

Bodyweight High-intensity Exercise Induces Lower Oxygen Consumption But Higher Lactate Concentration Compared With High-intensity Running

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High-intensity interval training (HIIT) has been shown to improve cardiometabolic health with low time commitment. Body weight style high-intensity interval training (BW-HIIT) might be a practical way to do HIIT. However, there is limited evidence that a single bout of BW-HIIT can induce comparable metabolic and perceptual disturbances to traditional treadmill running HIIT protocol (RUN-HIIT).

PURPOSE: To compare the metabolic and perceptual responses between a single bout of BW-HIIT and RUN-HIIT.

METHODS: Using a randomized crossover design, twelve recreationally active adults [age: 29.5 ± 5.3 years; body mass: 70.9 ± 15.0 kg; height: 167.9 ± 8.9 cm; body fat: $15 \pm 6.3\%$; maximum oxygen consumption (VO_2max): 48.7 ± 6.5 mL/kg/min] performed a bout of RUN-HIIT [10 x 1 min treadmill running at max velocity achieved during VO_2max with a 3% incline, followed by 1 min at 2.5 mph] and BW-HIIT (10 x 1 min of high knees, squat jumps, scissor jacks, jumping lunges and burpees at an all-out intensity followed by 1 min marching in place at 100 steps per minute). Expired metabolic gases, blood lactate (B_{lac}), heart rate (HR), and rating of perceived exertion (RPE) were measured pre, during and post each bout. Excess post-exercise oxygen consumption (EPOC) was calculated. Each exercise trial was separated by ≥ 72 hours.

RESULTS: Peak oxygen consumption relative to VO_2max was higher ($p < 0.001$) during RUN-HIIT ($88 \pm 3\%$) compared to BW-HIIT ($78 \pm 5\%$). B_{lac} was higher ($p < 0.001$) during BW-HIIT (11.2 ± 3.2 mmol/L) than RUN-HIIT (6.9 ± 2.0 mmol/L). Peak HR relative to HRmax was higher ($p = .001$) for RUN-HIIT ($97 \pm 5\%$) compared to BW-HIIT ($94 \pm 4\%$). EPOC was similar ($p = .50$) between RUN-HIIT and BW-HIIT (4.7 ± 1.3 vs 5.3 ± 1.9 mL O_2 /kg/min, respectively). Average RPE achieved was higher ($p = .003$) during BW-HIIT (16 ± 1.6) than RUN-HIIT (14 ± 1.8).

CONCLUSION: Although there were differences in oxidative and glycolytic metabolism and perceptual responses, our findings suggest that the BW-HIIT protocol studied here and a traditional HIIT protocol both elicit significant metabolic and perceptual stress. When access to equipment is limited, BW-HIIT may be a viable alternative to traditional HIIT.

Acute L-citrulline Attenuates Blood Pressure Responses To Exercise And Cold Stress In Hypertensive Postmenopausal Women

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Hypertension is a major risk factor for cardiovascular disease and is highly prevalent in postmenopausal women. Older women with hypertension have augmented blood pressure (BP) responses to exercise, which increases the risk for cardiovascular events. Recent literature has shown inefficiency of antihypertensive medications to control BP during exercise. L-Citrulline (CIT) is a non-protein amino acid that, when chronically supplemented, has shown to attenuate BP responses to metaboreflex activation and cold stress in healthy young men. The cold pressor test (CPT) is commonly used to test the ability of the arteries to overcome sympathetic-mediated vasoconstriction during exercise.

PURPOSE: To test the hypothesis that a single 6g dosage of CIT would attenuate brachial and aortic BP responses to low-intensity plantarflexion exercise alone (Ex) and with CPT (Ex+CPT) in hypertensive postmenopausal women.

METHODS: Eleven postmenopausal women (age: 61 ± 2 years) with hypertension were randomly assigned to consume either 6g of CIT or placebo on different visits separated by a minimum 3-day washout phase. Forty-five minutes after consumption, participants performed a 6-minute, rhythmic low-intensity plantarflexion exercise protocol at 20% of their estimated 1 repetition maximum. During the last 3 minutes of exercise, the participant's right hand was introduced into cold water ($\sim 4^\circ\text{C}$). Brachial and aortic BP responses were measured using an automated BP device and radial arterial tonometry at baseline and the 2nd minute of Ex and Ex+CPT.

