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The Relationship Between the Antioxidants Intake and Blood Indices of the Children with Thalassemia in Sabzevar and Mashhad

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Abstract: Most of thalassemic patients have with deficiency of anti-oxidants and increase of oxidative stress and few studies have been performed on deficiency of vitamins A, E, C in these patients. In this research we intend to study the antioxidants intake and its relationship with anemia indices in children with thalassemia. This study is a retrospective study which was performed on the children with thalassemia in Sabzevar and Mashhad cities. The sampling method was target-based. In this study, 85 patients with thalassemia were examined. After taking written consent and filling the demographic questionnaire, their height and weight were measured through the common standard methods. Then, two questionnaires of two day meal reminder and meal frequency were completed for them (in order to determine the rate and pattern of receiving antioxidant in the present and the past) and 5cc of blood was taken from each of them so that the blood indices could be measured. The data gathered using statistical SPSS software and applying the correlation coefficient, linear regression, t test, Analysis of Variance (ANOVA) the relationships were analyzed. In this study 85 patients were studied, 48(56.5%) of whom were females and 37(43.5%) of them were males. The average age of them is 16.97±7.02 years-old and mean BMI of them was 19.03±3.71 kg/m^2. The mean antioxidants received in these patients are vitamin A 883.35±1140.58 mcg, vitamin E 4.08±3.89 mg, vitamin C 204.40±238.71 mg and selenium 160±120 mcg, respectively. Among these antioxidants only vitamin C has a direct and significant correlation with hematocrit in the patients ($p<0.05$). In this study, between receiving vitamin A, MCV and MCH levels in the patients with thalassemia an inverse and significant relationship was observed.

Key words: vitamins A, E, and C, antioxidants, thalassemia

INTRODUCTION

Thalassemia syndromes, heterogenic group is of heredity anemia which is created due to deficiency type I making one or more globin chain. The thalassemia manifestations are widespread and range from asymptotic hypochromic and microcytosis to severe anemias and result in intrauterine death or death during childhood if not treated (Arzanian *et al*., 2005).

Iran is one of the countries in the world which has been located on the thalassemia belt. In the Caspian sea regions and the southern Iran, 10% of people are carriers of thalassemia genes and in the other regions this rate ranges from 4-8% and based on the reports by General Department for Disease Control of the Ministry of Health, Treatment and Medical Education, the number of patients with major beta-thalassemia is estimated to be 12494 people nationwide and considering the cases not yet diagnosed or cases with mean symptoms, it has been estimated to be around 15000 people (Hagh Shenasi *et al*., 1997).

These patients are encountered with various complications such as cardiovascular, pulmonary, neural, psychological, ophtalmological, dermal, bilious, joint, ENT, endocrine disorders and the cardiac complications is one of the most prevalent and important causes of death in these patients which appear at the second decade of life and after manifestation, they cause heart failure within a short time, the workload of the heart increases due to the hypoxia and sclerosis of the systemic vessels and the precipitation of iron in myocardium and subsequently results in the increase of oxidative stress and death (Hagh Shenasi *et al*., 1997; Aessopos *et al*., 2007).

Today, different studies indicate that high levels of oxygen together with hemoglobin containing iron attacking the non-saturated fat acids RBC result in producing free radicals(ROS) in the red blood cells of the thalassemic patients which through changing red-ox status of these patients and intensification of the oxidative stress, the complications of these disease are also intensified (Tesoriere *et al*., 2006; Cheng *et al*., 2005). The antioxidant systems include super-oxide demostasis and catalysis enzymes and the samples containing tioul such as glutathione and peroxyredoxin

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and also vitamin E are able to reduce oxidative stress (Cheng *et al*., 2005). In the recent years, the role of antioxidants on the improvement of oxidative stress and the heart failure has been emphasized. With regard to the fact that most diseases resulting from antioxidant deficiency and the increase of oxidative stress and few studies made in this respect, C, E, A deficiencies in these people have been considered (Tesoriere *et al*., 2006; Dhawan *et al*., 2005; Cheng *et al*., 2005). In this study, we intend to investigate the status of antioxidants received and the relationship between the anemia indexes in the children with thalassemia.

