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ORIGINAL PAPER

LIPID PROFILE AND THERAPEUTIC IMPLICATIONS IN OBESE CHILDREN

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Abstract. Introduction: Obesity, as a nutritional chronic disease, has an alarmingly rising prevalence in children, with a major risk for complications. Dyslipidemia is responsible for many comorbidities of obesity and its evaluation and management are compulsory. Objective: To evaluate the presence and prevalence of various dyslipidemic changes in obese children and adolescents, as well as evaluating their lipid profiles and the effects of specific therapeutic measures. Material and methods: The study group included 130 obese children aged 5 to 18 years, followed over 188 admissions in the 2nd Pediatric Clinic - Emergency Hospital for Children "St. Maria" Iaşi, Romania from January 2008 to January 2012. The inclusion criteria were the diagnosis of overweight and obesity. Patients were divided into three subgroups for therapeutic reasons, according to age: subgroup I - 5-9 years, subgroup II - 10-13 years and subgroup III - 14-18 years. There were performed anthropometric measurements to classify patients according to the degree of obesity and biological determinations. Results: Blood lipids were modified in more than 50% of obese children, in most cases hypertriglyceridemia, increased LDL-C and decreased HDL-C. Therapeutic measures were lifestyle changes and administration of ursodeoxycholic acid, vitamin E and probiotics. In 5 children was administered rosuvastatin. Conclusions: Obesity in children represents not only a nutritional risk, but also possible lifelong diseases. Evaluation of blood lipids and proper therapeutic measures can reduce the risk of metabolic syndrome.
Keywords: obesity, dyslipidemia, cholesterol, triglycerides

Background

Due to its rising prevalence of obesity in children and its many adverse health effects obesity has become a fundamental problem of the public health. [1]. Complications and comorbidities that have established obesity as a chronic metabolic disease are metabolic complications (insulin resistance, atherogenic dyslipidemia, dysglycemia, metabolic syndrome), cardiovascular diseases (atherosclerosis, coronary heart disease, thrombosis), gastrointestinal complications (gallstones, hepatic steatosis) [2]. Components of metabolic syndrome, dyslipidemia, diabetes and arterial hypertension are the most important complications that stem from obesity evolution, with a high risk of cardiovascular disease [3]. Clinical cardiovascular events are due to atherosclerosis development. The onset of atherosclerosis since childhood has been shown by studies that were performed on the intima media thickness in the carotid [4,5]. Stary showed the presence of lipid striae 10-20% of children under three years and significant increase in their prevalence (60%) in the age group 12-14 years [6, 7]. Early identification and ulterior treatment of dyslipidemia can prevent or postpone the atherosclerosis process [8], that increases the risk for metabolic and cardiovascular complications.

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Aims

The study objectives were to evaluate the lipid profile in obese children and adolescents and the effects of specific therapeutic measures.

Material and methods

The study group included 130 overweight and obese children aged 5 to 18 years, followed over 188 admissions in thr 2nd Pediatric Clinic- Emergency

Hospital for Children „St. Maria „Iaşi from January 2008 - January 2012. The inclusion criterion was a diagnosis of overweight and obesity. Patients were divided into three subgroups, for therapeutic reasons, according to age: subgroup I - 5-9 years, subgroup II - 10-13 years and subgroup III - 14-18 years.

Anthropometric measurements were performed to distinguish patients according to degree of obesity. Biological determinations were performed: total cholesterol, triglycerides, HDL-cholesterol, LDL cholesterol, along with other biological tests (blood count, blood glucose, hepatic and renal tests, total protein, serum protein electrophoresis). In interpreting the values of lipid profile we used Table I.

Blood chemistry assessed lipid levels in obese children, mainly cholesterol, triglycerides, HDL-C and LDL-C. Mean values of cholesterol and triglycerides were 167.26 mg/dl and 114.65 mg/dl, respectively (figure 5).

As for the values of the lipid profile, 47.69% of of the cohort of obese children showed normal cholesterol and triglycerides, while 18.5% showed only elevated triglycerides and 20.77% elevated cholesterol. Both lipid fractions were elevated in 13% of cases (figure 6).

