Echocardiographic Evaluation of Left Ventricular Function in Normotansive Obese Children: A Comparative Analysis According to Body Mass Index

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Objective

The purpose of our study was to determine in normotansive overweight and obese children structural and functional changes on the left ventricular function (LV) according to body mass index (BMI).

Materials-Methods

Normotansive 30 children with overweight (group 2) (mean age: 13.2±2.1 years, BMI: 25-30 kg/m2), and 30 children obesity (group 3) (mean age: 13.3±2.0 years, BMI ≥30kg/m2), and 30 healthy controls (group 1) (BMI: 18-24.9 kg/m2) were included in this study. Continuous ambulatory pressure monitoring in obese groups, standard and pulsed wave (PW) Doppler echocardiographic examination have been evaluated in all study groups. The independent t test, analysis of variance test (ANOVA, ANCOVA), Tukey HSD, Pearson and Spearman's correlation models were used for analysis.

Results

Clinical and demographic features obtained from study groups are presented in (Table 1).

Table 1. Clinical and demographic features obtained from study groups

	Obese group (n=60)	Control Group (n=50)	*p*
Age (year)	13.2±2.0 (10-16.5)	13.2±1.8 (10-16.5)	0.90
BMI (kg/m^2)	30.1±3.3	19.7±1.6	**<0.001**
BMIsds	2.3±0.5	-0.15±0.6	**<0.001**
Duration of obesity (year)	3.7±1.3	-	
Pubertal stage	2.7±0.5	2.6±0.5	0.36
Gender	28M /32F	27M / 23F	0.46
Systolic blood pressure (SBP) (mmHg)	106.8±8.5	98.5±10.3	**<0.001**
Diastolic blood pressure (DBP) (mmHg)	66.9±5.9	64.9±4.6	0.59
24-hour SBP (mmHg)	110.7±14.6	-	
24 -hour DBP (mmHg)	61.4±6.3	-	
Heart rate (beat/minute)	84.1±10.7	77.5±8.3	**0.01**
Insulin (mIU/ml)	14.2±11.6	-	
Glucose (mmol/L)	90.1±7.4	-	
HOMA-IR	3±2.6	-	

M: male F: female

In overweight and obese children left atrial volume, left atrial/aortic root diameter ratio, LV interventricular septum and posterior wall thickness, LV end-diastolic diameter and volume, LV mass were significantly higher compared to the control group (p<0.01). Blood pressure was within the normal range but increased control group in obese groups. Transmitral E/A and pulmonary vein (PV) systolic/diastolic velocities (S/D) ratio were decreased, but E-wave deceleration time, PVA velocities and end-diastolic distance from the mitral annulus to the LV apex were increased in both obese groups (p<0.05). The standard and tissue Doppler echocardiography findings according to BMI are shown in Table 2. BMI was a significant correlated with duration of obesity and LV mass (r=0.527, r=0.506, p<0.01, respectively). Significantly negative correlation was found between BMI, Mitral E/A, and PV S/D ratio (r=-0.230, r=-0.577, p<0.01, respectively).

Conclusion

In our study subclinical LV myocardial dysfunction was noted in obese subgroups. Determination of diastolic dysfunction by PV PW Doppler can be usefull a pre-obese period.

Table 2. Comparison of LV conventional and PW Doppler echocardiographic parameters between groups

Echocardiographic parameters	BMI<25 (n:50) Group 1	BMI:25-29.9 (n:30) Group 2	BMI≥30 (n:30) Group 3	P Group 1-2	P Group 1- 3	P Group 2 -3
IVSEDT (mm)	7.6±1.1	9.7±1.3	10.6±1.6	**<0.001** **<0.001***	**<0.001** **<0.001***	**0.02** **0.04***
LVEDD (mm)	40.9±3.5	45.1±1.9	45.8±2.5	**<0.001** **<0.001***	**<0.001** **<0.001***	0.68 0.90*
LVEDPWT (mm)	7.3±1.0	9.3±1.2	10.3±1.6	**<0.001** **<0.001***	**<0.001** **<0.001***	**0.01** **0.01***
LVEST (mm)	25.8±2.5	28±2.0	28.8±2.2	**<0.001** **0.002***	**<0.001** **<0.001***	0.54 0.81*
Ejection fraction (%)	68.1±3.1	65.5±12.2	67.7±3.3	0.68	0.89	0.91
Left atrium/aortic ratio	1.2±0.1	1.3±0.14	1.3±0.2	**0.01** **0.01***	**<0.001** **0.01***	0.34 0.57*
Aortic velocity (m/s)	0.94±0.1	1.1±0.11	1.1±0.09	**<0.001** **<0.001***	**<0.001** **<0.001***	0.78 0.91*
LVEDV (ml)	20.1±4.4	27.3±5.8	31.2±4.4	**<0.001** **<0.001***	**<0.001** **<0.001***	**0.02** **0.03***
LAEDVI (ml/m^2)	14.6±2.5	17.1±2.8	17.6±2.4	**<0.001** **<0.001***	**0.01** **0.01***	0.77 0.94*
LVEDV (ml)	65.9±8.2	92.2±11.9	99.1±17.5	**<0.001** **<0.001***	**<0.001** **<0.001***	**0.08** 0.21*
LVEDVI (ml/m^2)	47.8±5.9	54.1±5.1	52.7±7.9	**<0.001** **<0.001***	**0.01** **<0.001***	0.54 0.91*
Left ventricular mass (LVM) (g)	112.5±26	181.8±33.8	213.3±46	**<0.001** **<0.001***	**<0.001** **<0.001***	**0.01** **0.01***
LVM index (g/m^2)	79.9±12.4	105±17.5	111.2±20.6	**<0.001** **<0.001***	**<0.001** **<0.001***	0.38 0.61*
End-diastolic left ventricular apex-mitral annulus distance (cm)	5.9±1.0	6.4±0.52	6.42±0.7	**0.01** **0.03***	**0.01** **0.01***	**0.05** 0.76*
Early/late diastolic mitral inflow velocity	2.0±0.2	1.5±0.15	1.4±0.2	**<0.001** **<0.001***	**<0.001** **<0.001***	0.88 0.91*
E-DT (ms)	113.0±6.4	126.2±9.7	128.2±12.6	**<0.001** **<0.001***	**<0.001** **<0.001***	0.98# 0.54*#
PV systole / PVdiastole	1.1±0.9	0.93±0.11	0.91±0.06	**<0.001** **<0.001***	**<0.001** **<0.001***	0.70 0.87*
PVa (m/s)	0.21±0.03	0.28±0.03	0.28±0.02	**<0.001** **<0.001***	**<0.001** **<0.001***	0.82 0.99*#

P<0.05 was accepted as statistically significant. Values were expressed as mean±standart deviation.

P values that calculated by analysis of variance (ANOVA) test for comparison of groups. for the influence of blood pressure by ANCOVA, for comparing two groups by Tukey HSD and Tamhane **(#)** Post-Hoc test

IVSEDT, interventricular septum end-diastolic thickness; LVEDD, left ventricular end-diastolic diameter;

LVEDPWT, left ventricular end-diastolic posterior wall thickness; LVEST, left ventricular end-systolic thickness; LAEDV, left atrial end-diastolic volume; LAEDVI, left atrial end-diastolic volume index; LVEDV,left ventricular end-diastolic volume; LVEDVI, left ventricular end-diastolic volume; E-DT, early diastolic mitral deceleration time; PV, pulmonary vein; PVa, pulmonary venous retrograde flow