vitamin D or placebo). After 1 month of supplementation, statins were reintroduced. Before and 2 months after drug reintroduction, muscle damage (creatine kinase and myoglobin) and performance (hand grip strength) were measured, and the Short Form 36 Health Survey (SF-36) questionnaire and a visual analog scale (VAS) were administrated to assess participants' self-reported quality of life and SAMS intensity, respectively. Repeated-measures analyses were used to investigate the effects of time, supplementation, and their interaction, according to the presence of SAMS. Despite no change for objective measures, subjective measures worsened after reintroduction of statins, independent of supplementation (VAS, SF-36 mental component score, all $p\leq0.05$). However, no interaction between time and supplementation according to the presence of SAMS was observed for any variables. Vitamin D supplementation does not appear to mitigate SAMS. (Supported by the CIHR).

Assessing implementability of a multimodal group-based tele-prehabilitation program in a real clinical setting for people diagnosed with cancer

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Multimodal prehabilitation targets physical activity, nutrition, and psychosocial support to optimize patients' physical and psychological health between cancer diagnosis and surgery. Supervised and group-based interventions are encouraged during this critical period. However, most prehabilitation programs are offered on an individual basis and the main barrier is accessibility. To overcome these barriers, we developed and implemented a multimodal group-based tele-prehabilitation program for individuals diagnosed with cancer and aim to assess its implementability in a real cancer care context by measuring 1) acceptability, 2) fidelity, 3) feasibility, and 4) preliminary effects. The program includes three 90-minute weekly sessions with exercise and educational components, supervised by a kinesiologist. Descriptive analysis, paired t-test and Wilcoxon test were conducted. A total of 25 participants were assessed by a kinesiologist and completed three online questionnaires: at study inception (T1), before surgery (T2) and three months after surgery (T3). Acceptability of the intervention is high according to participant's satisfaction (60-100%), perceived utility (90%) and security (100%), intention to maintain physical activity after surgery (100%) and to recommend to a loved one (100%). The intervention was delivered as planned, but was slightly adapted over time to better meet the needs of the participants (fidelity). Feasibility is encouraging with its retention rate (98%), adherence (70%) and attendance (mean(SD): 5.9(3.5) sessions). The main barrier is referral rate (29%). Preliminary

effects after the intervention show a decrease in stress level (mean(SD) = T1: 3.16 (0.99); T2: 2,88 (1,01), p = 0.09)), anxiety (mean(SD) = T1: 7.8 (3.12); T2: 6.12 (2.76), p = 0.12)), and depressive symptoms (mean(SD) = T1: 4.84 (3.77); T2: 4.28 (3.60), p = 0.49)) and an increase in moderate physical activity (mean(SD) = T1: 0.47 (1.81) ; T2: 2.67 (0.96), p = 0.001)) and 30-sec Sit-to-Stand (mean(SD) = T1: 9.31 (2.21) ; T2: 10.71 (1.90), p = 0.01)). Implementability in a real clinical setting is promising. Future scaling-up across a variety of cancer contexts and populations is needed. (Programme de soutien aux projets technosociaux innovants de l'Université de Montréal)

Signalling and training responses to low-load resistance exercise with and without blood flow restriction performed to task failure

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Research has shown that low-load resistance exercise with BFR (LL-BFR) elevates acute physiological and muscle growth responses compared to low-load resistance exercise (LL-RE). However, LL-RE is often work-matched to LL-BFR, resulting in greater stress with LL-BFR. These designs are problematic when using small muscle samples containing active and inactive fibers. This study examined acute signalling and training responses following LL-RE and LL-BFR performed to task-failure, wherein work effort is similar. Ten males had each leg assigned to perform LL-RE and LL-BFR to task-failure. Muscle biopsies for Western blot and immunohistochemistry analyses were obtained before and 2h after the first exercise bout and after 6-weeks of training. Vastus lateralis muscle thickness was measured before and after training. AKT$^{(T308)}$ phosphorylation increased 2h after both LL-RE and LL-BFR (~145% of baseline, *p<0.05*) and trended for p70-S6K$^{(T389)}$ (LL-RE: ~158% and LL-BFR: ~137%, *p=0.06*). Fair-excellent ICCs were observed for signaling proteins involved in muscle anabolism ($ICC_{AKT(T308)}$=0.89, *p=0.001*; $ICC_{AKT(S473)}$ =0.52, *p=0.07*; $ICC_{p70\text{-}S6K(T389)}$=0.51, *p=0.10*), suggesting similar changes between each leg. The change in average muscle fibre cross-sectional area and whole-muscle thickness were similar between conditions (ICC≥ 0.64, *p≤0.03*). Similar acute and chronic responses between conditions and high ICC values suggest that both LL-BFR and LL-RE performed by the same person result in similar adaptations. These findings support the concept that muscular stress is an important factor for training-induced muscle hypertrophy with low-loads.

A longitudinal analysis of performance measures in collegiate male athletes across years of eligibility

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We examined the relationships between various performance metrics and collegiate eligibility to determine if performance changed over the course of an athlete's collegiate career. Varsity athletes completed a standardized testing battery, testing players' upper and lower body strength and power, aerobic power, anaerobic power, and agility. Year of eligibility was collected during each testing session. A total of 675 male collegiate athletes completed testing between August 2015 and August 2019 and 82 were included in the analysis having completed at least 4 years across the defined testing period. Repeated measures ANOVA using regression was performed for each performance measure, adjusting for sport. For the majority of sports, male varsity athletes recorded their peak fitness score in their third year of eligibility (p<0.001); 20 m sprint (overall mean ± SD: 2.67 ± 0.13 sec), T-test agility (8.50 ± 0.63 sec), broad jump (230.6 ± 21.91 cm), vertical jump (61.6 ± 9.00 cm) and grip strength (111.7 ± 18.80 kg). Curling and swimming athletes (grip strength; p=0.18 & p=0.20, respectively) and soccer and tennis (vertical jump; p=0.26 & p=0.33, respectively) showed no significant progression across their collegiate careers. 20 m shuttle run scores did not change across eligibility for any sport (9.5 ± 2.25, p=0.20). Collegiate athletes peak in the majority of relevant performance measures, on average, in their third year of eligibility, regardless of the sport they play.

Impact of a multidisciplinary COVID-19 clinical protocol on glucose profile during hospitalization in elderly

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Hyperglycemia, in people with and without diabetes, is a significant risk factor for severe COVID-19 and associated mortality. While insulin remains the gold standard for in-hospital glycemic control, few studies have explored non-pharmacological interventions to control glycemia in a non-pandemic context, specifically exercise. The purpose of this study was to assess the impact of a multidisciplinary clinical protocol (COVID-19 Rehabilitation program for the Elderly; CORE) that includes exercise for the management of COVID-19 on the glucose metabolism of hospitalized patients. Secondary data analysis was performed on 64 aging patients who had glycemia readings (fasting, postprandial meals) during their COVID-19 hospital stay: at admission (T1), mid-sojourn (T2) and hospital discharge (T3). Among the 64 patients (76 ± 11 years), 32 benefitted from the CORE protocol, while 32 received standard care (control group). Fasting hyperglycemia was observed in 59% at admission and decreased to 37% at discharge. A significant decrease in fasting glycemia was obtained over the hospital stay (T1= 8.8 ± 3.6 mmol/L, T2= 7.6 ± 3.3 mmol/L, T3 = 6.9 ± 2.3 mmol/L, p= 0.001), irrespective of the group. Regarding post-prandial glycemia, there was no change over time and no interaction. In conclusion, the CORE clinical protocol focused on managing the COVID-19 was not efficient in modulating the glycemic

profile. (Funding: FRQ-S with the Quebec Network for Research on Aging)

Use of a submaximal test with both subjective and objective measures of intensity in individuals undergoing chemotherapeutic treatments for a metastatic cancer

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While it is suggested that exercise intensity should be prescribed based on a cardiopulmonary exercise test, there are feasibility and acceptability issues with cancer patients undergoing chemotherapy. Although the use of submaximal testing with perceived exertion (PE) or predicted percentage (%) of heart rate reserve (HRR) are often suggested it could be associated to a suboptimal exercise prescription. The objective was to determine whether the use of lactatemia in addition to PE and %HRR during a modified submaximal YMCA (mYMCA) test can avoid a suboptimal exercise prescription. Ten individuals undergoing treatments for metastatic cancer performed a mYMCA test, randomly followed by a 10 x 1 min high intensity interval exercise (HIIE) and a 30-min moderate intensity aerobic exercise (MICE). Power output (PO) during the last completed stage (lactatemia > 4 mmol/L and 80% HRR or >8/10 Borg CR-10 scale) was used to prescribe high intensity bouts during HIIE, and 50% of this PO was used to prescribe MICE. The following measures were collected: HR, PE (Borg CR-10 scale), lactate, PO. On average, while lactatemia was 3.1±1.0 mmol/L, PE was 4.1±0.9 (*somewhat hard*), and HR 112±18 bpm (64% HRR) at the end of MICE. At the end of HIIE, lactatemia was 4.8±1.4 mmol/L, PE was 5.8±1.7 (*hard* on CR10), HR was 122±18 bpm (64% HRR). These results suggest that using lactate during a mYMCA may represent a good strategy to prescribe exercise intensity in cancer patients undergoing chemotherapy.

The association of objectively and subjectively measured physical activity and sedentary time with prediabetes and type 2 diabetes in adults: A cross-sectional study in Framingham Heart Study cohorts

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The purpose of this study was to examine whether using both objectively and subjectively measured moderate- to vigorous-intensity physical activity (MVPA) and sedentary time (SED) improves the prediction of prediabetes and type 2 diabetes (pre/T2D) using data from the Framingham Heart Study (n=4200). Logistic regression was used to examine the odds ratio of pre/T2D in groups cross-classified by subjective and objective MVPA and SED. Less than half of participants fell into concordant categories of MVPA and SED using subjective and objective measures, with 7.0-9.4% of participants in the extreme discordant categories of high-low or low-high subjective-objective MVPA or SED. Low objective MVPA, regardless of subjective MVPA status, was associated with a higher odds of pre/T2D (P<0.05). When cross-classifying by MVPA and SED, the majority of participants fell into concordant categories of MVPA-SED, with <4% of participants in the extreme discordant categories of MVPA-SED. Low objective MVPA, regardless of objective SED, was associated with a higher odds of pre/T2D (P<0.05). These findings suggest that low objectively measured MVPA appears more closely associated with pre/T2D risk compared to subjective measures, and there does not appear to be an additive effect of SED on pre/T2D risk after accounting for MVPA.

