



**International Journal of Biology, Pharmacy
and Allied Sciences (IJBPAS)**

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

INVESTIGATING THE EFFECTIVENESS OF IRON AND FOLIC ACID ON VO₂MAX SECONDARY SCHOOL STUDENTS

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ABSTRACT

Background: Although the device and tissue of the human body does not have the same response to a variety of activities, doing any activity that affects every cell of your body in different ways. One of these sectors, it is blood tissue and blood agents so that it seems more attracted scholars and researchers because of the importance of the role of metabolism and supply of oxygen and excrete carbon dioxide. This study is aimed at understanding and knowledge of the effects of iron and folic acid on vo₂max, blood parameters to enhance vo₂max and finally to postpone fatigue among female students in secondary school. **Methods:** This quasi-experimental research student's volunteer and non-athlete population in the age group 17-15-year-old girl in the city Firoozkooh as they were selected as Rick and availability. The sample consists of 60 students. Measuring the subjects' blood (iron, ferritin, mcv, mch, mchc, tbc, hemoglobin and hematocrit) it was done by a blood test and then test to determine vo₂max Bruce and calculate vo₂max. Along with Bruce test, blood oxygen saturation measured by pulse oximetry. The subjects were divided randomly into three groups: Iron, iron and folic acid and placebo (control). **Results:** Results were analyzed using SPSS software and found that iron and folic acid leads to an increase in serum ferritin subjects of iron, and iron and folic acid (first and second groups) and ultimately increase vo₂max in the two groups and there is a significant difference between iron and folic acid, with the placebo group the two factors vo₂max and ferritin. Hematological parameters did not change significantly and the difference was significant because of the blood to normal subjects.

Keywords: Ferritin, mcv, mch, mchc, tbc, hemoglobin and hematocrit, vo₂max

INTRODUCTION

Although the devices and tissues of the human body do not have the same response to a variety of activities, doing any activity that affects every cell of your body in different ways. One of these sectors, it is blood tissue and blood agents so attracted to most scholars and researchers because of the importance of the role of metabolism and supply of oxygen and excrete carbon dioxide. In particular, there is a variety of evidence the composition of the blood changes as a result of various physical activities. One component of blood, it is iron ore as this mineral deficiency is common in female athletes and it has been reported many times in studies of female athletes [1].

Iron is vital in optimizing athletic performance. Anemia caused by iron deficiency, which reduces the oxygen-carrying capacity and also minimizes the exercise tolerance. Iron is also important in the use of energy within the cell and it will serve as a factor for enzymatic reactions in the Krebs cycle and also as a component of myoglobin (as it is necessary for intracellular iron storage) and cytochrome (in the oxidation routes phosphorylated) [2].

Because we need to iron to form hemoglobin and myoglobin hemoglobin also plays an important role in the transport of oxygen in

the body, the railway plays an important role in the transport of oxygen in the body. Hemoglobin in red blood cells in the lungs, it is combined with oxygen and transported through the blood to all tissues of the body. Myoglobin in muscle, which combines with oxygen and stored until needed [1].

Iron deficiency is common around the world. In some studies it has been found that more than 25 percent of the world's people suffer from iron deficiency. Because women lose iron in their bodies because of menstruation and childbirth and why is that iron deficiency is more common among women than men. This problem is compounded by the fact that in general, women eat less food than men and therefore less iron absorption in the body [1]. Especially endurance exercise, it causes a decrease in serum ferritin levels. Because exercise reduces the amount of ferritin (iron stores), we can expect that the amount of iron in athletes is ready, it is less than non-athletes; in fact, the wave of cross-sectional research started more than two decades ago, it represents some of the athletes, especially endurance athletes caught in iron deficiency. Therefore, this study is important that can be used the results to an increase in female students vo₂max and it is essential in the sense that we can put an end to the problem

of female students vo2max and low levels of iron in their blood and finally, with this study, we can reduce the problems of their physical fitness and restore them to normal. As a result, it causes to their health and future generations in the community because these girls are future mothers.

