Plasma Lipid Profile in Obese Children and in Children with Hereditary Predisposition to Coronary Heart Disease

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SUMMARY

This study examined risk factors for coronary disease and plasma triglycerides, total cholesterol, HDL, LDL cholesterol (C), Apo A-1, and Apo B lipoprotein levels in obese children (n=107) aged 9-12 years old and in children (n=64) hereditarily predisposed to coronary heart disease (CHD). In the latter group, children's fathers had a history of MI before 50 years of age.

A control group of 30 children was also studied, and the plasma lipid profile was investigated in 35 fathers with premature myocardial infarction. Seventy-five percent of the obese children and 60% of the children hereditarily predisposed to CHD had three or more coronary artery disease risk factors. Plasma HDL-C ($p<0.001$), LDL-C ($p<0.001$ — $p<0.05$, respectively), Apo A-1 ($p<0.001$), and Apo B ($p<0.001$) levels were different in both groups compared with controls.

Key Words:

Plasma triglyceride Cholesterol HDL and LDL cholesterol
Apo A-1 and Apo B lipoproteins Coronary heart disease

AUTOPSIES of young servicemen killed in the Korean and Vietnam conflicts revealed coronary artery atherosclerotic lesions.^{1,2)} This discovery led both epidemiologists and clinicians to question whether atherosclerosis begins in childhood. If so, they reasoned it might be possible to identify high-risk individuals for intensive therapy.³⁾ In the Bogaluss heart study, black boys had higher Apo A-1 levels than white boys.⁴⁾ After the first year of life, serum cholesterol (Ch) and lipoprotein levels approximated those of adults.⁵⁾ Recently, Stary⁶⁾ confirmed that early coronary artery lesions can be seen at autopsy in at least 17% of infants and children under

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5 years of age.

It has been demonstrated that dyslipoproteinemias with elevated levels of cholesterol (Ch) and Apo B containing low density lipoproteins (LDL-C) and low levels of Ch and Apo A-1 containing particles of high density lipoproteins (HDL-C), and family history of coronary heart disease (CHD) are CHD risk factors among adults.⁷⁾ Some of the other risk factors are obesity, hypertension, high levels of triglycerides and low physical work capacity.⁸⁾ In the present study, plasma lipid profiles and risk factors were investigated in obese children and in children with a hereditary predisposition to CHD.

MATERIALS AND METHODS

Two groups of children were studied for determination of risk factors. The first group comprised 107 obese school children of both sexes in the age range 9–12 from a city in the east of Turkey called Erzurum. The other group consisted of 64 children whose fathers had premature coronary infarction (PCHD) before the age of 50. All the children had similar socioeconomic levels and dietary habits. Thirty control children were chosen without obesity and without a parental history of PCHD. Thirty-five fathers with PCHD were included in the study.

Obesity, hypertension, family history of CHD, plasma triglycerides, total (T) cholesterol, LDL-C, HDL-C, Apoprotein A-1, and B levels were investigated as risk factors. The criteria for obesity were body weight 20% higher than the ideal and triceps skinfold being greater than the 75 percentile with reference to age and sex. Blood pressures were taken after children had been resting in a supine position for 20 min. A systolic blood pressure above 130 mmHg and a diastolic blood pressure above 86 mmHg were accepted as hypertension (above normal) for this age group.*

Venous blood samples were taken (after overnight fasting) into vacuum tubes containing 1.0 g/l disodium EDTA. Plasma was obtained by low speed centrifugation for 30 min at 4°C. The plasma levels of cholesterol and triglycerides were measured on a Hitachi 705 Auto Analyzer, along with the HDL-C content after preliminary elimination of very low density LP and LDL from plasma with heparin manganese precipitation. The LDL-C level was calculated according to the formula of Friedwald et al.⁹⁾ Plasma concentrations of Apo A-1 and B were measured with immunoturbidimetric analysis, SPQTM test system (Hitachi 4020 Fotometer-Atab).

* From Task Force on Blood Pressure Control in Children—National Heart, Lung and Blood Institute: Report of the Second Task Force on Blood Pressure Control in Children—1987.

Statistical analysis of the results was conducted using Student's t-test (Table I).

RESULTS

Fifty-two percent of the obese students showed triglyceride values greater than 100 mg/dl and 13% had a triglyceride value greater than 200 mg/dl. By contrast, the 22% of the children who had a family history of PCHD also had a triglyceride value greater than 200 mg/dl and 63% had a value higher than 100 mg/dl. In this second group, 11% of both fathers and children displayed triglyceride values greater than 200 mg/dl.

Total cholesterol value higher than 200 mg/dl was found in 43% of the obese children, 51% of the fathers with PCHD, and 18% of their children. Fifteen % of the obese children had LDL-C higher than 150 mg, as did 15% of the fathers with PCHD, although none of their children did.

Apo B levels higher than 85 mg/dl were found in 29% in the obese children, 22% in the fathers with PCHD, but in none of their children.

Blood pressures were above normal in 24% of the obese children (17 of them had abnormal lipid profiles), and 15% of children with a family history of PCHD.

Plasma lipid profile of all groups are shown in Table I. Risk factors are shown in Fig. 1. In the obese group 75% had three or more risk factors. In the other child group 60% had three or more risk factors.

