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Effect of Aerobic Exercises on Iron Deficiency Anemia in Postnatal Women

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Abstract

Background: Iron Deficiency Anemia (IDA) is diminished red blood cell production due to low iron stores in the body. It is the most common nutritional disorder worldwide and accounts for approximately one-half of anemia cases, it is a common problem in postnatal period due to dietary deficiency of iron and folates during pregnancy and the blood loss during delivery.

Aim of Study: This study was conducted to determine the effect of aerobic exercises on iron deficiency anemia in postnatal women.

Material and Methods: Fifty post natal women after delivery complaint from iron deficiency anemia (diagnosied by gynacolgist/physican) shared in this study. their ages ranged from 20 to 35 years old, their body mass index >35kg/m^2 and thir serum ferritin level ranged from 30 to 70ng/dl. They were devided randomly into two groups (A & B) equal in numbers. Group A (study group) was treated by iron supplemnt tablets (ferrous sulfate 200mg once per day), diet therapy and aerobic exercises in a form of walking on elctrical treadmill (30min/ session, 3 times/week for 3 months), while group B (control group) was treated by iron supplement tablets (ferrous sulfate 200mg once per day) and diet therapy only. Serum ferriten level, body weight and body mass index were measured befor and after performing the treatment program for both groups (A & B).

Results: The obtaied result showed that there was significant decrease (p>0.01) in the mean values of serum ferriten levels, body weight and BMI in group (A) post-treatment when it compared to pre-treatment mean values, whlie in group (B) there was a statitcally signifcant increase in (p>0.01) in the mean values of serum ferritin levels in post-treatment when in compared to pre-treatmen mean values and there is significant decreace in mean values of body weight in posttest when it compared to pretest mean values with no significant difference in mean values of BMI in pre and post-test.

Conclusion: The result of this study could be concluded that aerobic exercises was not recommended for women with iron deficiency anemia during postnatal period.

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Key Words: *Iron deficiency anemia – Postnatal period – Serum ferritin – Aerobic exercises – Body mass index.*

Introduction

IRON Deficiency Anemia (IDA) is diminished red blood cell production due to low iron stores in the body. It is the most common nutritional disorder worldwide and accounts for approximately one-half of anemia cases [1,2].

Iron deficiency anemia can result from inadequate iron intake, decreased iron absorption, increased iron demand, and increased iron loss [3]. While menstrual blood loss is the most common cause of IDA in premenopausal women, blood loss from the Gastrointestinal Tract (GIT) is the most common cause in adult men and postmenopausal women [4]. In pregnancy, anemia is mainly nutritional due to dietary deficiency of iron and folates [5]. The American College of Obstetricians and Gynecologists has estimated that 5% of women who give birth lose 1000ml of blood or more during delivery. Bearing in mind that the limit value defining puerperal anemia is 1g/dl lower, the prevalence of anemia during this period remains comparable with that observed during pregnancy [6].

The diagnosis and management of IDA remains a challenge. Diagnosis of IDA requires laboratory-confirmed evidence of anemia, as well as evidence of low iron stores [7].

Ferritin, an iron storage protein, is the primary iron storage mechanism and is critical to iron homeostasis. Ferritin makes iron available for critical cellular processes while protecting lipids, DNA, and proteins from the potentially toxic effects of iron. Alterations in ferritin are seen commonly

in clinical practice, often reflecting perturbations in iron homeostasis or metabolism. It is increasingly recognized that ferritin also plays a role in a multitude of other conditions, including inflammatory, neurodegenerative, and malignant diseases [8]. A ferritin level tends to reduce before other laboratory indicators of iron deficiency and is the most reliable indicator of iron deficiency anemia [9]. In the study of Peeling et al., [10] suggested three stages for categorizing iron deficiency. Stage one, iron depletion, is SF levels of <35 µg/L indicating depleted iron stores in the spleen, liver, and bone marrow. Stage two, iron deficient erythropoiesis, is SF <20 µg/L which diminishes red blood cell production. Stage three, IDA, is SF levels <12 µg/L which is when hemoglobin production falls. Goddard et al., [11] founded that ID can be classified as severe ID when the serum ferritin level is below 20-30mg/L and mild-moderate ID if the serum ferritin level is below 70- 100mg/L. Ferritin level is considered the surrogate marker for ID. However, serum ferritin is an acute phase reactant and may be raised in cases of inflammation or infection, therefore a concurrent test for inflammatory markers is advisable in cases of anaemia with raised ferritin to exclude reactive causes. ID is most likely not present if the ferritin level is above 100mg/L.

