

## Percentile of Serum Lipid Profile in Children at Eastern Iran

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### **Abstract**

#### **Introduction**

Racial and environmental differences in communities leading cause of differences in serum lipids. It can be said this study aimed in assessing percentile curves of serum lipid profile in 6 to 18 year- old of students at Birjand, east of Iran.

#### **Methods and Materials**

The present cross-sectional study was done on 4168 students of Birjand aged 6-18 years. They were classified into three age groups (6-10) and (15-18) and (11-14) years. The 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles of lipids [Cholesterol, Low density lipoprotein (LDL), High density lipoprotein (HDL) and triglycerides] were determined by sex for different age groups.

#### **Result**

The 5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles for cholesterol, LDL, HDL, and Triglycerides (TG) were: (114,123, 138, 157, 176, 197, 210; 54, 59, 71, 86, 102, 119, 131; 33, 36, 41, 48, 56, 64, 68 and 43, 49, 61, 78, 103, 138, 164) respectively.

#### **Conclusion**

Percentiles of lipid in kids of Birjand were different in comparison with reference percentiles of the U.S and also Tehran. Triglycerides and HDL in children and adolescents were higher and lower, respectively than the Americans. This could be due to racial differences and environmental factors such as nutrition and sedentary life style. This should be considered in interpretation of normal and abnormal values and determination of dyslipidemia in children and adolescents.

**Keywords:** Adolescents, Birjand, Children, Dyslipidemia, Lipid profile.

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## Introduction

During these decades cardiovascular disease as the main reason of adult mortality has been increased especially in many of developing countries (1-3). Dyslipidemia or, abnormal levels of blood lipids such as hypercholesterolemia begins in childhood and adolescence and can lead to premature atherosclerosis (4-6). Bugalus Heart Study Autopsy studies showed that High total cholesterol (TC) , LDL and low HDL are associated with increasing coronary artery lesions (7, 8). It is known which not only in adults but also in children and adolescents, dyslipidemia is related with other cardiovascular risk factors such as hypertension and obesity (9, 10).

Serum lipids levels are related to gender, race, and age in children and adolescents (11). Like of many developing countries, cardiovascular disease and its associated risk factors such as obesity as a public health problem is increasing in Iran (12-14). Therefore study of lipid profile and prevalence of dyslipidemia especially in children and adolescents is important. Considering that the environment and racial differences could lead to difference in lipid profile of various communities, herein we aim to determine lipid percentiles in 6 to 18 year- old children in Birjand.

## Methods and Materials

The present cross-sectional, descriptive and analytical study was done on 4168 middle and high school students aged 6 to 18 years (2220 girls and 1948 boys) in Brigand, eastern Iran in 2012. The samples were selected through multistage cluster sampling. Considering the distribution of

schools in different districts of the city, at first 24 girls' schools and 24 boys' schools each consisting 10 primary, 7 middle, and 7 high schools were selected. Then, some students were selected from each class with respect to the population of each school and its ratio to the total number of students in that class. Firstly, 4500 students were chosen and a demographic questionnaire bearing a consent form was sent to each one's parents. The parents were requested to fill out the demographic and consent forms then return them to school if they agreed with their kid's participation in the plan. The exclusion criteria were: (a) not having any chronic disease or endocrine disorder such as diabetes; (b) not being on treatment of corticosteroids or drugs influencing lipid profile.

In the next step, after getting the permission from the education office and ensuring coordination with it, two trained nurses referred to the schools and recorded the demographic information in the data collection. At the end, because of defects in the information, a few of the subjects were excluded offered 4168 subjects remained for analysis. Blood samples of the subjects were derived in order to test blood lipids including cholesterol, triglyceride, HDL, and LDL after a 12 hour fasting from cubital vein of the left hand. The blood sample was taken in vacuum tubes in amount of 5 ml containing separator gel and clot activator manufactured by Becton Dickinson (U.K). In order of lipid levels determination, the obtained samples were immediately centrifuged, and applying enzymatic procedure using German Rosh kits, with Biochemical Autoanalyzer Prestige 24i (Japan). Statistical analysis was performed by means of SPSS software

(version15).  $P \leq 0.05$  was taken as the significant level.

**Results**

In the present study 4168 students, aged 6 to 18 year-old, including 1948 (46.7%) girls and 2220 (53.3%) boys, were included. 33%, 42.2%, and 24.8%, of students were in the age groups of 6-10, 11-14, and 15-18 years, respectively.

The 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles for cholesterol, LDL, HDL, and TG were 114, 123, 138, 157, 176, 197, 210; 54, 59, 71, 86, 102, 119, 131; 33, 36, 41, 48, 56, 64, 68, and 43, 49, 61, 78, 103, 138, 164, respectively (Tables 1-4).

