DOI: https://doi.org/10.54393/pbmj.v7i08.1125

PAKISTAN BIOMEDICAL JOURNAL
https://www.pakistanbmj.com/journal/index.php/pbmj/index
ISSN (P): 2709-2798, (E): 2709-278X
Volume 7, Issue 8 (August 2024)

Original Article

OPEN ACCESS

Impact of Moderate Intensity Exercise on Serum Albumin Concentration

Hozaifa Bin Asif[1], Shehzadi Sanam Roohi Farooqi[2], Rana Waqas[2], Noor Alam[2], Alamgir khan[1], Muhammad Jamil[3*], Zeliha Selamoglu[4], Huzran khan[1] and Aqib Ashraf[5]

[1]Department of Sports Sciences and Physical Education, University of the Punjab, Lahore, Pakistan
[2]Department of Sports Science and Physical Education, Riphah International University, Faisalabad, Pakistan
[3]Centre for Physical Education, Health and Sport Sciences, University of Sindh, Jamshoro, Pakistan
[4]Department of Medical Biology, Medicine Faculty, Nigde Omer Halisdemir University, Nigde, Türkiye
[5]Department of Sports Science and Physical Education, University of Haripur, Haripur, Pakistan

ARTICLE INFO

Keywords:
Moderate Intensity Exercise, Serum Albumin, Students Athletes, Oncotic Pressure

How to Cite:
Asif, H. B., Farooqi, S. S. R., Waqas, R., Alam, N., Khan, A., Jamil, M., Selamoglu, Z., Khan, H., & Ashraf, A. (2024). Impact of Moderate Intensity Exercise on Serum Albumin Concentration: Moderate Intensity Exercise on Serum Albumin Concentration. Pakistan BioMedical Journal, 7(08). https://doi.org/10.54393/pbmj.v7i08.1125

***Corresponding Author:**
Muhammad Jamil
Centre for Physical Education, Health and Sport Sciences, University of Sindh, Jamshoro, Pakistan
meharjamil88@gmail.co

Received Date: 16th July, 2024
Acceptance Date: 26th August, 2024
Published Date: 31st August, 2024

ABSTRACT

Serum Albumin is the highly active protein in the blood which is working for oncotic pressure as well as, transportation of endogenous and exogenous ligands throughout the body compartments. **Objective:** To study the moderate-intensity exercise outcomes on serum Albumin quantities in the students. **Methods:** Twenty participants with the age group of 18-25 years were randomly selected from the Department of Sports Sciences and Physical Education, University of the Punjab, Lahore, Pakistan by using a recruitment method based on a BMI of 18.5-24.9 and an albumin level between 3.5 and 4.9 g/dL and then divided the population into two groups, the Control, and the Experimental group, with each of 10 participants. 12- A week of exercise procedure was subjected to the experimental group. A blood sample (5mL) was collected from each subject and thus marked with a unique identification code. The data were analyzed through a statistical package for social sciences (SPSS, Version 22.0). However, appropriate statistical tools were used. **Results:** A significant variation was found in the albumin values before and after the intervention. The mean (including standard deviation) values for all tests of the experimental group were 4.650 ± 1269 pre-test, and 5.010 ± 0.994 post-test. The mean values of all control group tests were 4.620 ± 0.1135 pre-test, and 4.640 ± 0.1075 post-test. **Conclusions:** It was concluded that moderate-intensity exercise significantly impacts serum albumin concentration among non-athlete students.

INTRODUCTION

Albumin is very important protein in plasma and serves as a transporter for various chemicals, including calcium and other medicines, and is crucial in maintaining oncotic pressure. Albumin sensitivity is used to monitor kidney and liver conditions, nutritional status, danger from specific medicines that bind albumin and unstable hyperbilirubinemia [1]. Albumin is the most active protein in the blood, and it consists of 584 amino acids, total functions of albumin is still unknown, but the main function of albumin is to produce 75-80 percent of colloid osmotic pressure. Half of the total blood protein is made up of albumin. The liver of a healthy individual makes 9–12 grams of albumin each day [2]. Albumin production is also stimulated by cortisol, thyroxine, and insulin. However, the growth hormone has no discernible impact on the production of albumin. Importantly, severe malnutrition may cause a decrease in albumin synthesis. Albumin is primarily an extracellular protein with a total cell volume of about 160 g, although the amount in the interstitial tissue is relatively small compared to the total blood volume. The half-life of albumin is 17–19 days [3]. The primary function of albumin, a protein generated by the liver and involved in a variety of metabolic processes, is to control osmotic pressure. Albumin levels having a range of 3.5-5 g/dl, with 4.9 g/dl being considered a moderate level. Hypoalbuminemia, or a lack of albumin, is thought to be the cause of chronic diseases such as hepatitis, liver cancer, and liver failure. And the increased albumin causes