Previous studies have shown that exercise itself can change the iron status in the body. Studies of athletes suggest that athletes tend to have a low serum ferritin level [12]. These results are seen especially in long distance runners. During physical activity, iron losses can occur from several avenues, including red-blood-cell hemolysis, sweating, hematuria, and gastrointestinal bleeding [13,14]. In addition, female athletes suffer iron losses as a result of menstrual blood loss. As such, athletes are highly susceptible to the development of iron deficiency [14]. The most convincing evidence highlighting the effects of exercise on iron status and the risk of iron deficiency is presented by Pate et al., [15] their study showed that an iron depletion state was significantly more prevalent in habitual female runners compared to the inactive counterparts. Furthermore, serum ferritin concentrations showed a significant negative correlation with running activity.

Material and Methods

This is an experimental design study was carried out on fifty postnatal women diagnosed clinically by gynecologist/physician as iron deficiency anemia, confirmed by blood test. They were be selected randomly from the Obstetrics Department in Al-Mataria Teaching Hospital, their ages ranged from 20 to 35 years, their body mass index were less than 35kg/m^2 and they diagnosed as having iron deficiency anemia after stop of postnatal bleeding. During the period between from February 2017 to April 2018. The patients were randomly divided into two equal groups, group A (study group) included 25 patients received iron supplemnt tablets (ferrous sulfate 200mg once per day), diet therapy and aerobic exercises in a form of walking on elctrical treadmill (30min/session, 3 times/week for 3 months) and group B (control group) included 25 patients recived iron supplemnt tablets (ferrous sulfate 200mg once per day), diet therapy only.

Inclusion criteria:

All patients were chosen under the following criteria:

Their age was ranged from 20-35 years old, they was diagnosed as having mild or moderate degree of Iron Deficiency Anemia (IDA) post puerperium (after stop of postnatal bleeding) their BMI was less than 35Kg/m^2.

Exclusion criteria:

All patients were excluded for the following criteria:

History of bone disease, renal, liver or endocrinal disorders, mechanical back pain, any contraindication to aerobic exercises as: Elevated blood pressure, cardiomyopathy.

Methods:

Clinical evaluation:

All patients was given a full explanation of the protocol of the study and consent form was signed for each patient before participating in the study. Informed consent form had been signed by each women before participating in the study, the purpose and nature of the study was explained to all women.

1- Weight and height measurements was measured while the women wearing a thin layer of clothes used standard weight and height scale to measure BMI according to the following equation:

$$BMI = Weight/height^2 (Kg/m^2)$$

2- Blood sample analysis to show serum ferritin level before and after treatment program. The blood sample was drawn after the stop of postnatal bleeding and after 3 month from the beginning of the treatment. Each subject was asked to lie in half lying position, with well supported back and arms. The antecubital area was cleaned with alchohol. Blood sample was drawn from the antecubital vein from all subjects by disposable sterile syringe.

Procedures:

Treatment program started after stop of postnatal bleeding lasted for 3 month for all patients.

Treatment procedures:

• *For group A (study group):*

1- Aerobic exercises: All patients in group (A) performed walking on electric treadmill three times/ week day after day for three months. Each session was lasted for 30 minutes as the following: 5min. warming up exercises by walking on treadmill by low speed, 20min. walking at moderate intensity 60-70% of max HR (HR=220-age) and 5min cooling down by walking on treadmill by low speed as in warming up.

2- Diet therapy: All patients received diet therapy advices which was in form of healthy foods rich in iron (as green vegetables, grains and dried fruits) and vitamin C (like orange, guava, lemon, watermelon and clementine). The body weight was recorded each 2 week for each patient.

3- Iron supplements: All patients received ferrous iron salts are the preparation of choice. The oral does for iron deficiency anemia should be 100-200mg of elemental iron daily.

• *For group B (control group):* Received diet and iron therapy only.

Statistical analysis:

• Results are expressed as mean ± standard deviation. Test of normality, Kolmogorov-Smirnov test, was used to measure the distribution of data measured pre-treatment. Accordingly, comparison between variables in the two groups was performed using unpaired *t*-test.