MATERIALS AND METHODS

Vo2max the volume of oxygen or the maximum amount of oxygen a person or the maximum amount of energy that can be produced from the aerobic energy system for each unit of time. Vo2max depends on the ability of tissues to use oxygen for aerobic decomposition of metabolic fuels and the ability to mix in different systems (lung, cardiac, vascular and cellular) to transfer oxygen from the air to the mitochondria. Vo2max usually measured by oxygen consumption [3].

In other words, vo2max the same maximal oxygen uptake (aerobic capacity) and it is the highest amount of oxygen during the run up exercise until exhaustion as the maximum amount of energy that can be generated from an aerobic energy system for each unit of time [3].

Satin and others have reported that almost half of the progress after training in adult patients in Vo2max; it can be caused by an

increase in maximum oxygen consumption of arterial blood [1].

Vo2max is the total energy available to meet the needs of long-term exercise saved by the oxidation of food supply as it is the maximum capacity for oxygen when performing the most physical activity known as aerobic capacity, maximum oxygen absorption, burn up oxygen and cardiac capacity - respiratory [4].

Assessment of iron status iron is one of the essential metals in the human body and it is a component of hemoglobin, myoglobin and cytochrome in the meat green vegetables. Two-thirds of iron in the body, it is in the form of hemoglobin and it is the smaller value to other forms of liver and bone marrow. Consumption of plant foods such as spinach, lentils, chard, grapes, strawberries and etc. with animal proteins (meat, poultry and fish), it helps the body absorb iron [5].

If the body does not get enough iron from the diet, the iron in red blood cells is used in about 80%. Iron absorption from the digestive tract, it should be in the form of soluble salts of iron. Iron is absorbed in the body; it is driven more to places such as the liver, spleen, and bone marrow. Small amounts are excreted through feces, urine and bile [5].

Iron deficiency

Iron deficiency is divided into three stages:

1) First, it is a negative balance in iron, the withdrawal and destruction of red blood cells need to get more iron from it. In this step, the reduced iron stores as long as there are iron stores for compensation. TIBC is the natural, at this stage, the red blood cells are not as natural [5].

2) Next, iron stores are depleted and thus reduced iron. Until maintain normal serum iron, hemoglobin production is not affected but when the iron is reduced to a certain level, hemoglobin is impaired gradually will low the hemoglobin and hematocrit. At this stage, the red blood cells are not as natural [5].

3) At this stage, anemia occurs and the red blood cells become small and pale, reduction of serum ferritin and increased TIBC [5].

Iron deficiency, the most common dietary deficiency in the United States. About 35 percent and 58 percent of young people, in other words, healthy women suffer from iron deficiency. Scientific evidence suggests that athletes who train intensively, they need to have more iron than people who do not exercise. This demand is partly due to an increase in the destruction of red blood cells during exercise [6].

Athletes can benefit from iron supplements according to their actual needs. If they do this

without regard to their actual needs, iron supplements can increase the risk in addition to being expensive, for additional iron can not be excreted from the body and it is stored in the liver. There is a possibility of permanent damage to the liver for someone who consumes too much iron. So you have to do stress testing in accredited laboratories iron and to the activities of athletes [7].

Folic Acid

It is one of the vitamins in group B, an essential role in cell division and is prescribed to treat anemia. Folic acid is absorbed in the upper small intestine and appears in the blood to rate and linked to plasma proteins. It helps the absorption of iron [8].

Folic acid is also a term commonly used for acid glutamic menu Petroil, it has now been restored to the original by tetrahydrofolate as many reactions. Including conversion of homocysteine to methionine, Deoxythymidylate to Thymidylate imported in the synthesis of DNA. There folic acid in many fruits and vegetables (especially lemon and green leafy vegetables) [8].

BACKGROUND RESEARCH

In general, the iron has a positive effect on the development of aerobic exercise activities; as far as doctor Ros-hite (2000) concluded that iron can lead to improvements

in athletic performance although fatigue is not caused by iron deficiency and other pathogens are also effective on fatigue and the best way is to take iron supplements for intramuscular injection, especially in women [9].

