

Aberrant cardiopulmonary function during exercise testing and exercise intolerance in relation to cardiometabolic health in obese adolescents

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INTRODUCTION

Adults with obesity may display a disturbed cardiopulmonary function and impaired exercise capacity during maximal cardiopulmonary exercise testing (CPET), which relates to a worse cardiometabolic health and prognosis. In obese adolescents it remains uncertain whether specific cardiopulmonary abnormalities and exercise intolerance during CPET relate to cardiometabolic risk.

AIM

To compare cardiopulmonary parameters and exercise tolerance during CPET between obese and lean adolescents, and to examine associations between aberrant CPET parameters or exercise intolerance and cardiometabolic health in obese adolescents.

MATERIAL & METHODS

- Observational cross-sectional design
- 60 obese and 44 lean adolescents (12-16 years)
- Free of chronic cardiovascular, renal, pulmonary or orthopedic disease

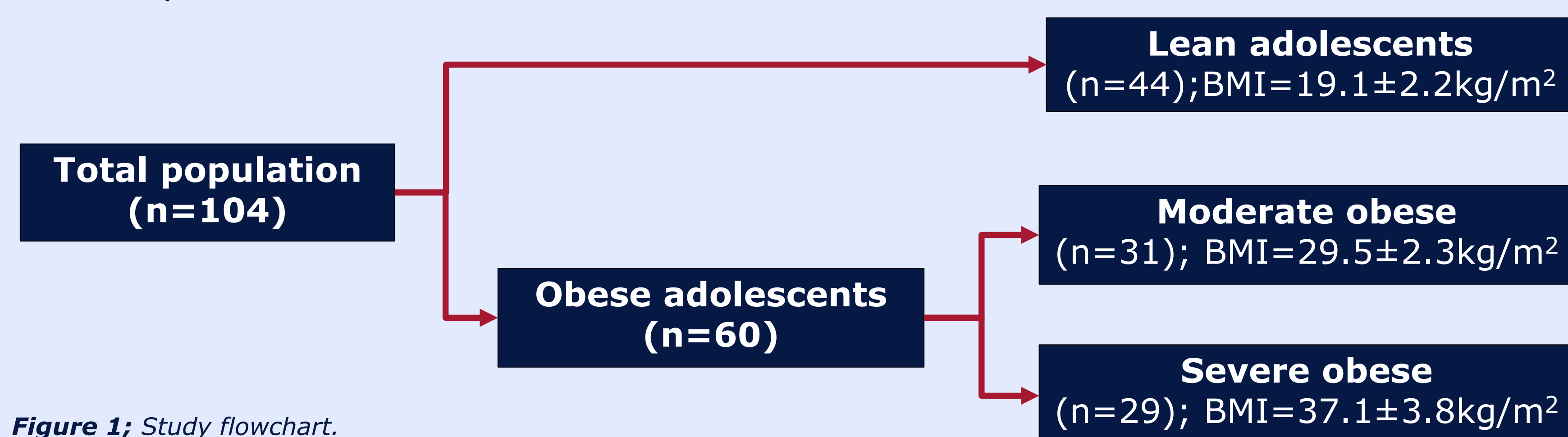


Figure 1; Study flowchart.

RESULTS

Table 1; Cardiopulmonary function during CPET in obese and lean adolescents.

Peak values	Lean (n=44)	Moderate obese (n=31)	Severe obese (n=29)	p-value
Oxygen uptake (ml/min)	2359 ± 642	2065 ± 444	2268 ± 492	0.087
Cycling power output (W)	186 ± 47	152 ± 36*	156 ± 35*	0.002
W per VO ₂ (W/ml/min)	80.1 ± 10.1	74.0 ± 9.0*	69.1 ± 10.1*	<0.001
Mechanical efficiency	0.22 ± 0.02	0.20 ± 0.02*	0.19 ± 0.03*	<0.001
Minute ventilation (l/min)	84 ± 23	71 ± 18*	76 ± 18	0.015
Breathing frequency (breaths/min)	44 ± 8	39 ± 8*	40 ± 7	0.021
Heart rate (bpm)	188 ± 9	183 ± 12	181 ± 13	0.062
Respiratory exchange ratio	1.20 ± 0.08	1.18 ± 0.09	1.16 ± 0.07	0.051

