Effect of a medium-term exercise intervention on fat mass is partially compensated for by increased appetite, but not reduced non-exercise physical activity

MYERS, Anna <http://orcid.org/0000-0001-6432-8628>, DALTON, Michelle, GIBBONS, Catherine, FINLAYSON, Graham and BLUNDELL, John

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[1]**Anna Myers***, [2]Michelle Dalton, [2]Catherine Gibbons, [2]Graham Finlayson & [2]John Blundell

[1]**Centre for Sport and Exercise Science, Faculty of Health and Wellbeing, Sheffield Hallam University**

[2]Appetite Control & Energy Balance Research, School of Psychology, University of Leeds

Contact: a.myers@shu.ac.uk

Background

- Exercise-induced weight loss is often less than expected and highly variable between individuals (1-2).
- This implies some degree of compensation in response to the exercise-induced energy deficit (3-4).
- Given that energy intake (EI), non-exercise physical activity (NEPA) and sedentary behaviour (SB) are major determinants of body mass, compensation in these components could undermine the exercise-induced energy deficit and attenuate weight loss.

Aim

- The aim of this study was to examine changes in body composition, appetite, NEPA and SB in response to a 12-week supervised and monitored aerobic exercise intervention in overweight and obese women.

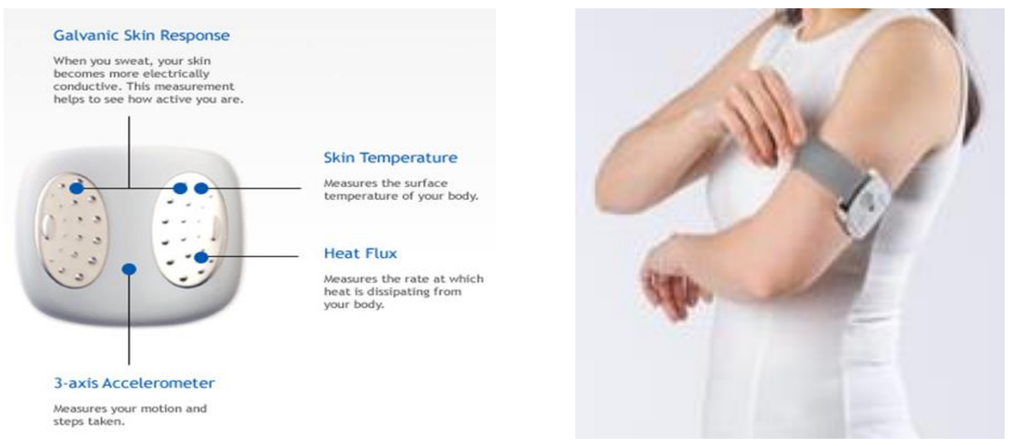

Figure 1. SenseWear Armband Mini specifications and positioning.

Methods

- Twenty-four women aged 33.1 years (SD = 11.7) with a body mass index (BMI) of 27.9 kg/m^2 (SD = 2.7) completed twelve weeks of supervised exercise (500 kcal, 5 times per week). See figure 2 for overview of study procedures.
- Body mass, waist circumference (WC), body composition, resting metabolic rate (RMR), total daily EI and subjective appetite sensations were measured at baseline (week 0) and post-intervention (week 13).
- Free-living physical activity (PA) and SB were measured at baseline, week 1 and 10 of the exercise intervention, and post-intervention (week 13) using the SenseWear Armband Mini (SWA; see figure 1).

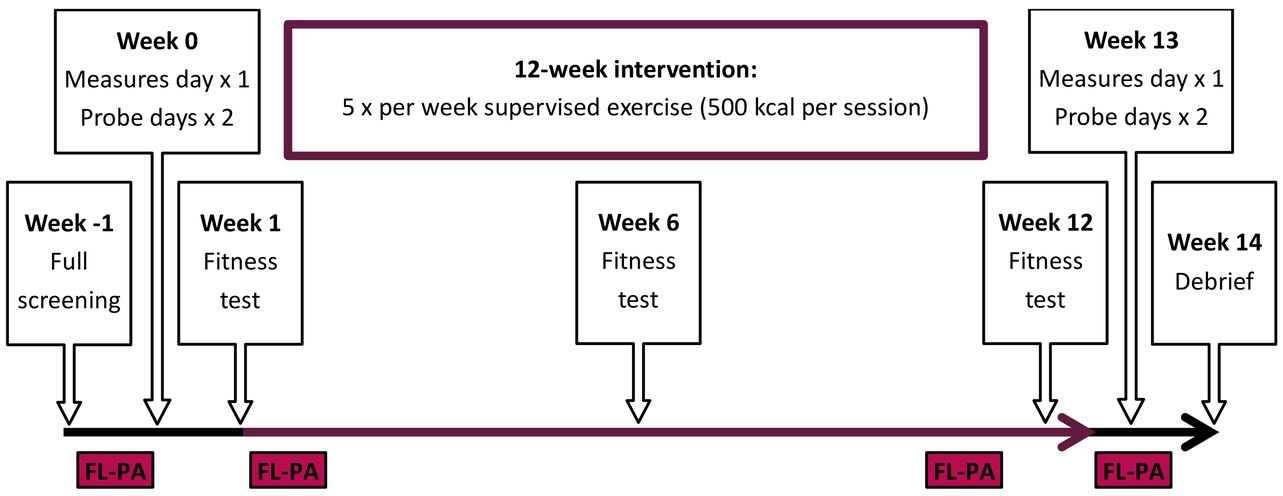

Figure 2. Overview of the medium-term exercise study procedures; FL-PA, free-living physical activity.

