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**STUDY OF THE EFFECT OF CONSUMING IRANIAN WALNUT ON SERUM LEVEL
OF IRON, FERRITIN, SATURATED TRANSFERRIN AND TOTAL IRON BINDING
CAPACITY (TIBC) AND BLOOD HEMOGLOBIN LEVEL IN 15-18 YEAR OLD BOYS**

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ABSTRACT

Introduction: Iron is an important element in human body which exists in the structure of hemoglobin, myoglobin, coenzymes such as catalase and peroxidase. Iron deficiency leads to disorders in many aspects of human health including reduced physical and mental ability in working, reduced antioxidant enzymes activity and creating oxidative stress in the body. Based on estimations by World Health Organization, iron deficiency anemia is frequent among adolescents. Use of medicinal herbs to cure diseases has been prevalent in human communities since old times. Given the unwanted side effects of some chemical medicines, more focus on potential effects of medicinal herbs on the functions of different parts of the body is justified. Walnut with a particular place in human nutrition is important, thus in this study, the effect of using walnut on iron absorption in boys (15-18) has been considered. Methodology: 15 people were randomly chosen as experiment sample and first stage of blood taking from each person as much as 5cc was performed. Then each person was given 75g of walnut per day for one month. The second stage of blood taking was conducted too and results were analyzed by paired t test. Findings: Statistical analysis indicated that taking walnut for one month increased serum iron, ferritin serum and serum saturated transferrin at a significant level ($P < 0.001$) while hemoglobin didn't increase at a significant level ($P < 0.5$). Also serum (TIBC) transferrin decreased at a significant level ($P < 0.001$). Conclusion: Based on results obtained, using 75g walnut per day for

one month can lead to more iron absorption and increased serum iron and iron carriers in the body .

Keywords: Nuts Juglans, iron, ferritin, full transferrin, total iron binding capacity (TIBC)

INTRODUCTION

Iron is an important mineral of human body involved in the structures of many vital proteins including hemoglobin and cytochromes enzymes [1]. Hemoglobin contains 34% iron [2]. Iron deficiency is the most frequent nutrition problem in human communities[3] leading to reduced mental concentration and learning ability, weakness, general fatigue, palpitation, reduced physical and mental abilities in the body[1-4]. Lower educational output and learning disorders in early school students may be the result of iron reserve deficiency, and many mental and behavioral problems in children are attributed to this phenomenon [5]. These complications given the role of iron in myelination of nerves and its impact on neural orientation speed is justified, and changes are evident in sense and behavioral responds due to iron deficiency[6]. This problem's prevalence in developing countries is much higher than industrial countries while it is particularly significant among some age groups such as adolescents and child bearing women [7]. Iron exists in different forms in body. Hemoglobin is stored as ferritin and hemosiderin in red cell circulation and

increased erythroblast, proteins containing iron such as myoglobin and cytochrome attached to transferrin. Iron hemostasis is well regulated at intestinal absorption level and iron exit from macrophages [8].

Using medicinal herbs to treat diseases has been common in human communities and until half a century ago plants were considered one of the most important sources for providing medicine to patients. Considering unwanted side effects of some chemical medicines justifies more consideration for potential effects of medicinal herbs on the functions of different parts of the body. Thus walnut with a special place in human nutrition is important and used extensively in the world traditional medicine. Walnut (*Juglans Regia L*) is from Juglandaceae family[9]. Walnut is one of medicinal herbs traditionally used for treating such diseases as stomach pain, eczema, dermal diseases, and sinusitis, endocrine, inflectional and parasite diseases. Its compounds has anti-microbial and antioxidant properties [10-11-12]. Walnut kernel in the Iranian ancient medicine is described as being fervid and dry,

hematopoietic, refining, treating lung disease and relieving gripes as well as preventing the formation of kidney stones and gall bladder stones. Recent research has shown that due to high amount of omega3 fatty acids, walnut reduces blood cholesterol and helps protecting body against cardiac diseases and cancer [13]. In reports by Kukongviriyapan et al. (2008) it has also been mentioned that presence of some antioxidants with high concentrations can help control red blood cells hemolysis through hydrogen peroxidase [14]. Walnut is the best source of minerals including copper, manganese, zinc and vitamins B and E. walnut contains 1.1% of copper [15]. Also among constituents of walnut are vitamins A and C[16-17]. The aim of this study is to examine the effect of consuming walnut on iron absorption in 15-18 year old boys. Since iron deficiency treatment by iron pills and its compounds causes stomach and intestine disorders [18], in this study it was decided to consider the effect of using walnut on iron absorption as a way to naturally increase iron level needed in the body.

