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Comparing two exercise training doses on metabolic control in adults with overweight/obesity and type 2 diabetes: a randomised controlled trial

Trishan Gajanand*, Shelley E. Keating, Wendy J. Brown, Matthew D. Hordern, Emily Cox, Robert G. Fasset, Jeff S. Coombes

School of Human Movement and Nutrition Sciences, The University of Queensland, Brisbane, Queensland, Australia

Background: Moderate intensity continuous aerobic training with moderate intensity resistance training (C-MICT) has been shown to improve insulin sensitivity and beta-cell function in people with type 2 diabetes mellitus (T2D). The combination of high-intensity interval aerobic training with high-intensity resistance training (C-HIIT) has not been previously investigated in people with T2D. We aimed to compare the efficacy of 8 weeks of low volume C-HIIT and C-MICT on beta-cell function, insulin sensitivity (IS) and resistance (IR), fasting plasma blood glucose (FPG) and insulin (FPI) in adults with T2D.

Methods: Forty-three adults (60 ± 7 y) with overweight/obesity ($BMI = 33.4 \pm 6.6$ kg/m²) and T2D (glycated haemoglobin [HbA_{1c}] 61 ± 13 mmol/mol [$7.7 \pm 1.2\%$]) were randomised into 8 wks of either: low volume C-HIIT ($n = 15$), C-MICT ($n = 16$), or control ($n = 12$). C-HIIT involved aerobic exercise for 4 min at 85–95% peak heart rate (HR_{peak}) followed by high-intensity resistance training (Rate of Perceived Exertion [RPE] ≥ 17) involving 8 exercises for 1-min each, on three days/week. Session time was 26 mins = 78 mins/week. C-MICT comprised aerobic exercise for 150 mins/wk over four days at 55–69% HR_{peak} and moderate intensity resistance training 60 mins/wk (RPE 11–13). Total exercise time = 210 mins/week. Blood samples were taken after an overnight fast with the homeostatic model assessment 2 (HOMA2) used as an indicator of beta-cell function, IS and IR. ANCOVA was used to determine differences in change scores between groups using the baseline value as the covariate. Values are reported as means \pm SD.

Results: There were no significant between-group difference for change in beta-cell function ($5.43 \pm 25.81\%$, $0.93 \pm 31.51\%$, and $15.23 \pm 77.06\%$ for C-HIIT, C-MICT and control, respectively), IS ($-1.36 \pm 23.34\%$, $-1.49 \pm 32.86\%$, $2.17 \pm 9.90\%$), IR (0.45 ± 0.82 , -0.36 ± 1.74 , 0.04 ± 0.90), FPG (0.24 ± 2.66 mmol/l, -0.89 ± 2.96 mmol/l, 0.42 ± 3.09 mmol/l) and FPI (3.23 ± 5.95 μ U/ml, -1.68 ± 9.87 μ U/ml, 0.87 ± 7.87 μ U/ml).

Conclusion: The novel findings from this study are that 8 weeks of low volume C-HIIT and C-MICT did not significantly improve metabolic control in adults with T2D.

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Effect of high intensity interval training on visceral adiposity and body composition in patients with coronary artery disease

Jenna Taylor^{2,1,*}, Jeff S. Coombes¹, Michael D. Leveritt¹, David J. Holland¹, Shelley E. Keating¹

¹ School of Human Movement and Nutrition Sciences, The University of Queensland, Brisbane, QLD, Australia

² HeartWise Cardiac Rehabilitation, The Wesley Hospital, Brisbane, QLD, Australia

Introduction: Obesity, and particularly visceral adiposity, is a significant contributor to lifetime risk of cardiovascular disease. Exercise training reduces visceral adipose tissue (VAT), however it remains unclear if exercise intensity influences the degree of fat reduction. The aim of this study was to compare isocaloric high intensity interval training (HIIT) and moderate intensity continuous training (MICT) on VAT and body composition.