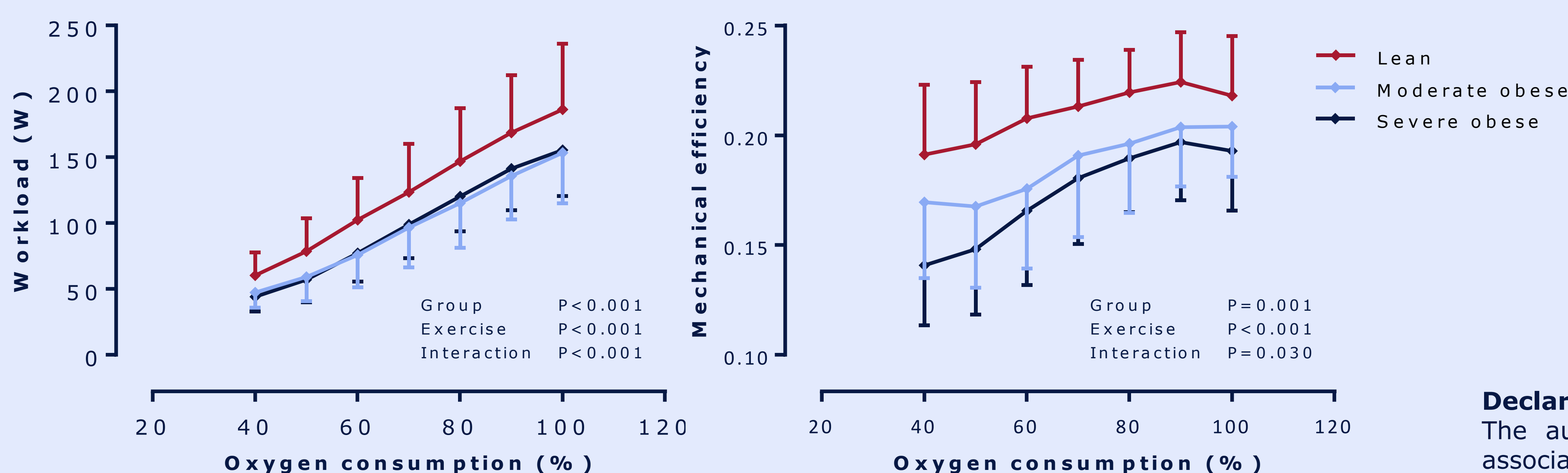


Figure 3; Cycling power output and the mechanical efficiency in relation to percentage of peak oxygen uptake in lean and obese subjects during exercise testing.

