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Mechanisms opposing exercise-induced perturbations in energy balance in overweight women

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The effectiveness of exercise in reducing body weight is individual and may be related to variability in compensatory responses⁽¹⁾. The aim of the study was to identify the underlying mechanisms opposing exercise-induced perturbations in energy balance in overweight women.

Thirty-one healthy sedentary women (mean age 31.9 (SD 8.3) years; BMI 28.8 (SD 3.6) kg/m²; percentage body fat 39.1 (SD 4.7) participated in a supervised 8-week exercise programme, which consisted of 150 min cycling per week at an intensity of 90–95% lactate threshold. Body composition, activity energy expenditure (AEE; calculated as energy expended during all active activities including exercise sessions), inactivity energy expenditure (IEE; calculated as energy expenditure of sedentary activities), sleeping energy expenditure (SEE) and energy intake (EI) were assessed at baseline and during week 8 of the exercise programme. AEE and IEE were estimated from individual relationships between V_{O2} and V_{CO2} and heart rate (HR) and records of HR and physical-activity diaries obtained during waking hours of week 0 and week 8⁽²⁾. SEE was obtained from basal metabolic rate (BMR) measurements (Deltatrac System; Datex Instrumentation Inc., Baldwin Park, CA, USA). EI was assessed by 7 d self-recorded weighed intake. Measures of body mass and its components were taken using bioelectrical impedance scales (Tanita TBF-300; Tanita UK Ltd, Yiewsley, Middlesex, UK). Nine of the subjects achieved ≥75% predicted body-fat loss and were classified as responders (R), while another twenty-two subjects fell into the group of non-responders (NR). Changes in all variables from baseline to post-intervention assessment were compared by two-way ANOVA (group × time) with repeated measures on the ‘time’ factor and *post hoc* Tukey test was used to identify changes within a group.

There was a significant interaction ($P < 0.05$) for the change in AEE between groups R and NR, with AEE during week 8 being significantly higher ($P < 0.05$) in comparison with baseline only in group R. Changes in IEE, SEE and EI from week 0 to week 8 were not significant within both groups and not different between groups R and NR. Reported daily EI of 41% of participants was below BMR × 1.3.

Table 1. Exercise-induced changes in daily AEE, IEE, SEE and EI

| Group ... | R (n 9) | | NR (n 22) | |
|-----------|---------|------|-----------|------|
| | Mean | SD | Mean | SD |
| AEE (kJ) | 1696* | 515 | 289† | 85 |
| IEE (kJ) | -316 | 31.3 | -131 | 306 |
| SEE (kJ) | 53.6 | 92.9 | 68.2 | 50.2 |
| EI (kJ) | 561 | 756 | 1028 | 528 |

Mean value was significantly different from that for baseline within the group: * $P < 0.05$.

Interaction for change from baseline was significant between groups R and NR: † $P < 0.05$.

In conclusion, in overweight women reduction in physical activity in the non-exercise time can be expected during supervised exercise programmes and thus explain a lower-than-predicted weight loss.

1. King NA, Hopkins M, Caudwell P, Stubbs RJ & Blundell JE (2008) *Int J Obes* **32**, 177–184.
2. Moon JK & Butte NF (1996) *J Appl Phys* **81**, 1754–1761.