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Original Article

Effect of Moderate Intensity Exercise on Serum Ferritin Concentration

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ABSTRACT

An iron-containing blood protein is called ferritin. The amount of iron stored in the body may be determined with this test. **Objective:** To evaluate the changes in serum ferritin concentration induced by moderate-intensity exercise for 12 weeks. **Methods:** Participants (n=20) for this study were selected through the developed inclusion and exclusion criteria which included age (18-25 years), BMI (18.5-24.9), and no chronic disease in participants and non-athletes. After the selection of participants, the participants were divided into two groups which were the control group (n=10) and the experimental group (n=10). After division only the experimental group was allowed to follow the 12-week exercise plan (intervention). Fresh blood samples of around (2-5 ml) were obtained in Ethylene-diamine-tetra-acetic Acid (EDTA) vacutainers using 5cc syringes with the help of the hospital paramedic staff. After the sample was collected, the sample was sent to a laboratory for further process of examination of serum ferritin concentration, which was done by professionals. **Results:** The data were analyzed and evaluated statistically using Version 22 of IBM SPSS software. Different tests including mean, paired sample t-test and independent samples t-test were applied to calculate the p-values of all studied groups. **Conclusions:** It was concluded that based on data analysis and findings, the researcher concluded that moderate-intensity exercise has a significant impact on serum ferritin concentration among the respondents.

INTRODUCTION

Ferritin is the first protein known to be involved in iron metabolism. Oswald Schmiedeberg a German pharmacologist, was the first to describe it in 1894 he noted that in horse liver there is an iron-rich component. But, in the year 1937 a Czech biologist named Vilém Laufberger purified the ferritin for the first time from horse spleen he suggested that it must be an element that serves as an iron store for the organism [1]. The protein known as ferritin is created by the cells of the human body, with a concentration mostly in the liver and immune system cells. Initially absorbing, storing, and subsequently releasing iron when required, also found vital in the production of red blood cells. By deficient iron, the human body cannot produce an adequate amount of haemoglobin, it is a crucial portion that helps the blood for oxygen circulation to human body organs as well as tissues [2]. Ferritin is an intracellular protein that stores, protects and releases iron in a controlled manner when needed [3]. It is produced by all living organisms. The quantity of ferritin in the blood is directly linked to the quantity of iron deposited in the body. Iron is required to make healthy red blood cells (RBCs). These cells transport oxygen to tissues and each organ of the body [4]. Ferritin is a different way to measure how much iron the body has overall and is the blood test of what's actually in the tissues [5]. The normal value of ferritin in humans ranges from 12-300 ng/ml in males and

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12-150 ng/ml in females [6]. Levels of serum ferritin are considerably lesser in persons with anaemia or undertaking phlebotomy. Insufficiency of ferritin results in iron-deficiency anemia which shows that a person has reduced RBCs in the body [1]. Ferritin has been compared to the bricks for the iron warehouse said Dr. Thomas DE Loughery. It depends on how much iron stores a person has in their body and how much ferritin seeps out into the tissues [7]. Ferritin is a 450 kDa hollow nano-cage with an exterior diameter of 12–13 nm and an inner diameter of 8 nm that may contain up to 4500 iron atoms in a form that is both non-lethal and bioavailable. There are 24 subunits present in each ferritin complex in mammals that create a sphere-shaped symmetrical protein shell [8]. In addition to being an intracellular version of ferritin, it is a crucial protein for blood flow. Serum ferritin is a kind of ferritin that was first discovered in 1948 in animals suffering from hepatic cirrhosis or shock. Later, in people with different forms of liver diseases, this initial finding was validated. Similar to ferritin samples taken from the spleen or liver, serum ferritin exhibited immunologic reactivity, molecular size, and isoelectric focusing properties. Additionally, serum ferritin had an astonishingly low iron content, only containing 4–20% of the iron found in liver or spleen ferritin. Even in patients with an excess of iron, this relatively low iron concentration persevered. Serum ferritin is a dependable gauge of iron stored in the body [9]. The normal value of ferritin in humans ranges from 12-300 ng/ml in males and 12-150 ng/ml in females. Levels of serum ferritin are considerably lesser in persons with anaemia or undertaking phlebotomy. Insufficiency of ferritin results in iron-deficiency anemia which shows that a person has reduced RBCs in the body [1]. As compared, serum ferritin levels were found greater in patients having iron-surplus disease and hemochromatosis. Serum ferritin is raised through prolonged and acute infection. C-reactive protein (CRP) and 1-acid glycoprotein are two other severe phase proteins whose levels have increased in correlation with their rise [9]. The acute role played by ferritin in the cellular and organismal homeostasis of iron is closely related to its major and best-studied function—iron sequestration. Iron in heme is compulsory for the transportation, binding, and oxygen release; the ready availability of iron for absorption into heme is necessary for the survival of organisms [10]. In recent times, it has become obvious that regulatory factors, in addition to those that regulate iron fluctuation, have an important effect on cellular ferritin. Ferritin can be noticed not simply as part of the iron regulatory proteins group, which contains transferrin and the transferrin receptor, but also as a protein family member that arranges cellular protection against stress and inflammation [11]. Exercise has been demonstrated to lessen stress and anxiety, as well as depressive symptoms. As a result, changes are made in the parts of the brain that regulate stress and anxiety. The neurotransmitters serotonin and norepinephrine, which diminish depression symptoms, may also be more readily available to the brain as a result of it [12-15]. Keeping in view, the above critical discussion now it is clear to say that exercise is basic tools which promote health and helps in avoiding health complications. Ferritin is a protein that helps store iron. What role is played by exercise with moderate intensity in serum ferritin concentration? The researchers intend to conduct this research study to discover this fact.