Methods: 29 participants (26 male) with coronary artery disease (CAD) commencing a cardiac rehabilitation program (mean age 64 ± 8 years and body mass index of 27.8 ± 3.5 kg/m²) were randomised to 12-weeks of HIIT or MICT, 3 times per week. Estimated energy expenditure for the training was ~ 1 MJ per session (3 MJ per week). Both groups received standard cardiac rehabilitation nutrition education. VAT and abdominal subcutaneous fat (SAT) were measured by a 3 Telsa magnetic resonance imaging system. Transverse slice images from diaphragm to pelvis (L5/S1) were used to quantify total volumes by semi-automated specialised software. Total fat mass (FM) and fat free mass (FFM) were measured by dual energy x-ray absorptiometry. Data was analysed by ANOVA with baseline data used as a covariate.

Results: There was a significant ($p < 0.05$) effect of time over 12 weeks on total VAT volume (HIIT: -348 ± 287 cm³ [$-13\% \pm 13\%$], MICT: -501 ± 495 cm³ [$-16\% \pm 14\%$]), total SAT volume (HIIT: -211 ± 186 cm³ [$-6\% \pm 5\%$], MICT: -315 ± 360 cm³ [$-9\% \pm 10\%$]), FM (HIIT: -1.0 ± 1.3 kg, MICT: -2.6 ± 2.4 kg), and FFM (HIIT: $+0.3 \pm 0.9$ kg, MICT: $+0.9 \pm 1.5$ kg), but only a significant group difference for FM favouring MICT ($p = 0.05$). No significant differences for time ($p = 0.82$) or group ($p = 0.69$) were found for energy intake. MICT participants reported significantly greater average exercise minutes per week (HIIT: 144 ± 51 min, MICT: 259 ± 131 min, $p = 0.006$).

Conclusion: Both HIIT and MICT provide a clinically significant reduction in VAT (13–16%) over 12 weeks in patients with CAD. HIIT may offer similar reduction in visceral adiposity with less time commitment.

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Predicting variations in individual response to different weight loss regimens

Alyssa Susanto*, Samantha Hocking, Tania Markovic, Timothy Gill

Boden Institute, The University of Sydney, Sydney, NSW, Australia

Background: A number of studies have shown that the mean response to a weight loss intervention hides significant individual variation with some individuals responding well and losing large amounts of weight and others failing to respond or even gaining weight. The reason for this wide individual variation is



currently the source of much speculation with some researchers implicating genetic or physiological difference and others highlighting behavioural disparities in participants as the explanation. This study aims to identify the demographic and psycho-social characteristics associated with responders and non-responders to a range of weight loss regimens.

Methods: Two complementary approaches were employed. A systematic search was performed to identify any reported associations between socio-demographic factors and weight loss outcomes noted in published reports of clinical trials employing common weight loss approaches (e.g. low carbohydrate diets). These factors were then examined in existing clinical trial datasets from studies undertaken at the Boden Institute that utilised a variety of weight loss regimens including defined calorie deficit, high protein, and Korean diet substitution, to determine whether similar associations were observed.

Results: A range of social and demographic variables were identified in the literature review to influence variations in weight loss but analysis of existing datasets was less revealing. Preliminary analyses suggests that older individuals are more likely to comply and adhere to defined calorie deficit weight loss interventions but no consistent gender differences exist in weight loss outcomes from a range of different regimens. Limited studies show that Caucasians have greater weight loss success on defined calorie deficits compared to those of other ethnicity or mixed races.

Conclusions: Current assessments have not identified demographic or simple psycho-social factors that strongly predict greater or poorer response to different weight loss regimens, but specific trends indicate the merit of further exploration in larger datasets.

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Assessing kidney disease risk in clinically obese youth: BMI better predicts renal tubular dysfunction, whilst BMI z-score better predicts glomerular filtration abnormalities



Brooke E. Harcourt*, Jeff Kao, Erin J. Alexander, Zoe McCallum, Matt A. Sabin

Murdoch Childrens Research Institute, Parkville, VIC, Australia

Background: Obesity is a well-established risk factor for the development of renal disease in adults. In children the contribution of obesity to renal dysfunction is less well understood. We investigated the prevalence of renal dysfunction in an obese paediatric cohort with the aim of understanding which anthropometric characteristics would be better indicators of risk in a clinical setting.

