RESEARCH TO PRACTICE 2018
27-29 MARCH 2018
BRISBANE, QUEENSLAND

YOUNG INVESTIGATOR AWARD
EXERCISE SCIENCE + HEALTH FINALISTS

Tuesday, 27 March 2018
1:30pm – 3:00pm

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Effects of exercise intensity and cardiorespiratory fitness on the acute response of arterial stiffness to exercise in older adults

Maria Perissiou[1], Tom Bailey[1,2], Mark Windsor[1], Anthony Leicht[3], Jonathan Golledge[3], Christopher Askew[1]
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Introduction: Elevated arterial stiffness is observed with ageing in those with low cardiorespiratory fitness, and is associated with an increased risk of cardiovascular events. Following a single bout of exercise, transient reductions in arterial stiffness may offer short-term benefit, but this may be dependent on exercise intensity. This study assessed the effects of cardiorespiratory fitness and exercise intensity on arterial stiffness responses in older adults.
Methods: Fifty-one older adults (72 ±5y) were stratified into fitness tertiles ($\dot{V}O_{2peak}$: low-, 22.3 ±3.1, mid- 27.5 ±2.4 and high-fit 36.3 ±6.5 mL.kg^{-1}.min^{-1}). On separate days and in a randomised order, participants underwent control (no-exercise), moderate-intensity continuous cycling (40% of peak power output; PPO), and higher-intensity interval cycling (12x1 min at 70%, separated by 1 min at 10% PPO) protocols. Pulse wave velocity (PWV), augmentation index corrected for heart rate (AIx75) and reflection magnitude (RM) were assessed at rest and during 90 min of supine recovery following each protocol.
Results: AIx75 at rest was higher in the low-fit group compared to the higher-fit group (P<0.010). There were no differences in PWV and RM between fitness groups. PWV and RM were lower after higher-intensity interval exercise compared to the control protocol in all fitness groups (P<0.001). PWV after moderate-intensity exercise was not different compared with the control protocol in the low-fit group (P=0.057), but was lower than control protocol in mid (P<0.031) and higher-fit (P<0.001) groups. Post-exercise AIx75 was higher than control in all fitness groups (P<0.001).
Conclusion: Submaximal exercise may reveal important differences in arterial stiffness between adults with higher and lower levels of cardiorespiratory fitness. Higher-intensity interval exercise may be an effective strategy to reduce post-exercise PWV and RM in older adults of all fitness levels.

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Can exercise prevent the negative metabolic effects of sleep-loss?

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Introduction: Sleep-loss is emerging as an important risk factor for the development of impaired glucose tolerance, insulin resistance and, subsequently, type 2 diabetes mellitus. While the mechanisms underlying these changes remain to be fully elucidated, one plausible mechanism is a sleep-loss induced reduction in mitochondrial function – although this remains to be verified in well-controlled laboratory studies. The possible relationship between reduced mitochondrial function and glucose tolerance also suggests exercise could be used as a strategy to counteract some of the detrimental physiological changes induced by sleep-loss.
Aims: To investigate the effect of sleep-loss, with or without exercise, on skeletal muscle mitochondrial function and glucose tolerance.
Methods: Twenty-two healthy male participants were allocated into either a control group (CON, n=6) (8 h time in bed (TIB) for 5 nights), a sleep-restricted group (SR, n=8) (4 h TIB for 5 nights), and a sleep-restricted and exercise group (SR+EX, n=8) (4 h TIB for 5 nights and 3 x high-intensity interval exercise (HIIE) sessions). Oral glucose tolerance tests (OGTT) and muscle biopsies were performed pre- and post-intervention.
Results: Mitochondrial respiratory function (O_2 flux – pmol/s/mg tissue) was reduced in the SR group (87 ± 26 vs 71 ± 25, $p<0.05$), but remained unchanged in the CON (70 ± 6 vs 64 ± 12, $p>0.05$) and SR+EX (81 ± 18 vs 81 ± 24, $p>0.05$) group. OGTT total area under the curve increased post intervention in the SR group (678 ± 92 vs 827 ± 56 units, $p<0.05$), but remained unchanged in the CON (714 ± 207 vs 634 ± 157, $p>0.05$) and SR+EX (638 ± 50 vs 705 ± 71, $p>0.05$) groups.
Conclusion: Sleep-loss was associated with a reduction in mitochondrial respiratory function and a decrease in glucose tolerance. However, these changes were mitigated by performing HIIE, demonstrating exercise as a potent and cost-effective strategy to alleviate some of the negative metabolic effects of sleep loss.

