AJPS, 2010, Vol. 7, No.1

Estimation of Selenium Level in Serum of Iraqi Thalassemic Patients After Ferritin Assay

Sundus, Kh. Al-Khazraji

MSc Clinical Biochemistry, Assistant Instructor, College of Pharmacy, Al-Mustansiriya University

الخلاصة

أجريت هذه الدراسة على 17 مريض مثبت سريريا أنهم مصابين بمرض الثلاسيميا، ثمانية من هؤلاء المرضى قد خضعوا لعملية نقل الدم، من بين هؤلاء الثمانية إثنان فقط قد أعادت عملية نقل الدم بروتين الفيريتين إلى مستواه الصحيح أما الستة الباقين فقد تجاوز المستوى الحد الطبيعي.

الهدف من هذه الدراسة هو معرفة تأثير عملية نقل الدم للمصابين بمرض الثلاسيميا على مستوى السيلينيوم في الدم.

أظهرت نتائج هذه الدراسة إن مستوى السيلينيوم في كلتا المجموعتين (المجموعة الأولى لم تخضع لعملية نقل الدم والمجموعة الثانية خضعت لعملية نقل الدم) قد هبط بشكل ملحوظ وان العلاقة التي شوهدت بين مستويات بروتين الفيريتين والسيلينيوم هي علاقة ضعيفة طردية.

من أعلاه تم الاستنتاج أن عملية نقل الدم ليس لها أي تأثير على مستوى السيلينيوم في دم مرضى الثلاسيميا وإن العلاج الأمثل لرفع مستوى السيلينيوم هو تعاطي أملاح السيلينيوم على شكل جرعات فموية مع مراعاة الإصابة بالتسمم عند زيادة تلك الجرعات عن الحد الطبيعي الذي يحتاجه الجسم.

Abstract

Background: Selenium, a trace element with antioxidant properties, decreased in patients with blood disorders.

Objective: To see if blood transfusion in those patients with thalassemia corrects the level of selenium in their blood.

Materials & Methods: Seventeen patients enrolled in this small study, ten of them females and seven were males, their ages were ranged from 1.5-73 years. Ferritin and selenium levels were estimated using Mini-Vidas and atomic absorption technique respectively.

Results: Decreased selenium level in both non-bloods transfused (0.33±0.17ppm) and blood transfused patients (0.30±0.24ppm) show no effect of blood transfusion on the level of this trace element.

Conclusion: Selenium supplement is the only way to elevate the level of this element in the body with some precautions of selenium toxicity. Further studies on this subject are recommended.
Keywords: Thalassemia, Blood transfusion, Ferritin, Selenium

Introduction

Thalassemia describes a heterogeneous group of an autosomal co-dominant condition inherited disorder [1] characterized by reduced or absent amounts of hemoglobin, the oxygen-carrying protein inside the red blood cells. These conditions cause varying degrees of anemia, which can range from insignificant to life threatening [2].

The fundamental abnormality in thalassemia is impaired production of either the alpha or beta hemoglobin chain. Thalassemia is a difficult subject to explain, since the condition is not a single disorder, but a group of defects with similar clinical effects. More confusion comes from the fact that the clinical descriptions of thalassemia were coined before the molecular basis of the thalassemias was uncovered [3].

Thalassemia is also define as a group of hyperplastic refractory anemia syndromes characterized by increased iron absorption which represent the most common forms of hereditary anemias in the world [4,5,6].

Blood transfusions are used to treat severe forms of thalassemia. Children and adults with beta thalassemia major require regular transfusions. Some individuals with beta thalassemia intermedia, E-beta thalassemia and hemoglobin H-Constant Spring require transfusions from time to time, or sometimes more frequently. Some may need a transfusion if they develop a viral illness or other infection, which may cause anemia to become more severe. Health care providers may recommend more frequent transfusions if these individuals develop complications [7].

Ferritin is a protein in the body that binds to iron; most of the iron stored in the body is bound to ferritin. Ferritin is found in the liver, spleen, skeletal muscles, and bone marrow. Only a small amount of ferritin is found in the blood. The amount of ferritin in the blood shows how much iron is stored in the body [8].

Selenium is part of glutathione peroxidase which protects cell components from oxidative damage due to peroxides produced in cellular metabolism [9].
Once absorbed, selenium interacts with the sulfur-containing amino acids (e.g., cysteine and methionine) to form the enzyme glutathione peroxidase, and for incorporation into various proteins, such as hemoglobin and myoglobin [10].

