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Determination of Lipid Profile in Preschool Children and Pre-college Students with Beta-thalassemia Minor and Control Group

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Thalassemias are heterogeneous group of inherited anemias caused by various mutations in the genes encoding the synthesis of α or β-chains of hemoglobin. It seems that there are some aspects in thalassemia that protect minor thalassemic patients from coronary heart disease. From those aspects we can count such as low serum lipoproteins, low arterial hypertension, and anemia and so on. A cross sectional descriptive and analytical study was designed to compare some lab data of minor thalassemic students and others. So 570 preschool children (6-7 years of age) and 450 pre-college students (17-19 year of age) in 4 educational discrete of Shiraz (center of Fars province-Iran) were selected in a random cluster manner were tested for CBC and serum lipids (TG, cholesterol, LDL, HDL) and were screened for minor thalassemia by CBC and HbA_2 (by column chromatography). For definition of minor thalassemia as cut-off Point $HbA_2 \geq 3.5\%$ was accepted. After selection of minor thalassemic patients, serum lipids (TG, cholesterol, HDL, LDL) for them and control group were checked. According to this study in preschool children there is no significant difference between minor thalassemic patients and control group. In pre-collage students TG in control group is lesser than minor beta thalassemic patients (P value=0.004); but total cholesterol and LDL in patients group is lesser than control group and difference is significant. Total cholesterol and LDL in pre-college beta thalassemia minor students are lesser than control group. But TG in control group is lesser than patients group. According to this study in preschool children there is no significant difference in serum lipids between minor thalassemic students and control group.

Key words: Minor Thalassemia, serum lipids, preschool age, pre-collage students.

Thalassemia is considered as a syndrome leading to decrease or loss of production of hemoglobin chains and is the most prevalent hereditary hematological disorder in the world[1].

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Although, due to immigrations, the disease is reported from several countries in the world, it is seen primarily on the coasts of Mediterranean Sea, the Equator, and Africa. In other words, thalassemia belt is extended from coasts of Mediterranean Sea and Arabia Peninsula, Turkey, Iran, and India to southeastern Asia including

Thailand, Cambodia, and south China. Iran is one of the countries that are located on the thalassemic belt. On the coasts of Caspian and Fars Province, rate of carriers is about 10%. In the other parts of Iran, this rate is between 4 and 8%[2].

Beta thalassemia minor is caused by a decrease in beta chain of hemoglobin. The patients usually have no clinical manifestations and only sometimes they have mild anemia.

The lower cholesterol and low-density lipoprotein levels in patients with β-thalassemia minor were reported earlier[3, 4]. The hematocrit of patients with β-thalassemia minor is lower than normal. Because hematocrit is the single most important determinant of blood viscosity, the viscosity in patients with β-thalassemia minor is likely to be lower than that in healthy people[5].

Lipid abnormalities, including low levels of all fractions of serum lipids, have been repeatedly reported in all phenotypes of β-thalassemia. The higher erythroid bone marrow activity with the enhanced cholesterol consumption could be the dominant mechanism implicated in the lipid abnormalities of Thalassemia Intermedia patients[6].

It has been shown that total cholesterol and low density lipoprotein (LDL)-cholesterol levels are significantly lower in β-thalassemia trait carriers when compared to controls[3, 4, 7, 8].

MATERIALS AND METHODS

The present cross sectional descriptive and analytical study was done on 6-7 years-old children (preschool children) and 17-19 years-old students (pre-college students) in Shiraz city in summer and fall, 1999. Considering the population density at each of the four educational districts of Shiraz city, sampling was done on preschool children and pre-college students.

The related authorities having been informed, the questioners referred to the place where registration for evaluation of preschool children was being performed, and handed letters of introduction, randomly, to a number of students specified for each level at each district, to refer to Shahid Dastgheib hospital with their parents' consent and perform blood tests. Then, the questionnaires were completed. Students were asked to come to the place in fasting state. Two blood samples were taken at the hospital one for complete blood counts (CBC) tests and one for blood serum lipids level.

For pre-college students also, the same questioners went to the pre-college centers in the four educational district of Shiraz City (considering the population density at such districts) and guided the students on a simple random basis to Shahid Dastgheib hospital to perform blood tests. Here also two blood samples were taken from the students, one for CBC test and the other for serum lipids level.

When the CBC results were obtained, HbA2 was done as a criteria for diagnosis of minor thalassemia (HbA2 larger than or equal to 3.5% in column chromatography method) on those preschool children MCV of whom was less than or equal to 78 and/or MCH of whom was less than or equal to 25, and on those pre-college students MCV of whom was less than or equal to 80 and/or MCH of whom was less than or equal to 27. On the individuals who were diagnosed to suffer from minor Thalassemia; TG, cholesterol, LDL, and HDL were checked. The tests were also done on the control population who were specified on double blind basis.