As shown in Table I, plasma HDL-C, LDL-C, Apo A-1, and Apo B values were significantly different from control values in the obese children and children with a family history of PCHD.

Table I. Lipid Profile of the Groups (mean $\pm$ standard deviations)

Parameters	Groups						
	I 42F/65M	P	II 14F/16M	P	III 28F/36M	P	IV 35M
Triglyceride (mg/dl)	138 $\pm$ 38	NS	127 $\pm$ 44	NS	147 $\pm$ 75	NS	171 $\pm$ 89
Cholesterol (mg/dl)	191 $\pm$ 26	NS	188 $\pm$ 32	NS	194 $\pm$ 37	NS	202 $\pm$ 46
HDL-C (mg/dl)	37 $\pm$ 11	0.001	49 $\pm$ 8	0.001	54 $\pm$ 10	NS	52 $\pm$ 13
LDL-C (mg/dl)	115 $\pm$ 2	0.001	98 $\pm$ 32	0.05	105 $\pm$ 38	NS	119 $\pm$ 59
Apo A-1 (mg/dl)	129 $\pm$ 23	0.001	165 $\pm$ 24	0.001	140 $\pm$ 17	0.001	105 $\pm$ 12
Apo B (mg/dl)	80 $\pm$ 14	0.001	58 $\pm$ 19	0.001	72 $\pm$ 12	0.001	81 $\pm$ 23

Group I: Obese children, Group II: children control, Group III: Hereditarily predisposed to coronary heart disease, Group IV: Parent with premature myocardial infarction.

NS=not significant; $p<0.05$: low-significant, $p<0.01$: significant, $p<0.001$: very significant statistical differences.

Fig. 1. Coronary artery disease risk factors in the obese (A) and having familial history of PCHD (B) children.

DISCUSSION

Obese adolescents have an alarmingly high incidence of multiple coronary heart disease risk factors.^{10)–13)} In the Wilmore,¹⁰⁾ Lauer,¹¹⁾ Gilliam et al,¹⁴⁾ and Fripp et al¹²⁾ studies, approximately 14, 4.6, 36, and 11% of the adolescents were reported to possess two or more coronary heart disease risk factors, with obesity the most prominent. In the Becque et al study, 35/36 obese adolescents had four or more risk factors.⁸⁾

In our study, 75% of obese children had three or more risk factors for CHD and 24% of them showed hypertension. Although plasma triglycerides and total cholesterol values did not differ from those of the controls, the obese children had lower HDL-C and Apo A-1 values and higher LDL-C and Apo B values than controls ($p < 0.001$). Becque et al⁸⁾ indicated that changes in blood pressure and other coronary heart disease risk variables may be achieved with diet and exercise intervention. The American Heart Association stated that exercise is an important factor leading to a more efficient cardiovascular system and reducing atherosclerotic risk.¹⁵⁾

Patients with Type II, III, and IV familial hyperlipoproteinemias have a high risk for CHD.¹⁶⁾ Aortic stenosis and CHD are complications of familial Type II hyperlipoproteinemia in early decades. In 2 cases presented by Özme et al,¹⁷⁾ familial hypercholesterolemic xanthomatosis was detected as a homozygous phenotype of familial Type II hyperlipoproteinemia. In

both patients, supraaortic stenosis, dermal fibroxanthomas, coronary atherosclerotic occlusions with high levels of cholesterol and lipoproteins were diagnostic for the disease.

Individuals with a family history of PCHD are at increased risk of developing CHD.¹⁸⁾ Among myocardial survivors under 60 years of age, with premature CHD about 15% have familial hyperlipoproteinemia, and a much smaller percentage, about 5%, have heterozygous familial hypercholesterolemia.¹⁹⁾ About one-third of the children of parents suffering from myocardial infarction before the age of 50 years were found to have primary dyslipoproteinemia.¹⁸⁾ Özme et al²⁰⁾ investigated the plasma cholesterol and triglyceride levels of children from families where one parent had a myocardial infarction before age 45. The average cholesterol and triglyceride values were significantly higher than control levels and half of their patient population had a prebeta band in the lipoprotein electrophoresis, compared with 8.1% in the control group.²⁰⁾

The findings in our study confirm previous reports in the literature. Perova et al⁹⁾ reported that a paternal coronary heart disease group had lower levels of HDL-C and Apo A-I, higher levels of LDL-C, triglycerides and apoprotein B than a control group, with blood pressure lability. In the Sveger et al²¹⁾ study, 14% of the 84 children with family histories of premature CHD had abnormally high T-Cholesterol and LDL-C concentrations and 13% of parents had abnormal T-Cholesterol and LDL-C concentrations. In 6% of the high risk families abnormal tests were found in both children and parents. Atilgan et al²²⁾ also reported that T-Cholesterol and LDL-C concentrations were significantly elevated in children whose parents had premature CHD. In our study, 60% of children with a family history of premature CHD had three or more risk factors for CHD. Triglycerides were higher than 200 mg/dl in 11% of both fathers and children. Apo A-I levels were lower ($p < 0.001$) and LDL-C and Apo B levels were higher ($p < 0.05$, $p < 0.001$, respectively) than controls in this population. These findings, then, suggest that obese children and children with a family history of premature CHD may have a greater risk of atherosclerosis. Measures such as diet and exercise must be considered for prevention.

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