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Cardiac adaptations following 8 weeks of high intensity single-leg cycle training in healthy middle-aged adults

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Introduction: Exercise can ameliorate the age related changes in cardiac structure and function that are known to increase the risk of developing coronary heart disease. Yet, the optimal exercise modality is unknown.
Methods: 53 healthy sedentary middle-aged adults (age: 61 +/- 6 y, BMI: 28.4 +/- 4.8 kg.m^2) were randomly assigned to complete 24 sessions (8 wk; 3 d/wk) of high-intensity double-leg (n=16; HDL), high-intensity single-leg (n=14; HSL) or moderate-intensity double-leg cycling (n=16; MDL). Resting left ventricular structure and function (magnetic resonance imaging), resting blood pressure and maximal cardiorespiratory function were assessed pre- and post-intervention. Linear mixed modelling was used to assess differences.
Results: Total work completed was greater ($p<0.01$) in MDL (5938 +/- 1462 kJ) compared with the HDL (3462 +/- 1063 kJ) and HSL (4423 +/- 1875 kJ). Pre-to-post training differences were observed for peak aerobic capacity (22.27 +/- 6.36 mL/kg/min vs 24.93 +/- 7.55 m/kg/min, $p<0.01$), peak power output (136 +/- 50 W vs 161 +/- 63 W, $p<0.05$) and resting blood pressure (systolic: 129 +/- 11 mmHg vs 124 +/- 12 mmHg, $p<0.01$; diastolic: 79 +/- 8 mmHg vs 76 +/- 8 mmHg, $p<0.02$), with no differences between conditions. No differences in post-training maximal stroke volume or cardiac output were observed between conditions. Pre-to-post differences were observed for resting left ventricular ejection fraction (62.00 +/- 4.00 % vs 64.75 +/- 5.64 %) in the MDL condition ($p<0.05$). No training effects were observed for resting left ventricular end diastolic volume, end systolic volume, stroke volume or mass in any condition.
Conclusion: Eight weeks of exercise training improved peak aerobic capacity and resting blood pressure in healthy sedentary adults with no differences between groups. Resting left ventricular ejection fraction was improved with MDL but no other changes in resting or maximal cardiac function were observed in any group.

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Optimal protocol for decreasing the number of 'low responders' for change in cardiorespiratory fitness

Camilla Williams[1], Ilaria Croci[1,2], Nir Eynon[3], Joyce Ramos[4], Robert Fassett[1], Jonathan Little[5], Monique Francois[5], Brendon Gurd[6], Jacob T Bonafiglia[6], Benjamin D Levine[7], Christopher M Hearon Jr[7], Satyam Sarma[7], Sylvan LJE Janssen[8], Emeline Craenenbroeck[9], Paul Beckers[9], Véronique A Cornelissen[10], Nele Pattyn[10], Erin J Howden[11], Ulrik Wisloff[1,2], Jeff Coombes[1]

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Introduction and Aims: High intensity interval training (HIIT) results in fewer individuals with a 'low response' in the improvement in cardiorespiratory fitness (VO_2peak) compared to moderate intensity continuous exercise (MICT). There are various protocols, with longer duration HIIT (3-5 minutes @ ± 90% $\dot{V}O_2$peak) typically more effective than shorter duration maximal intervals (e.g. sprint interval training; SIT) for improving $\dot{V}O_2$peak. The aim of this study was to compare low-responders to $\dot{V}O_2$peak change between HIIT, SIT and MICT protocols from different studies.
Methods: Data was sourced from seven sites that conducted HIIT or SIT studies within the last 15 years (Australia - UQ, Canada – UBC and Queen's, USA – UT SouthWestern, Belgium – UAntwerp and KU Leuven; and Norway - NTNU). $\dot{V}O_2$peak data (assessed via indirect calorimetry from maximal test to volitional fatigue) was analysed from participants who completed their respective interventions with >80% adherence to the training protocol. Comparator groups from these studies included participants who had completed MICT. Participants were classified as low-responders if $\dot{V}O_2$peak change was ≤100 mL/min.
Results: 436 predominantly Caucasian participants met the inclusion criteria completed either; 1) 4x4 HIIT protocols (4-minute intervals @ 90% $\dot{V}O_2$peak, repeated 4 times), n=175; 2) SIT protocols (≤1-minute repeated intervals, n= 72, and 3) a MICT intervention, n=189. There were significantly ($p=0.036$) fewer low-responders to training after completing 4x4 HIIT (21.7%) compared to SIT (34.7%) and MICT groups (32.3%). In all participants, 14.6% of $\dot{V}O_2$peak trainability was predicted by the participant's age, gender, baseline $\dot{V}O_2$peak and training intervention ($p<0.001$).
Conclusions: HIIT using a 4x4 protocol results in fewer low-responders in $\dot{V}O_2$peak improvements compared to MICT and SIT.