The effect of brief bodyweight exercise on acute glycemic control in healthy inactive adults: A randomized crossover study

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Brief vigorous exercise can enhance glycemic control. Limited work has investigated the effect of simple, practical interventions that require no specialized equipment. We examined the effect of bodyweight exercise (BWE) on acute glycemic control using continuous glucose monitoring (CGM; Abbott Libre Sense) under controlled dietary conditions (NCT05144490). Twenty-seven healthy adults (8 males, 19 females; age: 23±3 y) completed two virtually-supervised trials in random order ~1 wk apart. The trials involved an 11-min BWE protocol that consisted of five, 1-min bouts performed at a self-selected pace interspersed with 1-min active recovery periods or a non-exercise sitting control period (CON). Food intake was standardized for each participant using prepackaged meals supplied over 24 h. Mean rating of perceived exertion for BWE was 14±2 (6-20 scale). Mean 24-h glucose after BWE and CON was not different (5.0±0.4 vs 5.0±0.5 mM, respectively; p=0.39). Postprandial glucose peaks and 2-h mean postprandial glucose were also not different between trials for lunch, dinner and breakfast meals after each intervention. This study demonstrates the feasibility of conducting a remotely-supervised BWE intervention using CGM under free-living conditions. Future studies should investigate the effect of repeated sessions of BWE training as well as responses in people with impaired glycemic control.

Methodological considerations for the assessment of near-infrared spectroscopy derived skeletal muscle oxidative capacity

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Assessments of skeletal muscle oxidative capacity through the rate constant (Tau) of the muscle oxygen consumption ($\dot{V}O_2m$) using near-infrared spectroscopy (NIRS) during intermittent occlusions have gained popularity. However, how trials should be averaged and how many occlusions should be

included to optimize the fitting model is unclear. This study: 1) compared different approaches for averaging different trials; and 2) investigated the number of occlusions necessary to provide reliable measurements in two groups of participants of distinct fitness levels. Eighteen chronically trained (CT) and eighteen untrained (UT) individuals participated in the study. Maximal O_2 consumption ($\dot{V}O_{2max}$) was evaluated. NIRS-derived oxidative capacity was assessed in the vastus lateralis through 20 intermittent occlusions completed following 20 submaximal leg extensions. This trial was performed twice with 2 minutes rest. $\dot{V}O_2m$ was estimated as the slope of each occlusion period from the deoxy-hemoglobin signal. $\dot{V}O_2m$ derived from the two trials were superimposed, averaged, or kept separate. $\dot{V}O_2m$ values were then fitted using a monoexponential function and Tau was calculated. $\dot{V}O_{2max}$ was greater in CT compared to UT (58.2±4.8 *vs* 43.0±4.9 mL/kg/min, $P<0.0001$). Superimposing or averaging $\dot{V}O_2m$ values as well as averaging Tau values from the two trials did not change final Tau value obtained ($P=0.558$). Tau values were significantly smaller in CT compared to UT (23.5±5.8 vs 31.1±8.3 $P<0.0001$). Whereas in CT 9 occlusions were sufficient to estimate a Tau value similar to that obtained from 20 occlusions, in UT 14 occlusions were required. Different approaches for averaging trials do not lead to different Tau values. The number of occlusions needed to accurately estimate tau is lower in CT participants who show also smaller Tau values.

Improved $\dot{V}O_{2max}$ response classification using supramaximal verification protocol

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Supramaximal verification protocols following incremental step tests can provide validation of $\dot{V}O_{2max}$ – however, because repeated measurements improve confidence in outcome estimates, verification protocols may also improve confidence in individual $\dot{V}O_{2max}$ response classification and/or estimates of interindividual variability in exercise response. Thus, the purpose of this study was to examine the impact of repeated measurement of $\dot{V}O_{2max}$ (both incremental and constant load verification protocols) on the proportion of individuals classified as responders following exercise training. Thirty-four, recreationally active healthy young males (n=18) and females (n=16) were included in the study (age, 21.8±2.1 yrs). Participants were randomly allocated to a high-intensity interval training group (HIIT; n=25) or control group (n=9) and underwent two incremental tests (INCR) with supramaximal verification (SupraV) before and after the four-week training period. For three to four days a week, HIIT training consisted of four, four-minute intervals at 90–95% HR_{max} with three minutes of active recovery at 70–75% HR_{max} between intervals on a motorized treadmill. The inclusion of SupraV in $\dot{V}O_{2max}$ calculations resulted in a greater proportion of individuals classified as responders using zero-based (INCR1+SupraV1: 24% to 40%; INCR2+SupraV2: 28% to 40%) and smallest worthwhile change (1.75 mL/kg/min; INCR1+SupraV1: 16% to 24%; INCR2+SupraV2: 12% to 20%) thresholds. These results suggest supramaximal verification phases are useful for improving confidence in the observed response representing an individual's true change of $\dot{V}O_{2max}$ and for generating accurate proportion of response values representing a population's true change of $\dot{V}O_{2max}$ to aerobic exercise training.

Collaborative team-based approach in nutrition and graded exercise program effects on diet quality and reversal of metabolic syndrome

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Metabolic syndrome (MetS) refers to a cluster cardiometabolic of risk factors that include elevated waist circumference, high blood pressure, high plasma glucose, high triglycerides and/or low high-density lipoprotein-cholesterol. A collaborative team-based approach for the reversal of MetS has been of increased interest because of high prevalence in developed countries and evidence from clinical trials of the potential for reversal. The purpose of this project was assessing diet quality before and after participation in a 12-month nutrition and exercise program led by a Kinesiologist and Registered Dietitian. Nutrition sessions led by the RD focused on goal setting, label reading, meal planning and managing barriers to healthy eating. Mediterranean diet score (MDS) and Canadian Healthy Eating Index (HEI-C) were used to assess diet quality before and after the program. 100 participants completed the 12-month program, following the intervention the MDS increased significantly from 5.5 to 8.3 ($p<0.05$), along with a change from low to moderate intake of vegetables and fruits. HEI-C measures adherence to the 2019 Canada's Food guide recommendation on healthy food choices.The CHANGE program, group-based diet and exercise counseling led to clinically significant improvement in the MDS and HEI-C score, contributing to an overall decrease in MetS criteria among program participants.

Potential effects of a pre-bariatric surgery exercise intervention on irisin response and its association with physical capacity

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Irisin is associated with health benefits. However, the relationship between the change in irisin concentration

following a pre-bariatric surgery exercise intervention and its impact on clinical outcomes is not well-established. We investigated whether a 12-week pre-bariatric surgery exercise intervention would increase irisin, and whether the change in irisin was associated with enhanced physical capacity. Data from 14 adults (female n=10) awaiting bariatric surgery (BMI≥35 kg/m^2) were analyzed from a randomized controlled trial. The intervention group performed 12-weeks of aerobic and resistance training 3X/week. Irisin was measured from plasma obtained before and after exercise using enzyme immunoassay. Physical capacity was assessed using the 30-second chair stand, six-minute walk, balance (eyes opened/closed), sit and reach, and handgrip strength tests. Following the exercise intervention, irisin concentration did not significantly increase [exercise group average (95%CI): 2.7 ng/mL (2.2-3.4) to 2.8 ng/mL (2.3-3.3), p=.612; control group: 2.6 ng/mL (2.4-2.9) to 2.7 ng/mL (2.3-3.6), p=.310]. The change in plasma irisin was correlated with the change in sit and reach score (r=.626, p=.022) for the whole sample; however, when stratified by group, no correlations were observed between irisin and physical capacity (all p>0.05). Therefore, this pre-bariatric surgery exercise intervention did not increase irisin, and irisin levels do not predict changes in physical function following exercise. These data provide a greater understanding of the relationship between physical capacity and irisin in individuals awaiting bariatric surgery.

The role of ATF4 in mediating skeletal muscle function during acute contractile activity

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The transcriptional regulator ATF4 is translated during cellular stress, such as exercise, and mediates the mitochondrial unfolded protein response (UPR^{mt}). However, it is unknown whether ATF4 is necessary for muscle function in vivo during acute exercise. Our objective was to determine whether ATF4 is required for the maintenance of muscle function following acute contractile activity in tamoxifen-inducible muscle-specific ATF4 knockout (mKO) and wild type (WT) mice. Mice received either vehicle or tamoxifen for 5 days and were fed a tamoxifen or control diet for 3-weeks. An in situ protocol was utilized to acutely stimulate hindlimb muscles for 3 minutes each at 0.25, 0.5 and 1.0 tetani/sec. We observed no changes in % of maximum force production at 5 minutes, whereas there was a modest reduction in force production in the ATF4 mKO mice at 9 mins, suggesting increased muscle fatiguability in the absence of ATF4. Twitch 1/2 relaxation time in both our Cre and non-Cre expressing male mice administered tamoxifen was increased, suggesting an effect of tamoxifen on calcium cycling. Time to peak twitch tension was reduced only in males treated with tamoxifen. These data highlight a role of ATF4 in regulating muscle fatigability during acute exercise, and a possible effect of tamoxifen on muscle contractility.

