Original Article

Lipid Profiles and Prevalence of Dyslipidemia in Schoolchildren in South Khorasan Province, Eastern Iran

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Background: The aim of this study was to evaluate serum lipid profiles and the prevalence of dyslipidemia in schoolchildren in south Khorasan Province.

Methods: The participants of this cross-sectional study were 685 girls and 641 boys, aged seven to 12 years, selected by multistage random cluster sampling from urban and rural areas of south Khorasan Province (eastern Iran). Fasting blood samples were analyzed for total cholesterol, low-density lipoprotein cholesterol, triglycerides, and high-density lipoprotein cholesterol.

Results: The mean values of total cholesterol and low-density lipoprotein cholesterol were significantly higher in girls. There was no significant correlation between the mean values of serum lipids with age of the children. The mean values of triglyceride and high-density lipoprotein cholesterol were significantly higher and lower, respectively, in rural areas. In all the participants, the percentiles of triglycerides were higher and the percentiles of high-density lipoprotein cholesterol were lower than standard values according to Lipid Research Clinics data. The most common form of dyslipidemia was decreased high-density lipoprotein cholesterol (14.1%). The prevalence of hypertriglyceridemia, increased low-density lipoprotein cholesterol, and hypercholesterolemia were 5.4%, 4.1%, and 3%, respectively. There was not any significant relation between different forms of dyslipidemia with age of the children. Decreased high-density lipoprotein cholesterol and increased low-density lipoprotein cholesterol were significantly more common in girls. The prevalence of decreased high-density lipoprotein cholesterol was significantly higher in rural than urban areas.

Conclusion: Considering the high prevalence of dyslipidemia and undesirable lipid profiles in the schoolchildren of eastern regions of Iran, it is strongly recommended to search for underlying factors.

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Keywords: Children • dyslipidemia • Iran • lipids • prevalence

Introduction

Although cardiovascular disease (CVD) does not manifest until adulthood, its risk factors such as dyslipidemia are present in childhood and persist into adulthood.[1] So, some authors recommend that routine screening program for blood lipid levels should be performed in all children. They have provided

guidelines to identify and treat children who are at risk for the development of accelerated atherosclerosis in early adult life.[2,3]

CVD constitutes one of the main health problems in Iran but little is known about the lipid profiles and the prevalence of dyslipidemia among Iranian children. In Iran, only few studies focusing on the determination of lipid profile and the prevalence of dyslipidemia in children and adolescents have been conducted, which showed abnormal lipid profiles and a high prevalence of dyslipidemia.[4,5] These studies also reported the increasing rate of lipid disorders in Iranian children and adolescents. So, the present study was performed for the first time in east of Iran to identify the lipid profiles and the prevalence of

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dyslipidemia among schoolchildren in south Khorasan Province (eastern Iran). Such identification will be important in designing effective intervention and prevention programs aimed at reducing CVD risk factors in Iranian children and adolescents.

Materials and Methods

This cross-sectional study was carried out from September through December 2006. It was performed in urban (Birjand, Nehbandan, Ghaen, Sarayan, Darmian, and Sarbisheh) and rural areas of south Khorasan Province. The study protocol was approved by the Research and Ethics committee of Birjand University of Medical Sciences.

The sampling method was multistage random cluster sampling. At first, all elementary schools were identified according to location (urban and rural areas). From each area, a proportional, two-stage cluster sample of children was selected. At the first stage, the primary units (clusters) were the schools (30 schools). At the second stage, equal numbers of students were selected by systematic random sampling in every school.

Initially, a questionnaire including information about age, sex, and the area of residence, was filled by one of the parents. The students had been instructed to fast for 12 to 14 hours. After obtaining informed consents from the parents, antecubital venous blood was collected. Biochemical tests including measurement of total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol (LDL-C) were carried out.

TC, HDL-C, and TG were measured by an enzymatic method using an Elan 2000 auto-analyzer (Eppendorf, Germany). LDL-C was calculated according to the Friedewald formula.[6]

In children, high levels of TC and LDL-C were defined as ≥ 200 mg/dL and ≥ 130 mg/dL, respectively.[7] TG level ≥ 130 mg/dL was considered as high, and HDL-C level < 35 mg/dL was considered as low.[8,9]

Data were analyzed by SPSS (version 13). Student's *t*-test, Chi-square test, and one-way ANOVA were used. *P* value less than 0.05 was considered as statistically significant.

Results

This study was performed on 1326 school-children seven to 12 years old, with a mean age of 9.6 ± 1.2 years. The children consisted of 641 (48.3%) boys and 685 (51.7%) girls.

There was no significant correlation between the mean value of serum lipids with age of children. The mean value of TC and LDL-C were significantly higher in girls. The mean value of TG and HDL-C were significantly higher and lower, respectively in rural areas (Table 1).

In all the children, the 5th, 25th, 50th, 75th, 90th, and 95th percentiles of TG and HDL-C were higher and lower, respectively than the corresponding levels of Lipid Research Clinics (LRC) standard values.[10] Only a few percentiles of TC and LDL-C were higher than the standard values.

The prevalence of different forms of dyslipidemia were: low HDL-C 14.1%, hypertriglyceridemia 5.4%, high LDL-C 4.1%, and hypercholesterolemia 3%. There was no significant correlation between the prevalence of different forms of dyslipidemia and the age of the children. Low HDL-C and high LDL-C were significantly higher in girls (*P*=0.05 and *P*=0.01, respectively). The prevalence of low HDL-C was higher significantly in rural than urban areas (*P*=0.02).