Results

- There was a small significant reduction in body mass (p = .04), BMI (p = .035), WC (p < .001), fat mass (p = .003) and a significant increase in fat-free mass (p = .003).
- There was no significant change in RMR from baseline to post-intervention (p = .304), see table 1.
- There was considerable variability in body mass change between participants ranging from -4.3 kg to +3.1 kg.

Table 1. Anthropometrics, body composition and RMR at baseline and post-intervention (n = 24). Data are mean (SD).

	Baseline	Post-intervention	Change	*p*
Body mass (kg)	76.50 (10.40)	75.68 (10.23)	-0.83 (1.85)	***p* = .040**
BMI (kg/m^2)	27.94 (2.67)	27.63 (2.70)	-0.30 (0.66)	***p* = .035**
WC (cm)	95.21 (9.89)	91.60 (9.03)	-3.62 (3.85)	***p* < .001**
FM (kg)	30.28 (7.97)	28.78 (7.96)	-1.50 (2.18)	***p* = .003**
FFM (kg)	46.23 (4.16)	46.90 (3.89)	0.67 (0.98)	***p* = .003**
RMR (kcal/d)	1616.09 (201.98)	1668.85 (205.12)	52.76 (154.51)	*p* = .108

- There was an increase in total EI (M = 178.20 kcal/d, SD = 371.64; p = .028), *ad libitum* EI (M = 172.89 kcal/d, SD = 366.50; p = .03) and snack box EI (M = 108.38 kcal/d, SD = 254.68; p = .048).
- This was preceded by an increase in area under the curve (AUC) hunger (M = 2251.67 mm/min, SD = 4219.84; p =.016) and a decrease in AUC fullness (M=2327.71 mm/min, SD=5223.76; p = .04) throughout the day (see figure 3).

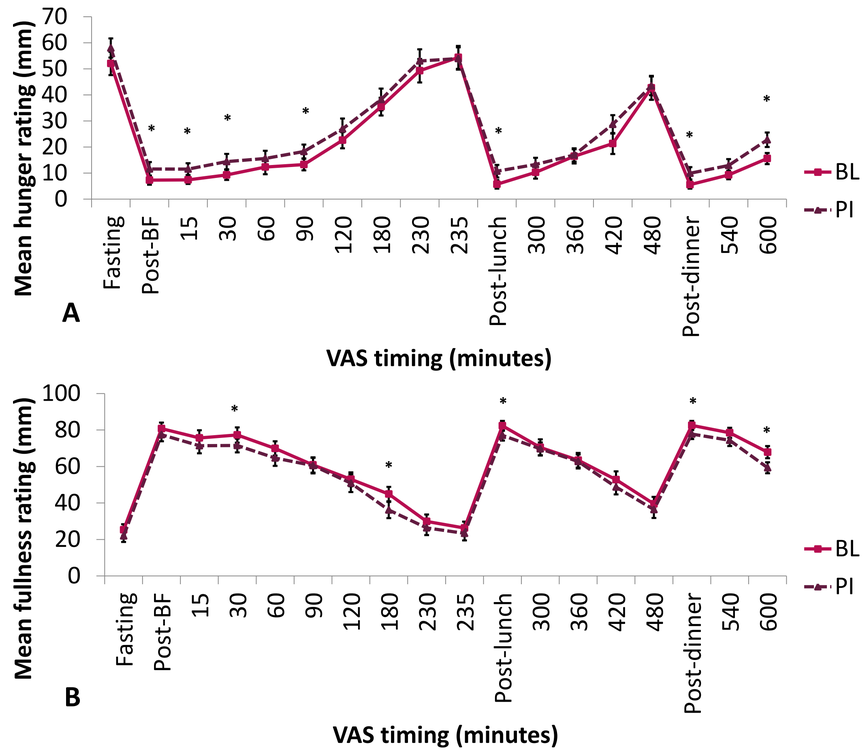

Figure 3. Visual analogue scale (VAS) hunger (A) and fullness (B) ratings during baseline and post-intervention probe days (error bars are standard error) * = p < .05 indicates significant difference between baseline and post-intervention.

- There was no compensatory reduction in NEPA [p = .99; figure 4], and no increase in SB as a result of increased structured exercise [p=.03].
- The structured exercise displaced some SB.

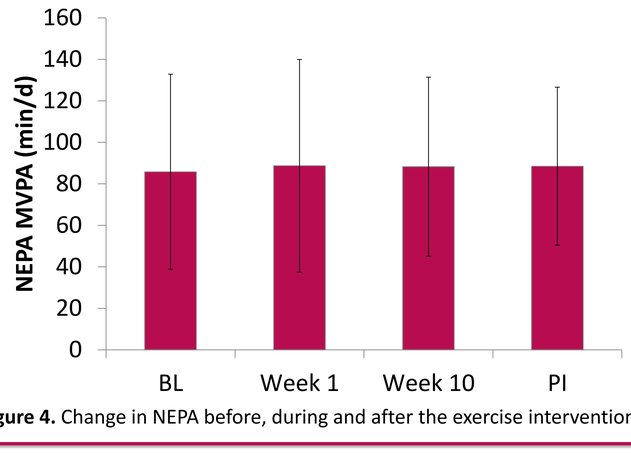

Figure 4. Change in NEPA before, during and after the exercise intervention.

Conclusions

- Twelve weeks of supervised aerobic exercise resulted in a small but significant reduction in FM and an increase in FFM. There was considerable individual variability.
- Overall, exercise increased hunger and EI which only partially compensated for the increase in energy expenditure (EE).
- There was no evidence for a compensatory reduction in NEPA or an increase in SB. The structured exercise displaced some SB.
- Dietary intervention, as an adjunct to exercise, may offset the compensatory increase in EI and result in a greater reduction in body mass.

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Acknowledgements

This research was supported by an EU project under grant agreement number 289800 (SATIN).