Selenium supplements have been used in the treatment of anemia and growth problems which would not respond to other kinds of treatment [10].

Clinical iron-overload has been reported to be associated with decreased concentrations of protective antioxidants (e.g., glutathione peroxidase, selenium, vitamin E) [11,12,13,14].

Materials and Methods

In this small study, from 1/June/2008 to 31/June/2008, seventeen proved thalassemic patients enrolled, their ages ranged from 1.5 to 73 years, ten of them were females while males were seven. Eight of them have blood transfusion; just two of them correct the ferritin level (for females: 20-250 ng/ml & for males: 30-350 ng/ml), yet the others have exceed the normal level value of ferritin.

Ferritin and selenium levels were measured to evaluate if blood transfusion affect the level of selenium (reference value of selenium in normal subjects is 1.15 ± 0.09ppm).

Estimation of ferritin established by Mini-Vidas, this test conducted in Central Public Health Laboratories/Ministry of Health, using ferritin kit (Biomeriuex), while atomic absorption spectrometry technique is used in the estimation of selenium and this test conducted in Ibn Sina State. Company/Ministry of Industry & Minerals using the direct injection method into the equipment (Atomic absorption flameless atomizer, Shemadzu 680T).

In this study, Microsoft Office Excel 2007 is the statistical program that is used to analyze the results, and t-test using p value > 0.01 as significant value.

Results

The current study revealed a very weak direct correlation (r=0.04) between ferritin level & selenium level as it show in figure-1.

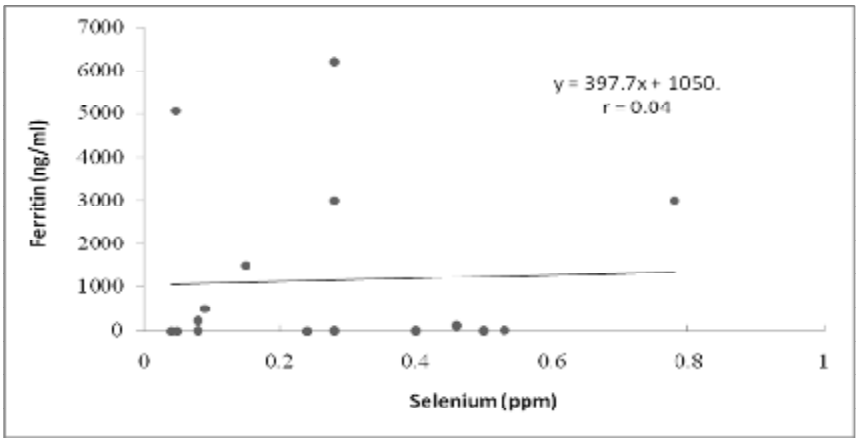

Fig-1: The correlation between ferritin level & selenium level.

Selenium level is significantly decreased (0.31±0.20ppm) in patients with thalassemia (p value > 0.001) was found in the current study (table-1).

	No. of subjects	Selenium (ppm)
Patients	17	0.31±0.20
Normal subjects	20	1.15±0.09
p-value		0.001

Table-1: Level of Selenium in both patients & normal healthy subjects.

Decreased selenium level in both non-blood transfused group (0.33±0.17ppm) and blood transfused group (0.30±0.24ppm) show no effect of blood transfusion on the level of this trace element (table-2).

	No. of patients	Ferritin (ng/ml)	Selenium (ppm)
Transfused group	8 patients	2450.62±2285.49	0.30±0.24
Non-transfused group	9 patients	6.40±4.01	0.33±0.17
p-value		0.01	0.9 *(NS)

Table -2: Level of Ferritin & Selenium in transfused and non-transfused groups.
***(NS) not significant**

Age and sex has report no effect on the level of selenium in this study. As in table (3), the mean±SD of selenium level in females was 0.28±0.25 and in males was 0.36±0.12. While in figure-2, the correlation coefficient 'r' for age and selenium is 0.12, that is mean a very weak direct correlation it occur between these two parameters.