This research study aimed to examine the impact of moderate-intensity exercise on serum ferritin concentration.

METHODS

This study was conducted in the Department of Sports Sciences and Physical Education, University of the Punjab, Lahore Pakistan from Nov 2022 to July 2023. The ethical approval of this study was taken from the Ethical Committee of the Department of Sports Sciences & Physical Education, University of Punjab, Lahore, Pakistan (ref no.696/SPS) for conducting the study and likewise, the protocol of study complied with the Declaration of Helsinki. Before drawing the sample from the participants (a consent form was signed from each participant).An experimental research design was applied by the researcher. The participants for this study were 20 non-athlete students at the University of the Punjab Lahore, Pakistan. The participants of the study were divided into two groups i.e. control group (CG) and experimental group (EG). Each group was comprised of ten (10) subjects. The sample size was determined using G*Power statistical software based on Cohen's effect size conventions. Furthermore, the below criteria were used for the inclusion of participants. (1) The gender of the study participants was male. (2) The age group of study participants was 18-25 years. (3) Only physically fit participants with no chronic health complications were included in the study. Fresh blood samples of around (2-5 ml) were obtained in EDTA vacutainers using 5cc syringes with the help of the hospital paramedic staff. On the EDTA tube, the patient name, code, and date, must be written to maintain the record. Under the sterilized conditions, fresh samples were collected and stored at 4 °C to protect their integrity. Then these blood samples were sent to Citi Lab and Research Centre (CC HARIPUR-0) for lab work. The normal value of ferritin in humans ranges from 12-300 ng/ml in males and 12-150 ng/ml in females [16]. After the sample was collected, the sample was sent to a laboratory for further process of examination of serum ferritin concentration, which was done by professionals. A self-made exercise protocol of twelve weeks (12) weeks comprised of moderate-intensity exercise was applied to the experimental group. The Max heart formula was used for calculating the volume and intensity of exercise. To examine the pre-intervention test

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and post-intervention test difference, the pre-test and post-intervention data were analyzed using the appropriate descriptive statistical tools (mean and standard deviation) and inferential statistical techniques (paired sample t-test and independent sample t-test) in the statistical package for social sciences (SPSS, version-22).

RESULTS

The mean and standard deviation values of EG regarding the above-mentioned variables were serum ferritin 69.130 ± 49.8428. The mean and standard deviation values of EG regarding the above-mentioned variable were serum ferritin 47.330 ± 29.9190. The mean and std. values of serum ferritin (ng/ml) fitness for the experimental group (n=10) before and after intervention are shown in table 1.

Table 1: Pre and Post Serum Ferritin (ng/ml) level of Experimental Group (EG)

Pre-Intervention Variables of EG	N	Mean ± SD
Serum Ferritin (ng/ml) Pre	10	69.130 ± 49.8428
Serum Ferritin (ng/ml) Post	10	47.330 ± 29.9190

$\bar{X}$ = Mean, SD = Standard deviation

The mean and standard deviation values of CG regarding the above-mentioned variable were serum ferritin 58.619 ± 41.9684. The mean and standard deviation values of CG regarding the above-mentioned variable were serum ferritin 58.510 ± 41.3402. The mean and std. values of Serum Ferritin (ng/ml) for the control group before and after intervention are shown in table 2.

