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A Follow-up Study of the Changes in some Immunity Factors of the Body after Performing One Session of Exhausting Physical Exercise

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ABSTRACT

The current research studies the response of immunoglobulins in blood serum to exhausting aerobic exercise. Twelve male students participated in this study. In the first stage, blood samples were drawn from the participants in a fasting state. Then, the participants performed Balke's 15-minute run to the point of exhaustion. After the physical exercise, the second blood samples were drawn. The third blood samples were also drawn after 24 hours of rest. The comparison of concentration mean of immunoglobulin A in the first and second stages suggested a significant difference (P= 0.014). From the comparison of the second stage and the third stage, also a significant difference was noticed (P= 0.003). The comparison of concentration mean of immunoglobulin G after exhausting aerobic exercise revealed a significant difference (P= 0.001). After 24 hours of the participants' rest, G immunoglobulins of serum revealed a significant difference (P= 0.014). Also, the comparison of immunoglobulins concentration between the first and second stages and also between the first and third stages suggested a significant difference. It can be said that in the current research, not only exhausting physical activity did not result in a decrease in immunity system, but also it caused the A, G, and M immunoglobulins concentration to increase significantly. As a result, one session of strenuous physical activity can strengthen the body's immunity system. It seems that individual differences, the increase in catecholamine secretion, and also nervous and hormonal responses are some of the reasons behind the change in blood serum's immunoglobulins.

Key words: Immunity Factors, Physical Exercise, Balk Test.

INTRODUCTION

Regular exercise with moderate impact is known to strengthen the immune system and increase the resistance against stress[1-3]. Since many studies have shown that regular moderate exercise positively influences cytokines, immunoglobulins, complement and lenfosite parameters, there have been follow-up studies that stress the importance of recommending moderate physical activity to strengthen the immune system in certain groups of people[4, 2, 6, 3].

While moderate exercise can strengthen the immune system, it is also known that maximal exercise can suppress the immune system[4,1,7]. The influence of moderate and maximal exercise on the immune system is also important for the trainers and coaches who work with amateur and professional athletes[4].

High training loads can negatively affect the athlete's immune system. A new form of immunodeficiency, referred to as sports immunodeficiency, was discovered the past decade[8]. Secondary immunodeficiencies, which can be caused by inadequate physical loads, are associated with decreased counts of immunocompetent cells in the peripheral blood[9,10].

There are few studies on athletes followed over a competitive season and there are few published data about exercise-induced changes on serum complement and immunoglobulin levels in sportsmen[11].

Secretory immunoglobulin A (sIgA) is the major immunoglobulin of the mucosal immune system. Heavy training over several weeks can depress the mucosal immune system in the resting situation. Indeed, decreased sIgA concentrations have been reported during periods of intense training[1,12,13]. Although the physiological mechanisms underlying the decline in sIgA are still unclear, it is likely that both neural and endocrine factors influence the immune response to exercise[14, 15].

There are contradictory results on the effects of acute exercise on the immune system in the literature. Nelhsen et al. (1991), have shown that acute exercise up to 60% of $V0_{2max}$ leads to a temporary increase in IgA, IgG and IgM values[4]. Some studies have shown that IgG and IgM levels increase after a short but maximal exercise (6, 16). Similar results were seen in moderate exercise (17, 4). But another research have found no changes in serum immunoglobulins immediately and 24 hours after a 13 km sub maximal exercise (4), but suppression was seen in serum, salivary and basal immunoglobulin secretions after a lengthy maximal exercise period[4].

Like other pathogenetic factors, the imbalance in the athlete's immune system can lead to infectious, oncological, autoimmune, and allergic diseases. As a consequence, it can restrict or even decrease the athlete's performance[18,10]. In this research blood samples were drawn three times so as to examine the effects of an exhausting and intense activity and also its 24-hour relaxation follow up on blood serum immunoglobulins.

MATERIAL AND METHODS

Twelve male student athletes purposefully participated in this semi-experimental research. They had no major medical illnesses, including neither cardiovascular nor metabolic disease. Prior to their first laboratory visit, subjects were informed of the details and risks associated with the experimental protocol and their freedom to withdraw at any time. Each subject gave his informed written consent to the experiment, which was approved by the Human Ethics Committee of the Payame Noor University. The mean of the participants' age, height, weight, Body Mass Index (BMI) were respectively (21.44±1.86), (174.99±5.37), (75.48±6.062) and (22.51±2.62). Other characteristics of the participants are displayed in Table 1.

