

Assessment of cardiometabolic risk factor clustering in obese children and adolescents with metabolic syndrome

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BACKGROUND

Obesity in childhood and adolescence has reached epidemic proportions. Endothelial dysfunction, as a consequence of dyslipidemia, hypertension, insulin resistance and inflammation, imposes a substantial risk for the development of metabolic syndrome (MS) in childhood and compromises the health of children and adolescents by promoting premature development of atherosclerotic cardiovascular disease (CVD).

AIM To investigate the cardiovascular risk in obese children and adolescents with MS compared with their age-, sex- and BMI- matched counterparts without MS.

METHODS Eighty eight (n=88) obese children and adolescents [mean age ± SD: 13.1 ± 1.9 years; 53 males (60.2%) and 35 females (39.8%); 14 prepubertal (15.9%) and 74 pubertal (84.1%)] with MS and sixty (n= 60) obese children and adolescents without MS [12.2 ± 2.1 years; 37 males (61.7%) and 23 females (38.3%); 18 prepubertal (30%) and 42 pubertal (70%)] were studied prospectively for one year. All participants received personalized advice on diet and exercise, while 26 (29.5%) participants in the MS group and 13 (21.7%) participants in the control group also received metformin. Biochemical and endocrinologic investigations, oral glucose tolerance test, echocardiography, ultrasonography of the carotid arteries and liver were performed at the beginning and at the end of study.

RESULTS Systolic (SBP) and diastolic (DBP) blood pressure was significantly higher in children with MS (127.9±13.1 and 76.7±11.3 mmHg, respectively) than those without MS (116.6±10.5 and 68.2±9.2 mmHg, P<0.001). At the beginning of the study (t₀), subjects with MS had significantly lower concentrations of HDL [39.1±1.2 vs. 45.2±1.2 mg/dL, p<0.001], and higher concentrations of triglycerides (125.1±1.6 vs. 86.5±1.5 mg/dL, p<0.001) and serum insulin (30.4±1.6 vs. 20.7±1.4 μU/mL, p<0.001) compared with the control group. The carotid intima-media thickness (cIMT) at t₀ was 0.8±1.1 mm in the MS group and 0.7±1.1 mm in the non MS group, respectively (normal range: 0.49±0.03 mm), whereas after 1 year of intervention cIMT_{t12} improved significantly only in children with MS (0.5±0.2 mm, p<0.05). Furthermore, patients with MS and ≥ 3 risk factors had significantly higher cIMT compared to those with 2 or less risk factors. Interventricular septal end diastole (IVSd) and systole (IVSs) were significantly higher in patients with MS (8.4±1.7 mm and 9.0±1.3 mm, respectively) than the control group (7.8±1.2 mm and 8.2±1.3 mm, p<0.05). Hepatic steatosis was identified in 69 (78%) of the participants with MS and in 34 (56.7%) obese without MS.

SONOGRAPIC INDICES EVALUATED	
Echocardiography:	
Interventricular septal end diastole (IVSd) and systole (IVSs)	
Ultrasound of the carotid arteries :	
Carotid intima-media thickness (cIMT)	
Right and left internal carotid arteries (RICA, LICA)	