Mean TC and LDL were significantly higher in girls than boys ( $p=0.007$ ) as  $(156.9 \pm$

$30.6)$  and  $(86.7 \pm 24.2)$  mg/dl for boys and  $(159.4 \pm 28.2)$  and  $(88.7 \pm 23.3)$  mg/dl for girls.

Mean TG was 87.9 mg/dl, that there was no statistically significant difference between the two groups ( $p=0.97$ ). Mean HDL was higher in boys  $(49.29 \pm 11.7)$  compared the girls  $(48.90 \pm 10.2)$ , however the difference was not statistically significant ( $p=0.25$ ).

The age groups of 6-10 and 15-18 years among of all age groups had highest and lowest amount of mean TC, LDL, and HDL, respectively. The lowest and highest mean of TG were obtained for 6-10 and 10-14 aged groups, respectively. Mean of all serum lipids at different age groups were significantly different ( $p < 0.001$ ).

**Table1:** TC percentiles and their mean values for different age groups/gender

	Age number	Number	Mean	SD	Percentile						
					5th	10th	25th	50th	75th	90th	95th
All	6-10	1374	168.16	27.04	127	135	150	166	185	205	217
	11-14	1761	156.06	28.61	115	122	136	154	173	193	206
	15-18	1033	148.85	29.82	107	114	129	146	164	184	200
	total	4168	158.26	29.38	114	123	138	157	176	197	210
Boy	6-10	629	169.54	27.18	125	138	151	167	187	207	219
	11-14	847	155.73	28.96	112	120	136	154	174	194	206
	15-18	472	142.32	30.82	104.6	111	123	138	155	176	198.3
	Total	1948	156.94	30.60	112	120	136	155	175	198	211
Girl	6-10	745	166.99	26.90	128	134	150	166	183	202	214
	11-14	914	156.36	28.30	116.7	123	136	154	173	192	206
	15-18	561	154.34	27.82	110	122	137	152	171	187.8	201.8
	Total	2220	159.41	28.23	118	125	140	158	176	195	209

**Table 2:** LDL percentiles and their mean values for different age groups/gender

Age number	Number	Mean	SD	Percentile							
				5	10	25	50	75	90	95	
All	6-10	1374	95.45	23.14	59	67	79	94	109	126.5	137
	11-14	1761	85.57	22.82	54	59	70	84	98	115	126
	15-18	1033	81.41	23.75	49	55	65	79	95	111	122
	total	4168	87.80	23.82	54	59	71	86	102	119	131
Male	6-10	629	95.69	22.93	61.5	68	80	93	110	129	137
	11-14	847	85.14	22.87	52.4	58	69	84	98	115	126
	15-18	472	77.67	24.51	45	53	62	74	89	105.7	119
	total	1948	86.73	24.27	52	58	70	85	100	119	131
Female	6-10	745	95.25	23.33	59	65	79	94	109	125	138
	11-14	914	85.97	22.77	54.7	60	71	83	97	115	128.2
	15-18	561	84.56	22.63	51	58	68	83	97	115	123
	Total	2220	87.73	23.28	55	61	73	87	103	118	131

**Table 3:** HDL percentiles and their mean values for different age groups/gender

Age number	Number	Mean	SD	Percentile							
				5	10	25	50	75	90	95	
All	6-10	1374	52.30	10.78	36	39	45	52	59	66	71
	11-14	1761	48.37	10.93	32	35	41	48	55	63	67
	15-18	1033	46.01	10.10	32	34	38	45	52	59	65
	total	4168	49.08	10.95	33	36	41	48	56	64	68
Male	6-10	629	53.55	11.30	37	40	45.5	53	60	67	74
	11-14	847	49.41	11.78	33	35	41	48	56	65	69
	15-18	472	43.39	9.33	31	32	36	43	49	56	59.3
	total	1948	49.29	11.70	32	35	41	48	56	65	70
Female	6-10	745	51.24	10.21	35	39	44	50	58	65	69
	11-14	914	47.40	10.00	32	35	40	47	54	61	66
	15-18	561	48.22	10.20	34	36	41	47	54	63	68
	Total	2220	48.90	10.26	34	36	42	48	55	63	67