Understanding the effects of acute stevia consumption on endothelial function in humans

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Ingestion of a high-sugar beverage/meal or 75g of glucose transiently impairs endothelial function in vivo. Despite widespread consumption of the low calorie sweetener stevia, no literature has reported its effects on human vascular function in vivo. It was hypothesized that the consumption of a single dose of stevia would acutely enhance brachial artery endothelial assessed via flow-mediated dilation (FMD). Twelve healthy men and women (mean age 21 ± 2 years) participated in two conditions where brachial artery FMD was assessed prior to and 15 and 60 min post the ingestion of either a stevia beverage (water with 4mg stevia/kg body weight) or a control beverage (water). Data are [mean ± SD]. There was no effect of trial (p=0.806) or condition (p=0.621) (interaction p=0.180) on FMD (Stevia FMD_{Pre}: 8.0 ± 1.1%, $FMD_{post\text{-}15}$: 8.2 ± 1.1%, $FMD_{post\text{-}60}$: 6.5 ± 1.0%; Water FMD_{pre}: 7.6 ± 1.0%, $FMD_{post\text{-}15}$: 7.7 ± 1.0%, $FMD_{post\text{-}60}$: 8.4 ± 1.0%). Including the shear rate stimulus as a covariate did not impact the results. Contrary to our initial hypothesis, these results suggest that a single ecologically relevant dose of stevia neither improves nor impairs FMD. (Funded by NSERC)

Effect of a community-based adaptive boxing program on motor symptoms and quality of life in Parkinson's disease patients: A retrospective study

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Parkinson's disease (PD) is a neurodegenerative disorder characterized by a variety of motor and non-motor symptoms. Exercise regimens have been shown to improve motor functioning in PD patients, highlighting the importance of exercise as adjuvant therapy. In recent years, adaptive boxing (AB) has garnered attention as an effective and motivating way of exercising for PD patients. The goal of the current retrospective study was to assess the impact of a community-based adaptive boxing program followed over a ~14-month period. Twenty-six early- to late-stage PD patients (10 females) with a median age of 69 (10) years agreed to share their data for this study. Participants completed the Fullerton Advanced Balance (FAB) scale, timed up and go (TUG) test, 30-s sit-to-stand (30-CST) test, and PD Questionnaire (PDQ-39) upon starting the AB program (PRE) and 14 months later (POST). Results showed that both TUG and 30-CST scores significantly improved from PRE to POST (p<0.001). In contrast, no change was detected on the FAB scale (p=0.79) and PDQ-39 scores increased (p=0.05). On an individual level, changes on the TUG, 30-CST and PDQ-39 generally fell below the minimal

detectable change. These results indicate that our community-based boxing program may not have been sufficient to meaningfully improve motor functioning or quality of life in PD patients.

Impact of habitual sedentary time and physical activity on beat-by-beat blood pressure variability in healthy adults

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Canada's 24-hour movement guidelines recommend that adults engage in higher-intensity physical activity (i.e., 150 mins/week moderate-vigorous physical activity) and limit their sedentary time for health benefits. Higher blood pressure variability (BPV) is an early marker of impaired blood pressure regulation that precedes pre-hypertension and hypertension. While lower aerobic fitness is associated with higher BPV, the impact of habitual activity that comprises national guidelines on BPV is unclear. We tested the hypothesis that less habitual physical activity and greater sedentary time would be associated with larger BPV. Ninety-two normotensive participants (age: 19-38 years, BMI: 23.6±3.3 kg/m^2, 44♀) wore an activPAL monitor on their thigh for 7.0±0.3 days. Ten-minutes of supine arterial pressure was measured via finger photoplethysmography (Systolic [SBP]: 115±11 mmHg, Diastolic [DBP]: 64±11 mmHg). BPV was measured using the average real variability index (ARV) for SBP (1.1±0.6 mmHg) and DBP (1.0±0.6 mmHg). Relationships between habitual activity outcomes and BPV were assessed via multiple regressions adjusted for age. Moderate-intensity physical activity (36±19 mins/day; SBP-BPV: β= -0.007, P=0.02) and sedentary time (566±115 mins/day; DBP-BPV: β=0.001, P=0.03), but not light-intensity, vigorous-intensity activity, or standing time (all, P>0.30) were predictors of BPV. Higher moderate physical activity and lower sedentary time were associated with attenuated BPV responses in young adults. These findings highlight the need for lifestyle interventions in younger adults aimed at preventing the development of hypertension.

Disuse-induced elbow flexor strength loss occurs independent of muscle atrophy and is accompanied by imbalances in corticospinal output following 14-days of unilateral upper-arm immobilization in young women

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Whether due to injury or illness, prolonged periods of muscle disuse such as those experienced during limb immobilization or bed rest can result in a rapid decline in muscle size and strength. The nervous system may be an additional site of adaptation in response to muscle disuse, as disuse-induced strength loss typically exceeds the reduction in muscle size. We evaluated changes in isometric muscle strength (Biodex dynamometry), muscle size (MRI), and neuromuscular function in response to 14-days of upper-arm immobilization in young women using a unilateral, within-subject design. Measures of neuromuscular function included resting motor threshold and corticospinal excitability (transcranial magnetic stimulation, TMS), and voluntary activation (interpolated twitch) of the biceps brachii. We hypothesized that immobilization would result in significant reductions in elbow flexor muscle strength, muscle size, and voluntary activation capacity in the immobilized arm only. 12 right-hand dominant women (20.6±2.1 years) with no conditions affecting the musculoskeletal or nervous system were included. Using an elbow brace and shoulder sling, participants underwent immobilization of their left arm for 14 days. Immobilization resulted in a significant decline in elbow flexor strength (mean change = -20.7±18.4%) in the immobilized arm only (P=0.006). Measures of elbow flexor muscle cross-sectional area and volume, resting motor threshold, and voluntary activation capacity were unchanged in both the immobilized and non-immobilized arm. Compared to baseline, corticospinal excitability decreased significantly only in the non-immobilized arm based on a 3.7±3.7-unit reduction in the slope of the TMS recruitment curve (P=0.015) and was accompanied by a trend (P=0.086) for an increase in excitability in the immobilized arm as evidenced by a 58.8±90.6% increase in area under the curve. Findings from this study suggest that immobilization-induced elbow flexor strength loss can occur independent of elbow flexor muscle atrophy, and that the nervous system represents a site of adaptation in response to 14-days of muscle disuse in young women.

Evaluating the association between energy availability and bone strength in young endurance-trained individuals: A cross-sectional study protocol

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Endurance athletes are at a greater risk of low energy availability (EA) due to high-volume training and heightened nutritional demands, which can impair metabolic function and bone health. Few studies have explored the association between EA and bone strength in endurance-trained individuals, with no studies comparing sexes. This study will evaluate the associations between EA and bone strength parameters in young endurance-trained individuals, and describe these associations stratified by sex. We will recruit 50 healthy males

and females aged 18-35 years with no known medical conditions/medication use affecting bone metabolism who participate on a competitive endurance sports team and/or in regular weight-bearing endurance exercise (≥180 minutes/week). Peripheral quantitative computed tomography will be used to assess total, trabecular and cortical volumetric bone mineral density (BMD) and area, cortical thickness, and bone compressive strength and stress-strain indices at the tibia. Dual-energy X-ray absorptiometry (DXA) scans will be performed to measure areal BMD at the lumbar spine and proximal femur. EA will be calculated as dietary energy intake from 24-hour dietary recall minus exercise energy expenditure from polar heart rate monitors adjusted for lean body mass from DXA. Pearson correlation coefficients and multivariable linear regression models will be developed. Independent samples t-tests will be used to compare outcomes between sexes. We anticipate a significant positive association between EA and bone strength regardless of sex. These findings will inform a future prospective study evaluating the effects of high-intensity resistance and impact training on bone strength in endurance athletes. (Funding Support: Fonds de Recherche du Québec - Santé, McGill University Master's Sports Science Fellowship, Natural Sciences & Engineering Research Council).

The impacts of pea-protein powder on iron levels in female runners

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Iron deficiency is the most prevalent nutrient deficiency worldwide. Female athletes are at a disproportionate risk of iron inadequacy due to blood loss through menstruation, inadequate dietary iron intake, and decreased absorption secondary to exercise. Field peas are naturally high in iron; however, peas are also high in phytic acid which decreases iron absorption. We investigated whether supplementing with a flour made with peas bred to have low levels of phytic acid would improve iron levels in female runners. Twenty-six recreational female runners (35.5±9.7y; $\dot{V}O_2$max: 50.7±8.9ml/kg/min) with low baseline iron intakes (<18mg/day) underwent measures of ferritin, hemoglobin, $\dot{V}O_2$max, 5km time trial, and body composition before and after 8-weeks during which they were randomly assigned to consume a flour made from regular peas, low phytic acid peas, or a non-pea control (maltodextrin). While no statistically significant differences were observed for ferritin ($p>0.05$), groups consuming the low phytic acid and regular pea flour increased their ferritin levels (+8.8 μg/L and +4.8 μg/L, respectively). In contrast, the maltodextrin group decreased ferritin (-0.5 μg/L). No significant differences were observed for any other measure ($p>0.05$). The development of low phytic acid peas may be a promising area of research to improve iron status. (Funded by Saskatchewan Ministry of Agriculture, Agriculture Development Fund and Saskatchewan Pulse Growers)

An umbrella review of the impact of exercise training interventions on flow-mediated dilation in adults

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Dysfunction of the endothelium is a key precursor of cardiovascular disease (CVD). Endothelial function, as assessed via the flow-mediated dilation (FMD) test, is attenuated with chronic disease. However, exercise training may mitigate this dysfunction and promote better overall vascular health. The objective of this umbrella review was to determine the impact of exercise training on FMD in healthy adults and those living with chronic disease. Studies were included if they conducted a systematic review and/or meta-analysis on FMD responses in any artery to aerobic and/or resistance exercise interventions in adults. Sources were searched in January 2022 and included Scopus, EMBASE, MEDLINE, CINAHL, and Academic Search Premier. National Institutes of Health quality assessment tools were used. Reviews that met the inclusion criteria included healthy adults (n=9), those living with type 2 diabetes mellitus (n=5), an increased CVD risk (n=11), and other chronic conditions (i.e., past/present cancer, autoimmune rheumatic diseases) (n=2). Overall, reviews that conducted meta-analyses indicated improvements in brachial FMD (ΔFMD=~1-2%, β-range: 0.41-10.68). However, potential approaches to improvement is not consistent across demographics. Healthy adults should be prescribed higher intensity aerobic training and/or more frequent low-to-moderate resistance training. In addition, adults with type 2 diabetes mellitus benefit most from low-intensity resistance or aerobic exercise training, whereas those with increased CVD risk should be prescribed high-intensity aerobic training.