The participants filled out formed showing they were healthy. They had been requested not to take any medicines at least one week before the performance of Balke Run Test. The participants attended the track and field in a fasting state in the morning on the day of the experiment. Height and weight indices were measured by the researchers. Five cc blood samples were drawn from their elbow. The blood samples were regarded as the first stage. The participants were asked to do some stretches and gentle warm-up exercises for 15 to 20 minutes. They were placed in two groups of 6 in track and field. They were advised to run as much as possible and to the point of exhaustion. If necessary, they were allowed to walk for a few seconds to relax and then continue running until their 15 minutes was over. The distance run by each participant was measured by the researchers and was registered as their record. Based on the covered distance by each participant, the maximal oxygen consumption ($V0_{2max}$) was calculated (19).

After performing the 15-minute Balke test, 5 cc blood samples were drawn from each participant. The participants were told not to do any physical exercises for 24 hours and to attend the pathology laboratory the morning after. For the third time, 5 cc blood samples were drawn from them. The laboratorial method of Immuno Turbidimetery was used to analyze blood samples. Also, in order to compare the concentration of serum immunoglobulins the statistical method of paired sample t test was employed.

RESULTS

The concentration mean of blood serum immunoglobulins in the three stages were compared and the following results were produced:

´ Comparison of concentration mean of

immunoglobulin A before the physical exercise and immediately after the performance of the exercise showed an increase. This increase was significant (P= 0.014), (t= 3.027).

- Concentration mean of immunoglobulin A after the physical exercise and its comparison after 24 hours of relaxation is indicative of a decrease in this immunoglobulin. This decrease is significant (P= 0.003), (t=4.04).
- Comparison of concentration means of immunoglobulin A in relaxation states was not significant (P=0.256), (t=1.213), (Figure 1).
- Comparison of concentration means of immunoglobulin G before and after the physical exercise showed an increase (P=0.001), (t= 5.181). This difference is significant.
- Comparison of concentration means of immunoglobulin G after the physical exercise and after 24 hours of rest is indicative of a decrease in this factor of the immunity system. This decrease is significant. (P=0.014), (t= 3.019).
- Comparison of concentration means of immunoglobulin G in resting states indicates an increase in this immunity factor. The amount of this increase was considered significant (P=0.002), (t=4.26), (Figure 2).
- Concentration means of immunoglobulin M in pre- and post-Balke Run Test states were compared and it was revealed that a significant increase exists (P=0.0001), (t= 5.327).
- Also, comparison of immunoglobulin A concentration in the states after the activity and after 24 hours of rest shows a significant decrease (P=0.0001), (t= 7.6).
- Comparison of relaxation states of

Table 1: Characteristics of Subject in Experiment Day

Standard Deviation	Mean	Variables
1.86	21.44	Age (Y)
5.37	174.99	Height (Cm)
6.062	75.48	Weight (Kg)
3.56	58.64	$V0_{2max}$ ml. kg^{-1}. min^{-1}
2.52	118.11	Systolic blood pressure (mm Hg)
3.82	8.01	Diastolic blood pressure (mm Hg)
2.62	22.51	BMI Cm^2

Table 2: Mean and Standard Deviations of Immunoglobulins and P Values

Immunoglobulin (mg/dl) (M±SD)	Immunoglobulin (mg/dl) (M±SD)	T Value	P Value
*IgA *S 1 (203±88.37)	IgA S 2 (245.5±121.64)	3.027	0.014
IgA S 1 (203±88.37)	IgA S 3 (195.8±90.13)	1.213	0.256
IgA S 2 (245.5±121.64)	IgA S 3 (195.8±90.13)	4.04	0.003
*IgG S 1 (1229±192.1)	IgG S 2 (1512.6±303.34)	5.181	0.001
IgG S 1 (1229±192.1)	IgG S 3 (1375.7±214.6)	4.26	0.002
IgG S 2 (1512.6±303.34)	IgG S 3 (1375.7±214.6)	3.019	0.014
*IgM S 1 (108.9±30.62)	IgM S 2 (128.5±36.1)	5.327	0.0001
IgM S 1 (108.9±30.62)	IgM S 3 (108.1±32.03)	0.232	0.821
IgM S 2 (128.5±36.1)	IgM S 3 (108.1±32.03)	7.60	0.0001

*IgA. Immunoglobulin A, *IgG. Immunoglobulin G, *IgM. Immunoglobulin M, *Stage

immunoglobulin M serum concentration didn't show a significant difference (P=0.821), (t= 0.232), (Fig. 3).

In general, it can be said that exhausting aerobic exercise, especially in the form of a one-session run in a track and field, has resulted in an increase in immunity factors in this research. This increase was 42 milligram per deciliter for immunoglobulin A, 28.36 milligram per deciliter for immunoglobulin G, and 19.6 milligram per deciliter for immunoglobulin M (Table 2).