Table 2: Pre and Post Serum Ferritin (ng/ml) level of Control Group (CG)

Serum Ferritin (ng/ml)	N	Mean ± SD
Pre	10	58.619 ± 41.9684
Post	10	58.510 ± 41.3402

$\bar{X}$ = Mean, SD = Standard deviation

Furthermore, the table interprets; that there is no change in the CG & EG regarding the pre-test of serum ferritin. The values of serum ferritin pre-test of CG were (M = 58.6190, SD = 41.9684) and of EG (M = 69.1300, SD = 49.8428; t = 0.510, p=0.616> significant level = 0.05). Therefore, no significant difference was found in the status of serum ferritin of the control and experimental group before intervention. The independent sample t-test shows the comparison of serum ferritin control and the experimental group before intervention in table 3.

Table 3: Independent Sample t-test Showing the Comparison of the Pre-Test of the Control and Experimental Group Before the Intervention of Serum Albumin

Variable (Pre-Intervention)	Group	N	$\bar{X}$	Std.	*df*	*t*	p-values
Serum Ferritin (ng/ml)	EG	10	69.1300	49.8428	18	0.510	0.616
	CG	10	58.6190	41.9684			

Significant level = 0.05, CG = Control Group, EG= Experimental Group

A paired samples t-test showed the variance in EG Pre and Post-intervention characteristics of serum ferritin concentration. There was no significant change found in serum ferritin concentrations in pre and post-intervention tests in the experimental group, the pre-serum ferritin value was (M = 69.130, SD = 49.8428) to post-serum ferritin (M = 47.330, SD = 29.9190; t = 1.835, p=0.100> significant level = 0.05). Comparison of EG Pre and Post-intervention characteristics are shown in table 4.

Table 4: Paired Sample t-test Showing the Comparison of Serum Ferritin Pre and Post-Intervention Characteristics of the Experimental Group

Variables		$\bar{X}$	N	Std.	*df*	*t*	p-values
Pair 1	Serum Ferritin-pre	69.130	10	49.8428	9	1.835	0.100
	Serum Ferritin-post	47.330		29.9190			

Significant level = 0.05

DISCUSSION

This research study aimed to evaluate the "effect of moderate intensity exercise on serum ferritin concentration". Ferritin is the major protein in the human body that is responsible for many important functions including absorption, storage and release of iron [17]. Therefore, exercise is essential for the development of the body and prevents the human body from disease. This research study contributes to highlighting the impact of 12-week moderate-intensity exercise on serum ferritin concentration, with the age range of 18-25 years non-athlete male students [18]. The results show that there was no significant change found in serum ferritin concentrations in pre and post-intervention tests in the experimental group. The findings of this study were supported by findings of the study conducted by [19] that states that the level of iron increased significantly after exercise, and then decreased within the next 3 hours of restitution. Except for iron levels, only Total iron binding capacity (TIBC) levels significantly increased after exercise and decreased to baseline levels during the rest period. No significant changes in the levels of hepcidin, IL-6, and other proteins related to iron homeostasis were observed. also concluded that there was no significant effect of moderate-intensity exercise on serum ferritin levels. Exercise puts a lot of load on an athlete, especially in competitive sports, and accelerates the ageing of the erythrocytes. Exercise-induced changes in metabolic acidosis, body temperature, hypoglycemia, and haemoglobin concentration all lower erythrocyte osmotic resistance [20]. The study mentioned above also showed that moderate exercise caused an increase in plasma ferritin concentration, with the increase being greater as the intensity and duration of exercise increased. Return to the basal level was slower after maximal-intensity exercise than after moderate exercise.

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CONCLUSIONS

Based on data analysis and findings, the researcher concluded that moderate-intensity exercise has a significant impact on serum ferritin concentration among the respondents.

Authors Contribution

Conceptualization: AA, ZUI
Methodology: SSRF
Formal analysis: SSRF
Writing review and editing: AK, MJ, HBA, TA, RW, NA, ZS

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

The authors declare no conflict of interest.

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