**Table 4:** TG percentiles and their mean values for different age groups/gender

Age number	Number	Mean	SD	Percentile							
				5	10	25	50	75	90	95	
All	6-10	1374	79.18	34.77	40.75	45	56	71	92	121	142
	11-14	1761	94.66	43.13	46	52	66	84	113	147	178
	15-18	1033	88.12	47.43	42	49	61	76	101	138	165
	total	4168	87.93	42.26	43	49	61	78	103	138	164
Male	6-10	629	76.65	32.65	38.5	44	54	70	91	118	138
	11-14	847	94.37	47.73	43	49	63	81	113	155	187
	15-18	472	91.32	53.19	41	46	60	77	106	147.7	189.7
	total	1948	87.91	45.61	41	46	59	76	105	141	173
Female	6-10	745	81.31	36.34	42	47	58	73	94	125	146.7
	11-14	914	94.92	38.41	50.7	55	68	86	113	141	166.7
	15-18	561	85.42	41.84	43	50	62	76	99	127	154
	Total	2220	87.95	39.09	45	51	62.2	80	103	134	159

## Discussion

In the present study, the mean TC, LDL, HDL, and TG were measured about 158 (boys 156 and girls 159), 87.8 (boys 86.7 and girls 87.7), 49 (boys 49.2 and girls 48.9), and 87.9 mg/dl in both sexes, respectively. According to the obtained results within 5th, 75th, 90th, and 95th percentiles of lipids, it can be concluded that with the exception of 5th percentile, total cholesterol of other percentiles in the cases of Birjand with the age group of 6-10 and 11-14 years old was higher than American ones (15). For the individuals of Birjand between 15-18 years,

all of TC percentiles were lower than the American ones except about the 95th percentile of males which it was higher than the America (15). In the present study, the 5th percentile for LDL in the age group of 6-10 years old was lower than the American cases. The 75th, 90th, and 95th percentiles of LDL in the males and females of Birjand were higher and lower than American ones, respectively (15). However, all of the percentiles of the cases of Birjand in the 11-14 and 15-18 ages were lower than the Americans (15). Nevertheless 10th HDL percentile of females and 95th HDL percentile of males aged 6-10 were respectively higher and

equal to American findings, the other HDL percentiles were lower than American ones. In the age group of 10-14 years old, all of the percentiles of Birjand teens were lower than the American ones (15).

The 5th and 95th percentiles of HDL within male teens aged 15-18 years were higher than American ones but 10th percentile was equal and the rest percentiles of Birjand teens were lower than the American ones(15). In this study, the 5th, 75th, 90th, and 95th TG percentiles were higher than American ones in the all age groups (15). The study on the students of Birjand aged 6-12 years indicates all of TG percentiles and HDL percentiles were higher and lower than American cases, respectively(16). The results of a study on the 4824 students aged 6-18 from six Iranian cities (Tabriz, Rasht, Gorgan, Mashhad, Yazd, and Tehran)(17) and findings of a few related studies showed that percentiles of TG and HDL of Iranian adolescents were higher and lower, respectively than American and many other countries adolescents(18-20). In another study conducted by Kelishadi on 2000 students from Esfahan, Iran it was found that percentiles of TC, TG, LDL, and HDL were higher and lower than those of USA. She compared the results of two conducted studies in 1993 and 1999 and revealed the increasing of TC, LDL, and HDL levels (21). In another study conducted by her about students aged 6-18 from 23 Iranian provinces, mean and percentiles of TG and percentiles of TC, LDL, and HDL in Iranian children and adolescents were higher and lower, respectively than the LRC (lipid Research Clinic) level (22). Herein, percentiles of TG and most of HDL were lower than American cases. These findings are in agreement with other Iranian studies (17-20). However, there are

different reports about cholesterol and LDL. Some Iranian studies have reported higher amounts and some others have concluded lower amounts of cholesterol and LDL in comparison to American studies. In the present study, we found different values for different age groups. In summary, our results indicate that cholesterol amounts of the 6-10 and 11-14 age groups were similar to Esfahan study findings and higher than American outputs (22). TC in the age group of 15-18 were lower than that American (22). Also, the results about LDL in the age group of 6-10 years old was higher but in the 11-14 and 15-18 years old were lower than that American ones respectively. They were consistent with Kelishadi findings conducted in 23 Iranian provinces (21,22).

According to a study among the Korean students aged 10-18, all percentiles of TC for Korean adolescents were lower compared to American ones. Mean and 50th percentile of LDL in Korean adolescents were near to results of American research while 95th percentile was lower (23). Another study on Korean adolescents showed that TC and LDL were near to findings about American ones and HDL has lower value (24). It can be due to racial differences and environmental factors such as nutrition and sedentary lifestyle which they could be influenced on the normal and abnormal amount of children and adolescent dyslipidemia. In order to make a diagnosis of dyslipidemia, preparation of regional lipid percentiles within Iranian kids is recommended.

### **Conflict of Interest**

The authors declare that they have no competing interests.

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