Artez and colleagues (1983) examined the size of red blood cells in conjunction with blood platelets and they found that red blood cells in patients with anemia sideroblastic small, it leads to loss of continuity in addition to being important in hematocrit, platelet adherence to the walls of the arteries [10].

Gonarson and colleagues (April 2005) investigated the iron status of communication with dietary and other factors in children 6 years old and they found that meat, fish, fruit juices, as well as multi-vitamins and minerals they are leading to an increase in iron in children 6 years of age while cow's milk may have a negative impact on the iron in these children [11].

S. Broberg and colleagues (2006- 2005) examined the blood pressure and the relationship between iron deficiency disease symptoms and exercise capacity in adults with congenital heart disease and they found that iron deficiency and microcytic not cause an increase in blood concentrations of these and symptoms such as fatigue, headache and dizziness are common in these patients and

exercise capacity in patients with hematocrit [12].

Agarwal (2006) examined the effect of zinc, iron, ferritin, transferrin and hemoglobin in people with chronic kidney disease and he found that iron supplementation resulted in an increase in transferrin and ferritin levels but no increase in hemoglobin was observed in these patients [13].

Mostahfezian (2002) studied the effect of aerobic training, particularly on iron, ferritin and total iron binding capacity of serum non-athlete students at Islamic Azad University of Najaf Abad; the research was carried out on 30 students 25-20 years old in two experimental and control groups [14].

SadeghianShahi (2002) examined the effect of a submaximal aerobic exercise on iron, ferritin and TIBC in patients with thalassemia major and he came to the conclusion that blood ferritin was significantly reduced in patients immediately after exercise while it shows a significant increase in the utilization of the training stage. In the recovery period, there was a significant positive correlation between serum ferritin with iron standards and TIBC. The results show that submaximal aerobic activity, it increases the release of tissue ferritin the recovery period in addition to

reducing ferritin in practice, and thus increases the impact of Desferal[15].

In most studies, the researchers concluded that the positive effects of iron supplementation, especially in relation to women. But we should not be oblivious of the fact that excess iron, it can lead to digestive problems like nausea and diarrhea and it must be in the prescribed drug interactions with other medications such as tetracycline (an antibiotic drug used to treat infection) because iron is due to a decrease in absorption of tetracycline and require a minimum distance between two or three hours of taking them. It should also be noted the Times of iron and food after it [16].

METHODS

This is a quasi-experimental study design was based on the objectives and questions and by taking samples. On the other hand, empirical research so that examined the effectiveness of two independent variables (iron and folic acid) to one dependent variable (Vo₂max). Of the 270 volunteered in high school girls in city Firoozkooch September 17, a total of 60 patients were selected with an average age between 18 and 16 years on a concerted period and get a testimonial from them. Then, referring to Imam Khomeini hospital Firoozkooch martyr Beheshti University of Medical Sciences,

Bruce test was carried out under the supervision of a cardiologist and in charge of subjects with exercise test (treadmill); then the 60 patients were divided into three equal groups randomly as one of the groups were given iron supplements, iron and folic acid supplementation to the next group and the third group a placebo. Then, after eight weeks, blood tests and the test beam was again the subjects.

After this phase, participants measured blood oxygen saturation, then Bruce test and continue to provide the desired products to each group for 8 weeks (Iron supplement to Group 1 or Group iron, iron and folic acid supplements to Group 2 or Group iron and folic acid and placebo group 3 (gender placebo belonged to starch) Bruce was again a blood test and test subjects after 8 weeks and the results were compared two together. Data collection tools include consent (to get the consent of the subjects or their parents to participate in the study) and questionnaires. A questionnaire is given to all participants to inform their health as this questionnaire contains all the information necessary to carry out this research like the types of food, when to use them, congenital diseases, blood diseases and other illnesses, type of activity, duration of exercise, and so on.