Discussion

The present study higher that in all schoolchildren percentiles of TG showed were and HDL-C were lower than the standard values. In a study on 2000 students in Isfahan Province, the percentiles of serum TC, TG, and LDL-C were significantly higher and the percentiles of HDL-C were lower than standard values according to LRC

Table 1. Comparison of the mean values of serum lipids according to sex and area of residence.

Serum lipids (mg/dL)	Total n=1326 Mean±SD	Boys n=641 Mean±SD	Girls n=685 Mean±SD	P value	Urban area n=1028 Mean±SD	Rural area n=298 Mean±SD	P value
T-C	152	150 ± 25.3	154 ± 23.2	0.002	152±23.7	150±25.8	0.12
TG	87	87 ± 39.7	87 ± 34.1	0.81	86±34.7	92±41.8	0.02
LDL-C	90	87 ± 22.7	93 ± 21.9	<0.001	91±22.1	89±23.3	0.11
HDL-C	44	45 ± 8.8	44 ± 9.2	0.15	44±9.1	43±8.9	0.05

data.[4]

In the present study, the mean TC levels were 150 mg/dL for boys and 154 mg/dL for girls. In a study performed in Tehran on seven to 13-year-old children, mean TC levels ranged from 170 to 171 mg/dL for boys and 173 to 179 mg/dL for girls.[5] In American children (six to 15 years old) in National Health and Nutrition Examination Survey (NHANES) III mean TC levels were 158 to 172 mg/dL for boys and 164 to 169 mg/dL for girls.[11] In a study on 7767 school-aged Greek children (six to 14 years old), mean TC ranged from 157 to 174 mg/dL for boys and from 158 to 172 mg/dL for girls.[12] In the present study, the mean TC level was lower than Tehran and other foreign studies.

In our study, the mean TG levels were 87 mg/dL for both sexes. In Tehran study, mean serum TG levels ranged from 93 to 105 mg/dL for boys and 98 to 128 mg/dL for girls.[5] In NHANES III study, mean serum TG levels of American schoolchildren were 87 mg/dL for boys and 96 mg/dL for girls (12 – 15 years old).[11] The serum TG levels of Greek boys ranged from 76 to 83 mg/dL and those for girls were 76 – 95 mg/dL.[12] In the present study, mean TG level was lower than Tehran study and American girls, however, it was equal to TG levels of American boys and was higher than the Greek study.

In the present study, the mean LDL-C levels were 87 for boys and 93 for girls. In Tehran study, mean serum LDL-C levels ranged from 104 to 105 mg/dL for boys and 105 to 112 mg/dL for girls. In NHANES III study, serum LDL-C levels of American schoolchildren were 88 mg/dL for boys and 94 mg/dL for girls. In Greek children, the levels ranged from 59 to 68 mg/dL for boys and 61 to 64 mg/dL for girls. In our study, mean LDL-C level was lower than Tehran study, higher than Greek study, and nearly equal to American study.

We found that mean HDL-C levels were 45 mg/dL for boys and 44 mg/dL for girls. In Tehran study, the mean HDL-C level was 46 – 47 mg/dL for boys and 43 – 47 mg/dL for girls.[5] In NHANES III study, mean value of HDL-C in American children was 50 mg/dL for both sexes.[11] The mean HDL-C of Greek children ranged from 59 to 68 mg/dL for boys and 61 to 64 mg/dL for girls. In the present study, mean HDL-C level was lower than Tehran and the other foreign studies.

In a study in Turkey on 397 healthy children (five to 14 years old), mean level of HDL-C was 46.7 mg/dL for boys and 46.3 mg/dL for girls. These levels were profoundly low on international comparison. The low levels of HDL-C in Turkish children may be associated with the high incidence of coronary artery disease (CAD) in the Turkish adult population.[13]

In a study in Spain, a significant increase in plasma TC and LDL-C levels was observed over time in schoolchildren. But the mean concentration of plasma HDL-C remained stable and very high. These high levels of plasma HDL-C in Spanish schoolchildren may help to explain why the coronary heart disease mortality rate is low compared with that in other developed countries.[14] So, the low levels of plasma HDL-C in Iranian children (Tehran and the present studies) may explain the high prevalence of CAD in Iranian adults.

In the present study, mean values of TC and LDL-C were significantly higher in girls, which is consistent with the findings in NHANES III study.[11]

Mean values of TG and HDL-C were significantly higher and lower, respectively in rural areas, which is consistent with the findings in a study on 2896 Turkish schoolchildren.[15] It can be probably because of consumption of local butter and oil in rural areas of Iran.

The most common form of dyslipidemia in the present study was a low HDL-C level and then hypertriglyceridemia. In Tehran study, the most common form of dyslipidemia was a high LDL-C and then hypercholesterolemia.[5] In a study in Saudi Arabia on 1390 students aged nine to 12 years, the most common form of dyslipidemia was hypertriglyceridemia.[16] In Bangkok study on primary schoolchildren, the most common form of dyslipidemia was hypercholesterolemia (40%) and high LDL-C (5.4%).[17] There was no association between the prevalence of different forms of dyslipidemia with age and sex of children in that study.

Our study has some limitations. The first is that the serum lipids were checked only once. Secondly our data on serum lipids were compared with the standard percentiles of Western references, which are not necessarily universally correct standards for Iranian children. We strongly need standard percentiles for Iranian children and adolescents.

Conclusion

Considering the high prevalence of dyslipidemia and undesirable lipid profiles in the schoolchildren of eastern regions of Iran, it is

strongly recommended to search for the underlying factors such as physical activity, eating habits, and food choices.

Acknowledgment

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