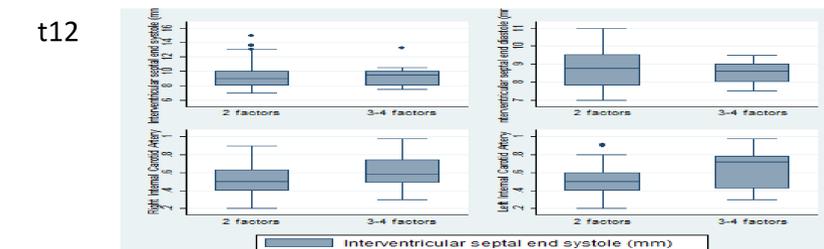
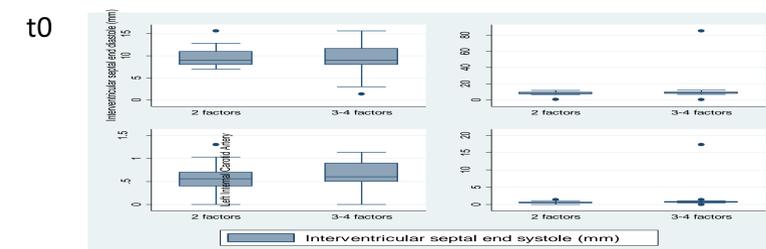
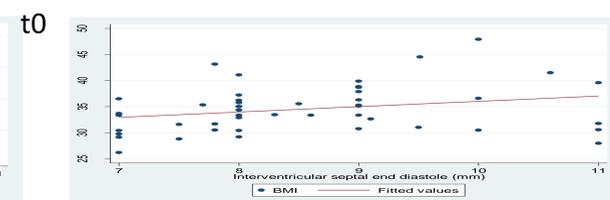
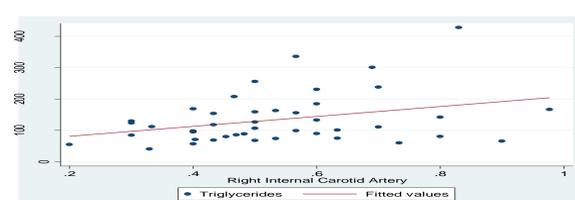
BIOCHEMICAL & ENDOCRINOLOGIC TEST	MS t0 MEAN ± SD	Non-MS t0 MEAN ± SD	MS t12 MEAN ± SD	Non-MS t12 MEAN ± SD
Plasma glucose (mg/dL)	85.6 ± 9.7	87.2 ± 8.0	91.0 ± 7.0	89.4 ± 5.5
Serum insulin (μU/mL)	30.4 ± 1.6	20.7 ± 1.4	31.3 ± 15.9	21.2 ± 5.5
HbA1c %	5.3 ± 0.2	5.2 ± 0.2	5.2 ± 0.2	5.3 ± 0.1
Cholesterol (mg/dL)	158.8 ± 29.1	158.3 ± 33.7	160.7 ± 41.8	156.0 ± 29.1
Triglycerides (mg/dL)	142.8 ± 66.4	94.6 ± 32.0	132.5 ± 78.1	97.6 ± 40.9
HDL (mg/dL)	38.7 ± 8.3	47.6 ± 10.5	41.0 ± 7.6	47.6 ± 7.6
LD L (mg/dL)	91.5 ± 26.3	89.6 ± 32.1	91.3 ± 26.1	89.0 ± 26.8
ApoA (mg/dL)	122.0 ± 17.1	138.9 ± 19.1	124.7 ± 14.4	138.3 ± 19.2
ApoB (mg/dL)	91.0 ± 21.3	88.1 ± 20.5	87.4 ± 18.8	82.8 ± 19.0
Lp(a) (mg/dL)	18.1 ± 22.4	14.9 ± 14.1	18.5 ± 23.1	12.4 ± 10.5

Fisrt year t0	Children with MS	Children without MS	p-value
	N (%)	N (%)	
RICA [N(Median, IQR)]	88 (0.6, 0.5 – 0.8)	60 (0.5, 0.3 – 0.6)	< 0.001
LICA [N(Median, IQR)]	88 (0.6, 0.4 – 0.8)	60 (0.5, 0.3 – 0.6)	< 0.001
CHILDREN WITH MS t0	2 Factors of MS	≥ 3 Factors f MS	p-value
RICA [N(Mean, Std)]	55 (0.6, 0.3)	33 (0.7, 0.2)	0.034
LICA [N(Median, IQR)]	55 (0.5, 0.4 – 0.7)	33 (0.7, 0.6 – 0.9)	0.003
IVSd [N(Median, IQR)]	46 (8.2, 7.6 – 9.9)	32 (8.5, 7.9 – 10.0)	0.482
IVSs [N(Median, IQR)]	48 (9.0, 8.0 – 11.0)	32 (9.0, 8.0 – 11.9)	0.945

§ t-test & mann-whitney u test

After a year of intervention t12	Children with MS	Children without MS	p-value
	N (%)	N (%)	
RICA [N(Mean, Std)]	45 (0.5, 0.2)	17 (0.6, 0.1)	0.623
LICA [N(Mean, Std)]	45 (0.7, 1.1)	17 (0.7, 1.1)	0.862
CHILDREN WITH MS t12	2 Factors of MS	≥ 3 Factors of MS	p-value
RICA [N(Median, IQR)]	25 (0.5, 0.4 – 0.6)	11 (0.6, 0.5 – 0.8)	0.135
LICA [N(Mean, Std)]	25 (0.5, 0.2)	11 (0.7, 0.2)	0.210
IVSd [N(Mean, Std)]	25 (8.8, 1.3)	11 (8.5, 0.7)	0.555
IVSs [N(Median, IQR)]	25 (9.0, 8.0 – 10.0)	11 (9.5, 8.0 – 10.0)	0.862

§ t-test & mann-whitney u test



CONCLUSIONS

Our findings demonstrate increased cardiovascular risk in children and adolescents with MS, as well as an improvement in certain cardiovascular parameters following intervention.