First, get a blood sample from all subjects to determine the level of hemoglobin, hematocrit, serum ferritin, TIBC percent free capacity of the carrier protein, iron, MCV (volume or size of red blood cells), MCH (hemoglobin concentration in the blood (or red blood cells)), MCHC (split these two factors together). The beam test of the three groups before you start taking these supplements and calculate VO_{2max} as well as measurement of blood oxygen saturation and heart rate by pulse oximeter (resting heart rate was measured with the help of a stethoscope on the chest and wrist tape). Subjects were transferred to the treadmill and they walked with a gradient of 10% and a speed of 7.1 miles per hour so were calculated every three minutes during stage seven (device speed increase of about 2% tilt the device and 8.0 miles per hour) and calculated according to the formula VO_{2max} keep participants on a treadmill. After this step, the turns seemed to provide the perfect complement to the subjects so that 50 mg ferrous sulfate tablets are given to people who were taking only iron for two days in between. A tablet of ferrous sulfate 50 mg tablets plus a 1 mg of folic acid, a group that received iron and folic acid every two days; and the third group received placebo (consisting of starch) in the same way that's

why they were given a 50-mg tablet of iron because according to studies in the medical books and literature as well as domestic and laboratory specialist, the daily intake of iron is 18 to 15 mg daily and folic acid can also be used to size 3/0 to 1 mg daily). After 8 weeks of supplementation, blood samples were taken again from all three groups, then Bruce test and calculate their VO_{2max} and measure hemoglobin oxygen saturation and compared with the first step before taking the supplement. In this study, we used descriptive statistics to describe data (including frequency tables, charts and indices of dispersion in the form of tables), Kolmogorov - Smirnov test for normality of the distribution curve, Levene test for homogeneity of variance test and inferential statistics one-way ANOVA to test the hypothesis and also to determine the Scheffe post hoc test between groups.

RESULTS AND DISCUSSION

The sample was selected from students. 20 of them belong to the first group were given iron supplements to them, 20 belong to the second group were given iron and folic acid supplements and 20 and the third group was given a placebo related to them. Information on descriptive data was summarized in three groups (Table 1). The results in Table 1 show that three groups are roughly equal in terms

of height, weight and age. However, the average age in the placebo group (control) is slightly higher than the other two groups (almost a year).

Vo₂max and blood in three groups of subjects were measured before and after taking the supplement. The mean and standard deviation for each of them were included in the three groups shown in Table 2. As can be seen, in the group that received aerobic power increased iron, the aerobic power increased in the group consuming iron and folic acid but aerobic power increased very slightly in the placebo or control group and it has little value because it is increasing less than 1%. The greatest increase was seen in the group of iron and folic acid. Oxygen saturation increased capacity in each of the three groups include iron, iron and folic acid and placebo firstly, the increase observed in the control group and placebo and secondly, the increasing poor (not very visible). Hemoglobin increased about 28/0 iron group also it has declined about 4.0 in iron and folic acid, 0.18 increase in the placebo group so that these increases are very low and unpredictable because it is under 1 gram per

deciliter. According to Table 2, the mean hematocrit was a slight increase in iron and placebo groups and a slight decrease in iron and folic acid. Ferritin levels in both groups: iron, and iron and folic acid have been a large increase: In the group of 12 mg iron per deciliter and in iron and folic acid 13 micrograms per deciliter so that it has a fairly good increase. But it has been a small increase in the placebo group or the control 0.23 micrograms per deciliter as has been seen the greatest increase in iron and folic acid. So it is observed that iron and folic acid causes an increase in serum ferritin subject to change. Percent free capacity decreased iron transport protein in iron but it has increased in iron and folic acid and the placebo group so the increase is similar. The average volume of red blood cells increased in groups, iron, and iron and folic acid but it has decreased in the placebo group. The average cell hemoglobin did not change much in all categories it has been a very small increase in the three groups. The average red blood cell hemoglobin concentration increased slightly (about 0.6 in iron, iron and folic acid in 0.36, and 0.44 in the placebo group).