DOI: https://doi.org/10.54393/pbmj.v7i08.1125

diarrhea and dehydration [4]. The primary function of the multifunctional protein albumin is to regulate oncotic pressure. Albumin bonds to molecules because of its chemical structure, and these molecules can bind to external substances like gases or medications [5]. Exercise has clear advantages for preventing heart disease. However, it is unclear what amount of exercise is necessary to provide the greatest cardiovascular effect. According to evidence, exercise intensity rather than exercise length or frequency is the most crucial factor in determining cardiovascular protection. In addition, Albumin acts as a strong carrier of various endogenous and exogenous substances, behave as a storage and transporter for these compounds because mixing with albumin can reduce their toxicity. Additionally, albumin attaches at least 39% of circulating calcium and is a conductor of hormones. Albumin is also a major carrier of fatty acids and contain important antioxidant properties. Albumin is also involved in maintaining acid-base balance as it behaves as a plasma buffer. Albumin is utilized as an indicator of nutritional condition and intensity of disease, especially in the elderly and sick [2]. Human health and well-being are improved by exercise, which is also linked to a lower mortality risk. For survivors, exercise is thought to be easy and safe, with positive impacts on physical function including heart health, muscle health, physical integration, mental and emotional health, and quality of life [5]. Exercise helps manage and prevent diseases like heart problems, type 2 diabetes, stroke, mental health problems, muscular disorders, and various types of cancer [6]. Exercise can also be helpful for mood reviving, fostering a sense of relaxation, and reducing daily stress [7]. Blood quantities of homocysteine can rise as a result of exercise, and high homocysteine quantities lead to oxidative stress [8]. The benefits of exercise extend to mental and physical well-being. Numerous brain imaging investigations looked into how neuroplasticity affects how well exercise improves cognition[9].

The study aimed to study the outcomes of moderate-intensity exercise on serum Albumin quantities in the students.

METHODS

This study was conducted in the Department of Sports Sciences and Physical Education, University of the Punjab, Lahore Pakistan from 12th December 2023 to 12th March 2024. The ethical approval of this study was taken from the Ethical Committee of the Department of Sports Sciences and Physical Education, University of Punjab, Lahore Pakistan (ref no.964/SPS) and thus protocol of study complied with the Declaration of Helsinki. An experimental research design was used in this particular research study. The participants of the study were comprised of 20 non-athletes from the Department of Sports Sciences and Physical Education, University of the Punjab, Lahore, Pakistan. Likewise, all the subjects fulfilling the inclusion criteria i.e. the participants aged 18-25 years with BMI 18.5-24.9, only male subjects with chronic health problems were included and thus finally the participants were divided into groups i.e. Control Group (CG)and Experimental group. Each group was comprised of 10 subjects. The sample size was calculated through the G power * statistic. A 12-week exercise protocol of moderate intensity was applied to the Experimental group and a Serum albumin test was conducted before and after the completion of the exercise protocol. After the completion of the Exercise protocol of 12 weeks' post-test (Serum Albumin Test) was conducted on both groups to identify the difference and the values were compared to find better results to study the "Impact of moderate intensity exercise on serum albumin concentration." The hospital paramedic personnel assisted in collecting fresh blood samples in EDTA vacutainers using 5cc syringes, ranging in size from 2 to 5 ml. To keep a record, the patient's name, code, and date must be recorded on the EDTA tube. Fresh samples were gathered and stored at 4 °C to preserve their integrity under the sterilized conditions. Tests were performed through Bio-Medical Laboratory (R-17633), Lahore, Pakistan. Venipuncture, the act of drawing blood from a vein, mostly occurs on the interior of the elbow or the behind of the hand. To examine the pre-intervention test and post-intervention test differences, the pre-test and post-intervention data were analyzed utilizing the appropriate descriptive statistical tools (mean and standard deviation) and inferential statistical techniques (paired sample t-test and independent sample t-test) in the SPSS version 22.0.

RESULTS

The mean and standard deviation values of EG (Pre) regarding the above-mentioned variable were serum albumin 4.650 ± 0.1269. The mean and standard deviation values of EG(Post) regarding the above-mentioned variable were serum albumin 5.010 ± 0.0994. The mean and SD value of Serum Albumin (g/dl) for the experimental group pre and post test intervention are shown in table 1.

