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The effect of an intense anaerobic exercise session on serum levels of IgG, IgM and IgA in handball, volleyball and climbing sports

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ABSTRACT

The immune system is protecting the body against many invasive foreign materials. The aim of this study was to investigate the effect of an intense anaerobic exercise session on serum IgG, IgM and IgA levels in Handballist, Volleyballist and Climbiest sports. In this study, 45 professional athletes with the mid age of 20-30 years old who have participated in the major leagues and the first batch of Zahedan city have been invited for this purpose. In this research, 30 second Wingate test was used to assess anaerobic power. Blood samples before, immediately after and 2h after exercises were collected and serum level of immunoglobulins IgG, IgM, IgA concentration were measured by nephelometry. The results of this study indicated that the level of serum immunoglobulins IgG, IgM, IgA concentration in all three study groups before and after and two hours post exercise, did not significant change ($P>0.05$). The results showed that short anaerobic exercise has not any effect on the level of immunoglobulins in athletes.

Key words: Intense anaerobic exercise session, IgG, IgM, IgA, handball, volleyball and climbing

INTRODUCTION

Regular and moderate exercise affects immune functions and have variety role in the prevention and treatment of many diseases, including cardiovascular disease, obesity, diabetes, hypertension and osteoporosis [1,2]. Effects of exercise on the immune function covers a wide range of sporting activities, including short-term and severe long-endurance activities and regular light exercise.

Study the long-term effects of regular exercise on performance of the immune system, has wide application in the development of public health and prevention among the nations that are increasing active elderly population [2,3]. Most studies have performed on adaptive response of serum and salivary immunoglobulin [4,5].

The most immunoglobulin in serum is IgG and in saliva IgA [6]. Immunoglobulins have direct role against infectious diseases and are important for the body defense as most of the IgA secretion of the mucous membranes in the first line of defense against viral infections is this immunoglobulin.

Exercise has effect on immune function and for susceptibility to diseases has double effects (positive and negative). Some evidences have shown that exercise induces changes in salivary IgA concentration that increase or decrease the amount of that strongly depends on the duration and frequency of exercise [7,8,9]. There are conflicting results on the effect of intense exercise on immunoglobulin levels so some studies have demonstrated increased concentrations of immunoglobulins such as reported by Hans and colleagues (2002). They indicated the serum levels of IgA, IgG, IgM in the first hours after a marathon race rose and returned to normal during recovery [10]. Pour Amani et al (2009) conducted research on active men showed that fourteen weeks running exercise significant difference in the level of IgA, IgM levels are created [11]. Amani Pour et al (2009) conducted research on active men showed that fourteen weeks running exercise had significant difference in the level of IgA, IgM levels [11]. Andrew et al (2009) conducted research on the fifteen active men who had exercise for 60 minutes with seventy-five percent of VO₂-max and their results showed that the amounts of IgA, IgG, IgG2 and IgG3 were significantly increased [12]. Whereas some other studies have pointed to a reduction in the concentration of immunoglobulin like David et al (2007) reported that the levels of IgG, IgM serum of ten elite male runners who had intensity of the training for three weeks with an average 38 percent increase was a significant decrease [13].

Daly (1998) and his colleague, Gleason et al (1995), Demytro et al (2002) Gleason et al (1999) reported decreased secretion of IgA [14, 15, 16, 17]. On the other hand, many studies have reported no change immunoglobulin concentrations like study of Cordova et al (2010) who reported that a volleyball tournament season is no effect on serum immunoglobulin IgA [18]. Mashiko and colleagues (2004) showed after 20 days of intense training rugby significant changes were observed in serum levels of male athletes IgG and IgM. While some studies have reported no change increased on IgA concentration [19].

Several studies have indicated that there had been changes in amount of immunoglobulin secretion in marathon runners [20, 21, 22]. ultramarathon [23] swimming [24] than normal.

Exhaustive exercise training is referred as intensity exercise that is at the highest level possible and after this activities, the athletes do not work and these will lead them to exhaustion [25]. Due to the conflicting results regarding the effect of exercise on serum immunoglobulin and unilateral attention to the long-term impact on these organisms and also due to a lack of investigation on the effects of short-term exhaustive training in various sports issues that need to perform a new study. Thus we performed this study to determine the effects of an exhaustive exercise on serum levels of immunoglobulin (IgG, IgM, IgA) in the field of sport athletes. .