Table 1: Profile of Participants

Physical and statistics characteristics Groups	Age (year)	Weight (kg)	Height (cm)	Person
	Mean and Standard deviation	Mean and Standard deviation	Mean and Standard deviation	Number
Iron	16.72±1.018	55.61±8.65	161.67±5.93	18
Iron and folic acid	16.72±0.826	54.89±10.31	159.17±3.75	18
Placebo	17.29±0.849	60.88±9.98	160.65±5.26	17

Table 2: Mean and standard error vo2max and blood factors in three groups before and after taking the supplements

Factors	Groups					
	Iron		Iron and folic acid		Placebo (control)	
	Pre-exam	Post-exam	Pre-exam	Post-exam	Pre-exam	Post-exam
Vo2max	36.66±1.34	40.28±1.39	33.49±1.83	39.81±1.46	36.99±1.48	37.96±1.40
Oxygen saturation capacity	96.11±0.96	96.39±0.43	95.17±0.73	96.00±0.33	95.82±0.36	96.59±0.33
Hemoglobin	13.36±0.19	13.64±0.21	14.1±0.21	14.06±0.19	13.64±0.24	13.82±0.26
Hematocrit	42.82±0.78	43.66±0.59	45.07±0.54	44.56±0.52	43.96±0.71	43.82±0.65
Ferritin	27.78±4.23	39.29±4.29	31.79±4.18	44.79±7.23	31.98±6.30	32.21±5.29
TIBC	341.78±15.8	338.61±13.20	322.39±7.30	330.39±7.74	339.82±11.88	347±12.5
MCV	89.51±1.33	89.59±0.99	89.9±1.05	89.28±1.009	89.25±1.70	88.55±1.62
MCH	28.064±0.47	28.21±0.35	27.59±0.35	28.81±0.35	27.65±0.57	27.82±0.55
MCHC	30.76±0.26	31.06±0.35	31.23±0.20	31.59±0.35	30.96±0.23	31.4±0.55

According to analysis of variance shown in Table 3, the following results were obtained:

- As you know, the null hypothesis is rejected at a significance level of $P \leq 0.05$, so there is a significant difference between vo2max of iron, and iron and folic acid in high school female students.
- There is no significant difference between the capacity of hemoglobin oxygen saturation in the consumption of iron and folic acid (supplement had no effect on blood oxygen saturation capacity).
- There are significant differences between subjects in the iron hemoglobin, and iron and folic acid (taking iron supplements and iron and folic acid had no effect on blood hemoglobin subjects).
- There are significant differences between hematocrit of iron, and iron and folic acid in girl's secondary school student the iron, and iron and folic acid had no effect on these factors.

- There are significant differences between serum ferritin iron in the blood, and iron and folic acid in girl's secondary school students.
- There is no significant difference between the percentage of free capacity of the iron-carrying protein in the blood, iron, and iron and folic acid in secondary school students the iron, and iron and folic acid had no effect on these factors.
- There is no significant difference between the average volumes of red blood cells caused by iron, and iron and folic acid in girl's high school students the iron, and iron and folic acid had no effect on these factors.
- There is no significant difference between the mean cell hemoglobin in the blood, iron, and iron and folic acid girl's secondary school student the iron, and iron and folic acid had no effect on these factors.
- There is no significant difference between the average red blood cell hemoglobin concentration of iron, and iron and folic acid girl's secondary school student the iron, and

iron and folic acid had no effect on these factors.

