Relation between cardiac function and anthropometric parameters in overweight and obese school boys

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Introduction: Nowadays approximately 42 million children under the age of five are overweight or obese worldwide. Childhood obesity has doubled in the past 30 years worldwide. According to official statistics in Ukraine, the prevalence of obesity among adolescents has increased 2.5 times over the past ten years [1]. Strong evidence shows the increase in childhood obesity has led to significant increases in heart disease risk factors, including type 2 diabetes, high blood pressure and high cholesterol. Of the adolescents who are overweight or obese, up to 60 % have at least one risk factor for cardiovascular disease. Obesity-related heart disease contributes to premature death. Being overweight or obese at a young age is linked to several health and economic consequences and it is, therefore, important to study causes and risk factors and identify the best prevention and treatment strategies.

The result of our previous epidemiological study of 277 school boys in Ternopil city (Ukraine) demonstrated that the prevalence of overweight and obesity among pupils are 7.6 % and 2.7 % respectively [2].

The aim of our current study is to identify the correlation between anthropometrical parameters of a body and some metabolic data with echocardiography data in obese school boys.

Methods and results: 45 obese school boys 10-16 years old were involved in the study. Echocardiography was performed under standard conditions and by standard technique. The recordings and measurements were obtained in accordance with the Recommendations for Chamber Quantification [3]. In order to assess systolic heart function M-mode Images under guidance of two dimensional (2D) echocardiography were obtained in the standard views (parasternal and apical views) and included the following measurements: Aorta Diameter (AD), Left atrium Diameter (LAD), Interventricular septum (IVS), Posterior Wall (PW), Left Ventricular End Systolic Diameter (LVESD); Left Ventricular End Diastolic Diameter (LVEDD); Left Ventricular Mass (LVM), Left Ventricular Systolic Volume (LVSV), Left Ventricular Diastolic Volume (LVDV), Ejection Fraction (EF). To assess the physical development of each child, measurements of body weight, height, waist (WC) and hip circumferences (HC) and body mass index (BMI) were matched. Waist circumferences (WC) were measured at midpoint between the last rib and the top of the iliac crest and evaluated by percentile charts for European-American children [4]. Hip circumference (HC) was measured at the maximum protuberance of the buttocks in a standing position.

Correlation was used to relate two numerical variables. A statistically significant level was considered when p value was less than 0.05. Pearson Correlation analysis was used to assess the strength of association between two variables. The correlation coefficient, denoted symbolically r, defines the strength and direction of the linear relationship between two variables.

Results: The strongest direct correlation was found between waist, hip circumferences and structural parameters (aorta diameter, left atrial diameter, left ventricular dimensions in diastole and systole, LV mass), r=0,515-0,798, p<0.001), that indicates LV hypertrophy. Similarly, functional values, like LVESD and LVEDD directly correlated with waist and hip circumferences (r=0,606-0,688, p<0.001). At the same time, we didn't find direct relation between BMI and any structural or functional parameters of heart, also ejection fraction was not directly related to anthropometric body parameters (tab. 1).

Table 1 Correlation (r) between cardiac function and anthropometric parameters in overweight and obese school boys

	AD	LAD	IVS	PW	LVESD	LVEDD	LV M	LV SV	LV DV	EF
BMI	0,489	0,321	0,266	0,143	0,242	0,256	0,279	0,266	0,41	-0,254
WC	0,798*	0,515*	0,496	0,473	0,616*	0,524*	0,572*	0,606*	0,688*	-0,385
HC	0,705*	0,552*	0,494	0,384	0,657*	0,515*	0,531*	0,620*	0,667*	-0,423

Also parameters of lipid profile, level of Thyroid-stimulating hormone, blood fasting glucose and after 2 hours loading were checked in our patients .

Our research identified no relation between structural parameters of heart and biochemical levels of glucose and almost all lipid fractions, but confirmed strong direct correlation between TSH and Interventricular septum, and strong opposite correlation of LVM and LVDV with level of TSH (tab. 2).

Table 2 Correlation (r) between cardiac function and metabolic parameters in overweight and obese school boys

	AD	LAD	IVS	PW	LVESD	LVEDD	LV M	LV SV	LV DV	EF
Fasting glucose	0,398	0,241	0,300	0,296	0,362	0,324	0,193	0,325	0,307	-0,312
Glucose 2 hours after loading	-0,419	-0,382	-0,068	-0,004	-0,009	0,022	-0,003	0,008	0,015	0,042
Total Cholesterol	-0,27	-0,112	0,005	0,061	-0,221	-0,12	-0,054	-0,215	-0,135	0,317
HDL cholesterol	-0,386	-0,538*	-0,473	-0,279	-0,54	-0,487	-0,487	-0,479	-0,516*	0,290
LDL cholesterol	0,017	0,110	-0,022	0,110	-0,084	0,108	0,076	-0,111	0,052	0,350
Thyroid-stimulating hormone	-0,463	-0,222	0,555*	-0,450	-0,469	-0,499	-0,520*	-0,445	-0,526*	0,101

Summary: Our research showed that abdominal obesity in school boys has direct effect on heart function, which means that excessive body fat might negatively affect cardiac health during childhood.

Similar results were received in some other studies [5,6], which presented that cardio-metabolic risk factors were more prevalent in children and adolescents with abdominal obesity than in those who are overweight or generally obese. Therefore, more attention should be paid to abdominal obesity of children and adolescents both in clinical practice and in epidemiological studies. Such simple measurements like waist and hip circumferences in school boys may be used as screening tests for further detailed examination of heart structure and function in obese boys.

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