As for the distribution of cholesterol and triglycerides, both elevated values were found in children with a higher degree of obesity, with statistical significance (p=0.002) (figure 7).

Child	Normal values (mg/dL)	Borderline values (mg/dL)	Abnormal values (mg/dL)
Total Cholesterol (TC)	<170	170-199	>200
LDL-Cholesterol (LDL-C)	<110	110-129	>130
HDL-Cholesterol (HDL-C)	>45	35-45	<35
Triglycerides (TG)	<150		

Table I. Reference values for lipids in children

Results

Mean age of children was 12 years and 5 months (5-18 years). Distribution according to age showed that most children with obesity were teenagers -37%, closely followed by subgroup II – 34% and subgroup I – 29%. Thus, there is quite an even distribution of obesity in all age groups (figure 1).

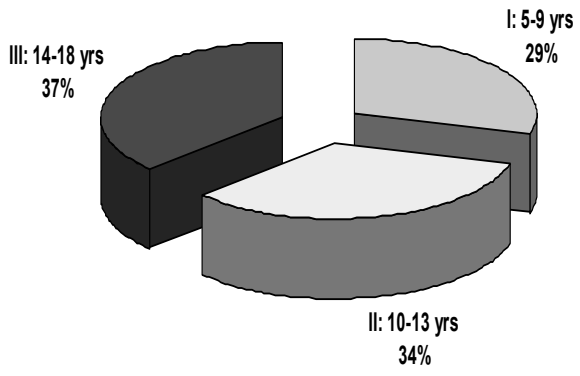


Figure 1. Age distribution in obese children

Demographics showed that most of the children were females (52%) (figure 2). Two thirds of children came from urban areas (figure 3).

Anthropometric measurements were made, in order to place children according to obesity degrees. Thus, half of the children were overweight, a quarter were stage I obese, while stages II and III of obesity were found at 18% and 7%, respectively (figure 4).