MATERIALS AND METHODS

This study was conducted based on fundamental research method. 15 individuals out of 150 were randomly chosen then questionnaires were distributed among them

to obtain information on physical and health condition, lack of anemia especially iron deficiency and other diseases affecting iron level in the body to ensure the health of individuals under experiment. Then with the presence of laboratory technician and hygienic considerations, blood taking was carried out before consuming walnut. Now feeding walnut began. Walnut consumption per person was 75g/day for one month [19-20-21]. After one month, second phase of blood taking was conducted. Factors for tests were all iron indices including iron, ferritin, transferrin and hemoglobin and all tests before and after feeding walnut were carried out by digital devices and results for every person were prepared for iron indices while transferrin level was obtained from formula: $\text{serum iron} \times \text{TIBC} \div 100$ [18]. Then all data were calculated and analyzed using paired t method.

FINDINGS

Table 1 shows data from test blood samples before and after test, mean, SEM and significance level of serum iron, serum ferritin, serum saturated transferrin, serum TIBC transferrin and blood hemoglobin. As the following table shows, mean serum iron following walnut consumption for one month has remarkably increased ($p < 0.001$). Also using walnut for one month has remarkably

increased mean serum ferritin ($p < 0.001$). Moreover, results indicated that consuming walnut increases mean bloodhemoglobin but difference was not significant. Results also

showed that one month consumption of walnut remarkably increased mean serum saturated transferrin ($p < 0.001$). But serum TIBC transferrin decreased ($p < 0.001$).

Table1. Mean±SEM before and after test and variables significance levels

variables	(MEAN±SEM)before test	(MEAN±SEM)after test	unit	Significance level
Iron	6/654±88/3	6/670±102/3		P<0.001
Ferritin	3/582 ±29/86	37± 4/156		P<0.001
Hemoglobin	0/2160±16/073	0/2337±16/14		P<0.5
Transferrin(TIBC)	10/707±322/8	4/146±283/4	μ	P<0.001
Saturatedtransferrin	2/593±28/18	2/764±36/49	μ	P<0.001

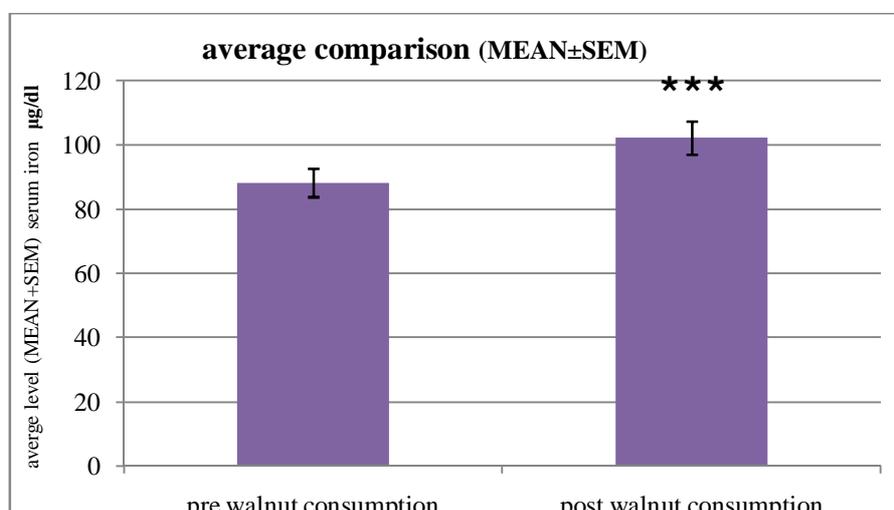


Figure 1: Iron Mean comparison pre and post walnut consumption. Results indicated a significant increase in serum iron level ($p < 0.001$)