Relative muscle fascicle length and the energy cost of cyclic contractions

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Compared to muscle contractions performed at optimal length, the energy cost (EC) is higher at shorter and longer muscle lengths. The exact mechanism(s) underlying this higher EC during in vivo, cyclic contractions has not been fully explored. We measured muscle EC in the right medial gastrocnemius (MG) muscle of 9 participants (24±3 years, 68±8 kg, 172±10 cm) at short ($0.85L_0$), optimal (L_0), and long ($1.15L_0$) muscle lengths by altering ankle joint angle. The maximal and submaximal MG force-fascicle length relationships were determined from dynamometry and ultrasonography. Participants performed 30 submaximal cyclic

contractions at 0.85L_0, L_0, and 1.15L_0 at 50% of the maximal force achieved at 0.85L_0. EC was quantified from near-infrared spectroscopy during blood flow occlusion and MG muscle activation was quantified using EMG. Mean EC was 36±24% higher at 0.85L_0 (p=0.005) compared to L_0 or 1.15L_0 (2±27% lower, p=0.81), despite lower forces at 0.85L_0 (p=0.02), no difference in fascicle shortening (14±5 mm, 12±4 mm and 10±5 mm, p=0.10), or fascicle shortening velocity (p=0.52). Target force was 54±5% of maximal force potential at 0.85L_0, 26±6% at L_0 and 28±7% at 1.15L_0. Muscle activation was also ~2-fold higher at 0.85L_0 compared to either L_0 or 1.15 L_0 (p=0.001), corresponding to the lower force potential at 0.85L_0 from the measured force-fascicle length relationship (r^2=0.54, p<0.0001). No differences in the EC per unit activation was seen (p=0.45). EC per unit force was significantly higher at 0.85L_0 compared to all other lengths (p=0.008). These results suggest muscle EC increases at short muscle lengths because of the need to activate a greater muscle volume and lower economy of force production rather than expending more energy per active muscle volume. (We acknowledge the support of the Natural Sciences and Engineering Research Council of Canada (NSERC)).

Fourteen days of head-down tilt bed rest with or without an exercise countermeasure on neuromuscular secretome and electrical activity

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Long-term spaceflight leads to considerable loss of muscle strength and impaired motor drive may play an important role in this process, particularly during early stages of disuse. It has been postulated that remodelling of neuromuscular junctions (NMJ) could partially explain motor drive impairment. C-terminal Agrin Fragment (CAF) is a novel biomarker for NMJ remodelling and a clinical marker for sarcopenia progression. The objectives of this project are to verify how 14 days of microgravity analog (mGa) influence CAF blood levels and skeletal muscle electrical activity. Twenty-four participants (aged 55-65; 12 men and 12 women) will be continuously bedridden at 6 degrees head-down for 14 days. Half of the participants will be engaged daily in an hour of mixed bed exercises (countermeasure), while the other half will receive daily passive mobilizations. Before and after the intervention, CAF blood levels will be measured by colorimetry; surface and intramuscular EMG signals will be recorded to evaluate electrical activity at rest and during muscle contraction. Data collection is ongoing, and the complete results will be presented at CSEP 2022. A better understanding of the disuse process could lead to better physical activity management for astronauts, bedridden patients and mGa participants. (Funding: Canadian Space Agency, Canadian Frailty Network and Canadian Institutes of Health Research)

Amino Acid Supplementation Following Combined Resistance and Plyometric Exercise Alters Anabolic Signaling, but Not Transcriptional Regulators of the Intramuscular Extracellular Matrix in Young Males

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Skeletal muscle is composed of myofibers surrounded by an extracellular matrix (ECM) primarily containing collagen. Essential amino acid (EAA) ingestion is known to increase post-exercise myofiber anabolism, but it is unknown if post-exercise ECM remodelling is nutrient sensitive. Seventeen males (21.1±3.3 years) completed combined plyometric and resistance exercise, and received biopsies of the *vastus lateralis* collected before, 2 and 4 hours post-exercise to assess mechanistic target of rapamycin (mTOR) pathway activation and translational regulators of ECM turnover. Immediately after exercise, participants consumed 15g of either a carbohydrate placebo, EAA, or collagen (enriched in non-essential amino acids) supplement; each participant completed two of the three pseudorandomized conditions. $RPS6^{Ser235/236}$ and $RPS6^{Ser240/244}$ phosphorylation increased in the EAA condition at 2 and 4 hours post-exercise (p<0.05), while the collagen condition showed the same pattern with the exception of $RPS6^{Ser235/236}$, which was not elevated 2 hours post-exercise (p=0.460). There was no effect of carbohydrate ingestion and exercise. mRNA expression of ECM regulators; connective tissue growth factor (*CTGF*) (2.9 ±3.46 fold), tissue inhibitor of metalloproteinases 1 (*TIMP-1*) (2.2 ±2.52 fold), and tenascin C (*TN-C*) (2.8 ±3.02 fold) increased (p<0.05) at 4 hours post-exercise with no effect of nutrition. These findings suggest that both EAAs and collagen intake can increase post-exercise mTOR pathway activation while acute transcription of ECM regulators occurs following exercise independent of nutrition. Further analysis will directly measure the effects of post-exercise nutrition on myofibrillar and ECM protein synthesis.

No impact of oral contraceptive or natural menstrual cycle phase on arterial stiffness in premenopausal females

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1.3 million Canadian women use oral contraceptive pills (OCP), including four OCP generations differing in

exogenous hormone type and dosage, with second-generation OCP (OCP2) and third-generation OCP (OCP3) most commonly prescribed. Preliminary research indicates that OCP3 may have beneficial effects, while OCP2 may have detrimental effects on vascular function across the hormonal cycle. Previous work has observed that hormonal cycle phase does not influence arterial stiffness [measured using pulse wave velocity (PWV)] in both naturally cycling (NAT) and OCP users; however, these participants were not stratified by OCP generation. Moreover, the limited research available investigating the effects of OCP and hormonal cycle phase on carotid artery compliance, distensibility, and beta-stiffness has conflicting results. In this study, forty premenopausal women (14 NAT, 16 OCP2, 10 OCP3) visited the lab during the low-hormone (i.e., early follicular or placebo) and high-hormone (i.e., mid-luteal or active) phase of the hormonal cycle where measures of resting hemodynamics and central PWV, peripheral arm PWV, peripheral leg PWV, and carotid artery distensibility were collected. A linear mixed model ANOVA with the factors hormone group and phase was performed. Central PWV, peripheral leg PWV and peripheral arm PWV were not different across either groups or phases ($p>0.05$). Similarly, carotid artery distensibility, compliance and beta-stiffness remained unchanged across groups or phases ($p>0.05$). In the current study, hormonal cycle phase did not influence measures of central or peripheral artery stiffness or carotid artery stiffness. Therefore, future studies may not need to control for the effects of hormonal cycle phase when including female participants. Funding provided by NSERC.

Knowledge and health-promoting behaviours in lifelong exercising premenopausal females

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Cardiovascular disease (CVD) is the leading cause of death for women worldwide. By midlife most women have at least one risk factor for CVD, yet are unaware of their risk status and lack knowledge of risk factors. Prior research has shown that knowledge of CVD risk is not enough for women to recognize their actual risk or engage in risk-reducing behaviours such as exercise.

The purpose of this investigation was to explore the association between knowledge, behaviours, and CVD risk by exercise status in premenopausal females. Participants were recruited to participate in an online survey if they were female at birth and aged 30-49y. Questions gathered qualitative and quantitative data on participant biometrics, medical history, demographics, CVD knowledge, and health-promoting behaviours. Participants were categorized by exercise status (lifelong exerciser, new-to-exercise, former exercisers, and never exercised). Knowledge score, Framingham risk score (FRS), and lifestyle risk, were evaluated by exercise status via chi-square, Kruskal-Wallis and Spearman correlation for categorical or continuous variables, respectively. Multiple linear regression modeling assessed key covariates associated with lifestyle risk (knowledge, age, education). 1645 participants completed the survey (38±5.5 years). FRS was low for 86% of the sample, did not differ by exercise status, and was positively associated with age ($r=0.52$, $p<0.001$). Lifelong exercisers had higher CVD knowledge and lowest lifestyle risk score ($p<0.001$). There were no differences in knowledge between former and lifelong exercisers. However, former exercisers had significantly higher lifestyle risk ($p<0.001$); that this was associated with lower education level ($p=0.004$). In lifelong exercisers it appears that greater CVD risk knowledge and education is related to lower lifestyle risk. This work highlights the need for targeted messaging related to CVD knowledge to women not currently engaged in exercise, and particularly those with lower education levels, with focus on the importance of health-promoting behaviours to prevent future CVD.

Hybrid cardiac rehabilitation models: A Review

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In contrast to traditional in-person cardiac rehabilitation (CR), hybrid CR includes training sessions at a CR centre and others at home. However, there are many different models of hybrid CR and it is unclear which may be most effective. The aim of this review was to identify and compare different models of hybrid CR. Original studies testing the effectiveness of hybrid CR were extracted from three databases (Medline, CINAHL and SPORTDiscus) and analyzed. Inclusion criteria were for the hybrid CR model to include a mix of supervised sessions in a centre setting and at home, to include at least two components of standard CR (exercise training, education, etc.) for adult cardiac patients. Twenty studies were found, and hybrid CR programs were divided according to three types of models: 1) initial CR in the centre followed solely by home-based CR; 2) gradual decrease of supervised exercise in CR centre combined with a gradual increase of sessions at home; 3) CR in centres with home-based sessions simultaneously. The period of CR varied from four to 25 weeks across models. All models appear to improve quality of life and exercise capacity. Models appear to decrease anxiety and depression. In particular, models 1 and 2 presented results equivalent to those of standard CR regarding quality of life, exercise capacity, anxiety, and depression. Instead, the third model shows improvement of these outcomes compared to usual care. Various models of hybrid CR appear to represent good alternatives to standard CR model. In addition to leading to similar effectiveness as standard CR, hybrid CR shows premising results to be more easily accessible and sustainable.

