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LEIGHTON, D., BURGESS, K., DOLAN, E., GOUA, M. and BERMANO, G.

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Dean Leighton, Katherine Burgess, Eimear Dolan, Marie Goua, Giovanna Bermano; Centre for Obesity Research Epidemiology, Institute for Health and Wellbeing Research, Robert Gordon University, Aberdeen, AB10 7GU.
Email: g.bermano@rgu.ac.uk

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Introduction

Two thirds of the UK population are overweight/obese (OW/OB) and typically characterised by systemic oxidative stress (OS); resulting from chronically high reactive oxidative species (ROS) formation and a reduced antioxidant status (Figure 1). Oxidative stress, *via* oxidation of lipids/proteins, is thought to have a key role in cardiovascular disease (CVD) development (1).

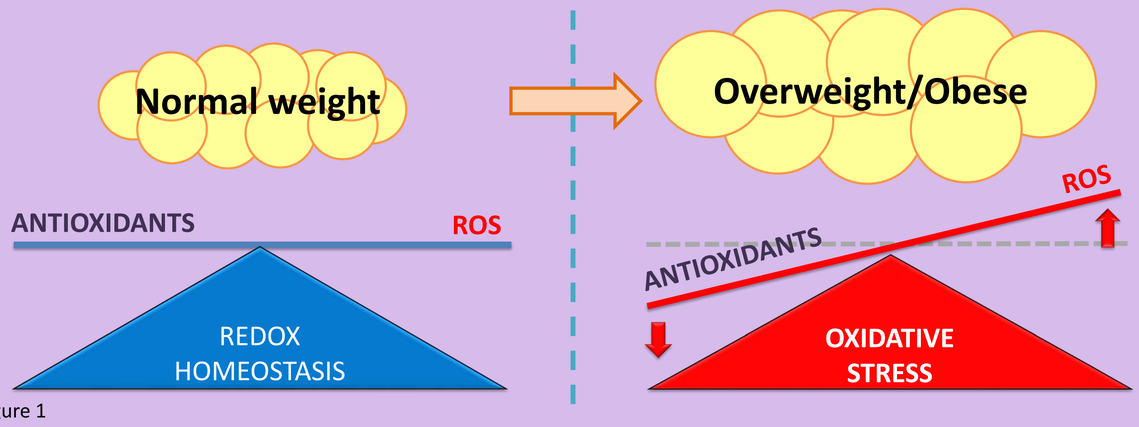


Figure 1

Although regular physical activity can counteract exacerbated OS by increasing endogenous antioxidant enzymes, only a minority of the UK population are sufficiently active (2) with a 'lack of time' being the predominant barrier (3).

Modified high intensity interval training (m-HIIT) protocols offer a time-efficient alternative which have been reported to significantly improve a number of cardio-metabolic risk factors in sedentary OW/OB adults (4). However, there is uncertainty how different m-HIIT protocols transiently modify OS in sedentary OW/OB individuals, with no study determining which m-HIIT protocol is optimal to modulate the acute post-exercise OS response.

Aims

To assess the acute OS response *(lipid peroxidation (TBARS))* and changes in antioxidant status *(glutathione peroxidase activity (GPx), total antioxidant capacity (TAC))* after a single session of three different m-HIIT protocols performed on a cycle ergometer.

Methods

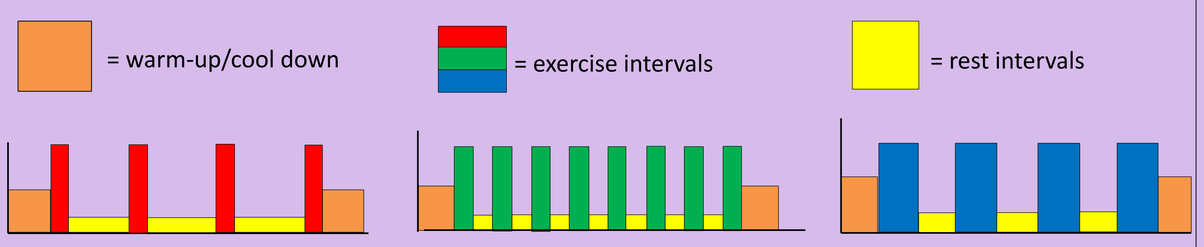
7 overweight/obese sedentary young males