MATERIALS AND METHODS

Method of study:

This semi-experimental study was performed on Zahedan male athletes of Sharyar Volleyball league and first batch of Handball and Climbing categories who were invited purposefully to the Zahedan city league.

Training programme:

In this study an anaerobic exercise training programme (Wingate) using a bicycle ergometer in three sessions were used. Each practice session lasted two hours and included a warm-up team at the beginning and then exercises and cool-down team at the end of each session.

Wingate test is a maximum effort (30-second) on a bicycle that calculates anaerobic function of the lower extremities.

Each person has to warm up for 5 minutes before the test readiness for physical activity on the exercise bike without pressure and after testing to prevent cramps, recovered for 1 to 2 minutes. Blood samples before and immediately after the end of the practice session and two hours after the exercise session were collected by expert lab and transferred to the laboratory for testing. The measuring of immunoglobulins levels was performed by nephelometry method using a kit manufactured by Binding company made in England.

Statistical Analysis

The results obtained from blood samples was analyzed using SPSS version 18. Descriptive statistics was used for the classification and regulation of index data (mean and standard deviation of the distribution). For determining the normal distribution of data, Klemogrof-Esmirof (KS) test was used. For comparison, the pre-test and post-test intra-group, repeated measures test was used and for the comparison between the study groups one way ANOVA test was used.

RESULTS

General and anthropometric characteristics of the subjects are presented in Table 1. Results of repeated measures showed that immunoglobulin levels in athletes Hndbalyst, Volleybalist and Climbiist before, after and 2 hours after exercise did not change significantly ($P > 0.05$).

Table 1: Anthropometric characteristics of male athletes of major league and first batch of Volleybalist, Handbalist and Climbiist of Zahedan city

Body mass index (BMI)	Age	Weight	Height	Group
23±2	26±4	71±5	176±5	Climbiist
26±9	25±7	79±6	183±8	Volleybalist
23±1	22±3	76±2	180±3	Handbalist

Results of one-way ANOVA showed that immunoglobulin levels are not significantly different among the three study groups ($P > 0.05$). Although serum levels of IgG in mountaineering athletes after exercise increased and then after two hours reduced and in Volleybalist group decreased immediately after exercise than before exercise and after two hours of increases, these changing was decreased IgG in the Mountaineers exhaustive exercise group. While IgM level in all three groups after training increased and then decreased and these changes were not significant. Serum IgA level in Climbiist and Handbalist athletes after exercise increased and then decreased and changes in levels of IgA in Volleybalist athletes was not observed before and after exercise. On the other hand the mean serum levels of IgG in all athletes group indicates that after exercise increased and then decreased while no changes in serum levels of IgM and IgA can be seen in Figure 1.

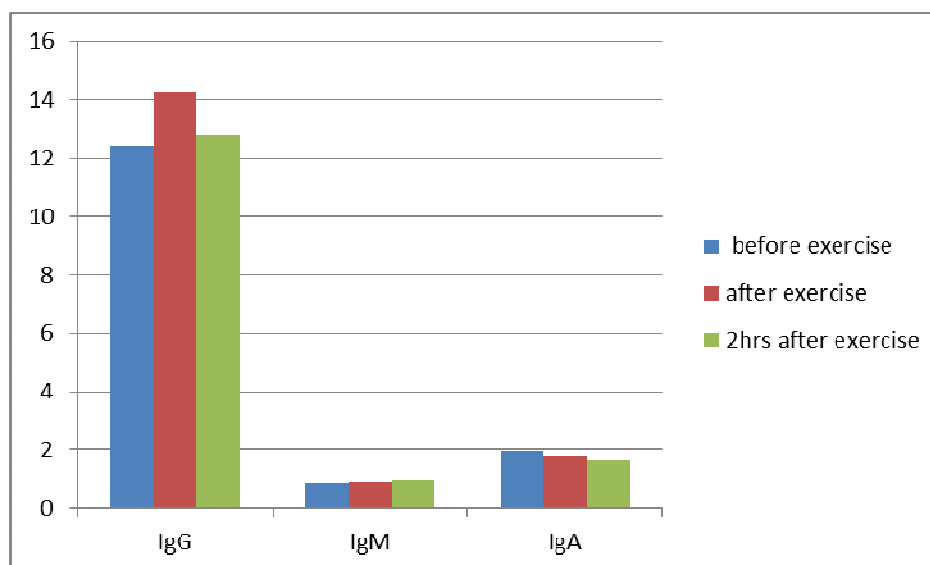


Figure1: The comparison of serum IgG, M and A (pg /ml) before, after two hours of training in Volleybalist, Handbalist and Climbiist of Zahedan city