Effects of high-intensity interval training, moderate-to-vigorous intensity continuous training and Nordic walking on functional fitness in patients with coronary artery disease

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Patients with coronary artery disease (CAD) frequently experience diminished functional fitness, the ability to perform activities of daily living (ADLs) to maintain independence. This study compared the effects of high-intensity interval training (HIIT), moderate-to-vigorous intensity continuous training (MICT) and Nordic walking (NW) on functional fitness in patients with CAD. A total of 130 participants (age: 60.7±7.5 years, 15.4% females) were randomized 1:1:1 to a 12-week HIIT (n=43, aerobic exercise equipment or dance/movement-based exercise), MICT (n=44, aerobic exercise equipment or walking) or NW (n=43, walking with Nordic poles) program. At baseline and 12 weeks follow-up, functional fitness was assessed by: 30-second chair stand/squat and arm curl, chair sit-and-reach, back scratch, and 8-foot up-and-go. Linear mixed models for repeated measures were used to compare the differences in functional fitness. There were significant improvements from baseline to follow-up in the total number of 30-second chair stands/squats (14±4 vs. 17±4 repetitions, p<0.001) and arm curls (16±4 vs. 18±4 repetitions, p<0.001), 8-foot up-and-go time (5.4±1.1 vs. 4.9±0.8 seconds, p<0.001), and chair sit-and-reach distance (5.8±34.8 vs. 0.3±31.8 cm, p=0.033). A significant time-by-intervention interaction effect indicated that NW increased arm curl repetitions (+4 repetitions) more than HIIT (+2 repetitions, interaction effect: p=0.017) and MICT (+2 repetitions, interaction effects: p=0.041). HIIT, MICT and NW were efficacious in improving upper and lower body strength, lower body flexibility, and agility. A whole-body aerobic exercise with greater involvement of the upper body, such as NW, may confer additional benefits in increasing upper body strength, an important indicator to perform ADLs and maintain independence following a cardiac event.

A longitudinal analysis of performance measures in collegiate female athletes across years of eligibility

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A comparison of female collegiate fitness measures and eligibility year were collected to see if performance changed across an athlete's collegiate career. Standardized combine testing measured upper and lower body strength and power, aerobic power, anaerobic power and agility, along with year of eligibility at each testing session. Between August 2015 and August 2019, 296 female varsity athletes completed testing, with the analysis including 32 in total; Those included in the analysis having completed at least 4 years of fitness testing. Repeated measures ANOVA using regression was performed for each performance measure. Female varsity athletes recorded a peak in fitness scores in the standardized tests of grip strength (overall mean ± SD: 75.31 ± 11.79kg) and 20 m sprint (overall mean ± SD: 3.37 ± 0.18 sec) in their fourth year of eligibility. The remaining testing battery had no significant progression across their varsity career; Long jump (p=0.16); Agility (p=0.10); Vertical jump (p=0.08); Shuttle run (p=0.23). Due to a high attrition rate, resulting in 89.19% of athletes completing their varsity careers prior to their 4th year of eligibility, insufficient data was available to compare differences in sports. Female varsity athletes peak in fitness scores of grip strength and 20 m sprint in their fourth year of eligibility.

Longitudinal associations between weight-control status and lifestyle behaviors during adolescence

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One-third of Canadian adolescents try to lose weight and many use various behavioural strategies to control their weight. Weight-control status (i.e., trying to lose, gain, or maintain weight) may be a determinant of adherence to healthy lifestyle recommendations. The aim of this study was to evaluate longitudinal associations between weight-control status and lifestyle behaviours, including consumption of fruits and vegetables (FV), sugary drinks (SD), fast food (FF), breakfast consumption (BC), moderate to vigorous physical activity (MVPA) and screen time (ST). Data from MATCH, a study of 929 New Brunswick youth who self-reported weight-control status, MVPA, and ST three times per year for eight years (from age 10 to 18), were used for this study. Nutrition outcomes were reported by a food frequency questionnaire once per year. Linear mixed models were used for continuous outcomes and generalised linear mixed models for categorical outcomes. The findings suggest that trying to gain weight was positively associated with MVPA and FV while trying to lose weight was associated with higher amounts of ST, SD and FF, and lower BC. This study shows that trying to lose weight is associated with unhealthy lifestyle behaviours throughout adolescence. Therefore, more efforts are needed to promote healthy interventions among adolescents.

Improvements in maximal aerobic capacity following blood-flow restriction treadmill walking are likely centrally rather than peripherally mediated

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Blood flow restriction (BFR) training has been shown to improve maximal aerobic capacity ($\dot{V}O_2$max) when combined with aerobic exercise; however, the physiological adaptions responsible are unknown. Using a classic model wherein $\dot{V}O_2$max is limited by peripheral or central factors, we sought to determine whether adaptations following BFR training are locally or centrally mediated. BFR or CON (no occlusion) treadmill walking was performed twice-daily for 4 weeks. Training comprised of five 3-min bouts, at a 5km/hr and 5% grade separated by 1-min rest. Tourniquets were inflated throughout the entirety of the BFR protocol except for a 1-min deflation period after the third set. Single- (SL) and double-legged (DL) $\dot{V}O_2$max testing was performed at baseline (BSL) and after training (POST). BFR training did not preferentially improve SL $\dot{V}O_2$max (interaction, p=0.2) (BFR: BSL=36.5±6.2 mL·kg^{-1}·min^{-1}, POST=38.6±6.9 mL·kg^{-1}·min^{-1}; CON: BSL=38.2±7.0 mL·kg^{-1}·min^{-1}, POST=38.8±7.4 mL·kg^{-1}·min^{-1}). DL $\dot{V}O_2$max increased after BFR (BSL=46.7±8.8 mL·kg^{-1}·min^{-1}, POST=50.7±9.5 mL·kg^{-1}·min^{-1}; p<0.001) but not CON training (BSL=48.8±8.8 mL·kg^{-1}·min^{-1}, POST=49.2±8.6 mL·kg^{-1}·min^{-1}; p=0.7). These results suggest aerobic BFR training may cause greater central, rather than peripheral physiological adaptations. Future work examining improvements to aerobic capacity following BFR training should characterize changes to the classic "limiters" of $\dot{V}O_2$max (maximal cardiac output, blood volume, transit time across the muscle).

Resistance training and cardiometabolic risk in metabolically healthy and unhealthy women with obesity

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Little is known on the effects of resistance training (RT) on cardiometabolic risk in metabolically healthy obese (MHO) and metabolically unhealthy obese (MUHO) individuals. Our objective was to compare the response to RT on the body composition, lipid-lipoprotein and inflammatory profiles, glucose-inulin homeostasis, and physical performance of 51 sedentary, MHO and MUHO postmenopausal women, according to the classification of Karelis and Rabasa-Lhoret or an approach based on the plasma adiponectin (A)/leptin (L) ratio. Participants followed a 4-month weekly program of 3 non-consecutive days composed of 6 exercises of major muscle groups targeting 80% of 1-RM for 3 sets of 10 repetitions. Most muscle strength variables increased after the intervention, in all groups, regardless of the classification (0.0001<p<0.01). Although triacylglycerol and HDL-cholesterol levels were slightly increased after RT in MHO participants using the A/L ratio approach (p<0.05), plasma IL-6sR decreased in both groups (0.002<p<0.02) and circulating sTNFR1/sTNFR2 in MUHO participants, only, using both definitions (0.0005<p<0.001). Except for an increased fasting glycemia (p=0.02) when using the A/L ratio approach, other glucose-insulin homeostasis indices did not change after RT, irrespective of the method. Our RT program improves most physical performance variables but does not impact cardiometabolic risk of MHO and MUHO postmenopausal women. (Supported by a start-up funding from the Université du Québec À Montréal, 2007, AD. Karelis, and by a funding from the CRIUCPQ, 2014, P. Mauriège).

Is intermittent walking really the most effective exercise modality for improving walking ability in intermittent claudication?

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It has been shown that intermittent walking is effective to improve walking capacity in individuals with intermittent claudication. Although this is an evidence-based recommendation, there is a growing body of evidence demonstrating an improved walking capacity in response to other types of exercise. Hence, the objective was to determine which exercise modality is superior in improving walking ability in individuals with intermittent claudication. A network meta-analysis was performed according to the PRISMA-NMA guidelines. The risk of bias was assessed with the Physiotherapy Evidence Database and results are presented as standardized mean difference [95% CI]. A total of 18 studies, including 1115 participants and six training modalities (Aerobic training; Strength training; Intermittent walking; Nordic walking; Combined training; Underwater exercises) were included. The intermittent walking (0.67 [0.22-1.11]) and combined training (1.20 [0.50-1.90]) groups promoted a greater maximal walking distance (treadmill test). The same results were observed for walking distance performed during the 6-minute walking test (intermittent walking: 0.41 [0.13-0.69]; combined training: 0.61 [0.16-1.67]). While underwater exercises seem to improve walking ability (0.60 [0.22-0.97]), more studies are needed to investigate this exercise modality. Although the difference between intermittent walking and combined training was not statistically significant, combined training seems to be a promising strategy to improve walking ability in individuals with intermittent claudication.

