ANALYSIS OF BLOOD PROTEIN LEVELS IN LONG-DISTANCE RUNNERS AFTER LOW-INTENSITY AEROBIC EXERCISE

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ABSTRACT

Background. Serum proteins as factors of the physiological adaptation and metabolic regulation in endurance athletes. Yet, the acute effects of low-intensity aerobic exercise on circulatory protein biomarkers remain less investigated among LDRs. **Objectives.** The objective of this study was to compare the serum levels of proteins (albumin, globulins, and fibrinogen) before and after low-intensity aerobic exercise in long-distance runners. **Method.** The sample was composed of 6 purposively selected runners from the Nineveh national team (60% of the total number). Venous blood samples were obtained before and after a standardized low-intensity aerobic exercise. Serum protein levels The serum protein levels were determined by standard biochemical methods. Statistical analysis were performed with using ARITH average, SD standard devitation, 2 paired t- test and TCV cioifficient of variation. SPSS version 11.0 was used for the statistical analysis. **Results.** There were no significant changes on serum albumin and fibrinogen with low-intensity aerobic exercise ($p > 0.05$). By contrast, serum globulin levels did not significantly change. These results demonstrate selective physiological changes in blood protein response to aerobic low intensity loading in endurance trained athletes. **Conclusion.** In response to low intensity physical activity there are marked changes of certain serum proteins (above all those of albumin and fibrinogen), while globulins do not change significantly. These data indicate that acute oxygen costs have an effect on some biochemical hydration, inflammation and metabolic markers. The present study adds to the knowledge of acute biochemical effects of low-intensity aerobic activity in athletes with endurance intensity. The results lay the groundwork for serum protein dynamics-based load training load optimization. Future work should use larger populations, differentiate between male and female athletes, differentiate training intensities and durations to increase the explanatory power of this biomarker analysis for sports performance and recovery in future studies.

Keywords; blood protein, long-distance, aerobic exercise, track and field.

A. INTRODUCTION

Exercise and physical activity are vital factors to promote cognitive function throughout the lifespan. Previous studies have shown that exercise has potential to improve academic performance and cognitive function in adults not only through lifestyle related mechanisms but it can also drive long term physiological adaptations. It has been found that even a single session of exercise, especially aerobic exercise, may elicit temporary and sustained effects on both physiological and cognitive rolling responses (Neuvonen, 2022) These acute and chronic adaptations emphasize the need to learn how different modes and intensities of exercise affect disparate tissue systems.

It is known that the prolonged and heavy exercise can change a number of blood physiological characteristics, i.e., some biochemical parameters such as: serum protein levels. Athletes involved in prolonged and intense exercise activity may therefore have to be aware of how their body might react, because heavy exercise produces enormous physiological responses from the whole organism (Teległów et al., 2022, 11). These biochemical changes might have implications on performance, recovery and health in general, specifically for endurance athletes who face repeated periods of aerobic exercise.

The circulation system is a primary provider of oxygen to muscles during exercise. Red blood cells (RBC) carry oxygen from the air we breathe in to our lungs and then on to the rest of the body through alveoli with most bound to hemoglobin (Hb). Hemoglobin helps to release and diffuse oxygen to tissues, which RBCs are also carrying carbon dioxide (CO_2) that the cells generate back in the lungs for expiration (Teległów et al., 2022, 12). Purposes other than gases transportHemoglobin serves in buffering the blood, and ATP and NO released from RBCs promotes vasodilatation and enhances flow to the active musculature. They need to ensure they have sufficient red blood cells, so as to maximize the oxygenation and metabolic efficiency during exercise (Mairbäurl, 2013: 332).

Taking account of these physiological factors, it is important to investigate the effects of low-intensity body movement exercise on serum protein responses in trained runners for their practical applications. This information is useful in the development of effective training programs for athletes, coaches, exercise physiologists and sport scientists searching for reliable evidences. Serum proteins, such as albumin, globulins and fibrinogen have

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important fluid regulatory, immune function, and haemostatic functions and could represent sensitive biomarkers of physiological strain and adaptation.

A search of all scientific databases returned the findings that further efforts are needed in order to define the most successful means for improving endurance Exercise performance. Blood constituents have a major influence on the effect of exercise upon maximal oxygen intake and both cellular elements and plasma proteins contribute to actual performance efficiency during sustained work. Knowing how serum proteins are influenced by exercise will help us to understand mechanisms underlying aerobic work capacity, blood cell mass and running performance.

Accordingly, we tried to find differences between serum protein levels in long-distance runners after low-intensity aerobic exercise as the context above. Namely, it aims to test whether there are noticeable alterations in the levels of serum proteins pre- and post-exercise protocol. As possible that there may be differences in the levels of serum proteins before and after low-intensity exercise activities and long run.

B. METHOD

Participant

Study population: the subjects were 10 players - team of Nineveh Governorate at middle and long distances for advanced level. research participants represented 60% of the total participants, and were drawn from a convenience sample which included six long distance players. researcher confirmed that sampled subjects agreed to a written consent after the nature and procedures of the research were explained coefficient of variation (**) Conclusions: research sample subjects were homogeneous. (1) Some details of research sample individuals The results of a form, which was used for recovering information on sample individuals_TABLE collected.