Table 3: Analysis of variance difference between pre-test and post-test and blood vo2max

P	F	The average differential in the placebo group (control)	The average difference in iron and folic acid.	The average differential in the iron group	Factors
0.005	6.231	0.96	6.32	3.68	Vo2max
0.949	0.052	0.86	0.83	0.61	Capacity hemoglobin oxygen saturation
0.114	1.18	0.141	-0.033	0.33	Hemoglobin
0.205	1.638	-0.15	-0.51	0.78	Hematocrit
0.041	3.405	0.168	13	11.52	Serum ferritin
0.248	1.29	-1.41	8.11	-6.61	TiBC
0.998	0.002	-0.6	-0.622	-0.561	MCV
0.979	0.022	0.17	0.23	0.2	MCH
0.475	0.755	0.27	0.41	0.14	MCHC

CONCLUSION

This study suggests the usefulness of iron and folic acid in vo2max improvement in aerobic activities in the girls' secondary school student and this effect is independent of the type of group) iron, iron and folic acid and placebo). It means that female students have no anemia and iron deficiency, they were able to increase their duration aerobic activities and avoid early fatigue if you take iron supplements for a day in between the size of a tablet 50 mg tablets 1 mg of ferrous sulfate and folic acid in fact, the vo2max grown in them. As a result, it is expected that they can improve their aerobic exercise record and success in activity of aerobic (endurance) more than before. What this study found is that presumably, blood ferritin level subjects leads to improved vo2max the effect of iron and folic acid. Evaluation of iron and folic acid supplements while on other blood factors, it showed that none of

the blood parameters were significantly increased.

REFERENCES

- [1] Roland Thomas, Exercise physiology growth period, translating Gaeni, Publication DaneshAfroz, 2000.
- [2] Morgan, R., Gleeson, M., Hough G., Paul, L. Biochemistry sporting activities; translation Gaeni and MR Hamedinia and Mary KoushkiJahromy and M. Fathi, Publication Samt, 2001.
- [3] Abraham, K.,Kozechian, M. Descriptive Glossary the Exercise Physiology, publication Azar.2006.
- [4] NejatiNarenjkoli, A. Weight loss, and its role in Fitness; publication Nilofaraneh, 2004.
- [5] Kazem Mousavi, M. R. Drug, treatment and complications; Publication Sepehr, 1999.

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- [6] Phillips, B. Encyclopedia of sports supplements, translated by M. Porfekri, publication Elm & Varzesh, 2006.
- [7] Gaeini, A. Strategies in sports nutrition and weight control; publication BamdadKetab, 2006.
- [8] Getry, H. A. Principles of nutrition, translated by M. Frozani, publication Chehr, 1997.
- [9] Highet, R. Fatigue and Iron Deficiency in Athletes – a patient's guide; 11/1/2000.
- [10] Aarts, P.A., Bolhuis, P.A., Sakariassen, K.S., Heethaar, R.M., Sixma, J.J. Red blood cell size is important for adherence of blood platelets to artery sub endothelium; Copyright © 1983 by The American Society of Hematology, 07/01/1983, 62(1): 214-217.
- [11] Gunnarsson, B. S., Thorsdottir, I., Palsson, G. Associations of iron status with dietary and other factors in 6-year-old children; EJCN (European Journal of Clinical Nutrition), 2007, Vol. 61, 398-403.
- [12] Broberg, Craig S., Bax, Bridget, E., Okonko, Darlington, O., Rampling, Michael W., Bayne, S., Harries, C., Davidson, Simon J., Uebing, A., Khan, A. A., Thein, S., Gibbs, J., Simon, R., Burman, J., Gatzoulis, M. A. Blood viscosity and its relationship to iron deficiency, symptoms, and exercise capacity in adults with cyanotic congenital heart disease; March 2006.
- [13] Agarwal, R. Proinflammatory effects of iron sucrose in chronic kidney disease; Kidney Int 69: 2006;1259-1263.
- [14] Mostahfazian, M. Especially aerobic exercise on iron, ferritin, and total iron binding capacity of serum non-athlete students; Journal of Sports Sciences, 2002, 1(3):64-55.
- [15] SadeghianShahi, M. R. The effect of a submaximal aerobic activity variation in iron, ferritin and TIBC blood in patients with thalassemia major; journal of Movement, 2001, Issue 11, pages 117-107.
- [16] Kalabi, D. Review of Biochemistry; translated by P. Pasalar, Tehran University Press, 2000.
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