Prevalence of hyperlipidemia among Saudi school children in Riyadh

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Background: Coronary heart disease (CHD) constitutes one of the main health problems in Saudi Arabia, but little is known on the lipid profile of the juvenile population.

Methods: We measured the prevalence of high-risk levels of serum lipids in 1390 boys and girls, aged 9 or 12 years, in Riyadh city.

Results: High-risk levels of total cholesterol (TC), low-density lipoprotein (LDL), triglycerides (TG) and triglycerides/high-density lipoprotein (TC/HDL) cholesterol ratio were found in 32.7%, 33.1%, 34.1% and 22.0% of the students. The prevalence of high-risk levels of TG increased with age among boys and girls, while the prevalence of high-risk LDL decreased with age in girls. Mean levels of TC, LDL and the TC/HDL ratio were higher among girls than boys in the 9-year-old age group. Mean levels of TG and the TC/HDL ratio were higher among girls than boys in the 12-year-old age group.

Conclusions: The prevalence of high-risk levels of serum lipids ranged from 32.7% to 34.1%. We emphasize the need to assess the prevalence of other CHD risk factors among our students and design a suitable control program.

Key words: Hyperlipidemia, coronary heart disease, children, adolescents, Saudi Arabia

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Coronary heart disease constitutes one of the main health problems in Saudi Arabia, representing the third most common cause of hospital-based mortality after accident and senility.[1] Extensive medical research has identified hyperlipidemia as the major heart disease risk factor. A clinical correlation between hyperlipidemia and incidence of heart disease risk has been established.[2] Risk factors associated with CHD include genetic susceptibility, elevated serum cholesterol, and a low level of high-density lipoprotein.[3] CHD results from a build up of cholesterol-rich plaque deposits inside the coronary artery wall. Eventually, occlusion of the vessel shuts off blood supply to the heart, resulting in CHD. The American Heart Association (AHA) stated that for every 1% reduction in total cholesterol (TC) level, there is a 2% promotion in heart and cardiovascular health. People with high levels of low-density lipoprotein (LDL) in the blood are at high risk while those with high-density lipoprotein (HDL) levels tend to have low risk.[4]

An individual's risk profile is not only affected by the presence of multiple risk factors but also by the level or severity of those factors.[5] In middle- aged men, high blood TC values may be the most significant risk indicator for CHD. It is estimated that for each 1% increase in TC level, CHD risk increases by 3%. While TC and LDL are important, the ratio of TC/HDL is most predictive of heart disease risk.[6] It is well recognized that the atherosclerosis process underlying the development of CHD in adults begins early in life. Thus, the identification of individuals at higher risk at an early age will help in the design of a prevention program.[7] In Saudi Arabia, however, there are insufficient data on the lipid profile of our juvenile population. The lack of basic information on children and adolescents in Saudi Arabia motivated us to determine the prevalence of high-risk levels of serum lipids among students in Riyadh.

Methods

A cross sectional study was carried out on 1390 male and female pupils, comprised of two age groups (9 and 12 years), from 30 primary schools, representing five districts in Riyadh city. The sample was selected by multistage stratified random sample technique to ensure the homogenous inclusion of different strata in the sample. The total sample size was determined according to the statistical equation based on estimating a population proportion with a specified absolute precision.[8]

Participants were required to fast for 12 hours prior to obtaining 5 mL of early morning blood from the antecubital veins in a tube containing heparin. Trained physicians took the blood samples. Breakfast was provided for students. Blood samples were rapidly centrifuged and separated plasma samples were used to assess serum lipids. The following cutoff points were used as an arbitrary level to determine risk levels:

- Total cholesterol: 5.2 mmol/L.
- Low-density lipoprotein cholesterol (LDL): 3.4 mmol/L.
- Triglycerides (TG): > 1.13 mmol/L
- TC / HDL: > 4.5 for boys and > 4.0 for girls.[9-10]

Data were collected by questionnaire and analyzed using Epi-Info (version 6.02). Student's t and the chi-square tests were used to determine statistical significance. The 5% level was

Table 1. Lipid profiles of students by sex and age group.

	Males		Females	
	9 years	12 years	9 years	12 years
Total cholesterol				
Normal	275 (66.7)	181 (66.3)	257 (65.9)	222 (70.5)
High risk	137 (33.3)	92 (33.7)	133 (34.1)	93 (29.5)
LDL-cholesterol				
Normal	288 (70.4)	187 (68.5)	**232 (59.9)**	**214 (69.5)**
High risk	121 (29.6)	86 (31.%)	**155 (40.1)**	**94 (30.5)**
Triglycerides				
Normal	**315 (76.6)**	**190 (69.3)**	**253 (65.5)**	**155 (49.2)**
High risk	**96 (23.4)**	**84 (30.7)**	**133 (34.5)**	**160 (50.8)**
TC/HDL ratio				
Normal	351 (85.6)	232 (85.0)	265 (68.5)	227 (73.7)
High risk	59 (14.4)	41 (15.0)	122 (31.5)	81 (26.3)

Statistically significant differences ($P<0.05$) between age groups within genders in bold (*chi*-square test)

Table 2. Mean values for serum lipids and TC/HDL ratio among students by age group and sex.