Table 1: Pre and Posttest Data of the Experimental Group(EG)

Pre-Intervention Variable of EG	N	Mean ± SD
Serum Albumin (g/dl) Pre	10	4.650 ± 0.1269
Serum Albumin (g/dl) Post	10	5.010 ± 0.0994

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

The mean and standard deviation values of CG (Pre) regarding the above-mentioned variable were serum albumin 4.620 ± 0.1135.The mean and standard deviation values of CG(Post) regarding the above-mentioned variable were serum albumin 4.640 ± 0.1075. The mean and SD values of Serum Albumin (g/dl) for the control group pre and posttest intervention were shown in table 2

DOI: https://doi.org/10.54393/pbmj.v7i08.1125

Table 2: Pre-Test Data of the Control Group (CG)

Pre-Intervention Variable of CG	N	Mean ± SD
Serum Albumin (g/dl) Pre	10	4.620 ± 0.1135
Serum Albumin (g/dl) Post	10	4.640 ± 0.1075

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

The table interprets; that there is no difference in the CG & EG regarding the pre-test. The values of serum albumin of CG were (M = 4.6200, SD = 0.11353) and EG (M = 4.6500, SD = 0.12693; t = 0.557, p = 0.584 > significant level = 0.05). Therefore, no significant difference was found in the status of serum albumin of the control and experimental group before intervention. Independent sample t-tests showing the comparison of serum albumin control and experimental group before intervention were analyzed in table 3.

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

Variable (Pre-Intervention)	Group	N	$\bar{X}$	SD	df	t	Sig.
Serum albumin (g/dl)	CG	10	.6200	0.11353	18	0.557	0.584
	EG	10	.6500	0.12693			

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

The table interprets; that there is a high difference in the pre and post-data. The values of serum albumin of pre-test were (M = 4.650, SD = 0.1269) and EG (M = 5.010, SD = 0.0994); t = -10.590, p = 0.000 > significant level = 0.05). Therefore, a highly significant difference was found in the status of serum albumin of pre and post-group after intervention. Paired sample t-test showing the comparison of serum albumin pre-test and post-test data of the experimental group after intervention in table 4.

Table 4: Paired Sample T-Test Showing the Comparison of Pre-Test and Post-Test of Serum Albumin of the Experimental Group After Intervention

Variable (Pre-Intervention)	Group	N	$\bar{X}$	SD	df	t	Sig.
Serum albumin (g/dl)	Pre	10	4.650	0.1269	18	-10.590	0.000
	Post	10	5.010	0.0994			

Significant level = 0.05, Experimental, pre and post

DISCUSSION

The results of this research study show that a significant difference was found in the status of serum albumin concentration of the experimental group after the application of the prescribed exercise protocol. In line with this emerging finding the study conducted indicated that there is a significant impact of exercise on serum albumin concentration among the subjects (p<0.05) [11]. Such an emerging concept is supported by [12, 13] showed that exercise with moderate intensity and volume changes the biochemical parameters of livers such as Alanine transaminase (ALT), Alkaline phosphatase (ALP) and Aspartate transaminase (AST) [14]. The same findings were drawn by concluding that exercise plays a vital role in the functional capacities of the liver [15]. Likewise, the results of the study conducted supported the present study findings [16, 17]. that exercise promotes all the biochemical parameters of the liver particularly serum albumin and bilirubin, along with exercise, a healthy diet also promotes the functions of the liver. Furthermore, the study conducted supported the current study to examine the claim that vigorous exercise increases albumin production. The study conducted supported the present study showing that exercise increased the value of albuminuria that are most likely caused by the changes in blood acidity brought on by exercise that modify how the albumin molecule is arranged [18]. A study conducted indicated that the plasma albumin concentration rose quickly after doing intensive upright exercise and stayed high for 48 hours [19]. During the rigorous training camp, vigorous exercise significantly raised the level of oxidized albumin in extracellular fluids [20]. Also a study shows that a single bout of cycle ergometer exercise lasting 40 minutes at 70% of one's maximum oxygen uptake activates the serum albumin system in the blood. As exercise intensity grew, the serum albumin modification's scope also did Vigorous exercise increase the value of albumin and low-intensity exercise has no impact on albumin, these findings support the current study.

CONCLUSIONS

Based on findings, this study concluded that moderate-intensity exercise significantly impacts serum albumin concentration among non-athlete students.

Authors Contribution

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

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

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

REFERENCES

[1] Rosenoer VM, Oratz M, Rothschild MA. Editors. Albumin: Structure, function and uses. Elsevier. 2014 May.
[2] Belinskaia DA, Voronina PA, Goncharov NV. Integrative role of albumin: evolutionary, biochemical and pathophysiological aspects.

DOI: https://doi.org/10.54393/pbmj.v7i08.1125

Journal of Evolutionary Biochemistry and Physiology. 2021 Nov; 57: 1419-48. doi: 10.1134/S0022093021060020X.

[3] Răcătăianu N, Leach N, Bondor CI, Mârza S, Moga D, Valea A *et al*. Thyroid disorders in obese patients. Does insulin resistance make a difference? Archives of Endocrinology and Metabolism. 2017 Dec; 61(6): 575-83. doi: 10.1590/2359-3997000000306.