	No. of patients	Selenium (ppm)
Females	10	0.28±0.25
Males	7	0.36±0.12
p-value		0.3 *(NS)

Table-3: Selenium level & sex.
***(NS) not significant**

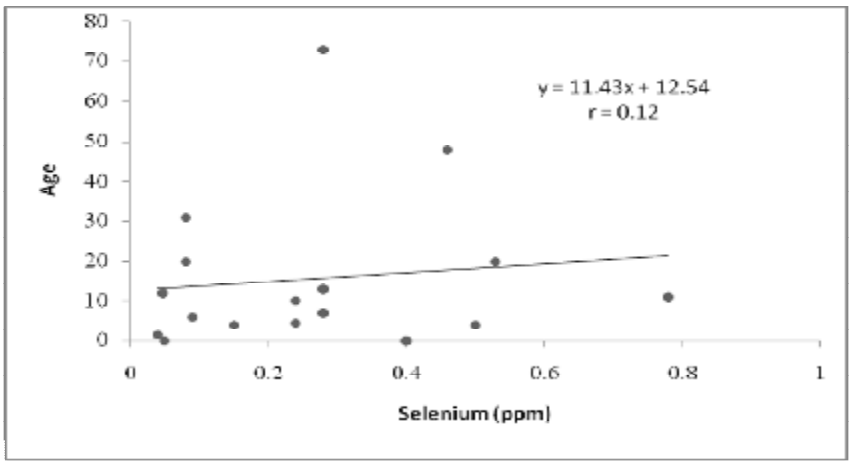

Fig-2: The correlation between Selenium level & Age.

The correlation between the level of ferritin and the level selenium was studied in all patients as one group and it found as a very weak direct correlation (r=0.04) (fig-1), while it studied in patients without blood transfusion and it is found as weak direct correlation (r=0.38) and in patients with blood transfusion and also it is found as weak direct correlation (r=0.26).

Discussion

Deficiencies of selenium have been reported to affect the iron-binding capacity of transferrin, and result in increased cellular heme and iron concentrations in various tissues [15,16,17,18,19,20,21].

A study interested with reference intervals and correlations for zinc, copper, selenium, iron, vitamins A and E, and related proteins with sex and age found that age was an important covariate for selenium and ferritin in healthy boys [22].

While other study on growth impairment, the problem of thalassemia major, divide the patients into 2 groups with and without growth failure and the correlation between growth failure and: age, sex, serum ferritin level, serum zinc and copper concentrations, serum copper-zinc ratio, regularity of blood transfusion, and the regularity and duration of chelation therapy, and the result were evaluate no significance differences between these parameters except in age, duration, and type of chelation therapy and age of beginning chelation therapy [23].

In the current study, age and sex has no effect on the level of selenium, also there is no difference in its level between patients with or without blood transfusion.

Patients with beta-thalassemia major and chronic iron-overload have decreased concentrations of the essential element selenium and the protective

selenium-dependent antioxidant enzyme GPx [13], which revealed an agreement with current study that considered selenium level.

The result of Suthutvoravut *etal*. tudy demonstrate that some types of thalassemic patients have vitamin E deficiency and support that vitamin E and selenium have related functions in the prevention of RBC oxidation. Vitamin E supplementation increased RBC resistance to oxidative damage [24].

An Egyptian study on the effect of repeating blood transfusion and its effect on the level of the antioxidants' function found that this transfusion subjected the patients to peroxidative tissue injury by secondary iron overload[25].

In-vitro study, effects of vitamin C and selenium on natural killer (NK) cell activity of ss-thalassemia major patients was investigated; Low-dose selenium treatment enhanced NK activity in patients and high-dose selenium decreased NK activity significantly in splenectomized patients so that selenium dosage should be arranged carefully in thalassemia patients [26].

From the results of these three mentioned studies which revealed the same conclusion of this study, selenium supplement is the only way to re-elevate the level of this trace element with taking selenium toxicity as a serious problem and further researches on this subject is recommended.

Acknowledgements

I owe Mrs. Zeana Y. Abdul-Razaq special thanks for her efforts in the sera collection & her support in this work.

References

1. Kumar, V.; Cotran, R.S. and Robbins, S.L.; The hematopoietic and lymphoid system. Basic pathlogy, 6th ed. chapter12.
2. http://www.lifesteps.com/gm/Atoz/ency/thalassemia.jsp
3. http://sickle.bwh.harvard.edu/thalover.html
4. Andrews, N.C. (1999). Disorders of iron metabolism. NEJM, 341(26), 1986-1995.
5. Olivieri, N.F. (1999). The ²-thalassemias, New Eng J Med, 341, 99-109.
6. Bottomley, S.S. (1998). Secondary iron-overload disorders. Semin Hematol, 35: 77-96.
7. http://www.marchofdimes.com/pnhec/4439_1229.asp; What is the treatment for thalassemia?
8. http://www.webmd.com
9. American regent laboratories INC. Selenium injection treatment only.pdf TRACE ELEMENT ADDITIVE FOR IV USE AFTER DILUTION
10. http://www.SB3.com/Minerals ~ Selenium.htm
11. Livrea, M.A.; Tesoriere, L.; Pintaudi, A.M.; Calabrese, A.; Maggio, A.; Freisleben, D. and Anna, R.D. (1996). Oxidative stress and antioxidant