Baseline testing session

- Anthropometrics (height/weight/waist + hip circumference) and body composition (BMI/% body fat)
- Resting blood pressure
- Cardiorespiratory fitness ($VO2_{peak}$)
- Blood sample (Oxidative stress (TBARS), antioxidant capacity (TAC and GPx))

Three m-HIIT sessions (randomised crossover manner)

= warm-up/cool down; = exercise intervals; = rest intervals



SIT: 4x30s (6.5% fat free mass) exercise intervals; 4 min rest

HIT: 8x1 min (60% aerobic power) exercise intervals; 1 min rest

AIT: 4x4 min (80-90 HR_{max}) exercise intervals; 3 min rest

- 15 minute post-exercise blood sample
- Enjoyment/ feeling state/ adherence questionnaires
- 60 minute post-exercise blood sample
- 24 hour post-exercise blood sample

Figure 2: Sedentary overweight/obese participants completed three m-HIIT protocols (sprint interval training (SIT), high intensity training (HIT), aerobic interval training (AIT)) in a randomised, crossover manner (at least 1 week between each bout). Blood samples were taken at 15 minutes, 1 hour and 24 hours after each m-HIIT bout. Additionally, ratings of perceived exertion and affective measures (enjoyment, feeling-state and future adherence ability) was determined after each m-HIIT bout.

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Results

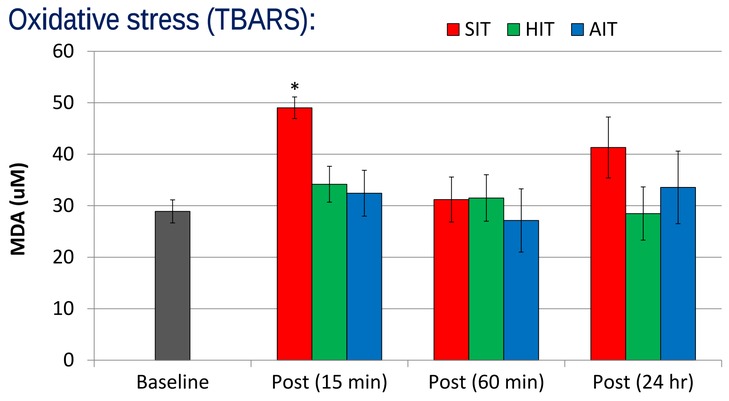
Participant characteristics

Characteristic	Participants: Overweight (n=4)	Obese (n-=3)	Combined (n=7)
Age (years)	28.2 (4.7)	34.0 (4.2)	30.7 (5.5)
BMI (kg/m^2)	26.4 (0.9)	31.4 (1.2) *	28.1 (2.7)
Body Fat (%)	23.1 (1.6)	27.8 (4.2) *	24.4 (3.5)
VO_{2max} (ml/min/kg)	36.3 (4.4)	26.7 (3.1)*	33.2 (4.7)

Table 1: Baseline participant characteristics. Values are means ± SEM. * denotes a significant difference between overweight and obese participants ($p<0.05$).

Acute oxidative stress/antioxidant response to m-HIIT

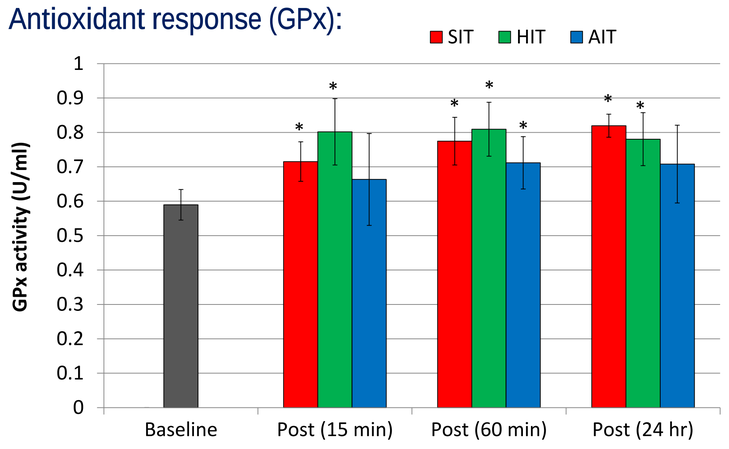
Oxidative stress (TBARS):



MDA was significantly increased after 15 min following SIT (72% above baseline) and levels returned to baseline after 60 min.