One-day hospitalization

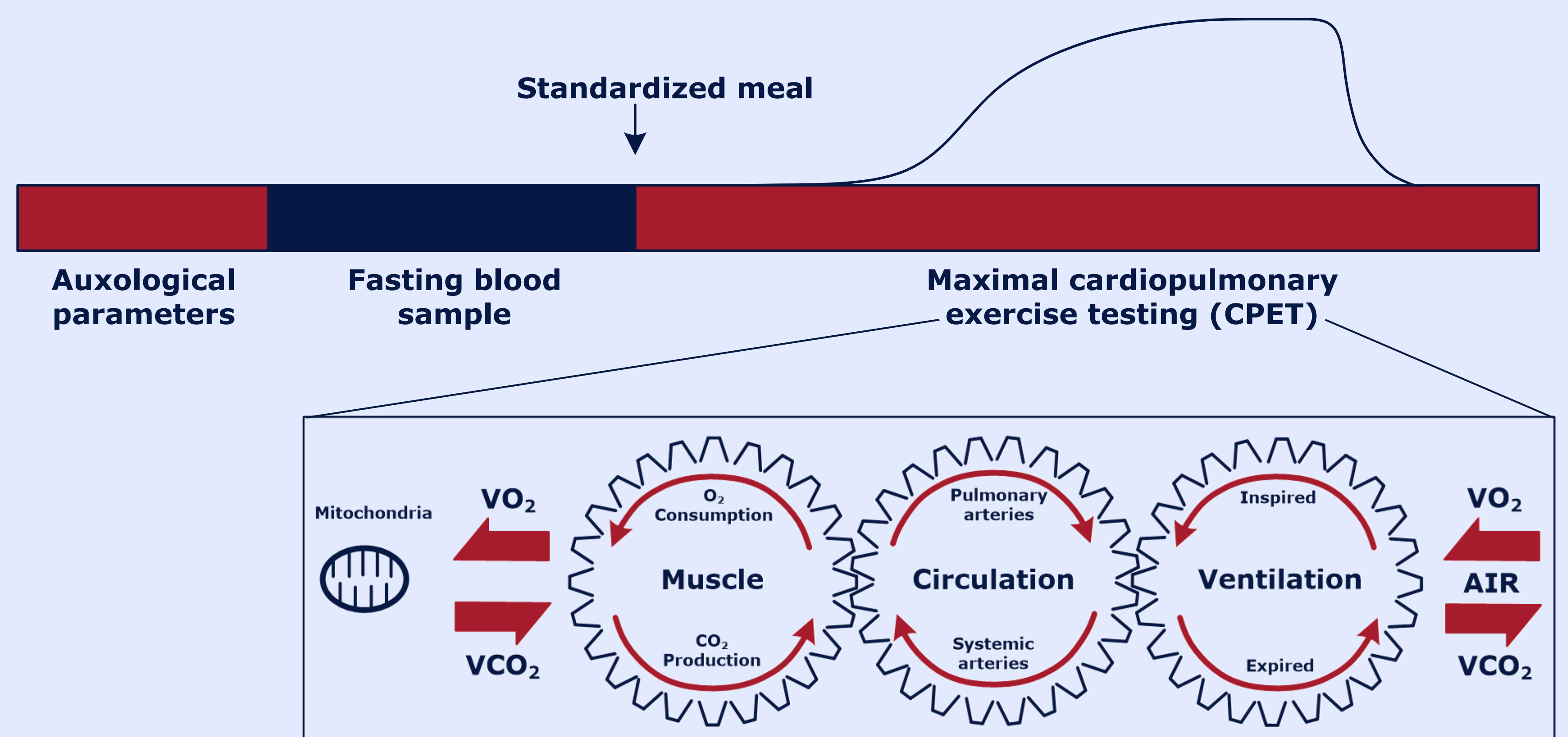


Figure 2; Schematic representation of different measurements at various time points during a one-day hospitalization. Subjects underwent measurements in exact chronology.

Table 2; Multivariate regression analyses explaining aberrant cardiopulmonary parameters.

	Adjusted r ²	SC (B)	p-value
Workload	0.611		<0.001
Body height		0.370	<0.001
Haemoglobin		0.260	0.002
Leptin		-0.241	0.006
Triglycerides/hdl ratio		-0.206	0.009
W/VO₂	0.294		<0.001
Fasting glucose		-0.438	<0.001
QRS width		-0.283	0.003
Mechanical efficiency	0.214		<0.001
Leptin		-0.452	<0.001
Minute ventilation	0.419		<0.001
Leptin		-0.279	0.002
Breathing frequency	0.218		<0.001
Leptin		-0.252	0.012

Regression model was corrected for age, sex and Tanner stage. P-value <0.05 (2-tailed) was considered statistically significant.

CONCLUSION

In obese adolescents specific cardiopulmonary parameters deviate during CPET and peak workload capacity is lowered, which relate to altered blood and electrocardiographic parameters. These data highlight the relevance of CPET in the clinical evaluation of obese adolescents, and the impact of obesity on health.

Declaration of interest

The authors declare that there is no conflict of interest associated with this publication

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