Effect of three-month diet and physical activity on adipokines and inflammatory status in children with metabolic syndrome

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Abstract: The prevalence of metabolic syndrome (MetS) in young population continues to rise. Obesity is a chronic inflammatory disorder in which leptin, adiponectin and C reactive protein (CRP) play an important role. This study aimed to determine whether these adipokines are significant markers in defining MetS in pediatric population and to assess the effect of hypocaloric diet and physical activity on serum concentrations of adiponectine, leptin, and high sensitivity CRP (hs-CRP).Material and methods: A prospective study was conducted over a period of 1 year, between January 2015 and December 2016, on 66 cases of obesity in children diagnosed at the Louis Ţurcanu Emergency Hospital for Children Timişoara. The patients diagnosed with MetS were put on diet and physical exercise for 3 months. Results: MetS was present in 63.6% of obese children.
There was a significant and positive correlation between MetS and both leptin and hs-CRP, and a significant, negative correlation between MetS and adiponectin. After diet and physical activity 3 patients no longer met the criteria for MetS. Leptin, adiponectin and hs-CRP concentrations statistically improved after a three-month diet and physical activity program.Conclusions: hs-CRP, leptin and adiponectin can be used as predictors of cardiovascular risk in pediatric population. Diet and physical activity have an impact on the metabolic status.
Key words: adiponectin, leptin, hs-CRP, child obesity

Introduction

As the obese population continues to rise, the prevalence of MetS is increasing in both children and adolescents.Prevalence of MetS and its components increases strongly with age, but unfortunately it can also be diagnosed in infants. As indicated in previous studies, children and adolescents with risk factors such as obesity, dyslipidemia, elevated blood pressure and impaired glucose metabolism are at increased risk of developing atherosclerosis in adulthood. It has been found that obesity results in the early onset of adulthood chronic disease such as cardio-cerebrovascular disease.

Material and Methods

This study aimed to investigate the relationship between markers of adiposity like leptin, adiponectin and hs-CRP in obese children, and to determine whether these adipokines are significant markers in defining MetS in pediatric population; a further goal was to assess the effect of hypocaloric diet on serum adiponectine, leptin, and hsCRP concentrations.

We tested the hypothesis that long-term lifestyle changes and moderate weight loss would reduce the plasma concentrations of adipokines involved in inflammation, angiogenesis, and chemotaxis and would increase adiponectin concentrations.

Material and methods:

A prospective study : 1 year (January 2015 and December 2016)

66 cases of obesity in children diagnosed at the Louis Ţurcanu Emergency Hospital for Children Timisoara.

The patients diagnosed with MetS were put on diet and physical exercise for 3 months

Subjects were considered obese on the basis of age specific BMI reference guidelines from CDC Prevention Child Growth Standards 2000 (above 95th percentile).

MetS was defined using Weiss criteria.

Hs-CRP was determined by immunonephelometry from serum samples and processed in a BN ProSpec® system (Siemens Healthcare Diagnostics Inc.) (undetected if < 0.02 mg/dl).

Quantitative measurements of serum leptin and adiponectin levels were performed using commercially available enzyme-linked immunosorbent assay kits (Antisel and Diamedix).

Exclusion criteria were obesity caused by endocrine disease, syndromic obesity, systemic disease or acute illness.

We analyzed 66 patients diagnosed with obesity.

The data are expressed as means ± standard deviation or as frequencies.

Statistical analysis was performed with SPPS. A $p<0.05$ was considered statistically significant.

Consent was obtained from the parents and the Ethical Committee of the hospital.

Results and Discussions

Table 1- Anthropometric and metabolic characteristics of the obese group

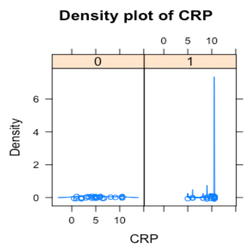
	N	Range	Minimum	Maximum	Mean
	Statistic	Statistic	Statistic	Statistic	Statistic
Age (years)	66	13	5	18	11.82
sex	66	1.0	1.0	2.0	1.485
BMI kg/m2	66	26.00	22.00	48.00	30.54
SBP mmHg	66	50	108	158	127.59
DBP mmHg	66	48	59	107	77.73
Cholesterol mmol/l	66	3.00	2.00	5.00	3.6364
LDLc mmol/l	66	2.00	1.00	3.00	2.0455
HDLc mmol/l	66	1.00	.00	1.00	.6212
Baseline glucose mmol/l	66	3.00	3.00	6.00	4.2879
2hglucose mmol/l	66	8.00	3.00	11.00	6.1970
Adiponect ug/ml	66	65.00	.00	65.00	19.2424
Lept ng/ml	66	60.00	5.00	65.00	25.1515
hsCRP mg/dl	66	10.0	.0	10.0	7.621
MetS	66	1	0	1	.61

BMI body mass index, SBP systolic blood pressure, DBP diastolic blood pressure, hsCRP high sensitive C reactive protein, MetS metabolic syndrome

Table 2 OR for adiponectin and hs-CRP

	OR	2.5 %	97.5 %
(Intercept)	1.3970231	0.7819226	2.4959934
adiponectin	0.9913831	0.9887168	0.9940566
hs-CRP	1.1152802	1.0932874	1.1377154

hsCRP favours the occurrence of MS (OR> 1), while adiponectin has a protective effect (OR <1).
Distribution of the selected variables according to the presence, respectively the absence of MetS, is illustrated in figures no 2,3



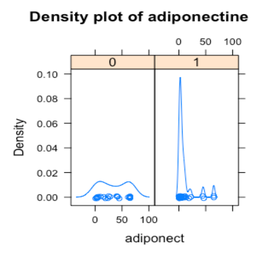


Fig. 2 CRP distribution Fig.3 Adiponectine distribution

42 out of 66 patients met the criteria for MetS. They were put on diet and physical activity over a period of 3 months. Anthropometric and biological changes are shown in Table 3.

Table 3 Anthropometric and biological changes following diet and physical activity

Parameters n=42	Baseline	After 3 Months	P value
BMI kg/m2	31.98±3.11	30.65±4.2	<0.01
Adiponectine ug/ml	9.77±2.70	11.07±23.40	<0.01
Leptin ng/ml	28,32 ±14.23	16,03±13.08	<0.01
hsCRP mg/dl	9.955±2.43	9.06±3.16	<0.01
MetS	42	39	0.72

hsCRP high sensitive C reactive protein, MetS metabolic syndrome

Discussions

Obesity is a chronic inflammatory disorder, in which leptin, adiponectin and CRP play an important role
The present study proposes an assessment of the importance of various adipogenic factors (adipokines, inflammation) as incipient risk factors for atherosclerosis in pediatric population. The atherosclerotic profile can be improved by diet and physical activity. We studied a group of children with obesity and divided the group according to the presence or absence of MetS. The group with MetS was put on diet and physical activity for three months. Changes in adiponectin, leptin and hs-CRP concentrations following this period were measured.

There were statistically significant differences in plasma leptin, adiponectine and hs-CRP concentrations after the diet and exercise program.

Conclusions

Obesity is a chronic inflammatory disorder, in which leptin, adiponectin and CRP play an important role.
MetS correlates with high levels of hs-CRP and low levels of adiponectin.
Leptin, adiponectin and hs-CRP can be used as predictors for cardiovascular disease in pediatric population.
Leptin, adiponectin and hs-CRP plasma concentrations can improve after 3 months of diet and physical activity.

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