RESULTS

Considering the statistical calculations, 1020 people were studied in this study including 570 preschool children and 450 pre-college students. This number of people was chosen based on the population density over the four districts of Shiraz city (Table 1).

From 570 preschool children 54 were diagnosed to be carriers of minor β-thalassemia (prevalence = 9.2%). From 450 pre-college students 31 were known to suffer from minor β-thalassemia (prevalence = 6.8%). A total of 85 individuals were the patients of the research project for whom serum lipids level were checked. Due to a drop in sampling, the serum lipids level test was only done on 64

Table 1. Frequency of preschool children and pre-college students in 4 educational districts of Shiraz

	Area 1	Area 2	Area 3	Area 4
Preschool	29%	10%	39%	22%
Pre-college	15%	25%	32%	16%

minor beta-thalassemic patients and the control group included 130 people. Although β-thalassemia is not influenced by sex, it was tried to choose equal numbers of boys and girls. This was observed on the preschool children, but not on the pre-college students due to the more tendency and participation by the girls.

Table 2 shows the distribution of blood indexes among preschool children, pre-college students, and both.

Blood indexes in two healthy and minor thalassemic groups are shown in table 3. There is a significant difference between the two groups in all groups under study ($P < 0.001$). Since the two indexes of Mentzer and Kerman index-II with their sensitivity and specificity are useful for distinguishing minor thalassemic patients from patients who suffer from Iron deficiency anemia, we discriminated two groups of healthy people and patients with minor β-thalassemia as the range for these two indexes, which has been shown in the table.

Mentzer index = MCV/ RBC (In the case of MCV<80 then figures less than 13 are in favor of minor thalassemia), Kerman II = (MCV* MCH)/ (RBC * MCHC)

Figures less than 8 are in favor of minor thalassemia,8-10.5 in favor of mixed iron deficiency

Table 2. Hematological parameters in study population

Hematological	Preschool	Pre-college	Total
parameters	N=570	N=450	N=1020
Hb	13.22±1.04	14.3±1.3	13.2
HbA_2	3.3±1.24 (N=175)	3.5±1.2 (N=107)	3.4 (N=282)
HCT	39.93±2.75	42.9±3.3	41.4
MCH	26.2±2.79	28±3	27.1
MCV	78.9±7.4	84±7.8	81.4
MCHC	33.1±1.3	33.2±1.25	33.1
Platlet/10^3	269±70	240.3±51.2	256
RBC	5.07±0.4	5.11±0.51	5.1
WBC	7.08±1.7	6.7±1.7	6.8
Mentzer Index (MCV/RBC)	15.8±2.4	16.6±2.7	16.2
Kerman Index II (MCV*MCH/RBC*MCHC)	12.6±2.8	14.2±3.3	13.3

Table 3. Mean and SD of Hematological parameters in healthy and minor thalassemia patient in study population

Hematological parameters	Preschool		Pre-college	
	Healthy thalassemia N=516	Minor thalassemia N=54	Healthy N=389	Minor N=31
RBC/10^6	4.9±0.3	5.7±0.4	5.05±0.4	5.9±0.6
Hb	13.3±0.8	11.6±0.9	14.4±1.2	12.8±1.3
Hb A_2 (N=175)	2.5±0.4	4.9±0.8 (N=107)	2.8±0.3	5.1±1
MCV	80.8±4.8	62.5±6.5	85.4±5.9	66.4±7.1
MCH	26.8±1.8	20.1±2.2	28.5±2.4	21.4±2.5
Mentzer		10.9±1.9		11.3±2.1
Kerman II	13.3±2.1	6.9±2	14.7±2.8	7.7±2.1

Mentzer index = MCV/ RBC (In the case of MCV<80 then figures less than 13 are in favor of minor thalassemia), Kerman II = (MCV* MCH)/ (RBC * MCHC)

Table 4. Mean of lipid profile and Hb in case and control groups

Variable	Preschool			Pre-college			Total		
	control N=29	case N=24	P_{value}	control N=101	case N=40	P_{Value}	control N=130	case N=64	P_{Value}
Triglyceride	85.9±30.37	87±34.55	0.9	90.89±33.62	110.68±51.95	0.004	89.91±33.75	102.42±46.77	0.024
Cholesterol	152.58±26.86	144.77±27.49	0.28	145.70±29.15	135.28±19.40	0.016	147.28±28.69	139.23±23.39	0.036
HDL-Cholesterol	46.03±16.05	41.23±12.86	0.23	38.66±14.31	35.95±9.66	0.27	40.30±14.97	38.03±11.24	0.278
LDL-Cholesterol	87.38±27.89	85.008±26.58	0.76	88.48±22.07	78.65±18.47	0.016	88.24±23.34	81.04±21.88	0.046
Hb	14/42±.8	12/72±.8	<0.05	13/49±1.2	12/83±1.3	0.88	13/91	13/44	0.036

anemia and minor thalassemia,10.5-13 in favor of iron deficiency and more than13 is in favor of normal.