Table 1. Shows Statistical Characteristics Of Some Specifications Of Research Sample.

Variables	Height	Weight	Age	Training age
Mean	175.4	67.34	22	2.6
Standard deviation	3.13	5.51	1.41	0.54
Coefficient of variation	1.78	8.18	6.42	21.06

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Research Design

Descriptive research design was used establishing as very suitable to investigate the physiological responses of low intensity aerobic exercise. The descriptive method allows the researcher to examine alterations in serum protein levels in a practical and organised way, as is commonly done for applied exercises science problems. This model was proposed to permit a comprehensive examination on pre- and post-exercise biochemical changes in long-distance runners, thereby enabling the trustworthiness of natural physiological responses to be established, where variables have not been manipulated.

Procedures

Methods of data collection Anthropometric measurements Measurement of body height and weight was conducted using the Detecto apparatus with participants standing barefoot; measures were to the nearest 200gm. The training intensity was designed as low-intensity interval training according to Fox tables, a Zone 4 (Fox, 1984, 214). Two series of three VEPT repetitions were carried out rotationally, and the total duration of the aerobic fitness test was 15 minutes (treadmill speed: 10 km/h; intensity: 50%–65% maxHR; VO2: 29 mL kg−1 min−1; and heart rate [HR]: 130–150 bpm). Repetitions were separated by a positive rest interval of 2.5 minutes and sets by a negative one of 5 minutes. It could regulate temperature from 22 to 24°C and maintain relative humidity at a stable level with the 3-ton air conditioner installed in the climate cell. The participants completed a warm-up before testing and fasted from food and liquid (including water) for 10–12 h prior to both pre- and post-exercise blood collection in order to maintain plasma volume, as recommended by experts in general and sports physiology. Intensity of exercise Exercise intensity was calculated using heart rates based on resting HR, estimated maximum HR (using the formula 220 – age) and the Karvonen equation: (MaxHR − RestHR)*(Desired Intensity %) + Resting Heart Rate (Nieman; 2002:243). Blood samples were obtained at baseline, postexercise, and recovery. During the resting period, subjects sat quietly and a venous blood sample was taken (5 cc) and then they began training at 5 km/h for 5 minutes with short rest. Post-exercise samples were taken at the end of the treadmill protocol. The central trial was performed on 28th to 29th of July, 2024 at 9:00 a.m., while physiological assays were measured in Al-Kawthar Laboratory and Radwan Al-Jama'a laboratory.

Instruments

A series of instruments and laboratory equipments were applied to guarantee the reliable data acquisition and bio-chemical examination. Homogeneity of the samples was tested by the coefficient of variation where values below 30% were evaluated as adequate (Al-Takriti & Al-Obeidi, 1999, 161). The study was approved to use instruments in the Physiology Laboratory of Basic Science Departments. The main equipment used were a Trackmaster electric treadmill (USA), a Detecto medical scale (for height and body weight) (USA), and a Delta Trak digital thermometer (China) used to track the ambient temperature and humidity. More tools, like oximeter for the continuous monitoring of heart beat during experiment time, electronic stopwatches, laptop computer and blood collection and storing medical equipment were also applied. Plasma separation was carried out using a centrifuge in laboratory analyses; an ELISA instrument (ELX 800, Bio-Kit, USA), special analysis kit; fibrinogen measurement using a Stago instrument (fibrinogen assay); albumin and associated proteins measured on a Roshn C311 instrument using the Cobas kit system (USA). Blood was collected venously with a sterile syringe, transported in cooler, centrifuged at 3000 rpm for 20 minutes the separated plasma was moved with micropipette for biochemical analyses.

Statistical Analysis

The data were analyzed using the Statistical Package for Social Sciences (SPSS version 17) and Microsoft Excel. The calculations included arithmetic means and standard deviations, and paired-sampler t-test and coefficient of variation for the latter were also used to check sample homogeneity (Al-Takriti & Al-Obeidi 1999,161). These statistical techniques made it possible to test whether the observed differences in pre and post-exercise serum proteins levels were statistically significant and to determine how big and consistent is, on average, the physiological response of long-distance runners.

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C. RESULTS AND DISCUSSION

Results

Table 2. shows means, standard deviations, and probability and significance values of research variables before effort

Variables	Unit of Measurement	Mean	Standard Deviation	t-Value	Probability Level	Sig.
Albumin	g/dl	47.60	2.01	1.281	0.256	Insig.
Globulin	g/dl	26.73	3.90	0.147	0.889	Insig.
Fibrinogen	mg/dl	268.87	70.23	1.705	0.149	Insig.

"The significance level used ($p > 0.05$)"

From Table 2. it is evident that there are no statistically significant differences between pre-test and post-test for both interval and continuous effort units in variables (albumin, globulin, and fibrinogen). calculated t-values were (1.281, 0.147, and 1.705) at probability levels of (0.256, 0.889, and 0.149), respectively.