MATERIALS AND METHODS

This study is a retrospective research which has been performed on the thalassemic children in Sabzevar and Mashhad cities. The sampling method is target-based. This study has been performed on 85 subjects selected from among the patients with thalassemia. The sample was obtained concerning vitamin A which the most required sample has been estimated among the variables with type 1 error 0.05 and the test potential of 80%. The thalassemic children referred to the Vasee Hospital and Thalassemia Hospital in Mashhad (Sarver clinic) who have been prescribed blood transfusion and had already done three blood transfusions during a week and received 450 cc pack cell each time, were selected as subjects. After taking written consent and filling demographic questionnaire, their height and weight was measured through standard methods. Then, two day food reminder questionnaire and meal frequency questionnaire were filled for them (in order to determine the level and pattern of receiving antioxidants in the present and the past) and 5cc blood was taken from them for measuring the blood indices.

Data collection instruments in this study include questionnaire and laboratorial checklist. For determination of reliability of the researcher-made questionnaires, content validity and equivalent reliability were used for evaluating the credibility of the research. The questionnaire and lab check lists were assessed by two university professors. The lab methods and food process application are also standard.

The data gathered with the SPSS software and through correlation coefficient, linear regression, t test, ANOVA (for eliminating confounding variables) were analyzed.

RESULTS

In this study, 85 patients were examined [48 (56.5%) were females and 37 (43.5%) were males]. The average age of the patients was 16.97±02 and their average BMI was 19.03±3.71 kg/m^2. Among these patients 47.8% had family background with thalassemia and 52.2% did not have any history of this disease. 86.1% of them were with minor and 5.1% were with major type and both types of thalassemia were seen in the family history of 8.9% patients. 42.9% of the people were affected by splenomegaly after being affected with thalassemia, 30.7% of them were splenectomized. The average antioxidants received and the hematological indices of the patients and their relationship with one another are presented in the Table 1, 2 and 3, respectively.

Table 1: Mean±SD of antioxidants intake in thalassemic patients

Antioxidant	Mean±SD
Vitamin A (mcg)	883.35±1140.58
Vitamin E (mg)	4.08±3.89
Vitamin C (mg)	204.40±238.71
Selenium (mcg)	160±120

Table 2: Mean±SD of blood indices in thalassemic patients

Blood indices	Mean±SD
Hemoglobin	9.72±1.70
Hematocrit	28.61±3.08
Ferritin	3147.94±1855
MCV	80.70±4.83
MCH	26.90±1.95
MCHC	33.54±4.58
RBC	3.51±0.35

DISCUSSION

In this study, the average antioxidants received excluding vitamin C is lower than the standard amounts in the thalassemic patients. Only vitamin C is about three times more than the amount received. Claster *et al*. (2009) indicated that 40-75% of the patients with thalassemia are with antioxidant deficiencies such as vitamins A and C and Selenium (Claster *et al*., 2009).

In the study made by Livrea, in the thalassemic patients as compared with healthy people, the vitamin C rate of serum was 44%, vitamin E of serum was 42%, vitamin A of serum was 44%, Beta carotene of serum was 29% and lycopen of serum was 67% lower. He believes that the low level of vitamins E and A in serum of these patients is due to the disorder in the liver function, increase of oxidative processes and receiving low amount of foods rich in these vitamins (Livrea *et al*., 1996).

Therefore, the results of this study are supported by Ali *et al*. (2003). In the study which was performed on 63 patients who were 2-18 year old with thalassemia and 62 healthy subjects, the vitamin E, selenium and zinc in the serum in the people with thalassemia were lower than the control group (Ali *et al*., 2003).

Livrea *et al*. (1998) studied that 35 patients with thalassemia between 10-60 years of age indicated that the vitamin E level and beta-carotene in the LDL-C of these patients are 45 and 24%, respectively. In the healthy people, it is somewhat correspondent with the results of our study. In addition, in his study, oxidized LDL-C of patients with thalassemia are triple and the MDA level of them is double than the healthy people which represents an increase in the oxidative stress in these patients (Livrea *et al*., 1998).