status in beta-thalassemia major: iron overload and depletion of lipid soluble antioxidants Blood, 88, 3608-3614.
12. Young, I.S.; Trouton, T.G.; Torney, J.J.; McMaster, D.; Callender, M. and Trimble, E.R. (1994). Antioxidant status and lipid peroxidation in hereditary hemochromatosis. Free Radic Biol Med, 16, 393-397.
13. Bartfay, W.J. and Bartfay, E. (2001). Selenium and glutathione peroxidase with beta-thalassemia major. Nursing Res, 50(3), 178-183.
14. De Luca, C.; Filosa, A.; Grandinetti, M.; Maggio, F.; Lamba, M. and Passi, S. (1999). Blood antioxidant status and urinary levels of catecholamine metabolites in beta-thalassemia. Free Radic Res, 30(6), 453-462.
15. Chou, H.T.; Yang, H.L.; Tsou, S.S.; Ho, R.K.; Pai, P.Y. and Hsu, H.B. (1998). Status of trace elements in patients with idiopathic dilated cardiomyopathy in central Taiwan. Chung Hua I Hsueh Tsa Chih (Taipei), 61(4), 193-198.
16. Pighetti, G.M.; Eskew, M.L.; Reddy, C.C. and Sordillo, L.M. (1998). Selenium and vitamin E deficiency impair transferrin receptor internalization but not IL-2, IL-2 receptor, or transferrin receptor expression. J Leukoc Biol, 63(1), 131-137.
17. Chen, H. and Tappel, A.L. (1993). Protection of heme proteins by vitamin E, selenium, and beta-carotene against oxidative damage in rat heart, kidney, lung and spleen. Free Radic Res Commun, 19, 183-190.
18. Chareonpong-Kawamoto, N. and Yasumoto, K. (1995). Selenium deficiency as a cause of iron-overload and unbalanced distribution of other minerals. Biosci Biotech Biochem, 59, 302-306.
19. Chareonpong-Kawamoto, N.; Higasa, T. and Yasumoto, K. (1995). Histological study of iron deposits in selenium-deficient rats. Biosci Biotechnol Biochem, 59(10), 1913-1920.
20. Christensen, M.J.; Olsen, C.A.; Hansen, D.V. and Ballif, B.C. (2000). Selenium regulates expression in rat liver of genes for proteins involved in iron metabolism. Biol Trace Elem Res, 74(1), 55-70.
21. Kumerova, A.O.; Petukhov, V.I.; Letse, A.G.; Silova, A.A. and Shkesters, A.P. (1997). The effect of treatment with superoxide dismutase and selenium on blood ferritin and transferrin level in patients with hemoblastosis. Eksp Klin Farmakol, 60(3), 48-50.
22. Lockitch, G.; Halstead, A.C.; Wadsworth, L.; Quigley, G.; Reston, L. and Jacobson, B. (1988). Age- and sex-specific pediatric reference intervals and correlations for zinc, copper, selenium, iron, vitamins A and E, and related proteins. Clinical Chemistry 34:, 1625-1628.
23. Eshghi, Peyman; Alavi, Samin; Ghavami, Saeed; Rashidi, Armin (2007). Growth Impairment in [beta]-Thalassemia Major: The Role of Trace Element Deficiency and Other Potential Factors. J Pediatr Hematol/Oncol., January; 29(1):5-8.

24. Suthutvoravut, U.; Hathirat, P.; Sirichakwal, P.; Sasanakul, W.; Tassaneeyakul, A.; Feungpean, B. (1993). Vitamin E status, glutathione peroxidase activity and the effect of vitamin E supplementation in children with thalassemia. J Med Assoc Thai Oct; 76 Suppl 2:146-52.
25. M.R. Nasr; S. Ali; M. Shaker and E. Elgabry (2002). Antioxidant micronutrients in children with thalassaemia in Egypt. Eastern Mediterranean Health J. Sep; 8, No 4&5.
26. Atasever, B.; Ertan, N.Z.; Erdem-Kuruca, S. and Karakas, Z. (2006). In vitro effects of vitamin C and selenium on NK activity of patients with beta-thalassemia major. Pediatr Hematol Oncol; 23(3):187-97