Lengthening contractions resulting in delayed onset muscle soreness induce transcription of the putative nociceptor activator nerve growth factor (*NGF*) in young adults

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Delayed onset muscle soreness (DOMS) has classically been described as a consequence of damage or inflammation within the myofiber or surrounding matrix, however emerging evidence from animal models suggests that it may instead result from the sensitization of nociceptors by specific neurotrophic factors. The present study aimed to investigate the changes in expression of nerve growth factor (*NGF*) and glial cell line-derived neurotrophic factor (*GDNF*) in human skeletal muscle following lengthening contractions. Participants (6 female, 10 male; age 20.9 ± 4.1 years; mean ± SD) performed 300 maximal eccentric knee extensions. Biopsies of the vastus lateralis were collected immediately prior to and 48 hours after exercise, and the expression of NGF and GDNF was examined using quantitative RT-PCR. Visual analog scale muscle soreness was increased above baseline at 24 hours (374.9 ± 403.7%, $p < .001$) and 48 hours (371.9 ± 573.7%, $p = .035$) post-exercise. NGF was upregulated 6.12 ± 9.45-fold ($p = .007$) at 48 hours post-exercise. GDNF mRNA was detected in only 43% of samples with no effect of exercise. The present study establishes a plausible temporal link between *NGF* but not *GDNF* expression and DOMS. Further research is required to establish a causal relationship and identify the cellular source of increased *NGF* expression.

Comparing ramp and step incremental tests for the determination of maximal oxygen uptake and ventilatory thresholds

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Incremental exercise tests are useful for determining maximal oxygen uptake ($\dot{V}O_2$max), peak power output (PPO), the gas exchange threshold (GET), and the respiratory compensation point (RCP); however, the agreement between values obtained from ramp and step tests is not well studied. Twenty-nine fitness-matched, healthy, young females (n=16, $\dot{V}O_2$max=53.2 ± 6.3 ml • kg fat-free mass [FFM]$^{-1}$ • min^{-1}) and males (n=13, $\dot{V}O_2$max=56 ± 5.5 ml • kg FFM^{-1} • min^{-1}) completed two incremental test protocols: a ramp test (0.5 W/s) and a step test (3-min, 25 W stages). Participants cycled until volitional exhaustion, and pulmonary gas exchange was monitored to determine ventilatory thresholds and $\dot{V}O_2$max. Intraclass correlation coefficients (ICC), bias, and limits of agreement (LoA) were quantified to assess agreement for each outcome. ICCs were moderate for $\dot{V}O_2$ at GET (ICC=0.569) and PPO (ICC=0.663) and excellent for $\dot{V}O_2$max (ICC=0.976) and $\dot{V}O_2$ at RCP (ICC=0.929). There was no significant bias in $\dot{V}O_2$max (bias: 0.01 L/min, p>0.05; LoA: -0.31 to 0.33 L/min) or $\dot{V}O_2$ at RCP (bias: -0.06 L/min, p>0.05; LoA: -0.45 to 0.33 L/min), but there was a bias towards lower PPO (bias: -66 W, p<0.05; LoA: -94 to -38 W) and lower $\dot{V}O_2$ at GET (bias: -0.34 L/min, p<0.05; LoA: -0.71 to 0.03 L/min) during the step test compared to the ramp test. Agreement between protocols was variable for ventilatory thresholds, but despite the expected large differences in PPO, $\dot{V}O_2$max values were independent of test protocol. (Supported by the Natural Sciences and Engineering Research Council of Canada (NSERC) and the University of Calgary, Faculty of Kinesiology)

Comparing Ovarian Hormones and Appetite Response in Pre- and Post-menopausal Women

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Exercise-induced appetite suppression is well demonstrated in males, especially at higher intensities. Some research in females standardizes to the follicular phase (FP) of the menstrual cycle where ovarian hormone concentrations of estrogen (E_2) and progesterone (P_4) are lowest, rather than the luteal phase (LP) where hormonal fluctuations are most prominent. Menopause represents a decline in ovarian function and an opportunity to further examine the role of ovarian hormones in the appetite response to exercise. To examine the role of ovarian hormones on exercise-induced appetite suppression. Sixteen 40-60 y healthy females (8 pre- and 8 post-menopausal) were recruited in a between-subjects experimental design. Both groups completed one HIIT (high-intensity interval training; 10x1 min intervals at 90% HR_{max}) with pre-menopausal women in the LP. Subjective appetite perceptions were measured fasted, post-prandially/pre-exercise, 0, 30, and 90 min post-exercise. Energy intake was assessed the day before and day of the session. There were no differences between groups for overall appetite score (p=0.211, η_p^2=0.127) though feeding decreased appetite (p<0.001, η_p^2=0.958). There was no difference between groups for energy intake (p=0.768, η_p^2=0.008). These results suggest no differential effects of HIIT on subjective appetite or energy intake in pre- and post-menopausal women.

The Effect of Ice Hockey-Specific Exercise on Inter-Limb Asymmetries in Elite Youth Athletes

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Inter-limb asymmetry (ILA) is defined as reduced function, physical capacity, or strength of one limb in relation to the other. With links to physical development, injury risk, and athletic performance, ILA can negatively influence neuromuscular function. Exercise-induced fatigue is also known to impair neuromuscular function and potentially exacerbate ILA. The purpose of this study was to determine if ice hockey-specific exercise creates or exacerbates lower-limb ILA. Thirty ice-hockey athletes (15.1±1.6 years; 11 females) performed three vertical countermovement jumps

before and after an on-ice training session. Peak takeoff force, rate of force development, concentric impulse, and eccentric impulse were used to quantify lower-limb ILA (Asymmetry Index = [(Right Limb – Left Limb) ÷ Max of Right and Left Limb)] × 100). Post-exercise concentric impulse and rate of force development ILA were greater ($p<0.05$) than pre-exercise (6.4±3.0 vs. 5.2±2.6% and 18.9±7.8 vs. 15.2±6.6%, respectively). There were no pre- and post-training session differences detected for eccentric impulse (pre: 9.4±5.7%; post: 9.9±6.9%) or peak takeoff force (pre: 5.9±4.1%; post: 6.4±4.5%). In conclusion, youth athletes concentrically develop and transfer force more asymmetrically following ice hockey-specific exercise, which may be owing to the development of exercise-induced fatigue.

Parvalbumin does not Attenuate the Progression of Centronuclear Myopathy caused by Phospholamban Overexpression

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The sarco(endo)plasmic reticulum (SR) Ca^{2+} ATPase (SERCA) is essential in regulating intracellular Ca^{2+} concentrations ($[Ca^{2+}]_i$). Recently, it was discovered that overexpression of phospholamban (PLN), a SERCA inhibitor, results in a muscle wasting disease resembling centronuclear myopathy (CNM). CNM is identified by 1) an increased proportion of centralized nuclei, 2) centralized oxidative activity and 3) an increased proportion of type I fibres. The CNM-like phenotype developed in PLN overexpressing (PLN^{OE}) mice suggests dysfunctional Ca^{2+} homeostasis may lead to the pathogenesis of CNM. The purpose of this project was to examine the therapeutic potential of overexpressing the cytosolic Ca^{2+} buffering protein parvalbumin (PV) in diseased PLN^{OE} mice, creating a new transgenic line (DB^{OE} mice). PV overexpression did not change the rate of Ca^{2+} sequestration (PLN^{OE} 7.24±2.54nM/s vs DB^{OE} 7.38±2.15 nM/s, $p>0.05$) and did not improve tetanic force production in soleus tissue (PLN^{OE} 146.9±70.7mN/mm^2 vs DB^{OE} 132.4±53.7 mN/mm^2, $p>0.05$)). Furthermore, the introduction of PV did not attenuate ($p>0.05$) any of the histological markers associated with CNM. These findings show PV did not improve the CNM disease phenotype in DB^{OE} mice suggesting that buffering excess cytosolic Ca^{2+} may not be a feasible therapeutic intervention in this mouse model of CNM.

Physiological contributors to ratings of perceived exertion during cardiopulmonary exercise testing on a cycle ergometer

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The perceived intensity of physical activity can be quantified with Borg's ratings of perceived exertion (RPE) scale. The RPE scale was developed using heart rate as a physiological indicator of exercise intensity. While the physiological responses to exercise have been extensively explored, the relationships between these physiological responses and the perceptual contributors to RPE are still poorly understood. Patients were referred to a clinical exercise lab from 1988 to 2012 and 35,597 participants (53±17yrs, 60% male) were included in a retrospective analysis. Multiple analysis of variance was used to determine the physiological variables that contribute to the RPE throughout cardiopulmonary exercise testing a leg cycle ergometer. Height, weight, age<20, age>35, baseline forced expired volume over 1-second, respiratory diffusion capacity, leg cycling power (P_c), and maximum cycling power output (MPO_c) were considered as variables used to describe the effort required to breathe (breathing RPE) and the effort required to cycle (cycling RPE). The equations are: cycling RPE = $P_c^{2.12} \bullet MPO_c^{-1.86}$(r=0.8159) and breathing RPE = $P_c^{2.23} \bullet MPO_c^{-1.99}$(r=0.7446). Given that MPO_c is a dependent variable, forward linear regression revealed quadriceps strength was the dominant physiological contributor to MPO_c. This study shows that the perceptual consequences of incremental leg cycling exercise to maximum capacity are dependent on P_c and quadriceps strength.

The utility of detrended fluctuation analysis alpha 1 (DFAα1) to assess exercise intensity in incremental and constant-speed running tests

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Detrended fluctuation analysis alpha 1 (DFAα1) is a non-linear heart rate variability index that has recently been applied to exercise physiology. The purposes of this study were to (i) confirm, as has been reported, that values of 0.75 and 0.50 coincide with the gas exchange threshold (GET) and respiratory compensation point (RCP), respectively, during incremental testing and (ii) determine whether a DFAα1 value of 0.50 corresponds to constant-speed running at the maximal lactate steady state (MLSS). Eleven runners (5F, 6M; 172±8 cm; 68.5±9.4 kg; 56.4±6.2 mL/kg/min) completed the study. The GET $\dot{V}O_2$ (2.66±0.45 L/min) was not significantly different from the $\dot{V}O_2$ at a DFAα1 of 0.75 (2.71±0.50 L/min; $p=0.275$; $n=11$), but the RCP $\dot{V}O_2$ (3.36±0.69 L/min) was significantly greater than the $\dot{V}O_2$ at a DFAα1 of 0.50 (3.10±0.73 L/min; $p=0.020$; $n=9$). There was excellent agreement between pairs of GET (ICC=0.982) and RCP (ICC=0.935) measures, with narrow (0.935-0.995) and wide (0.469-0.987) 95% confidence intervals, respectively. The $\dot{V}O_2$ at RCP was not significantly different from the $\dot{V}O_2$ at MLSS (3.34±0.57 L/min; $p=0.98$; $n=11$); however, the DFAα1 associated with running for ~20 min at MLSS (0.65±0.14) was significantly greater than 0.50 ($p=0.005$; $n=11$). Overall, DFAα1-based measures accurately identified the GET but underestimated the RCP and overestimated the MLSS. Furthermore, DFAα1 values derived from incremental testing do not directly translate to constant-speed running. (Supported by the Natural Sciences and Engineering Research Council of Canada (NSERC), NSERC CREATE We-TRAC training program, and Alberta Innovates).