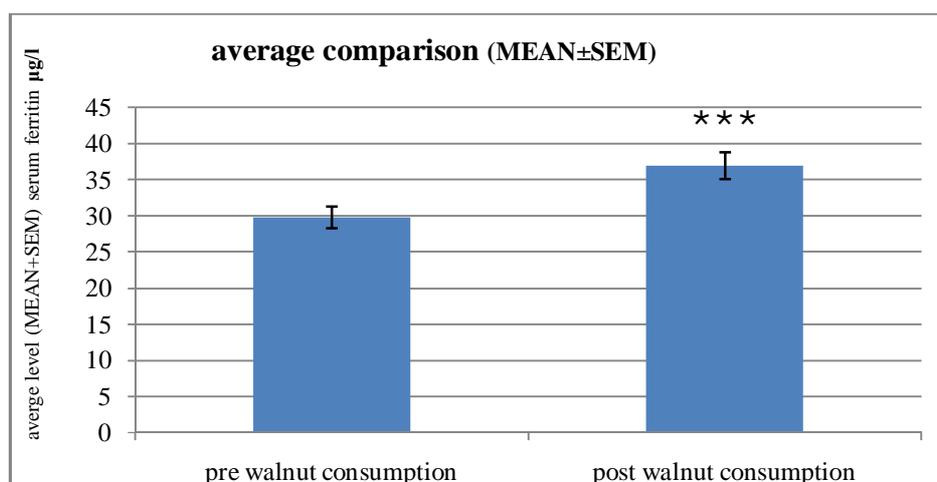


Figure 2: Ferritin Mean comparison pre and post walnut consumption. Results indicate a significant increase in serum ferritin level ($p < 0.001$).

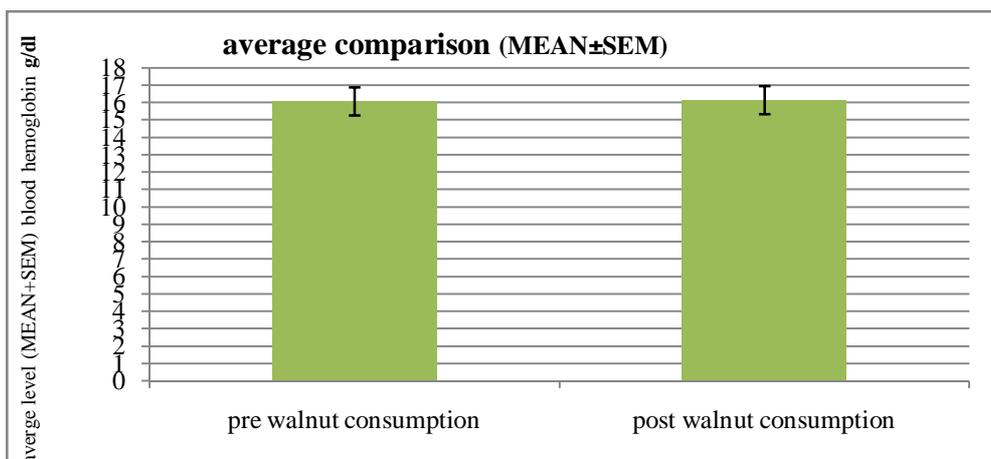


Figure 3: Hemoglobin Mean comparison pre and post walnut consumption. Results indicated that increase in blood hemoglobin level following walnut consumption was not significant.

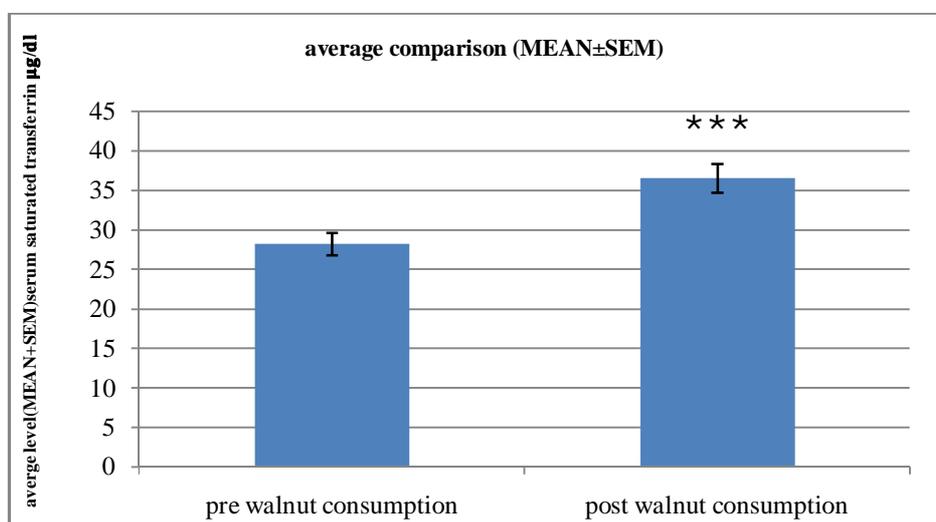


Figure 4: Saturated transferrin Mean comparison pre and post walnut consumption. Results indicate a significant increase in serum saturated transferrin level (p<0.001).