• Comparison between variables measured pre- and post-treatment in the same group was performed using paired *t*-test.

• Statistical Package for Social Sciences (SPSS) computer program (Version 19 windows) was used for data analysis. *p*-value ≤0.05 was considered significant.

Results

The result of this study showed that there was significant decrease ($p>0.01$) in the mean values of serum ferriten levels, body weight and BMI in group (A) post-treatment when it compared to pre-treatment mean values, whlie in group (B) there was a statitcally signifcant increase in ($p>0.01$) in the mean values of serum ferritin levels in post-treatment when in compared to pre-treatmen mean values and there is significant decreace in mean values of body weight in posttest when it compared to pretest mean values with no significant difference in mean values of BMI in pre and post-test. The percentage of decreasing in body weight was founded to be more in group (A) than group (B).

Table (1): Inter and intra-group comparison between mean values of ferritin in the two studied groups (A & B) measured before and after treatment.

	Group A (N=20)	Group B (N=20)	*t*# value	*p*-value
Pre-treatment	55.44±6.96	51.61±12.50	1.337	0.189 (NS)
Post-treatment	38.92±8.32	56.07±11.28	–6.117	0.001 (S)
Mean difference	16.52	4.46		
% change	29.80↓↓	8.64↑↑		
t## value	13.026	–5.135		
p-value	0.001 (S)	0.001 (S)		

Table (2): Inter and intra-group comparison between mean values of BMI in the two studied groups (A & B) measured before and after treatment.

	Group A (N=20)	Group B (N=20)	*t*# value	*p*-value
Pre-treatment	28.04±2.15	28.93±2.05	–1.486	0.144 (NS)
Post-treatment	26.91±2.16	28.82±2.11	–3.162	0.003 (S)
Mean difference	1.13	0.11		
% change	4.03↓↓	0.38↓↓		
t## value	22.041	1.988		
p-value	0.001 (S)	0.058 (NS)		

Table (3): Inter and intra-group comparison between mean values of weight in the two studied groups (A & B) measured pre-and post-treatment.

	Group A (N=25)	Group B (N=25)	*t*# value	*p*-value
Pre-treatment	77.20±8.73	78.92±6.93	–0.770	0.445 (NS)
Post-treatment	74.04±8.69	78.57±7.05	–2.024	0.049 (S)
Mean difference	3.16	0.35		
% change	4.09↓↓	0.44↓↓		
t## value	22.495	2.422		
p-value	0.001 (S)	0.023 (S)		

Discussion

This study was conducted to investigate the effect of aerobic exercise (in a form of walking on electrical treadmill) on postnatal iron deficiency anemia by using blood sample test for evaluate the serum ferritin level before and after treatment program for both group (A & B). The result of this study revealed that, using of aerobic exercises and received diet and iron therapy in group (A) there was a statically significant decrease in the mean value of ferritin measured at post-treatment when compared with its corresponding value measured at pre-treatment, while in group (B) who received diet and iron therapy only, was a statistical significant increase in the mean value of ferritin measured

at post-treatment when compared with its corresponding value measured at pre-treatment.

The result of this study was supported with the results of Nahid et al., Furqan at al., Moosavi and Schmid et al., Nahid et al., **[16]** examined the effect of aerobic exercise on serum ferritin levels in untrained middle-aged women and found that decrease in serum ferritin level after 6 months of aerobic training in both groups with no significant difference between both groups. Also in this study agreed with the present study as there was decrease in body weight and body mass index after 6 months of aerobics training. Also, Furqan et al., **[17]** examined the difference effect between moderate physical activity and vigorous activity on serum ferritin level and reported that moderate physical activity decreased serum ferritin level than vigorous activity. Also, Moosavi **[18]** reported that eight weeks aerobic training which including 40 minutes running twice a week with 60% to 65% reserve heart rate caused decrease in serum iron, serum ferritin and transferrin concentration and serum ferritin in girls. Schmid et al., **[19]** studied the effect of exercise training on different variables of iron status in different groups for study and different types of physical exercises, and founded that serum ferritin level decreased after prolonged aerobic exercise in trained females when compared with its level before training.