Table 3: Correlation between antioxidants and blood indices in thalassemic patients

	Hb	Hct	Ferritin	MCV	MCH	MCHC
Vitamin A (mcg)	NS	NS	NS	P = 0/001 R = -0/36	P = 0/01 R = -0/28	NS
Vitamin E (mg)	NS	NS	NS	NS	NS	NS
Vitamin C (mg)	NS	P = 0/007 R = 0/3	NS	NS	P = 0/02 R = 0/25	NS
Selenium (mcg)	NS	NS	NS	NS	NS	NS

Table 4: Mean±SD of energy and nutrients intake in thalassemic patients

Energy and nutrients	Mean±SD
Energy	2397.61±1065.23
Carbohydrate	335.13±136.60
Protein	92.01±57.93
SAFA	23.64±15.60
MUFA	28.56±15.45
PUFA	18.21±9.81
Calcium	1271.64±1271.54
Phosphor	1200.98±743.66
Sodium	1143.33±771.57
Potassium	2681.45±1784.56
Iron	26.10±11.15
Zinc	10.06±7.03

Also, the study made by Dissagabutra (2005) indicated that vitamins C and E levels, glutathione and the Total Antioxidant Content (TAS) in these patients were low. This supports our results about the deficit in vitamin E and contradicts with our results about receiving the vitamin A (Dissagabutra *et al*., 2005). As you can see in the findings of this study, the hematocrit and hemoglobin levels of the serum are lower than the normal and the ferritin of serum is higher than normal. Dissagabutra believes that the low level of hemoglobin in the blood is due to the over-hemolysis of the red blood cells because of synthesis of un-natural hemoglobin and on the other hand due to the increase of producing free radicals such as peroxide hydrogen and destruction of the cell membranes, RBCs (Dissagabutra *et al*., 2005).

Lisboa believes that by inhibiting the destruction of red blood cells, antioxidants are protectors of RBCs and prevent from their hemolysis. In his study performed on 24 thalassemic patients (18 patients with major thalassemia and 18 with thalassemia sickle badge), receiving daily 500-1000 mg vitamin E during one year, then reducing lipid peroxidation and MDA in Red Blood Cells, the half life of the RBCs were increased and the average of annual hemoglobin increased (from 10.52-11.96 gr/deciliter) (Costa, 1986).

Livrea believes that production of free radicals by ferritin of serum has a direct relationship and in his study, he has demonstrated that the concentration of vitamin A of the serum has an inverse relationship with ferritin and the production of free radicals (Livrea *et al*., 1996). In our study, due to the low intake level, no relationship was observed. In Cay and Naziroglu, (1999) also receiving antioxidants such as vitamin A and Selenium for five consecutive weeks by the mice could not change hematological indices: MCV, MCH, MCHC as compared with control group (Cay and Naziroglu, 1999).

In our study, there is a significant and direct relationship only between receiving vitamin C and hematocrit which can be due to the high reception of vitamin C by the patients. The Chen *et al*. (2000) results support our results, these researchers stated that overload of iron in the presence of vitamin C reduces oxidative stress and the production of iso-prostan F2 and vitamin C deficit creates pathologic changes especially as increasing triglycerides of the serum and oxidized products are increased (Chen *et al*., 2000). Gerster indicated that reception of vitamin C has been useful for thalassemic patients and has adversely affected incurrence of heart disease (Gerster, 1999). Dissagabutra states: "Combined consumption of vitamins E and C has promoted the antioxidant status of the thalassemic patients and has improved their liver function in them and bilirubin of the serum has been reduced (Dissagabutra *et al*., 2005).

Furthermore, in this study between receiving vitamin A, MCV and MCH levels, an inverse and significant relationship was observed. Up to the present time, no studies have been made on the effect of the vitamin A on the MCV indexes (average globulin volume) and MCH (mean hemoglobin cells) so that we can compare our findings with them. But Bazuaye has suggested that between the reception of vitamin A and anemia megaloblastic in which MCV increases, there is an inverse relationship (Bazuaye *et al*., 2005). Ozdem *et al*. (2008) showed that patients with acid folic and B12 vitamins deficit are affected with degrees of megaloblastic anemia (Ozdem *et al*., 2008). In our study, reception of vitamin A was at the borderline and such a relationship was observed. Katerels believes that low amount of vitamin A and protein carrying (RBP) in the thalassemic patients can be the cause for the abnormal performance of liver in these patients (Katerelos *et al*., 1979).

Conclusion: The results of this study indicate that there is deficiency in receiving total antioxidants excluding vitamin C in the patients with thalassemia and regarding the benefits of these micronutrients for these patients, the necessity of consuming vegetables and fruits which are replete with antioxidants is recommended.

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