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Lipids and lipoproteins in blood serum of children with simple obesity

Lipidy i lipoproteiny w surowicy krwi u dzieci z otyłością prostą

INTRODUCTION

Obesity is an important risk factor of numerous somatic diseases, like cardiovascular diseases, stroke, diabetes mellitus and hyperlipidemia. Obese children can constitute a group that is predisposed to an early development of atherosclerosis. The most common form of obesity in childhood and adolescence is so called simple obesity [1, 2, 9, 10, 11].

The assessment of obesity itself is not satisfactory. An important problem is so called type of obesity or distribution of fatty tissue in the region of abdomen or buttocks. Obesity of android type with characteristic accumulation of fatty tissue in the abdomen region is closely related with increased risk of atherosclerosis and particularly with hyperlipidaemia whereas gynoid obesity is rarely connected with these complications.

It results from the differences in adipocytes metabolism localised in buttock–thigh and abdomen regions. Buttock–thigh adipocytes have smaller ability of triglicerides mobilisation than the abdomen adipocytes, probably due to higher activity of adrenergic system. Lipoprotein lipase activity (LPL) responsible for lipids accumulation is higher in the buttock–thigh region than in the abdomen region. In women LPL indicates higher activity in the buttock-thigh region than in men [4, 12].

Anthropometric indicators play a very important role in the clinical diagnosis and prediction of the development and disorders as well as they are helpful for evaluation of the applied therapy. The commonly used anthropometric indicators are Quetelet

index, Body–Mass Index and Rohrer Index [3, 8]. For evaluation of the state of nutrition or the degree of obesity there are used direct measurements of fatty tissue in standardised places. The distribution of fatty tissue is assessed by WHR (waist–hip ratio) [6].

One of the earliest symptoms of atherosclerosis is the increased level of cholesterol and lipids metabolic disorders in blood serum [4, 5, 7].

The basic condition of initial evaluation of cardiovascular disease risk is determining of total cholesterol concentration and triglicerides concentration in blood serum. The next stage of diagnosing is determination of lipoprotein fraction concentration, i.e. LDL, VLDL and HDL cholesterol. LDL and VLDL cholesterol play a significant role in pathogenesis of cardiovascular disease, whereas HDL cholesterol constitutes a protection fraction in cardiovascular disease occurrence.

THE AIMS

The aim of the study was analysing the concentrations of apolipoproteins (apoA and apoB), triglicerides and total cholesterol fractions (HDL, LDL, VLDL) in children with obesity with relation to BMI and WHR.

MATERIAL AND METHODS

The study included 27 children (15 girls and 12 boys) aged 9–15 years with simple obesity.

In all of the children the measurements of height and body weight were made and BMI was calculated.

Body mass index = body mass (in kg) / Body height (in meters^2)

Body fat distribution was assessed with WHR index defined as waist to hip circumference ratio. Blood was sampled from the elbow vein on an empty stomach and after 12-hour interval from the last meal.

Concentration of total cholesterol, cholesterol-HDL and triglicerides was measured by means of Cormay set in apparatus Cobas–MiraS. Cholesterol LDL and VLDL fraction was defined by indirect method. Apolipoproteins Apo-A and Apo-B were measured by means of Roche.

RESULTS

The obtained results were analysed statistically and basic statistical characteristics were calculated (mean, standard deviation). Correlation between lipids metabolism parameters and the BMI and WHR were checked up with Pearson correlation coefficient.

In the group of obese children the mean values were as follows: total cholesterol — 186.4 mg%, HDL-cholesterol — 56.1 mg%, LDL-cholesterol — 109.5 mg%, VLDL-

Table I. Lipids and lipoproteins in blood serum of children with simple obesity (mg%)

	Sex								
	Female			Male			Total		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation	N	Mean	Std. Deviation
Triglyceridies	15	104,13	42,36	12	92,41	29,05	27	98,93	36,86
Total cholesterol	15	178,73	29,56	12	196,00	31,98	27	186,41	31,30
LDL–cholesterol	15	100,77	33,54	12	120,43	29,55	27	109,51	32,78
HDL–cholesterol	15	55,27	18,18	12	57,08	17,13	27	56,07	17,40
VLDL–cholesterol	15	20,83	8,47	12	18,48	5,81	27	19,79	7,37
Apo–A	15	307,93	62,49	12	298,42	42,56	27	303,70	53,78
Apo–B	15	118,93	21,48	12	135,42	20,19	27	126,26	22,15
BMI	15	25,89	3,37	12	26,25	2,62	27	26,05	3,01
WHR	15	0,81	0,043	12	0,88	0,043	27	0,84	0,053

Table 2. Correlations between lipids and lipoproteins and BMI in both groups (boys and girls)

		BMI
Pearson Correlation	Triglicerides	–0.217
	Total cholesterol	+0.240
	LDL–cholesterol	+0.379
	HDL–cholestreol	–0.076
	VLDL–cholesterol	–0.217
	Apo–A	–0.064
	Apo–B	+0.165
Sig. (2–tailed)	Triglicerides	+0.277
	Total cholesterol	+0.277
	LDL–cholesterol	+0.051
	HDL–cholestreol	+0.705
	VLDL–cholesterol	+0.277
	Apo–A	+0.751
	Apo–B	+0.410

Table 3. Correlations between lipids and lipoproteins and WHR in both groups (boys and girls)

		WHR
Pearson Correlation	Triglicerides	–0.327
	Total cholesterol	+0.43
	LDL–cholesterol	+0.02
	HDL–cholestreol	+0.263
	VLDL–cholesterol	–0.327
	Apo–A	+0.199
	Apo–B	+0.321
Sig. (2–tailed)	Triglicerides	+0.096
	Total cholesterol	+0.83
	LDL–cholesterol	+0.923
	HDL–cholestreol	+0.185
	VLDL–cholesterol	+0.096
	Apo–A	+0.319
	Apo–B	+0.102

cholesterol — 19.8 mg%, triglicerides — 98.9 mg%, Apo-A — 303.7 mg%, Apo-B — 126.3 mg%. Mean value of BMI — 26,05; WHR — 0.84 (Table 1).