As is obvious in table 4, a significant difference is observed in blood hemoglobin between the preschool thalassemic children and the control group, but no difference is seen in the types of blood serum lipids. The difference of TG, Cholesterol and LDL levels was a significant one between the pre-college thalassemic students and the control group, but no significant difference was seen between the two groups in respect of HDL and Hb. The difference of TG, Cholesterol, LDL, and Hb levels between the two groups was a significant difference, but the difference was not a significant one in respect of HDL.

DISCUSSION

Some factors have been studied in thalassemic patients in previous researches which seem to play protective roles against coronary vascular diseases in such patients. In Honolulu's study, the relationship between hematocrit and the risk of coronary heart disease has been studied. In a cohort study, 8000 Japanese men were studied for 10 years prospectively. Factors directly increasing the risk of coronary vascular diseases are: rising of diastolic blood pressure, Body Mass Index, serum total cholesterol, random triglyceride, serum glucose 1 hour after smoking, and uric acid. In this study, a significant statistical relationship was observed between the level of hematocrit and death caused by coronary vascular diseases, and it was seen that it leads to death from coronary vascular diseases more than any other cause[9].

The plasmatic level of cholesterol has a close relationship with the level of hematocrit. In thalassemic patients, serum lipoproteins show abnormal structure compared with the control group[10].

Goldfrad et al having compared 67 homozygote thalassemic patients with the control group showed that the total cholesterol, LDL, and HDL cholesterol of plasma were lower in such group of patients than in the control group, but there were no difference between the two groups in respect of plasma TG[11].

The reason of change in the level of serum lipoproteins is not known to us. In the group

where major thalassemic patients with alternative blood transfusion level have been chosen, the reason has been said to be the damage to liver and a reduction in biosynthesis of lipoproteins due to iron over load[12].

In a study made by Dr. Pedram et al at Ahwaz University of Medical Sciences, the serum lipoproteins in 100 minor thalassemic patients were compared with the control group. Based on the results of their research, a remarkably lower level of the average of total serum cholesterol and LDL cholesterol was observed among the thalassemic patients, but a higher serum level was obtained for HDL cholesterol among the patients with minor beta-thalassemia compared with the control group[13].

Maioli et al found that the patients suffering from minor beta-thalassemia had a lower level of LDL and total cholesterol, but their HDL cholesterol level is equal to that of the control group. They suggested that this was due to the increased erythropoiesis and LDL uptake by the reticuloendothelial system[12].

Fessa et al reported that only 3.6% of the Greeks suffering from minor thalassemia had a cholesterol level greater than 215mg/dl, while it was 15% in comparison with the non-thalassemic control group. In addition, one third of the patients with minor thalassemia had a cholesterol level equal to or less than 150 mg/dl [4].

The above results are comparable with the results obtained from our study.

In a study done by Gallerani et al, they found that minor thalassemia was less prevalent among patients with myocardial infarction. Furthermore, the average age for being affected by myocardial infarction among minor thalassemic patients was significantly more than that of the non-thalassemic patients[14]. It seems that some factors in patients with minor thalassemia causes them to be protected against coronary diseases. Among such factors is the reduction of serum lipids due to anemia. Due to a lower level of hematocrit, the minor thalassemic patients are less exposed to the risk of heart diseases. During the study we concluded that the prevalence of thalassemic diseases in Shiraz is just the same as what was obtained through previous studies. Interesting results were gained regarding the serum lipids level in patients with minor thalassemia, in healthy individuals and through comparison thereof. In preschool children no significant difference in the serum lipids indexes were seen. There were no significant difference in the level of the HDL cholesterol in any of the age groups but, total cholesterol and LDL cholesterol in the pre-college group and thus, the whole population under study had a significant difference between patients and the control group. Patients had a lower level of cholesterol and LDL cholesterol which is justifiable with the uptake of cholesterol from the blood in order to produce a greater number of red blood cells, and this can be an important factor in reducing the risk of ischemic heart diseases.

The level of TG showed to be higher among pre-college students and finally, the whole population of patients compared with the control group. The factor of age may be influent on this; an issue which needs more thinking and studying.

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