DISCUSSION

Overall, the researchers reported that the change in concentration of the various factors related to different agents so that different mechanisms are proposed to explain the changes in immunoglobulin concentrations that can be mentioned. Serum immunoglobulins in response to exercise, especially with athletes disease affecting one of the mechanisms that have been neglected [2] and any changes in amount of these materials must be considered.

A slight increase (less than 20%) in the concentration in serum that after largely acute exercise can be seen attributed to changes in serum volume. Increase in serum immunoglobulin concentrations less than 10% of immunoglobulins attributed to the daily changes and reserve immunoglobulin exchange of extravascular circulation and lymphatic vessels or circulation [26, 27, 28]. In the regulation of Ig production by cells B cells, cells and soluble factors are involved. These factors include the number and proportion of circulating lymphoid cells and lymphoid tissues, release of immune regulatory factors such as cytokines or the number and sensitivity of lymphocyte receptors for these molecules, neuro-hormonal changes such as a circulating hormone levels and receiver sensitivity and the effects of psychological stress.

These factors may act in parallel to each other. In addition, the acute effects of exercise programme may be prolonged and having chronic effects that may have overlap or interfere [2] as Hans and colleagues (2002) reported that plasma levels of Ig A, IgG and IgM in the first hours after Marton race increases and the processing returns to normal [10]. Since monocytes are increased during exercise and prostaglandins are produced by these cells, the findings suggest that soluble factors such as prostaglandins released during exercise has indirect effects on the production of immunoglobulins [29]

The major salivary secretory immunoglobulin is IA that prevents antigen enter to the upper respiratory tract. Excretion of this molecule depends on, intensity, duration and type of physical activity. Different mechanisms have been proposed by researchers to explain any change of this molecule that are included as: reduction of salivary flow, physical and psychological pressures, sympathetic nervous system and secretion of immune system suppressive such as cortisol, epinephrine, enkephalins [30]. Perhaps one of the reasons that in our study IgA did not change significantly, was due to severity and duration of the activity of athletes.

Some researchers reported the decrease amount of serum immunoglobulin levels after stressful activities has been due to fall from its previous activities in the bloodstream [17]. Some as Portman reported the reason for this part of reduction has been due to the increase in blood cells [31]. Some believe that the bad position of the arm during blood sampling may affect the serum immunoglobulin levels [17]. Also, several studies have noted that serum immunoglobulin levels 24 hours after intense physical activity will return to the initial level [32-34].

The results of these researches are consistent with Michel *et al* (1996) Mashyko *et al* (2004), Cordova *et al* (2010) and inconsistent with the results of Allegro and colleagues (2008), Dolly *et al* (1998), Gleason *et al* (1995), Demytro *et al* (2002) [35,12-19].

The results of Platinum and colleagues (1999) showed that exercise intensity has no significant influence on the salivary IgA concentration [36]. While Klentro and his colleagues (2002) showed that reduced the number of immunoglobulins after intense physical activity and increased after prolonged moderate activity [37].

CONCLUSION

According to the research results because the duration and intensity of the determining factors in the immune response to exercise were introduced [16, 37-39], it can be concluded that short intense exercise given the appropriate intensity due to time of low activity, has no significant effect on IgG, IgA and IgM concentration so some limiting factors such as the duration of investigation of this study can be considered for this research. As the evaluation of immune system components in combination with each other and also connection of this system with other organ systems is complex, the results of this study should be reviewed in future research and the role of short-term intense exercise or exercise with prolonged anaerobic on serum immunoglobulins and other immune system functions as well as the role of these factors on the creation of response in skeletal muscle after exhaustive exercise should be investigated precisely in future.

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