	9 years		12 years	
Parameter (Mean±SD)	Males (n=495)	Females (n=415)	Males (n=339)	Females (n=336)
Total cholesterol (mmol/L)	**4.87±0.85**	**4.95±0.83**	4.89±0.84	4.84±0.82
LDL-cholesterol (mmol/L)	**2.98±0.84**	**3.23±0.87**	3.04±0.82	3.04 ±0.85
Triglycerides (mmol/L)	0.99±0.61	1.06±0.55	**1.04±0.57**	**1.21±0.54**
TC/HDL ratio	**3.44±1.06***	**4.22±1.83***	**3.60±1.19***	**3.89±1.45***

Statistically significant differences ($P<0.05$) between males and females within age groups in bold (*t* test)
* $P<0.05$ vs. LDL-cholesterol within sex and age groups.

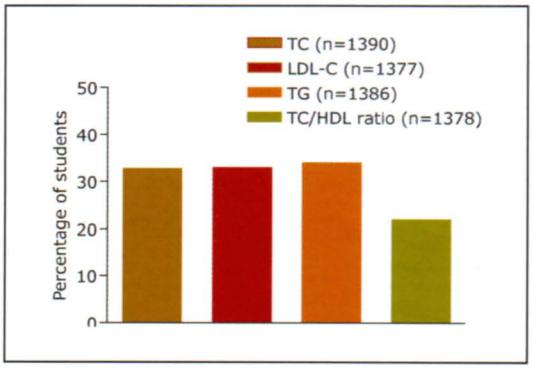

Figure 1. Prevalence of high-risk levels of serum total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), triglycerides (TG), and the TC/high-density lipoprotein cholesterol (TC/HDL) ratio among 9- and 12-year-old students in Riyadh.

chosen as a minimum acceptable level of statistical significance in this study. Appropriate ethical protocols were followed in all study phases. Free and voluntary written informed consent was obtained from the pupils and their parents.

Results

The percentage of students with levels of TC, LDL, TG and a TC/HDL ratio in the high-risk category are shown in Figure 1. Table 1 shows the percentage of students in the high-risk category by sex and age group. Statistically significant differences were found for TG level and age group for boys and for LDL and TG levels and age group for girls (Table 1).

In the 9-year-old age group, the mean values for TC, LDL and the TC/HDL ratio for boys were lower than those for girls (Table 2). The mean value for TG was also higher among girls than boys, but the difference was not statistically

significant. In the 12-year-old age group, the mean values for TG and the TC/HDL ratio for boys were lower than those for girls (Table 2). Also, a statistically significant difference could be detected between LDL serum level and TC/HDL ratio among boys and girls of the same age group.

Discussion

The present study found high-risk levels of TC, LDL and TG in 9- and 12-year-old students in Riyadh. Our data is consistent with a study in Campinas, Brazil, in a similar population.[11] Lower figures were reported for Northern Ireland and Colombia, where the percentages of children with high-risk levels ranged between 12.5% to 24.0%. [12-13] These differences could be attributed to variations in demographic features, lifestyles, methodological procedures and the time lag between these studies. The high-risk TC/HDL ratio of 22.0% is similar to that found in Colombia and in the Bogalusa Heart Study.[13,14]

The differences in prevalence of high-risk TG level between boys aged 9 and 12 years (23.4% and 30.7%, respectively) was statistically significant. Differences in the prevalence of high-risk TC, LDL and TC/HDL ratio between 9- and 12-year-old boys were not statistically significant, which could be attributed to the limited time span (3 years) between the two age groups. The difference in prevalence of high-risk TG levels might be explained by the nature of TG, which represents the main form of fat in food, whether monosaturated or polysaturated. However, it is debatable whether a high TG alone is predictive of heart disease. The prevalence of high-risk values for TC, LDL and the TC/HDL ratio levels among girls tended to decrease with age. This finding is in agreement with Gliksman et al in Australia, who detected an obvious trend in reduction in serum cholesterol with increasing age in girls and a reversible trend in boys.[15]

The present study showed a tendency for serum triglycerides to increase with age in both genders. The levels were higher among girls than boys. The mean serum triglycerides of boys aged 9 and 12 years were 0.99±0.61 mmol/L and 1.04±0.57 mmol/L respectively, while the corresponding figures among girls were 1.06±0.55 mmol/L and 1.21±0.54 mmol/L, respectively. This is in accordance with reports from western countries, in which serum triglycerides were increased with age and mean values were slightly increased in girls compared with boys.[15-16] In our study, this same pattern is evident from the increase in prevalence of high-risk levels of serum triglycerides with age, from 23.4% in boys aged 9 years to 30.7% in those aged 12 years. In the USA, a lower figure was reported for the prevalence of high-risk levels of serum triglycerides (18.0 % of boys aged 7-12 years).[10] The difference from our results could be attributed to differences in the studied populations, diagnostic criteria and methodological approaches conducted in both studies.

We conclude that high-risk levels of serum lipids among pupils in Riyadh ranges between 32.7% and 34.1%. TG increases with age among boys and girls, while LDL decreases with age, particularly among girls. The mean level of LDL was higher among girls than boys in the younger age group. Since our target population is limited to the school-age population in Riyadh, our conclusion cannot be generalized further. Further in-depth studies are needed to assess the prevalence of other CAD risk variables among our students and to assess the factors that affect their occurrence in our societies in order to design a suitable control program.

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