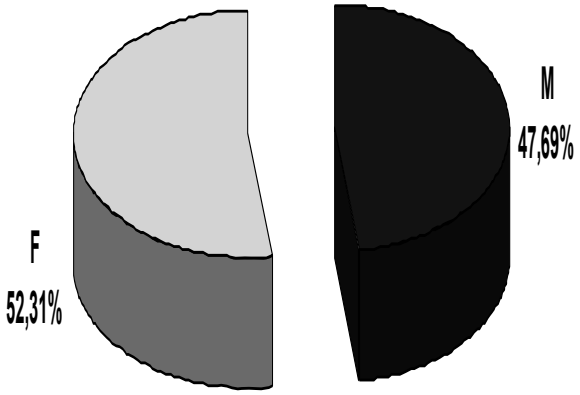


Figure 2. Sex distribution in obese children

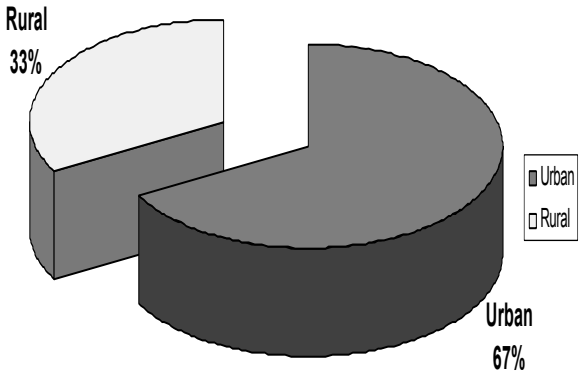


Figure 3. Sex distribution in obese children

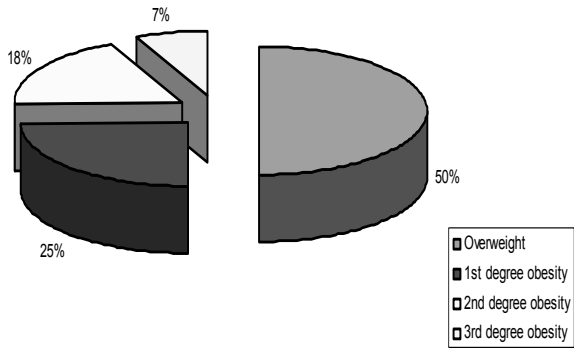
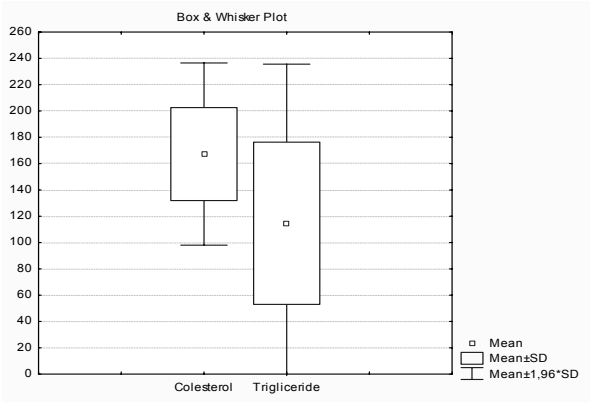


Figure 4. Degrees of obesity



Descriptive Statistics

	N	Min.	Max.	Mean	Std. Dev.
Cholesterol	188	74	321	167,26	35,348
Triglycerides	188	35	370	114,65	61,694
Valid N (listwise)	188				

Figure 5. Mean values of cholesterol and triglycerides
There was a slightly positive correlation between the levels of cholesterol and tryglicerides (p=0.03)

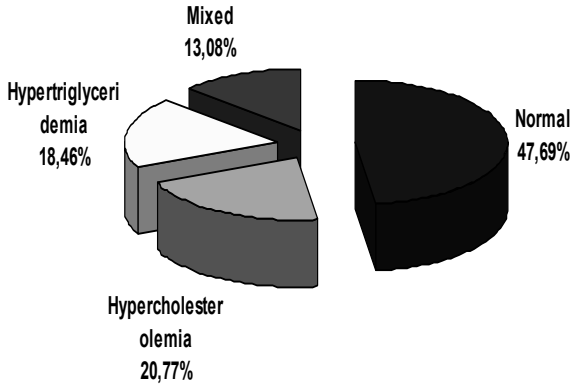


Figure 6. Lipid profile of obese children

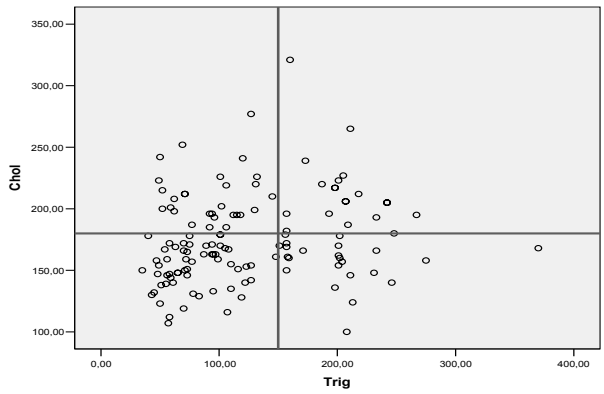


Figure 7. Blood lipids' distribution in obese patients

		Chol	Trig
Chol	Pearson Correlation	1	,190(*)
	Sig. (2-tailed)		,031
	N	130	130
Trig	Pearson Correlation	,190(*)	1
	Sig. (2-tailed)	,031	
	N	130	130

Table II. Correlation between the values of cholesterol and tryglicerides in obese children
* Correlation is significant at the 0.05 level (2-tailed)

HDL-cholesterol and LDL-cholesterol were assessed in 108 patients (83%). Risk values – high or borderline LDL-C and low HDL-C were found in half of the obese patients, mark of an elevated risk for developing metabolic syndrome and later-on systemic complications.