No significant relationship between total cholesterol, cholesterol HDL and VLDL, triglicerides and apolipoproteins (Apo-A, Apo-B) was confirmed. Significant positive correlation between BMI and cholesterol LDL in the whole group of studied children was confirmed ($p < 0,05$) (Table 2).

Table 4. Correlations between lipids and lipoproteins and WHR in the group of girls

		WHR
Pearson Correlation	Triglicerides	−0.490
	Total cholesterol	+0.114
	LDL–cholesterol	−0.010
	HDL–cholestreol	+0.543
	VLDL–cholesterol	−0.490
	Apo–A	+0.647
	Apo–B	−0.016
Sig. (2–tailed)	Triglicerides	+0.064
	Total cholesterol	+0.686
	LDL–cholesterol	+0.972
	HDL–cholestreol	+0.036
	VLDL–cholesterol	+0.064
	Apo–A	+0.009
	Apo–B	+0.955

Table 5. Correlations between lipids and lipoproteins and WHR in the group of boys

		WHR
Pearson Correlation	Triglicerides	+0.060
	Total cholesterol	−0.493
	LDL–cholesterol	−0.517
	HDL–cholestreol	−0.049
	VLDL–cholesterol	+0.060
	Apo–A	−0.274
	Apo–B	+0.319
Sig. (2–tailed)	Triglicerides	+0.852
	Total cholesterol	+0.103
	LDL–cholesterol	+0.085
	HDL–cholestreol	+0.880
	VLDL–cholesterol	+0.852
	Apo–A	+0.388
	Apo–B	+0.313

There was no significant correlation between WHR and the concentration of total cholesterol, cholesterol-LDL, cholesterol-VLDL, triglicerides and apolipoproteins (ApoA, ApoB) both in girls and in boys (Table 3).

Significant positive correlation between WHR and cholesterol HDL and between WHR and ApoA ($p < 0.05$) were observed in the group of girls (Table 4, 5).

DISCUSSION

Body-mass index (BMI) is used as a routine in adults, and its extent is within 20–25 in subjects with regular body weight. Application of BMI for monitoring child's body weight requires considering age and sex. The value of BMI above 90th centile allows for diagnosing obesity. The obesity lasting from infancy is a very significant factor of atherosclerosis risk. The period of latency of atherosclerosis symptoms may last for a dozen of years and the predisposition for obesity increases with age [1, 2, 3, 8].

With the progress of obesity there is an increase of cholesterol concentration, particularly transmitted by aterogenic LDL fraction and the reduction of the level of HDL cholesterol, the protective fraction [5, 11].

Therefore the earlier is the treatment of obesity, the bigger the likelihood that it will not occur in adult age.

With years of studying obesity it has been noticed that in some groups of obese subjects there is a bigger risk of atherosclerosis. So the division into android and gynoid obesity was suggested. For evaluation of the type of obesity the WHR coefficient was suggested. High WHR values (above 0.9) indicate the central obesity and may be a prognosis of such disorders as: diabetes, dislipidemia, cardiac ischaemia, hypertension, coronary insufficiency, stroke.

Prevention of obesity from the earliest years of child's life seems to be a very important problem in atherosclerosis prophylactics, one of the most severe civilisation diseases of our times.

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STRESZCZENIE

Otyłość jest poważnym czynnikiem ryzyka wielu schorzeń somatycznych, takich jak: choroby układu krążenia, udary mózgu, cukrzyca i hiperlipidemia. BMI — wskaźnik wagowo-wzrostowy — jest często używany w ocenie stopnia otyłości u dzieci i u dorosłych. Bardziej dokładnym wskaźnikiem do oceny rozmieszczenia tkanki tłuszczowej jest wskaźnik WHR, określający typ otyłości (stosunek obwodu bioder do tali). Rozmieszczenie tkanki tłuszczowej w organizmie ma duży wpływ na zagrożenie miażdżycą. Prowadzone badania potwierdzają, że otyłość brzuszna (górnej części ciała) jest odpowiedzialna za większe ryzyko wystąpienia miażdżycy i chorób sercowo-naczyniowych. Celem pracy była analiza zachowania się poziomu cholesterolu całkowitego i jego frakcji (HDL, LDL, VLDL), trójglicerydów oraz apolipoprotein (Apo-A, Apo-B) u dzieci ze stwierdzoną otyłością w zależności od BMI i WHR.

Badania przeprowadzono u 27 dzieci (15 dziewcząt i 12 chłopców) ze stwierdzoną otyłością prostą w wieku 9–15 lat.

Stwierdzono dodatnią korelację pomiędzy stężeniem cholesterolu LDL a BMI w badanej grupie dzieci ($p < 0,05$). Stwierdzono istotną korelację dodatnią w grupie dziewcząt pomiędzy WHR a HDL ($p < 0,05$). Nie stwierdzono istotnych związków pomiędzy typem otyłości (otyłość brzuszna i pośladkowo-udowa) a poziomem trójglicerydów, cholesterolu całkowitego, LDL i VLDL w grupie badanych dziewcząt i chłopców.