Examining relationships between gut microbiota, cardiometabolic health, mental health, and lifestyle factors in healthy older adults

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The gut microbiome is effectively the most metabolically complex organ in the human body. It consists primarily of beneficial bacteria that aid in digestion, metabolism, immunity, and maintaining intestinal homeostasis. Gut microbial composition varies greatly between individuals due to differences in host lifestyle and environment: poor physical activity, sleep, stress, or diet can reduce the abundance of beneficial species and overall diversity. Further, research shows that aging inversely correlates with bacterial diversity. The ensuing gut dysbiosis has been linked to cardiometabolic dysfunction and mental illness. The present study aims to investigate relationships between gut microbiota, cardiometabolic health, mental health, and lifestyle factors in healthy older adults (aged 55+y). Data and samples were collected in three stages: 1. Mental health and lifestyle factors were obtained via an online survey; 2. Cardiometabolic health data were collected in one in-person laboratory visit, and 3. A three-day food log and fecal sample were provided within a week of the in-person visit. Currently there are ten cardiometabolically healthy participants (9 male; 1 female): age 61±5y; BP 124±8/74±7mmHg; central pulse wave velocity 8.6±1.8m/s; fasting blood glucose 4.4±0.2mmol/L; BMI: 23.7±2.3kg/m^2; body fat: males 17.4±3.7%, female 24.6%. While sleep quality was poor (PSQI: 5±3), mental health and lifestyle behaviours were healthy: low anxiety (GAD-7: 2±3), depression (PHQ-9: 3±5), and stress (PSS: 8±8); high physical activity levels (IPAQ: 448±430min MVPA/week) and healthy eating patterns and behaviours (REAPS: 32±4; TFEQ: cognitive restraint 14±4, uncontrolled eating 15±4, emotional eating 4±1). However, food log analyses revealed three participants consumed less carbohydrates and five participants consumed more fat than the AMDRs; micronutrients from whole foods were within the DRI ranges, except for low vitamin D and high sodium intake. Ongoing fecal sample analyses via 16S rRNA sequencing will allow for an exploration of these predictor variables on gut bacterial species abundance and diversity.

Sex-differences in the physical and mental health profile of patients with persistent or permanent atrial fibrillation

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Higher stroke and mortality risk in females with atrial fibrillation (AF) than males may be due to poorer physical and mental health, and health behaviours including lower moderate-to-vigorous intensity physical activity (MVPA) levels; yet, whether these sex differences exist is unknown. This cross-sectional study compared physical and mental health, including AF-specific quality of life (Atrial Fibrillation Severity Scale), peak aerobic power ($\dot{V}O_2$peak, cardiopulmonary exercise test), functional capacity (6-minute walk test), MVPA levels (ActiGraph accelerometer), body mass index (BMI), body fat, resting heart rate, anxiety and depression (Hospital Anxiety and Depression Scale) between females and males with persistent or permanent AF. Independent t-tests and Mann-Whitney U tests were used for sex comparisons for continuous variables, Chi-square analyses for categorical variables. A total of 29 females and 60 males (f: 70±9, m: 69±8 years) participated. Females self-reported greater duration (2.5±2.5 vs. 1.5±1.6 points, p=0.013) and frequency (2.2±1.7 vs. 1.3±0.9 points, p=0.002) of AF episodes; had a lower $\dot{V}O_2$peak (14.9±4.0 vs. 19.4±5.6 mL/kg/min, p<0.001) and higher body fat (36.0±7.3 vs. 27.4±7.0%, p<0.001) and resting heart rate (78±13 vs. 70±13 bpm, p=0.009). No differences were observed between females vs. males in functional capacity (501.9±76.7 vs. 533.1±115.9 metres), MVPA (135±106 vs. 108±95 mins/week), BMI (30.3±7.5 vs. 30.4±5.1 kg/m^2), anxiety (5.5±3.2 vs. 4.6±3.4 points) and depression (4.2±4.2 vs. 4.5±3.2 points). Only 19% of females and 16% of males met the 200 mins/week of MVPA as recommended by the Canadian Cardiovascular Society (p=0.752). Several modifiable risk factors including obesity and low MVPA levels were prevalent in both sexes, highlighting a need for lifestyle strategies; these may also mitigate sex-differences in symptoms and physical health.

Aerobic Exercise and Physiological Post-Concussion Syndrome: Does Restoration of Exercise Capacity Influence Autonomic Function

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We tested autonomic nervous system (ANS) function before and after rehabilitation from Physiological Post-Concussion Syndrome (P-PCS) using aerobic exercise. Five varsity athletes (n=3 female, n=2 male, 18-24 yrs) with P-PCS were prescribed individualised aerobic exercise (5 d·wk^{-1}, 20-min at 70-80% of concussion-symptom threshold) until exercise capacity was restored (asymptomatic at intensity ≥95% age-predicted max heart rate) using the Buffalo Concussion Treadmill Test (BCTT). ANS function was examined pre and post the aerobic exercise program using a 3-minute Face Cold Pressor Test (FCPT, typical response = -5-15 b·min^{-1} in heart rate at 2-minutes in healthy controls). Exercise capacity increased over the course of training (range: 5-8 wks), from First-BCTT (10.0±3.4 min, 170.0±12.0 b·min^{-1}, Δ+3 concussion-related symptoms (0-10 visual analogue scale)) to Final-BCTT (15.0±5.0 min, 195.0±4.0 b·min^{-1}, Δ+0 concussion-related symptoms, all p<0.05). There was no significant FCPT response at 2 min for heart rate (p=0.415) and mean arterial pressure (p=0.100) pre-training (Δ0.0±4.0 b·min^{-1}, Δ6.2±10.3 mmHg) or post-training

(Δ-2.0±4.0 b·min^{-1}, Δ4.8±5.6 mmHg). Among athletes with P-PCS, individualized aerobic exercise improved exercise capacity while ameliorating concussion symptoms during the BCTT. While concussion symptoms were minimized at rest and during exercise, there was no change in ANS function during the FCPT pre-post aerobic exercise intervention.

Are we really Stronger Together? Evaluating a social support mHealth intervention for Canadians living with chronic disease during COVID-19

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Social support (SS) is known to promote physical activity (PA) among people living with chronic conditions. Specifically, peer connection can help patients better manage barriers to PA resulting from chronic conditions. The demand for SS interventions has been exacerbated by COVID-19 (e.g., physical distancing, quarantine). Mobile health (mHealth) has the potential to offer at-home peer support that may otherwise be unavailable. This study aimed to explore the changes in SS over time among people with chronic conditions using Stronger Together, a 12-week mHealth SS intervention. In this mixed-methods, repeated-measures longitudinal study, adult participants with chronic conditions (n=106) were recruited by healthcare professionals, or social media. Pearson r correlations indicated significant negative correlations between perceived SS and stress at weeks 4, 8, and 12 of the intervention. A mixed-design ANOVA was used to evaluate longitudinal changes on perceived SS. Similar analyses examined changes in our secondary outcome of perceived stress. There were no significant main or interaction effects. Semi-structured exit interviews gathered perspectives about program utility and overall experience. Qualitative data supports positive user experiences, with most participants reporting an enriched sense of peer support following the intervention. The small sample size (n=42) at follow-up may have been impacted by the ongoing COVID-19 pandemic. Nevertheless, there is preliminary evidence to suggest that the delivery of a mHealth intervention can improve perceptions of SS among Canadians living with chronic conditions.

A preliminary analysis of the association between strength and muscle quality with indices of muscle fatigue during eccentric quasi-isometric loading

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Eccentric quasi-isometric (EQI) loading involves periods of isometric and low-velocity eccentric muscle actions. EQIs are suggested to produce substantial time-under-tension (TUT) and mechanical stretch of a target muscle, leading to changes in musculotendinous morphology. As EQIs are performed to task failure, however, TUT and the resulting mechanical stimuli will be limited by muscle fatiguability, which is associated with absolute strength. This exploratory analysis examined the relationship between absolute elbow flexion strength (maximal voluntary isometric torque; MVIT) and muscle quality (MVIT (N m)/segmental lean body mass (kg)) on TUT and electromyographic (EMG) measures of muscle fatigue during EQI elbow extension. Ten resistance-trained individuals (4 male, 6 female) performed 2 unilateral maximal isometric contractions at 120°, 90°, and 60° of elbow flexion, followed by 4 EQIs from 130° to 0° at ∼50% MVIT, while high-density EMG was collected from the biceps brachii. TUT, integrated EMG, and mean power frequency were recorded from EMG onset to 10° of elbow flexion and totaled across EQIs. Relationships with strength and muscle quality were examined using Spearman's rank-order correlation. No significant correlations were present for any variable, preliminarily suggesting the manifestation of muscle fatigue during EQIs is not affected by absolute strength or muscle quality.