RESULTS: There were no significant differences ($p > .05$) between CIT and placebo in baseline brachial systolic BP (126 ± 4 vs 124 ± 3 mmHg) and the increases in brachial systolic BP ($\Delta 14 \pm 3$ vs $\Delta 14 \pm 3$ mmHg), brachial mean arterial pressure (MAP) ($\Delta 12 \pm 3$ vs $\Delta 10 \pm 2$ mmHg), and aortic systolic BP ($\Delta 13 \pm 3$ vs $\Delta 12 \pm 2$ mmHg) from baseline to Ex. Acute CIT attenuated the increases in brachial systolic BP ($\Delta 27 \pm 3$ vs $\Delta 38 \pm 3$ mmHg, $p < .05$), brachial MAP ($\Delta 20 \pm 3$ vs $\Delta 30 \pm 3$ mmHg, $p < .05$), and aortic systolic BP ($\Delta 26 \pm 3$ vs $\Delta 36 \pm 3$ mmHg, $p < .05$) from baseline to Ex+CPT compared with placebo.

CONCLUSIONS: Acute ingestion of CIT may be beneficial in controlling the exaggerated BP responses to exercise and cold stress in hypertensive postmenopausal women.

Metabolic And Ventilatory Responses To Exercise In Young Adults Following Sars-cov-2 Infection

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BACKGROUND: The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) targets organ angiotensin-converting enzyme 2 receptors and infection can lead to pulmonary and cardiovascular abnormalities.

PURPOSE: To examine whether metabolic and cardiorespiratory responses during exercise were different in young adults who previously tested positive for SARS-CoV-2 compared with control participants.

METHODS: A cross-sectional analysis ($n = 26$) was performed between young adults that tested positive for SARS-CoV-2 in the three-to-four weeks prior to data collection (CoV+: $n = 13$) and healthy control participants (CON: $n = 13$). Participants were matched according to sex, age, and BMI (CoV+: $7F, 21 \pm 1$ yr, 24.3 ± 3.0 kg·m $^{-2}$; CON: $7F; 21 \pm 2, 23.3 \pm 3.5$ kg·m $^{-2}$; $p > 0.05$). Participants completed an incremental peak aerobic capacity test on a cycle ergometer. Metabolic and cardiorespiratory measurements were collected every minute using a metabolic cart. Data were compared at rest and during cycling at 60 W, 120 W, and at peak exercise. Values are expressed as mean \pm SD.

RESULTS: No significant differences were observed between groups for relative or absolute peak oxygen uptake ($\dot{V}\text{O}_2\text{peak}$) (CoV+: 35.6 ± 5.8 mL·kg $^{-1}$ ·min $^{-1}$, 2.64 ± 0.68 L·min $^{-1}$; CON: 33.3 ± 6.5 mL·kg $^{-1}$ ·min $^{-1}$, 2.37 ± 0.68 L·min $^{-1}$, respectively; $p > 0.05$). Heart rate expressed as absolute or as a percentage of age-predicted maximum values was not different between CoV+ and CON ($p > 0.05$). Minute ventilation ($\dot{V}\text{E}$), tidal volume, and breathing frequency were similar between groups at each exercise intensity ($p > 0.05$). The ratio of $\dot{V}\text{E}$ to the volume of carbon dioxide produced ($\dot{V}\text{E}/\dot{V}\text{CO}_2$) was not significantly different at any stage of exercise between groups ($p > 0.05$). Additionally, ratings of perceived exertion were similar at submaximal intensities (CoV+: 8.2 ± 1.8 60W, 11.2 ± 2.1 120W; CON: 8.2 ± 2.4 60W, 11.2 ± 3.8 120W; $p > 0.05$) and at $\dot{V}\text{O}_2\text{peak}$ (CoV+: 16.4 ± 2.6 ; CON: 17.1 ± 2.0 , $p > 0.05$).

CONCLUSIONS: Metabolic and cardiorespiratory responses during incremental exercise test were not different between young, healthy control participants and individuals who tested positive for SARS-CoV-2 three-to-four weeks prior. These data suggest that exercise after 3-4 weeks following SARS-CoV-2 infection does not alter physiological or perceptual responses in young adults.