Table 3. Shows means, standard deviations, probability levels, differences between two means, and significance for research variables after exertion (effort).

Variables	Unit	Air Effort	Mean	Standard Deviation	t-value	Probability	Significance
Albumin	g/dl	50.93	50.93	1.15	2.89	0.03	Sig.
Globulin	g/dl	27.60	27.60	2.69	1.094	0.324	Insig.
Fibrinogen	mg/dl	276.11	276.11	58.26	2.99	0.03	Sig.

"The significance level used ($\alpha < 0.05$)"

Table 3. shows that there are significant differences between pre- and post-exercise tests in variables (albumin and fibrinogen), with a t-value of (2.89, 2.99) at a probability level of (0.03, 0.03), respectively. There were no significant differences before and after aerobic exercise in variable of globulin, with a t-value of (1.094) at a probability level of (0.324).

Discussion

Results of the present study show great differences in some serum protein variables after a low intensity aerobic exercise. These alterations may be counteracted by the physiological stress induced by exercise and during the positive rest intervals in Zone 4 according to Fox, and mathiots table. Low Intensity Interval Training aims to develop certain physical abilities, such as general endurance, speed endurance, strength endurance and power by stimulating an adaptive response in various body systems (Ben Aslon et al., 2017, p.13). This programme is based on moderate-intensity training (ending 60-80% of the participant's maximal capacity during running exercises, and 50-60% during strength

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exercises with external resistance or body weight). Being of a continuous nature, it enhances the general and specific endurances by increasing the efficiency of circulatory and respiratory systems and blood oxygen-carrying capacity, in addition to enhancing toleration of physical exertion and delaying onset of fatigue (Dubik & Qasim Asad Qasim, 2017:45)

It has been shown that endurance capacity is affected by work load and plasma volume, which are temperature-dependent . Dirix et al. (1988) that changes associated with temperature during exercise are reduced plasma volume and hence concentrations of plasma constituents such as serum proteins. These results are consistent with physiological concepts, which have been demonstrated that heat stress can alter blood profile and affect humoral responses during exertion.

The present results also attest with those of Othman (1990) who showed that regular aerobic training leads to adaptations in cells and tissues, especially within muscle fibers. Aerobic training increases muscle capacity to perform against oxygen demand, through elevation of myoglobin concentra t ion, mitochondria numbers and glycogen stores (Othman 1990,89). Similary,Al-Ashou (2010) pointed out that while the functional adaptations of blood components are important in allowing athletes to accommodate and respond to training stimuli. Blood constituents help in the carrying of nutrients which are vital, allows immune and functioning defense system of the body and also transport chemical materials necessary to maintain performance mainly during intense/prolonged exercise (Al-Ashou, 2010; p.agination34). These observations provide a context for the substantial changes in fibrinogen that occurred after exercise in this study.

Nevertheless, failure to observe statistical reductions in albumin concentrations can perhaps be attributed to the exercise conditions of this study. The author suggests that little modification in the albumin could be because of small change in core temperature among subjects. Extraordinarily albumin evolves transiently an additional antioxidant capacity, after one or several attacks of TGR-α (36) and that a profound increase of temperature up-regulates such phenemenon following the conclusion drawn by Medina et al. (2010) who indicated that albumin's antioxidant capacity increase at high temperature (Medina. et al., 7, 2010). This could not be the case in the current investigation, where exercise intensity was moderate and ambient environment controlled which would appear to have been insufficient to evoke such thermal reactions. Furthermore, the length and intensity of the exercise protocol (both intermittent and continuous) may not have been long or intense enough to produce detectable changes in albumin.

Overall, the findings indicate low-intensity aerobic exercise may induce marked alterations in specific serum proteins yet that additional proteins, including albumin, may need higher-intensity or longer-duration exercise stressors in order to exhibit substantial physiological responses. These data emphasize the specificity of biochemical adaptations to varying exercise loads and demonstrate once again, the need to precisely specify intensity and duration of training in order to regulate a desired physiological outcome.

D. CONCLUSION

The material incentives enhance the faculty members' motivation to conduct original high-quality research. One of the significant ways that we can assist faculty to develop better skills as researchers is by providing regular - vigorously ongoing/properly rotating training. Regularly publishing faculty research in peer-reviewed scientific journals strengthens science and the reputation of the science program. Providing specialist writing and editing of university texts and on-going scientific texts and references. When faculty members go to scientific conferences and seminars, they are able to share what they know in addition to learning from others based on their research. Colleges and universities need to put more money where their faculties are to foster science research that engages faculty in new, different types of projects. The study recommends that more educational resources should be provided to faculty for further education so they can enhance their teaching and research abilities. Faculty need to be encouraged in continuous publication of their results in prestigious international scientific journals with high impact factors. Teachers need to be given the opportunity and encouragement to attend scientific conferences and seminars. Faculty need to be writing and revising specialized university textbooks that keep pace with the latest research in their field.

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F. AUTHOR CONTRIBUTION STATEMENT

Shaza Hazem Korkis is fully responsible for the content of the article.

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