Original Article

Relationship of Body Mass Index with Serum Lipids in Elementary School Students

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ABSTRACT

Objective. To determine the relationship of body mass index with serum lipids in elementary students. **Methods.** This prospective analytic study was conducted among 954 elementary school students (9-11years), selected by multi stage random systematic method from 6 cities and their rural areas from The South Khorasan province (eastern Iran) from September to December 2006. Height and weight was measured and Body mass index was calculated. Total cholesterol (TC), triglyceride (TG), low-density lipoprotein cholesterol (LDL-C) and high-density lipoprotein cholesterol (HDL-C) were determined. **Results.** 954 students 9-11 years old were studied. 45.4% were boys. 76.5% were living in the city. 1.8% of students were obese and 3.4% were over weight. There was no significant relation between obesity and overweight with sex, age and the area of residence. There was significant relation between BMI with TC (P= 0.003), TG (P< 0.001) and LDL-C (P= 0.04). TG was significantly higher in obese and overweight students than in normal weight students (P< 0.001). TC (0.002) and LDL-C (0.01) were significantly higher in obese students than normal weight students. The prevalence of high TG was significantly higher in obese and overweight students than normal weight students (0.003). There was no significant difference between different kinds of dyslipidemia with area of residence. **Conclusion.** it is necessary to measure serum lipid profile in obese and overweight children. **[Indian J Pediatr 2009; 76 (7) : 729-731]** *E-mail: fesharakinia@yahoo.com*

Key words : *Obesity; Body Mass Index; Serum lipids*

Obesity is a widespread and growing problem in the world with significant medical, psychosocial and economic consequences.[1] Widespread reports indicate that the prevalence of obesity among children and adolescents has been increasing in recent years.[2,3] In the US, one-third of overweight Americans are at an increased risk of developing chronic disease such as type 2 diabetes, cardiovascular disease and hypertension.[4] In children, the development of obesity is associated with the simultaneous deterioration in chronic disease risk profiles,[5] including adult-onset diabetes mellitus, coronary heart disease and respiratory disease.[6] In many studies overweight children had abnormal levels of lipids[7,8] and a longitudinal change in relative weight was associated with changes in this risk factors.[9]

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This study was performed to assess the relationship of Body mass index (BMI) with serum lipids and prevalence of dyslipidemia according to level of BMI in elementary students of South Khorasan province, Eastern Iran.

MATERIAL AND METHODS

This cross-sectional study was carried out in 9-11 years old students of South Khorasan province from September to December 2006. This province has 6 cities and this study was done in all these cities and some rural area from every city that was selected randomly. At first all the elementary schools in urban and selected rural area were divided into two groups: girl and boy's schools and then some schools were selected randomly appropriate to the number of schools in every area. One class was selected randomly from every grade in chosen schools. The students were selected by systematic random sampling in every class.

After filling a questionnaire by parents, height and

weight were measured in light clothing and no shoes. Weight and height were measured to the nearest 0.1kg and 0.1cm using Seca Beam Balance and Seca stadiometer, respectively. Body mass index (BMI) was measured as weight (kg) divided by height (m) squared. Children with BMI ≥ 95th percentile for age and sex and between 85th percentile to 95th percentile for age and sex were considered as obese and overweight respectively.[10]

Students had been instructed to fast for 12 to 14 hours. Antecubital venous blood was collected, biochemical tests, including measurement of total cholesterol (TC), triglyceride (TG), High-density lipoprotein cholesterol (HDL-C) and Low-density lipoprotein cholesterol (LDL-C) were carried out, and TC and TG were measured by German made Ependrof Elan 2000 outoanalyzer using the enzymatic method. HDL-C was measured using heparin-manganese precipitation method. LDL-C was measured in samples containing TG≤ 400 mg/dl using the friedwal formula.[11] It was otherwise measured using a special test kit. Dyslipidemia was defined as a TC, LDL-C or TG higher than the level corresponding to the standard age- and gender-specific 95th percentile.[12]

Statistical analysis was performed with SPSS statistical package using partial Pearson correlation coefficients, ANOVA, chi-square and tukey test. P value less than 0.05 was considered as significant.