Depression, Dementia And Psychiatric Disorders: The Heart Of The Problem

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Depression affects approximately 1.5% of American adults and incidence increases with age (5% of adults over 60). Incidence of dementia and psychiatric diseases also increase with age. Deeper understanding of contributing factors can aid in the prevention and treatment of these disorders.

PURPOSE: To identify cardiovascular abnormalities that may underlie these illnesses.

METHODS: 2,306 hospital patients were evaluated for cardiovascular and cognitive health. Demographic information, anthropometric values, clinical tests, and diagnostic history were collected. Independent variables were heart rate, blood pressure, and diagnosis of hypertension. Dependent variables were depression, dementia, cerebrovascular accidents, and psychiatric disorders. Descriptive statistics characterized the sample. Logistic regressions tested the effect of the cardiovascular predictors on cerebral and psychological outcomes. Significance was set at $P < 0.05$.

RESULTS: 23 patients had depression, 115 were diagnosed with dementia, 92 experienced a cerebrovascular accident, and 161 had a psychiatric illness. Patients with hypertension were diagnosed with depression 120% more frequently ($P=0.045$); 56% of depressed patients were hypertensive. Among patients with depression, there was a 264% increase in the odds of a dementia diagnosis ($P=0.006$). In patients with dementia, systolic blood pressure (SBP) was 13mmHg (9%) higher ($P < 0.001$), pulse pressure was 13 mmHg (23%) higher ($P < 0.001$), and heart rate was 7 bpm (8%) lower ($P < 0.001$). Patients with hypertension were diagnosed with dementia 379% more frequently than normotensive patients ($P < 0.001$). A diagnosis of hypertension also corresponded to 436% higher incidence of cerebrovascular accidents ($P < 0.001$). Controlling for age, there was a 2.2-fold increase in the odds of an adverse event in patients with dementia ($P=0.005$). However, patients with psychiatric disorders had SBP that was 5 mmHg (4%) lower ($P=0.018$); similarly, pulse pressure was 5 mmHg (7%) lower ($P=0.007$).

CONCLUSIONS: These findings support the hypothesis that cardiovascular deterioration coincides with increased risk for depression and neurocognitive issues. Aerobic exercise training oriented toward improved cardiovascular health likely reduces adverse events and psychological decline.

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Exercise Performance And Aerobic Capacity In Adults With Congenital Heart Disease: A Follow-up Study

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In order to control the development of persons with congenital heart disease, it is important to follow their aerobic capacity (AC), especially when they exercise.

PURPOSE: To study the progress of Exercise Performance (EP) and AC in the follow-up of adults with congenital heart disease (CHD).

METHODS: A longitudinal study with 127 adults with a mean age of 33.77 years (11.57) (71 women; and 56 men) who have undergone two cardiopulmonary exercise test (CEPT) in at least one year between the first and the second test. The AC and EP were assessed by a CPET using a ramp protocol over a treadmill obtaining cardiovascular and metabolic data. Participants started walking at 3km/h and 0% grade for two minutes, increasing the speed 0.3km/h, and 1.4% grade every minute to a maximum of 12% until exhaustion. Descriptive for all variables were obtained, and an analysis of variance (ANOVA one way; post-hoc Bonferroni) to evaluate significant differences among the first and the second CPET in the VO_{2Peak} , body weight, time of effort, maximal velocity and % grade was applied.

RESULTS: A significant decrease of AC appeared, where the VO_{2Peak} in the first CPET was 27.73 (0.68) ml/kg/min versus in the second CPET was 26.62 (0.69) ($P=0.015$). A significant increase was observed in the body weight 64.98 (1.13) versus 66.55 (1.17) ($P=0.001$). No significant differences were observed in terms of EP. Comparing the first with the second CPET, the mean exercise time was 12.75 min (3.11) versus 12.46 min (2.62) ($P=0.420$); the mean maximal velocity was 6.2 km/h (0.8) versus 6.1km/h (0.8) ($P=0.114$); and the maximum % grade was 11.45% (0.11) versus 11.62% (0.09) ($P=0.159$).

CONCLUSIONS: The results suggest that despite observed decline in VO_{2Peak} and an increase in the body weight the EP (duration of exercise time, velocity and percentage of grade) has been maintained without a deterioration along the time, sign of favorable evolution of the CHD in adults. More research is needed to find the reason why the EP does not correspond to the AC. Supported by SUR of DEC Generalitat de Catalunya and European Union 2020FI_B200128.