Methods: Patients were enrolled into the Childhood Overweight Biorepository of Australia (COBRA) study, from the multidisciplinary weight management service at the Royal Children's Hospital in Melbourne ($n=297$, M 47%, mean BMI z-score 2.47, mean BMI 35.74 ± 6.38 , mean age 11 years). Extensive clinical, pathology and biochemistry data were collected. Renal function was assessed by eGFR, urinary albumin to creatinine ratio (ACR), urinary cystatin C, osteopontin, β_2 microglobulin and NGAL. Statistical modelling was used to assess each measurement against anthropometric data; BMI z-score, BMI and total body fat %.

Results: BMI, but not BMI z-score correlated with urinary Cystatin C/creatinine ratio ($r=0.249$, $p=0.039$), urinary osteopontin ($r=0.362$, $p=0.005$) systolic ($r=0.489$, $p<0.001$) and diastolic blood pressure ($r=0.271$, $p=0.36$). Calculations for glomerular filtration correlated with BMI z-score (eGFR, $r=-0.409$, $p=0.017$, ACR $r=0.294$, $p=0.017$). In multiple regression modelling age and BMI

z-score accounted for 27% of the variation in eGFR ratio ($R=0.572$, $p<0.01$).

Conclusion: Paediatric obesity is a risk factor for the development of renal disease, and hence should be included in the common assessments of co-morbidities. Total BMI rather than BMI z-scores may better predict early renal disease.

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Standardised baseline data collections in obesity management services in Australia: Recommendations from an expert panel



Divya Ramachandran^{3,1,2,*}, Evan Atlantis^{4,3,5}, Samantha Hocking^{6,1}, Tania Markovic^{1,7}, Timothy Gill^{1,2}

¹ The Boden Institute of Obesity, Nutrition, Exercise & Eating Disorders, Sydney School of Public Health and Charles Perkins Centre, Faculty of Medicine and Health, University of Sydney NSW, Sydney, NSW, Australia

² Prevention Research Collaboration, Sydney School of Public Health and Charles Perkins Centre, Faculty of Medicine and Health, The University of Sydney, Sydney, NSW, Australia

³ Capital Markets Cooperative Research Centre, Sydney, NSW, Australia

⁴ School of Nursing and Midwifery, Western Sydney University, Sydney, NSW, Australia

⁵ School of Medicine, The University of Adelaide, Adelaide, South Australia, Australia

⁶ Central Clinical School, Faculty of Medicine and Health, The University of Sydney, Sydney, NSW, Australia

⁷ Metabolism and Obesity Services, Royal Prince Alfred Hospital, Camperdown, NSW, Australia

Background: Specialist obesity management services that provide care by multi-disciplinary teams incorporating behavioural weight loss management programs, treatment with pharmacotherapy and bariatric surgery are an important, but currently limited, component of comprehensive obesity care in Australia [1]. At present, there is little collaboration or co-ordination across services that differ in composition and service provision. To address this issue, we aimed to develop an expert consensus on standardising data collection in specialist obesity services.

Methods: A panel of sixteen experts recruited from obesity management services in Australia participated in a structured consensus-driven Delphi process [2] to develop an agreed set of data that should be collected from patients during their initial attendance at specialist obesity services. The panel included surgeons, clinicians, allied health professionals (dietitian, exercise physiologist, psychologist), a bariatric nurse, and obesity researchers. We chose a 70% threshold to define attainment of consensus for data items to be included in the final baseline dataset.

Results: We produced a recommended list of core and useful data items that should comprise the initial patient dataset within obesity management services. Consensus was achieved for recommended measures of demographic, anthropometric, weight loss history, biochemical measures, medication, medical history and comorbidity data items and included consideration of data items specific to surgical patients. Measures of diet and physical activity were considered core but the best instruments for capturing such data could not be resolved in this study.