HIT and AIT protocols did not significantly increase MDA at any time point.

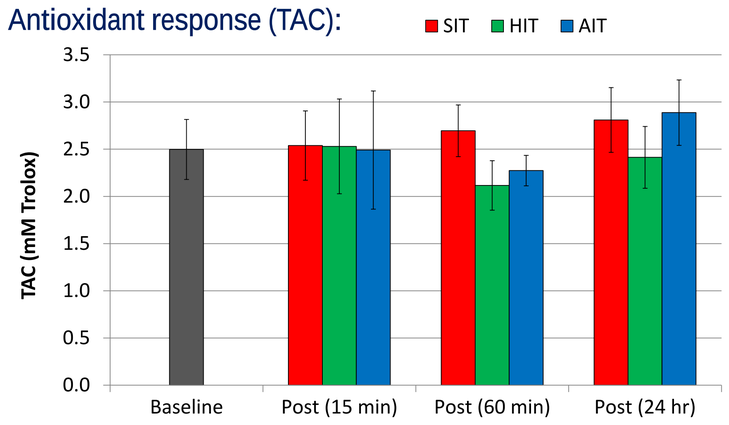
Antioxidant response (GPx):



GPx activity was significantly increased at 15 min, 60 min and 24 hr following SIT (21%, 30%, 29% above baseline, respectively) and HIT protocols (33%, 32%, 31% above baseline, respectively).

GPx activity was significantly increased only at 60 min following AIT (26% above baseline).

Antioxidant response (TAC):



Total antioxidant capacity (TAC) was not significantly affected by any of the m-HIIT protocols, at 15 min, 60 min and 24 hr, compared to baseline.

Figure 3: Acute oxidative stress (TBARS)/antioxidant (GPx and TAC) response at rest (baseline) and after a single bout of SIT, HIT and AIT (15 minutes, 60 minutes, 24 hours) (TBARS; n=3, GPx and TAC; n=7). Values are means ± SEM. * denotes a significant difference between post m-HIIT time point and baseline ($p<0.05$).

Post-m-HIIT Affective responses

	SIT	HIT	AIT
Ratings Perceived Exertion (RPE) (6-20)	15.9 (0.7)	13.2* (0.4)	14.1* (0.3)
Enjoyment (1-7)	3.9 (0.6)	1.9* (0.2)	3.1 (0.3)
Feeling state (1-11)	7.7 (0.5)	9.9* (0.4)	8.8 (0.3)
Adherence (Scheduling self-efficacy; 1-10))	6.3 (1.0)	7.3 (0.6)	6.6 (0.8)
Adherence (Task self-efficacy; 1-10))	5.4 (1.0)	8.9* (0.2)	7.5 (0.3)

Table 2: Acute affect scores of RPE (during m-HIIT protocol) and enjoyment, feeling state and adherence (upon completion of m-HIIT protocol). (n=7). Values are means ± SEM. * denotes a significant difference vs SIT ($p<0.05$).

The SIT protocol elicited a significantly higher RPE response compared to the HIT and AIT protocols.

The HIT protocol induced significantly greater affective response ratings compared to the SIT and AIT protocols.

Conclusion and future work

- These preliminary results suggest that, despite SIT being the only m-HIIT protocol to significantly induce OS, a significant concomitant up-regulation in GPx activity was obtainable after both SIT and HIT protocols in sedentary overweight/obese young males.
- Collectively, the HIT model appeared to be the optimal m-HIIT protocol. HIT may therefore be effective in the prevention of future CVD in overweight/obese individuals, by reducing the detrimental effects of OS via a significant improvement in the endogenous GPx antioxidant activity.
- Intervention studies are required to investigate the ability of the HIT model to induce chronic OS/antioxidant training adaptations in sedentary overweight/obese young males.

References

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