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Acute High-glucose Exposure Potentiates The Response To Capsaicin-induced Trpv1 Activation In Group Iv Muscle Afferents.

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Cardiovascular and sympathetic responses during exercise are abnormally exaggerated in patients with diabetes. We previously demonstrated that the skeletal muscle afferent response to capsaicin, a transient receptor potential cation channel subfamily V member 1 (TRPV1) agonist, is heightened in both type 1 and type 2 diabetic rats, likely contributing to the potentiated pressor and sympathetic responses to exercise in this disease. However, the mechanism mediating TRPV1 sensitization in diabetes remains unclear. Hyperglycemia is one of the pathophysiological characteristics of diabetes mellitus. Therefore, it was hypothesized that the capsaicin-evoked potentiation in muscle afferent discharge is mediated by high glucose-induced TRPV1 sensitization.

PURPOSE: To investigate the impact of acute high-glucose exposure on neuronal responses to TRPV1 activation via the agonist capsaicin in group IV afferents innervating skeletal muscle.

METHODS: Normal, healthy Sprague-Dawley (8-10 weeks old) rats were used in this experiment. Capsaicin (1 μ M)-induced nerve firings were assessed by single-fiber recordings in an *ex vivo* muscle-nerve preparation. Isolated tissue was kept under laminar superfusion with a Krebs-Henseleit solution that included either 20 mM or 75 mM glucose for 7-10 hours.

RESULTS: There were no significant differences in spontaneous nerve activity between the 20 mM and 75 mM glucose conditions ($P=0.43$). Discharge of group IV muscle afferents to capsaicin was significantly greater in the 75 mM glucose condition as compared to 20 mM glucose (0.37 ± 0.5 vs. 1.1 ± 0.8 Hz, $P < 0.05$). Similarly, the greater discharge responses were persistent up to 60 seconds after capsaicin stimulation in the 75 mM glucose condition compared to 20 mM glucose as evidenced by larger discharge area under the curve (2.17 ± 1.3 vs. 0.92 ± 1.1 Hz \cdot s, respectively, $P < 0.05$).

CONCLUSIONS: These findings suggest that acute high-glucose exposure induces TRPV1 overactivity in group IV afferents innervating skeletal muscle. Importantly, the data support the tenet that hyperglycemia-induced sensitization of skeletal muscle afferents may facilitate the exaggerated pressor and sympathetic responses to exercise in diabetes.

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One Week Of Long Duration Sleep Improves Forearm Reactive Hyperemia

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Sleep deprivation is known to reduce peripheral vasodilation, but the impact of long duration sleep is unclear.

PURPOSE: The aim of the study was to determine the effect of one week of long sleep duration on reactive hyperemia, an index of peripheral vasodilation.

METHODS: Eleven participants (46 \pm 5 years) spent 8 and 10+ hours time-in-bed (TIB) in a crossover fashion while wearing a wrist-worn accelerometer. The order of TIB protocols was randomized between participants, and resulted in normal (7.1 \pm 0.3 hours per night) and long duration sleep times (9.1 \pm 0.3 hours per night, $p < 0.001$), respectively. Forearm reactive hyperemia was measured using venous occlusion plethysmography for three minutes following 10 minutes of arm ischemia. Paired t-tests were used to assess differences between sleep durations in resting and peak forearm blood flow (FBF) along with total excess flow (area under the curve excluding resting flow).

RESULTS: Resting FBF was similar between sleep durations (8 vs. 10+ TIB: 1.5 \pm 0.7 vs. 1.7 \pm 0.7 ml/100ml/min, $p=0.15$). However, peak reactive hyperemia (8 vs. 10+ TIB: 23.4 \pm 7.3 vs. 28.1 \pm 9.3 ml/100ml/min, $p=0.03$) and excess flow (8 vs. 10+ TIB: 25.5 \pm 12.1 vs. 30.5 \pm 10.3 ml/100ml, $p=0.01$) were higher following long duration sleep as compared to normal duration sleep.

CONCLUSION: One week of long duration sleep increased peripheral vasodilation in middle-aged adults. These findings suggest that sleep duration is an important factor to consider with regard to vascular function.

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