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Influence of exercise and body composition on fasting ghrelin, glucose, insulin and HOMA-IR in men

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Ghrelin, glucose and insulin can be influenced by exercise and body composition, and have a role in appetite control. Although, it is well established that a single exercise bout improves glucose metabolism acutely, the effects appear to diminish within 48 to 72 h[(1)]. The aim of this investigation was to assess the effects of (1) habitual exercise, and (2) a short-term exercise intervention on fasting ghrelin, glucose, insulin and HOMA-IR in men, and to explore associations with body fat and energy expenditure.

In the first cross-sectional study, forty-four men (Active: $n = 22$, Inactive: $n = 22$; range BMI 21–36 kg/m^2; range percent fat mass 9–42 %) were studied. For the second study, a subset of fifteen inactive overweight men subsequently completed a 4-wk supervised exercise intervention, consisting of 5 exercise sessions per week on a cycle ergometer. Body composition was assessed by air displacement plethysmography, activity energy expenditure (AEE) by accelerometery and fasting levels of glucose, insulin and ghrelin were taken. The measurements were repeated (≥48 h) after the final exercise session in the second study.

Active and inactive men differed significantly for a number of characteristics including ghrelin, insulin and HOMA-IR (Table 1a). When the data were pooled ($n = 44$) the strongest correlates of fasting insulin and HOMA-IR were percent fat mass ($r = 0{\cdot}57$ and $r = 0{\cdot}56$, $p < 0{\cdot}01$) and resting heart rate ($r = 0{\cdot}56$ and $r = 0{\cdot}54$, $p < 0{\cdot}01$) and the strongest correlate of ghrelin was AEE ($r = 0{\cdot}33$, $p < 0{\cdot}05$).

Following the 4-wk exercise intervention in inactive males, despite a modest reduction in body weight and fat mass and 13 % increase in VO_2max, fasting glucose, insulin and ghrelin were unchanged (Table 1b). Individual variability in response was explained mostly by changes in body fat, with changes in insulin and HOMA-IR from pre-to post-intervention being associated with changes in body fat (insulin: $r = 0{\cdot}69$, $p < 0{\cdot}01$; HOMA-IR: $r = 0{\cdot}70$, $p < 0{\cdot}01$). Change in glucose was negatively correlated with baseline glucose levels ($r = -0{\cdot}68$, $p < 0{\cdot}01$). Ghrelin did not correlate with changes in other variables or with baseline values.

Table 1a. $n = 22$ per group

	Inactive		Active		
	Mean	SE	Mean	SE	*P*-value
Weight (kg)	87·1	15·8	79·2	11·7	0·07
BMI (kg/m^2)	27·4	4·2	24·5	2·6	**0·02**
Body Fat (%)	26·2	8·7	14·3	5·8	**<0·01**
VO_2max (ml/kg/min)	35·3	6·5[1]	46·4	8·0[2]	**<0·01**
Ghrelin (ng/L)	797	341	1067	308	**0·01**
Glucose (mmol/L)	5·4	0·3	5·5	0·5	0·35
Insulin (mU/L)	8·9	4·3	4·7	2·7	**<0·01**
HOMA-IR	2·1	1·1	1·2	0·8	**<0·01**

Table 1b. $n = 15$ Pre/Post Intervention

	Pre		Post		
	Mean	SE	Mean	SE	*P*-value
Weight (kg)	95·6	13·0	94·7	13·0	**<0·01**
BMI (kg/m^2)	29·7	3·3	29·3	3·2	**<0·01**
Body Fat (%)	30·0	6·8	29·0	6·7	**0·01**
VO_2max (ml/kg/min)	34·3	5·9	38·7	5·9	**<0·01**
Ghrelin (ng/L)	805	338	761	331	0·12
Glucose (mmol/L)	5·5	0·3	5·4	0·2	0·39
Insulin (mU/L)	9·4	4·7	8·7	4·2	0·19
HOMA-IR	2·3	1·2	2·1	1·1	0·20

P-value: Independent t-test (Table 1a), Paired t-test (Table 1b). [1]$n = 19$, [2]$n = 13$.

In conclusion, fasting ghrelin is higher and insulin and HOMA-IR lower in active compared to inactive men. Despite significant improvements in VO_2max, four weeks of exercise training did not alter these measures in inactive overweight men. In the absence of acute exercise effects, these markers may only adapt to a greater volume of exercise or changes in other characteristics associated with regular exercise including reduced fat mass. Findings support the view that exercise should be performed on a regular basis or to induce a greater reduction in fat mass to improve fasting insulin and HOMA-IR. Further work is required to examine implications of these findings for food intake regulation with exercise.

1. Ross R (2003) *Diab Care* **26**, 944–945.