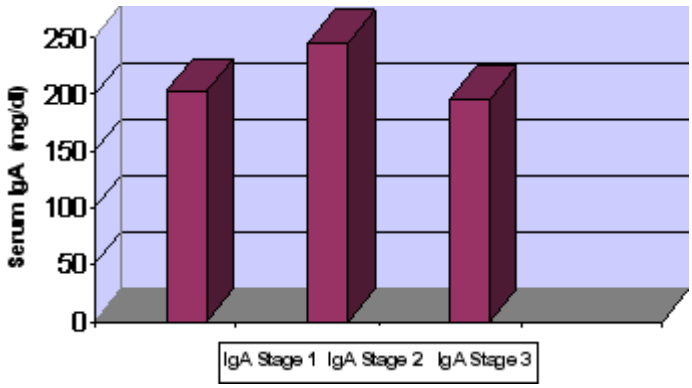

Fig. 1: Mean of Three Stages of Immunoglobulin A

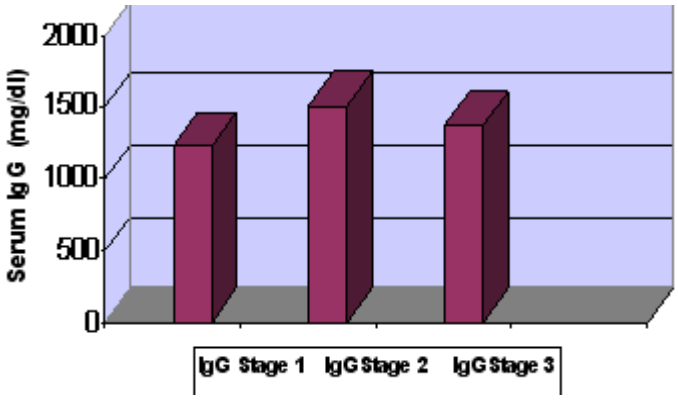

Fig. 2: Mean of Three Stages of Immunoglobulin G

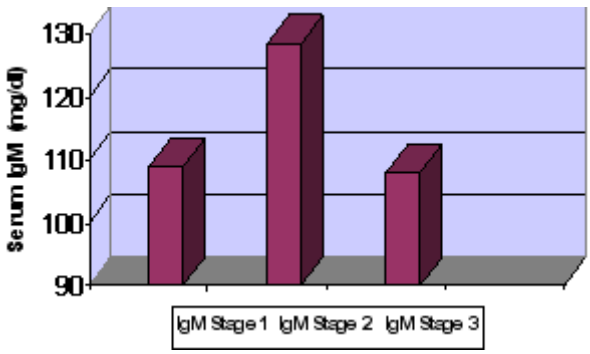

Fig. 3: Mean of Three Stages of Immunoglobulin M

DISCUSSION

In the current study, the response of some blood serum immunoglobulins to aerobic exercise has been examined. The examination of this change continued in a follow-up manner until 24 hours after the physical exercise. To this end, blood samples were drawn from the participants in three different stages. The research results showed an increase in concentration mean of immunoglobulins A, G, and M immediately and after 24 hours of physical activity. As a result, it can be said that one session of intense aerobic exercise results in the stimulation of some factors in the body's immunity system. The increase in immunoglobulin A was calculated 41.5 mg/100 ml, which is equal to 20.93 % increase after the physical exercise.

After the physical exercise, a significant increase equal to 283.6 mg/100 ml was observed in immunoglobulin G. This increase is equal to 23.07 %.

Also, an increase of 19.6 mg/100 ml was observed in immunoglobulin M, which is equal to 17.99%.

The present research confirms the findings of Nelhsen *et al*. (1991) as they also reported an increase in immunoglobulins A, G, and M after an intense physical activity[4]. It also agrees with the findings of Makinnon *et al*. (2000) since it has been mentioned in their research that the physical activity has been intense and has been done for one session[3].

The current study does not agree with the results of Karacabey et al. (2005) since the researchers experimented on their participants after 13 kilometers of average and sub maximal running[5].

In the current research, the participants rested for 24 hours. This relaxation caused serum immunoglobulins A and M to return to their former state but serum immunoglobulin G was to some extent higher than the relaxation period. More rest is probably needed for immunoglobulin G to return to its former state[5].

The reason for the change in serum immunoglobulins after the physical activity can be attributed to nervous and hormonal responses[14, 15]. On the other hand, changes in the level of blood plasma, is another reason that can bring about extensive changes in increasing or decreasing the level of serum immunoglobulins[11].

It seems that different physical exercises can generate diverse responses in immunoglobulins of blood serum. In addition, the duration of exercise and physical activity is one of the major factors influencing immunoglobulins of blood serum. Not only one session of intense and moderate exercise does not put any pressure on immunity system, but also it increases and strengthens immunoglobulins. The contradiction observed in diverse studies is mostly due to different intensities and durations of the exercises as well as individual differences of the participants. Therefore, a 15-minute session of intense physical activity strengthens the immunity system when it comes to blood serum immunoglobulin.

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