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Changes in cardiorespiratory fitness and body composition six months following eight week high and moderate intensity exercise interventions in colorectal cancer survivors

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Introduction: Compared to moderate intensity continuous training (MICT), high intensity interval training (HIIT) elicits greater improvements in cardiorespiratory fitness ($\dot{V}O_2$peak) and body composition in colorectal cancer (CRC) survivors. Whether these differences are maintained following the cessation of supervised training in this population remains unknown.

Aims: This randomised controlled trial aimed to examine $\dot{V}O_2$peak and body composition 6 months following an 8-week HIIT or MICT intervention in CRC survivors.

Methods: CRC survivors (n=31; aged 61±10 years) were randomised to 8 weeks (24 sessions) of supervised HIIT (4x4min at 85-95% peak heart rate) or MICT (50min at 50-70% peak heart rate). After 8 weeks, supervision ceased and participants were advised to continue exercising. $\dot{V}O_2$peak and body composition (via dual-energy x-ray absorptiometry) were assessed at baseline, 8 weeks (end-of-intervention) and after 6 months (follow-up). Analyses included mixed effects modeling with Bonferroni adjustments for pairwise comparisons.

Results: Significant between-group differences were observed at follow-up for $\dot{V}O_2$peak (2.4ml.kg^{-1}.min^{-1}, p=0.046), fat mass (2.8kg, p<0.001) and lean mass (1.4kg, p=0.008), all favouring HIIT. From baseline to follow-up, $\dot{V}O_2$peak increased (+3.4ml.kg^{-1}.min^{-1}, p<0.001) and fat mass decreased (-1.4kg, p=0.002) following HIIT, but not MICT (+1.2ml.kg^{-1}.min^{-1}, p=0.386; +1.4kg, p=0.054, respectively). Moreover, from end-of-intervention to follow-up, lean mass was maintained with HIIT (+0.4kg, p=0.678) but reduced with MICT (-1.1kg, p=0.036). No between-group difference in moderate-to-vigorous physical activity was observed at follow-up (54min, p=0.280).

Conclusion: In CRC survivors, HIIT appears to promote superior long-term maintenance of cardiorespiratory fitness and body composition compared to MICT. These results provide novel insights into the optimization of exercise maintenance strategies for improving health parameters in CRC survivors.

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Australian Haematologists' Perspectives on Exercise for Patients with Multiple Myeloma

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Introduction and Aims: Patients with multiple myeloma (MM), an incurable cancer of the plasma cells, often suffer from disease symptoms and treatment toxicities that may be alleviated through physical activity (PA). The attitudes and practices of treating physicians regarding PA participation for MM patients remains to be elucidated. This study aimed to explore the perspectives of haematologists on PA and exercise for patients diagnosed with MM.
Methods: Paper-based surveys were distributed to haematologists at Queensland hospitals. The survey included 30 questions on a 5-point Likert scale rating the importance of, or agreeance to, the benefits and barriers of PA participation, and their confidence and attitudes towards discussion of PA and exercise with MM patients.
Results: Twenty-eight haematologists (62% response rate), who cumulatively saw over 280 MM patients each week, completed the survey. The majority of respondents were male (85%), of whom 62% did not personally meet the Australian PA guidelines.
Almost all respondents (96%) agreed that PA was important for MM and discussed it with their patients. Consultation time constraints were seen as a barrier to discussion by 39% of haematologists. Exercise recommendations by haematologists diverged for MM patients who were experiencing disease complications; 56% did not recommend exercise when patients had spine fractures or were physically unwell. Whilst many haematologists (64%) were not confident advising specific exercises or identifying PA resources, 39% never referred patients to exercise professionals, with a further 18% only doing so if the patient asked.
Conclusion: Haematologists perceive PA as very important for MM patients, however often do not recommend exercise for those experiencing disease complications. Further advocacy and/or clearer referral pathways are required to increase the number of MM patients being referred by their haematologists to exercise physiologists to enhance patient outcomes.