[4] Raoufinia R, Mota A, Keyhanvar N, Safari F, Shamekhi S, Abdolalizadeh J. Overview of albumin and its purification methods. Advanced Pharmaceutical Bulletin. 2016 Dec; 6(4): 495. doi: 10.15171/apb.2016.063.

[5] Kragh-Hansen U. Human serum albumin: a multifunctional protein. Albumin in Medicine: Pathological and Clinical Applications. 2016 Nov: 1-24. doi: 10.1007/978-981-10-2116-9_1.

[6] Luan X, Tian X, Zhang H, Huang R, Li N, Chen P *et al*. Exercise as a prescription for patients with various diseases. Journal of Sport and Health Science. 2019 Sep; 8(5): 422-41. doi: 10.1016/j.jshs.2019.04.002.

[7] Thayer RE. Calm energy: How people regulate mood with food and exercise. Oxford University Press, USA; 2003.

[8] Shinagawa A, Yamazaki T, Hinemats A, Senzaya N, Hosoi Y, Ninomi a Y *et al*. Changes in homocysteine and non-mercaptoalbumin levels after acute exercise: a crossover study. BMC Sports Science, Medicine and Rehabilitation. 2023 Apr 17; 15(1): 59. doi: 10.1186/s13102-023-00656-w.

[9] De Sousa Fernandes MS, Ordônio TF, Santos GC, Santos LE, Calazans CT, Gomes DA *et al*. Effects of physical exercise on neuroplasticity and brain function: a systematic review in human and animal studies. Neural Plasticity. 2020 Dec; 2020(1): 8856621. doi: 10.1155/2020/8856621.

[10] Tabata F, Wada Y, Kawakami S, Miyaji K. Serum albumin redox states: More than oxidative stress biomarker. Antioxidants. 2021 Mar; 10(4): 503. doi: 10.3390/antiox10040503.

[11] Bari MA, MahmoodAlobaidi MA, Ansari HA, Parrey JA, Ajhar A, Nuhmani S *et al*. Effects of an aerobic training program on liver functions in male athletes: a randomized controlled trial. Scientific Reports. 2023 Jun; 13(1): 9427. doi: 10.1038/s41598-023-36361-4.

[12] Olisah MC, Nwafia WC, Onwugbufor PC, Nwachukwu OR, Dim CN. Assessment of Some Biochemical and Immunological Changes during Strenuous Exercise in Undergraduate Students. IPS Intelligentsia Multidisciplinary Journal. 2023 Jun; 3(1): 14-7. doi: 10.54117/iimj.v3i1.7.

[13] Khan A, Butt MZ, Khan S, Nazir S, Asghar E, Khan S *et al*. Impact of Low Intensity Exercise on Liver Enzymes (ALT & ALP). Journal of Pharmaceutical Research International. 2021 Sep; 33(44B): 370-7. doi: 10.9734/jpri/2021/v33i44B32688.

[14] Khan A, Butt MZ, Jamil M, Iftikhar M, Soomro JA, Ahmad MA. Estimation of Key Parameters Of Liver Among Healthy Volunteers Of Endurance Exercise. Journal of Positive School Psychology. 2023 May; 7(5): 311-8.

[15] Su H, Liu D, Shao J, Li Y, Wang X, Gao Q. Aging Liver: Can Exercise be a Better Way to Delay the Process than Nutritional and Pharmacological Intervention? Focus on Lipid Metabolism. Current Pharmaceutical Design. 2020 Nov; 26(39): 4982-91. doi: 10.2174/1381612826666200605111232.

[16] Shephard RJ and Johnson N. Effects of physical activity upon the liver. European Journal of Applied Physiology. 2015 Jan; 115: 1-46. doi: 10.1007/s00421-014-3031-6.

[17] Olisah MC, Nwafia WC, Onwugbufor PC, Nwachukwu OR, Dim CN. Assessment of Some Biochemical and Immunological Changes during Strenuous Exercise in Undergraduate Students. IPS Intelligentsia Multidisciplinary Journal. 2023 Jun; 3(1): 14-7.doi: 10.54117/iimj.v3i1.7.

[18] Sasuthasan A, Ali A, Lee SK, Rutherfurd-Markwick K. Assessment of changes in physiological markers in different body fluids at rest and after exercise. Nutrients. 2022 Nov; 14(21): 4685. doi: 10.3390/nu14214685.

[19] De Simone G, di Masi A, Ascenzi P. Serum albumin: a multifaced enzyme. International Journal of Molecular Sciences. 2021 Sep; 22(18): 10086. doi: 10.3390/ijms221810086.

[20] Pokan R, Ocenasek H, Hochgatterer R, Miehl M, Vonbank K, Von Duvillard SP *et al*. Myocardial dimensions and hemodynamics during 24-h ultra-endurance ergometry. Medicine and Science in Sports Exercise. 2014 Feb; 46(2): 268-75. doi: 10.1249/MSS.0b013e3182a64639.