No impact of natural menstrual cycle and hormonal contraceptive phase on substrate oxidation during rest and acute submaximal aerobic exercise in healthy young females

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Previous research has identified sex differences in substrate oxidation during submaximal aerobic exercise, including a lower respiratory exchange ratio (RER) in females compared to males. While these results may be due to differences in sex hormones, a comprehensive evaluation of the influence of naturally cycling and contraceptive hormones on substrate oxidation has not been conducted. Therefore, this study examined the impact of natural menstrual cycle (NAT) and 2nd and 3rd generation oral contraceptive pill (OCP2, OCP3) phases on substrate oxidation during rest and submaximal aerobic exercise. After assessing peak oxygen uptake ($\dot{V}O_2$peak), participants (n=43; 16 NAT, 16 OCP2, 11 OCP3) took part in two randomized experimental visits in the low hormone/early follicular phase and high hormone/mid-luteal phase of their hormonal cycle. Gas exchange was collected to calculate RER and carbohydrate and lipid oxidation rates during 10 minutes of supine rest, 5 minutes of seated rest, and 8 minutes of submaximal exercise at each of ∼40% and ∼65% of $\dot{V}O_2$peak. For all groups, there was no difference in RER between the low and high hormone phases during supine rest (0.73±0.05 vs 0.74±0.06), seated rest (0.72±0.04 vs 0.72±0.05), exercise at 40% (0.78±0.04 vs 0.78±0.04) and 65% $\dot{V}O_2$peak (0.86±0.04 vs 0.86±0.04; $p>0.05$ for all). Similarly, carbohydrate and lipid oxidation rates were also unchanged across phases during rest and exercise. We conclude that, under the conditions studied, natural and contraceptive

hormonal cycles generally do not influence substrate oxidation. (Funding provided by NSERC).

The role of TFE3 in endurance training-induced skeletal muscle adaptations

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TFE3 is a transcription factor that activates the expression of lysosomal genes involved in the clearance of dysfunctional mitochondria, termed mitophagy. With exercise, TFE3 is presumed to optimize the mitochondrial pool through the removal of organelles via lysosomes. However, the molecular mechanisms of the involved pathways remain unknown. We hypothesized that loss of TFE3 would impair skeletal muscle mitochondrial adaptations to 6 weeks of voluntary wheel running, reducing mitochondrial function and impairing muscle performance during acute *in situ* stimulation of the sciatic nerve innervating hindlimb muscles. Fatiguability during stimulation was reduced with training in WT animals, as seen by a 12% increase in percent of maximum force at 5 minutes of stimulation, and a 17% increase at 30 minutes. Concurrent with improved muscle function, COX I and COX IV mitochondrial proteins were increased in trained WT animals compared to untrained animals. Permeabilized fiber oxygen consumption was also improved with training. Both protein and oxygen consumption adaptations were abolished with the loss of TFE3. Surprisingly, untrained TFE3 KO animals experienced a greater induction of mitophagy flux with acute stimulation compared to their WT counterparts. Our results suggest that the loss of TFE3 compromises skeletal muscle endurance and mitochondrial adaptations in response to exercise.

Peripheral hypercapnic chemosensitivity at rest and varying exercise intensities

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Peripheral hypercapnic chemosensitivity (PHC) is the ventilatory response to hypercapnia, and has been shown to be enhanced with acute exercise. However, less is known about the mechanism behind this increase in PHC and if progressive exercise leads to further augmentation. We hypothesized that cycle exercise in the absence of load (0 Watts) would increase PHC but progressively increasing the intensity would not further augment the response. Eight healthy subjects participated in 2 testing days. Day 1 was a maximal exercise test on a cycle ergometer. Day 2 consisted of six separate 12-minute stages as follows: (i) rest on a chair, (ii) rest on the bike, (iii) 0 watt unloaded cycling, (iv) 25% peak power output, (v) 50% peak power output, and (vi) 70% peak power output with ~10 min of rest between each exercise stage. In each stage PHC was assessed via 2 breaths of 10% CO_2 that was repeated 5 times with ~45 sec between each to ensure end-tidal CO_2 and ventilation were stable and back to baseline. Pre-stimulus end-tidalCO_2 was not different between rest and unloaded cycling (39±3 vs. 38±5 respectively, p=0.45). There was a trend for increasing PHC between seated rest and 25% peak power (0.96±0.3 vs. 1.1±0.67 L/mmHg∗min, for seated rest and 25% peak power respectively p=0.059), and between seated rest and unloaded cycling (0.96±0.3 vs. 1.1±0.5 L/mmHg∗min, for seated rest and unloaded cycling respectively, p=0.077). There was no effect of exercise intensity on PHC (1.1±0.67 vs. 1.07±0.7 vs. 0.98±0.55 L/mmHg∗min for 25, 50 and 70% $\dot{V}O_{2max}$, p=0.44). The trend for an increased PCH response from seated rest to unloaded and 25% peak power exercise, but no effect of exercise intensity suggests a possible feedforward mechanism causing increased PCH sensitivity through the act of cycling. However, further increases in exercise intensity do not appear to impact the initial augmentation. (Funding: NSERC, CFI)

Low-intensity Exercise Elicits Maximal Fat Oxidation in Young Healthy Men

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Maximal fat oxidation (MFO) is a marker of skeletal muscle oxidative capacity measured through submaximal exercise testing. However, the intensity at which it occurs remains to be evaluated in nonathletic populations. The study investigated the effect of self-selected walking pace on whole-body fat oxidation. Fourteen young healthy men (age = 28.5±5.0, weight = 76.9±10.9 kg, height = 176.9±5.9 cm, BMI= 24.5±2.8, $\dot{V}O2_{max}$ = 3.8±0.6 mL/min) performed a running incremental test (GXT) prior to partaking in two 30-min self-selected walking pace (low and high) trials. Walking paces, $\dot{V}O2$, $\dot{V}CO2$, HR, and RPE, were recorded, and substrate oxidation rates were calculated through stoichiometry equations. MFO rate determined during the GXT was 473± 201 mg/min and occurred at 39.6±11.8% of $\dot{V}O2_{max}$. Peak fat oxidation (PFO) rates at the lowest (3.5±0.7 km/h) and highest (5.7±0.8 km/h) walking paces were significantly different (*p*-value=0.001; 254±90 vs. 469±139 mg/min, respectively). The lowest and highest self-selected walking paces corresponded to 21.2±3.8 and 35.8±5.9% $\dot{V}O2_{max}$, respectively. At the highest walking pace, no statistical difference was observed between MFO and PFO.

Competing Effects of Post-activation Potentiation and Prolonged Low Frequency Force Depression on Human Motor Unit Firing Rates

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Prolonged muscle activation impairs subsequent contractile responses due to neuromuscular fatigue. However, acute activation enhances subsequent submaximal contractile responses for the same input, known as post-activation potentiation (PAP). PAP dissipates within minutes

while prolonged low frequency force depression (PLFFD) following a fatiguing task can take many hours to recover. To investigate whether PAP reduces motor unit firing rates (MUFRs) during the initial development of PLFFD, known to correspond to increased MUFRs compared to pre-fatigued values, we hypothesized inducing PAP during PLFFD will reduce MUFRs. In the tibialis anterior of participants to date 612 MUs were recorded with tungsten microelectrodes. At 25% maximal voluntary contraction (MVC) pre-fatigued MUFRs were ~14 Hz. During a 1-min MVC force declined ~40%. Following task-termination, stimulation (10 and 50 Hz) and MUFRs were assessed, pre and post a 5s MVC every 10 min for 60 min. The 10:50 Hz ratio was depressed ~30% (indicating PLFFD) and MUFRs increased relative to baseline values by ~10% at pre MVC (PLFFD) time points. Inducing PAP (5s MVC) during PLFFD increased the 10:50 Hz ~40% and MUFRs decreased relative to PLFFD units by ~20%. Therefore, PAP reduces MUFRs during PLFFD perhaps as a mechanism to mitigate PLFFD. (NSERC supported)

Peripheral fatigue is mitigated while sessional perceived exertion is exacerbated across multiple high intensity interval cycling workouts performed within 24 hours

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In recreational and competitive settings, athletes often undergo multiple training sessions within a short span; yet, the potential transfer of exercise-induced neuromuscular fatigue and perceptual modulations across repeated sessions is unclear. Seventeen participants (8 females; 25±7 years) performed high-intensity interval training (HIIT) consisting of ten 2:2min work:recovery intervals at 80% peak power output on a cycle ergometer in the morning (HIITa), afternoon (HIITb), and following morning (HIITc). Work- and time-matched continuous cycling (CONT) was performed in the same pattern (i.e., CONTa, CONTb, CONTc) with a 2-week washout. Prior to and immediately following each workout, participants performed a maximal voluntary contraction (MVC) with the dominant knee-extensors, coupled with a superimposed high-frequency doublet (100Hz; Db100) and resting Db100, low-frequency doublet (10Hz; Db10), and single (QTw) supramaximal stimuli on the femoral nerve, to quantify central and peripheral fatigue. Blood lactate concentration was sampled and sessional perceived exertion (sRPE) and leg muscle pain were rated in the final minute of each session. MVC force, QTw, and Db10:100 declined more, while sRPE and pain increased after HIIT compared to CONT condition ($P<0.05$), supporting a greater, and expected, intensity-induced exercise stress. Across HIIT workouts, QTw declined more after HIITa (-49.3±17.5% from baseline) compared to HIITb (-37.2±15.9%; $P=0.031$) and HIITc (-34.5±13.9%; $P<0.001$). Similarly, Db10:100 decreased more after HIITa (-32.7±14.8%) than HIITb (-17.2±17.7%; $P=0.010$). No evidence of voluntary activation decline appeared between or across conditions. End-exercise lactate was higher in 'a' (HIITa and CONTa: 8.1±3.5mmol/L) compared to 'b' (5.6±2.8mmol/L) and 'c' sessions (6.2±2.6mmol/L; both $P<0.001$). sRPE was rated higher in 'b' ($P=0.025$) and 'c' sessions ($P=0.005$) than 'a' (time effect), and pain was higher in 'c' than 'a' ($P=0.027$). Therefore, while HIIT impairs muscle force generating capacity to a greater extent than CONT, these peripheral perturbations are mitigated across subsequent workouts, contradicting the pattern of perceived workout intensity.