RESULTS

This cross-sectional study was carried out on 954 elementary students, comprising of: 321 (33.7%) students' 9-years-old, 417 (43.7%) 10-years-old and 216 (22.6%) 11-years-old. 433 students (45.4%) were boys. 730 (76.5%) students were living in the city. 17 (1.8%) students were obese and 33 (3.4%) were overweight. There was no significant relation between obesity and overweight with sex, age and the area of residence. There was significant relation between BMI with TC, TG and LDL-C (Table 1).

DISCUSSION

The purpose of this study was determination of relation between body mass index and serum lipids and prevalence of dyslipidemia according to BMI in elementary students of South Khorasan province. The results demonstrated significant relation of BMI with TC, TG and LDL-C levels in these students. In a study on 1569 Tunisian school children obese children were found to have higher plasma triglyceride levels and lower HDL-C than children of normal weight.[13] In the Bogalusa heart study on 9167, 5 to 17-years-old, 11% of TG was significantly higher in obese and overweight students than in normal weight students. TC and LDL-C were significantly higher in obese students than normal weight students. There was no significant difference about HDL-C (table 2).

TABLE 1. The partial Pearson correlation coefficients between BMI and serum lipids

Variable mg/dl	TC	TG	HDL-C	LDL-C
BMI				
BMI	r= 0.1 P= 0.003 *	r= 0.17 P< 0.001 *	r= 0.004 P= 0.91	r= 0.07 P= 0.04*

r: partial correlation
P: Pearson coefficient

TABLE 2. Comparison of mean TC, TG, LDL-C and HDL-C according to percentiles of BMI.

BMI Variable mg/dl	Normal X±SD	Over weight X±SD	Obese X±SD	P-value
TC	151.2±24	156.5±24	170.8±34.9	0.002*
TG	86.9±34.9	107±51.6	110.6±42.1	< 0.001 **
LDL-C	89.9±22.4	92.3±19.6	105.8±26.4	0.01*
HDL-C	44.2±9.2	43.1±10.6	47.6±7.5	0.26

Tukey test:
* Significant for obese with normal students
** Significant for obese and overweight with normal students

The prevalence of high TG was significantly higher in obese and overweight students than normal weight students (table 3).

TABLE 3. Prevalence of lipid disorders according to percentile of BMI.

BMI Variable (mg/dl)	Normal N	 %	Over weight N	 %	Obese N	 %	P-value
High cholesterol	31	3.4	1	3	1	5.9	0.85
High TG	53	5.9	6	18.2	3	17.6	0.003 *
High LDL-C	39	4.3	1	3	2	11.8	0.31
Low HDL-C	145	16	8	24.2	—	—	0.09

* Significant for obese and overweight with normal students

There was not significant difference between different kinds of dyslipidemia with area of residence (table 4).

TABLE 4. Comparison of prevalence 0f dyslipidemia according to area of residence.

Area of residence Variable (mg/dl)	Rural area N	 %	Urban area N	 %	P-value
High cholesterol	9	4	24	3.3	0.6
High TG	16	7.1	46	6.3	0.66
High LDL-C	10	4.5	32	4.4	0.96
Low HDL-C	45	20.1	108	14.8	0.06

examined school children were considered overweight. Compared with other school children, an overweight youth was 2.4 times as likely to have a high TC level, 7.1 times to have a high TG level, 3 times to have a high LDL-C and 3.4 times to have a low HDL-C and 12.6 times more likely to have hyper insulinemia.[14] In a study in Taiwan on 1366 school children, obese children had higher TG and lower HDL-C than normal weight children.[15] The long-term observation in the Bogalusa heart study indicates the obesity in childhood to be the driving force for multiple risk factors related to the insulin resistance syndrome. In more recent studies in children, insulin resistance was also implicated in the association between obesity and dyslipidemia.[16] Hyperinsulinemia is known to enhance hepatic very-low-density lipoprotein synthesis and thus may directly contribute to the increased plasma TG and LDL-C levels. [17] Resistance to the action of insulin on lipoprotein lipase in peripheral tissue may also contribute to elevated TG and LDL-C levels.[18,19] It has been suggested that insulin resistance may be responsible for the reduced levels of HDL-C observed in type 2 diabetes patients. [20] According to results of this study, it is recommended to measure serum lipid profile in obese and overweight children.

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