Faculty Medicine and Life Sciences

An impaired cardiac diastolic function and adverse cardiac remodelling independently relates to hyperinsulinemia and insulin resistance in obese adolescents, but not to cardiopulmonary exercise capacity

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INTRODUCTION

The metabolic syndrome has a significant effect on cardiac health and is a predictor of cardiovascular disease in adulthood (Figure 1). **Evidence for cardiac dysfunction is accumulating in adolescents with obesity**. However, which cardiometabolic disease risk factors relate to cardiac dysfunction, and whether a cardiac dysfunction relates to a worse cardiopulmonary exercise capacity, remains to be clarified in obese adolescents.

AIM

To examine associations between cardiac structure/ function and cardiometabolic disease risk factors or cardiopulmonary exercise capacity in obese adolescents, to gain greater insights in the aetiology and clinical consequences of cardiac dysfunction.

MATERIAL & METHODS

- Observational cross-sectional design
- 29 obese and 29 lean adolescents (12-16 years)
- Free of chronic cardiovascular, renal, pulmonary or orthopedic disease

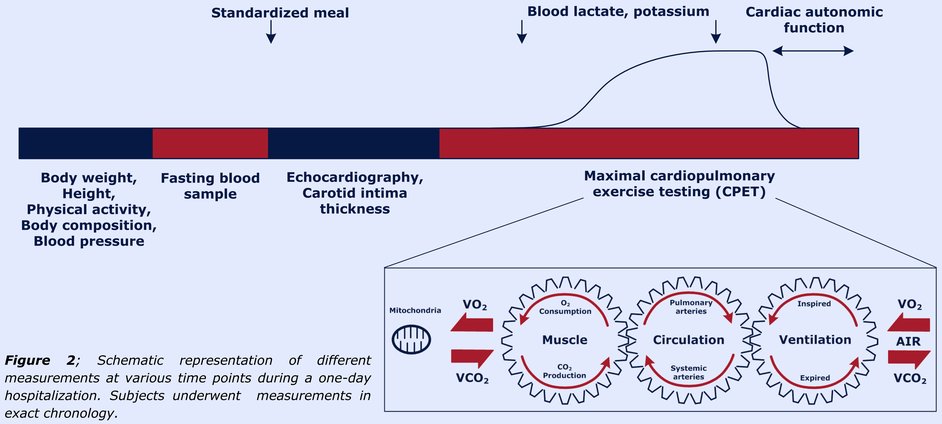

***Figure 2**; Schematic representation of different measurements at various time points during a one-day hospitalization. Subjects underwent measurements in exact chronology.*

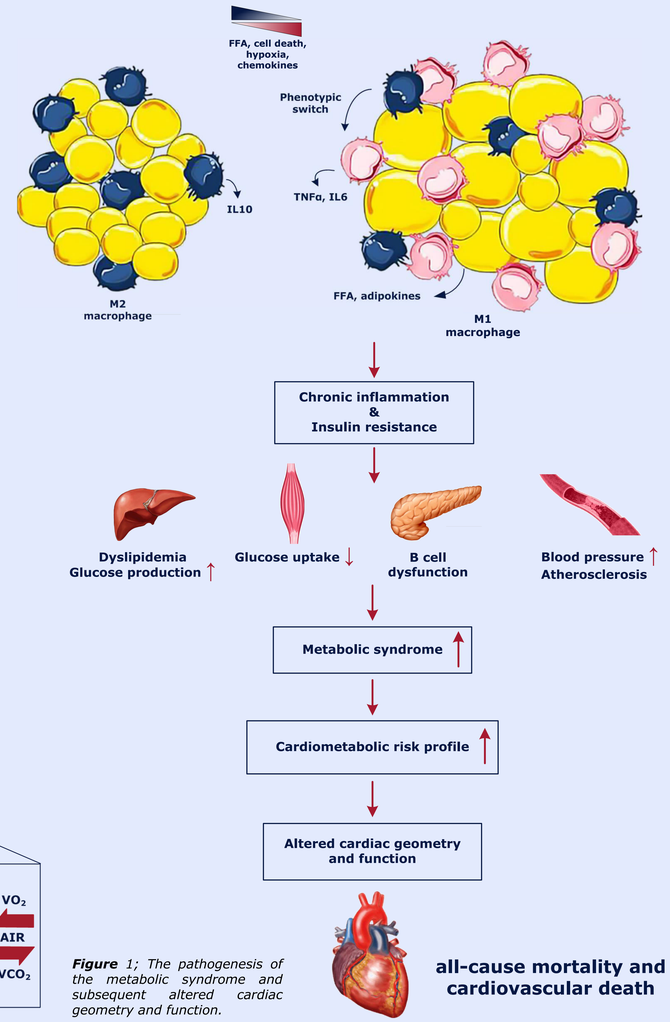

***Figure 1**; The pathogenesis of the metabolic syndrome and subsequent altered cardiac geometry and function.*

RESULTS

***Table 1**; Morphological and functional echocardiographic parameters of obese and lean adolescents.*

	Obese (n = 29)	Lean (n = 29)	p-value
LV dimensions			
LV septum thickness (mm)	8 ± 1	7 ± 1	**0.003**
LV diameter (mm)	46 ± 4	46 ± 4	0.925
LA dimensions			
LA diameter (mm)	34 ± 5	29 ± 4	**<0.001**
LV systolic function			
Cardiac output (l/min)	5.2 ± 1.1	4.7 ± 1.1	0.167
LV ejection fraction (%)	61 ± 6	60 ± 6	0.706
LV diastolic function			
Mitral E wave velocity (cm/s)	85 ± 16	83 ± 14	0.502
Mitral A wave velocity (cm/s)	53 ± 15	46 ± 8	**0.028**
E/A ratio	1.7 ± 0.5	1.8 ± 0.4	0.160
Mitral deceleration time (ms)	153 ± 24	147 ± 27	0.373
Mitral e' wave velocity (cm/s)	9 ± 2	11 ± 3	**0.009**
E/e' ratio	9.2 ± 1.8	7.8 ± 1.6	**0.005**

Abbreviations: LV: Left ventricular, LA: Left atrium. P-value <0.05 (2-tailed) was considered statistically significant.

***Table 2**; Multivariate regression analyses explaining aberrant echocardiographic parameters.*

	R^2 adjusted	SC (B)	p-value
LV septum thickness (mm)	0.119		
Fasting insulin (µU/l)		0.368	**0.006**
LA diameter (mm)	0.219		
HOMA-IR		0.482	**<0.001**
Mitral A wave velocity (cm/s)	0.113		
CRP (mg/l)		0.358	**0.006**
E/e' ratio	0.300		
HOMA-IR		0.378	**0.004**
Uric acid (mg/dl)		0.321	**0.013**
Mitral e' wave velocity (cm/s)	0.183		
Fasting insulin (µU/l)		-0.446	**0.001**

Abbreviations: LV: Left ventricular, LA: Left atrium, CRP: C-reactive protein, HOMA-IR: Homeostatic Model Assessment of Insulin Resistance. Regression model was corrected for age, sex and Tanner stage.
P-value <0.05 (2-tailed) was considered statistically significant.

CONCLUSION

In obese adolescents a **worse cardiac diastolic function** was **independently related to hyperinsulinemia and insulin resistance**. Such worse cardiac diastolic function was not related to cardiopulmonary exercise capacity.