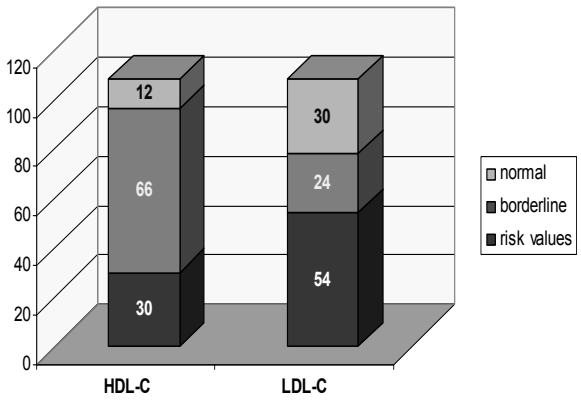


Figure 8. HDL-C and LDL-C in pediatric obese patients

Therapeutic measures included personalized diets for all patients, with restriction of lipids and a caloric intake that would cover the energy expenditure for age and sex. Patients were counseled about their diet, allowed foods and dietary risks. Physical exercise was also encouraged, in order to decrease

or at least maintain body weight. Exercise showed also a beneficial improvement of the quality of life for those obese patients.

An improvement in weight related to age was found in 17 patients (13.07%) in repeated admissions, along with a slight improvement of the blood lipids.

Three quarters of patients also received ursodeoxycholic acid, 10 mg/kg/day as a hydrophyllic acid with rheogirric effects on bile, thus improving lipid absorption and metabolization. It showed a cholesterol-lowering and liver-protecting effect.

Vitamin E was also administered in selected cases, in order to improve hepatic and systemic metabolization of lipids.

In the study group there were 5 teenagers with ages between 14-18 years considered at risk that received rosuvastatin. Two patients developed liver cytolysis, an adverse reaction that imposed discontinuation of the medical therapy.

Probiotics were administered in 30% of children, with a positive overall effect of normalization in gut flora, thus improving intestinal metabolization of lipids.

Discussions

The presence of atherogenic profile associated with obesity even in childhood can be observed by elevated triglycerides, total cholesterol, LDL-C and low HDL-C levels. Individual values were compared to normal values for age and sex (5-90 percentiles). The prevalence of obesity is highest in the IIIrd subgroup – teenagers. Some children have one, two or both lipid fractions modified. As for the HDL-C and LDL-C, changes were found in more than 50% of patients.

In the United States, the prevalence of hypertriglyceridemia is 54% and in France 14.3% [9]. Compared to other studies, the levels of HDL cholesterol are lower than those recorded in Bolivia (55.7%) [10] and higher than those reported in France (4.1%) [11]. Prevalence of dyslipidemia in obese children in Israel reaches 51% and 40% in the U.S. [12].

The metabolic syndrome is defined using five criteria, the visceral obesity assessed by waist circumference, HDL cholesterol, triglycerides, blood pressure and fasting glucose levels [13]. Only for groups II and III (patients over 10 years) were we able to link the individual values of lipid profile parameters to the values that are recognized by the IDF as risk factors for metabolic syndrome and including only two parameters (HDL cholesterol and triglycerides), because of the lack of criteria for LDL cholesterol as well as all lipid fractions in children younger than 10 years. The IDF established that the risk factor for low HDL cholesterol is 40 mg/dL in females and 50 mg/dL in males, without taking into account the fact that both total cholesterol, as his fractions (HDL, LDL) increase with age. Thus, a value considered normal in relation to the 5 percentile for age and sex of evaluated patients, can be labeled as pathological by using IDF criteria. Also for hypertriglyceridemia, IDF criteria recommend the threshold of 150 mg/dL for defining it, not taking into account normal variations with age and sex of the child.

Hygiene theory finds itself a good applicability also in lipid disorders in obese children. There is now the idea that early modulation of gut immune tolerance by probiotics will lead to lowering the risk for obesity, dyslipidemia and insulin resistance [14].

Conclusions

Obesity in children represents not only a nutritional risk, but also a possible complex lifelong pathology (hepatic, renal, cardiovascular). Blood lipids were modified in more than half of a group of obese children, along with low levels of HDL-C and high levels of LDL-C. Therapeutic interventions at pediatric age require individualization of lifestyle changes and sometimes drug administration, according to age, lipid profile, comorbidities, socio-economic issues, ethical problems.

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