This study also agreed with Bejenariu et al., and Breymann et al., Breymann et al., **[21]** who study the effect of intravenous iron supplement versus oral iron supplement for anemic postpartum patients, and founded that at the end of the study (after 12 weeks of treatment with oral ferrous sulfate) there was a significant elevation at the level of serum ferritin from 34.8mg/l to 43.3mg/dl. And Bejenariu et al., **[20]** studied the effect of oral iron supplement on post-natal iron deficiency anemia 117 women received oral ferrous sulfate (100mg twice daily) for four weeks and founded that there was a significant increase in serum ferritin level post-treatment (p>0.01) which agreed with the current study result.

On the other hand the result of this study was disagreed with the study of Schumacher et al., **[22]** they attributed an increase in serum ferritin concentration after the laboratory tests for trained and untrained subjects and after prolonged aerobic exercise in male cyclists in thirty nine subjects.

Conclusion:

The obtained results of this study founded that the aerobic exercise not recommended for patients with iron deficiency anemia patients as it decreased serum ferritin levels in postnatal women.

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تأثير التمرينات الهوائية على أنيميا نقص الحديد لدى السيدات فى مرحلة ما بعد الولادة

الغرض: تهدف هذه الرسالة إلى دراسة تأثير التمرينات الهوائية على أنيميا نقص الحديد لدى السيدات فى مرحلة ما بعد الولادة.

الأشخاص والأساليب المستخدمة: تم إجراء هذا البحث على خمسين سيدة تعانين من أنيميا نقص الحديد بعد الولادة، وقد تم تشخيصهن من خلال قسم النساء والتوليد فى مستشفى المطرية التعليمى، تراوحت أعمارهم من عشرين إلى خمسة وثلاثين عاما ومؤشر كتلة الجسم لديهم أقل من خمسة وثلاثين كجم/م^2 ومستوى مصل الفريتين فى الدم تراوح بين ثلاثين إلى سبعين نانوجم/ديسلتر. وقد تم تقسيمهن عشوائيا إلى مجموعتين متساويتين فى العدد. المجموعة أ (مجموعة الدراسة): تكونت من خمسة وعشرين سيدة تلقين البرنامج العلاجى من خلال أقراص مكملات الحديد (كبريتات الحديدوز ٢٠٠ مجم مرة يوميا) والنظام الغذائى بالإضافة إلى التمرينات الهوائية فى صورة المشى على جهاز المشايه الكهربائية (ثلاثون دقيقة/الجلسة، ثلاث مرات إسبوعيا). المجموعة ب (مجموعة ضابطة): تكونت من خمسة وعشرين سيدة تلقين البرنامج العلاجى من خلال أقراص مكملات الحديد (كبريتات الحديدوز ٢٠٠ مجم مرة يوميا) والنظام الغذائى فقط. وقد تم تقييم المجموعتين (أ و ب) قبل وبعد البرنامج العلاجى عن طريق قياس نسبة مصل الفيريتين لكل سيدة كذلك قياس الوزن ومؤشر كتلة الجسم لكل منهن.

النتائج: أظهرت النتائج أن هناك إنخفاض ذو دلالة إحصائية فى القيم الوسطية لمصل الفيريتين بعد الإختبار فى المجموعة (أ) مقارنة بالقيم الوسطية قبل الإختبار، فى حين أن هناك زيادة ذات دلالة إحصائية فى القيم الوسطية لمصل الفيريتين بعد الإختبار للمجموعة (ب) مقارنة بالقيم الوسطية قبل الإختبار. أيضا حصلت هذه الدراسة على إنخفاض ذو دلالة إحصائية فى القيم الوسطية لمؤشر كتلة الجسم فى مجموعة (أ) فى مرحلة بعد الإختبار مقارنة بالقيم قبل الإختبار فى حين لا يوجد إختلاف فى القيم الوسطية لمؤشر كتلة الجسم فى مجموعة (ب) قبل وبعد الإختبار. كما حصلت هذه الدراسة أيضا على إنخفاض ذو دلالة إحصائية فى القيم الوسطية لوزن الجسم بعد الإختبار فى المجموعتين (أ و ب) ولكن بنسبة أعلى فى مجموعة (أ) عن مجموعة (ب).

الإستنتاج: يمكن أن نستنتج من هذه الدراسة أن التمرينات الهوائية غير موصى بها للسيدات اللاتى يعانين من أنيميا الحديد فى فترة ما بعد الولادة.