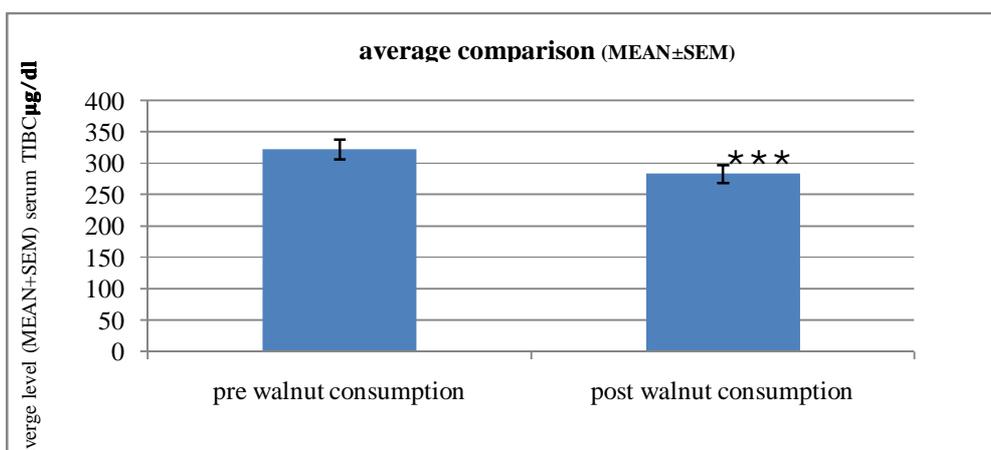


Figure 5: Transferrin Mean comparison pre and post walnut consumption. Results indicate a significant decrease in serum TIBC level (p<0.001)

DISCUSSION AND CONCLUSION

In the results of this study, serum iron level significantly increased ($p < 0.001$). Based on Iranian traditional medicine, walnut is described as hot, dry and hematopoietic in nature [13-22]. Walnut is the best source of copper [15], which after iron and zinc is the most important micronutrient in human diet [23]. There is a positive correlation between copper and Ceruloplasmin [24-25]. Ceruloplasmin is the essential relation factor between copper and iron metabolism in human. It is the most important protein with copper and it is a ferroxidase needed for releasing and transferring iron from tissues [23]. Thus, since walnut contains copper [15], it helps absorb iron in human body. Vitamin C is also another constituent of walnut [16]. It helps increase iron absorption in intestines [18-26] and its deficiency can lead to iron deficiency [27]. In this study, simultaneous prescription of iron and vitamin C significantly reduced anemia [28]. Concurrent consumption of vitamin C and iron will be effective only when there is 100mg vitamin C for every 15 mg of elemental iron in consuming materials so that iron absorption increases by 30% [29].

Serum ferritin level in this study too had a significant increase ($p < 0.001$). When vitamin C is insufficient [16], serum ferritin decreases

without being associated with serum iron reserve [30]. Therefore, given vitamin C in walnut, increased ferritin is justified [18]. Also given the role of copper in iron absorption and presence of copper in walnut [15], it can be said that consuming walnut can lead to increased serum ferritin.

Results of this study indicate decreased serum TIBC at a significant level ($p < 0.001$) and increased serum iron at a significant level ($p < 0.001$) too. Given that walnut contains vitamin C [16], and helps iron absorption in intestines [18] as this vitamin converts Fe^{2+} to Fe^{3+} , when serum iron increases, serum TIBC will decrease [31]. In a study conducted on Indian people with serum iron deficiency treated by vitamin C, there was a significant increase in blood hemoglobin, serum iron and serum saturated transferrin while a significant decrease in serum TIBC level [32]. In the present study, hemoglobin level has increased but difference was not significant.

Consuming walnut for one month led to a significant increase in mean serum saturated transferrin ($p < 0.001$). While walnut effect on serum transferrin level was reversed. As mentioned before, in the study on Indian people there was a significant increase in saturated transferrin with vitamin C consumption [32]. And in Mejia study (1998),

a group who received vitamin A with iron showed a better respond to increasing serum iron and transferrin saturation percentage compared to other groups which is consistent with the results of the present study[35]. Given the presence of the above mentioned vitamins in walnut, this increase is justified. Thus given the numerous medicinal properties of walnut, further research is needed into food models so that it is used as an effective herbal medicine in iron absorption and treating iron deficiency.

Conclusion: According to results of the research, consuming walnut for one month for 75g per day can help absorb more iron and increase serum iron and iron carriers in the body and prevent iron deficiency in people as a result.

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