The effects of 8-week regular morning exercises on the Immunoglobulin A and Serum Cortisol in women of ShahreKord, Iran

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Abstract

Background: physical activity is a variable which creates hormonal and physiological adaptation and changes the many aspects of immune function. This study aimed to examine the effects of 8-week morning exercises on the Immunoglobulin A and Serum Cortisol and the relationship between them in women.

Methods: this study is experimental and 32 healthy sedentary women aged 30 to 40 years old were selected randomly and divided to two test group and control group. The test group has done morning exercises at 6:00 o’clock, 3 times per week for 8 weeks and the control group had continued their normal life style. Fasting blood samples were gathered a day before doing exercises and also, on last day after doing exercises at the same time (8:00 a.m.) and then tested. The data were analyzed by descriptive statistical methods.

Results: the results showed that doing morning exercises for 8 weeks increases the Serum Cortisol level in women significantly and its mean was 17.7±6.02 µg/dl in test group (P<0.001). No changes were observed at the level of Immunoglobulin A in both groups (P>0.05). No significant correlation was observed between Immunoglobulin A and Serum Cortisol.

Conclusion: it can be concluded that doing morning exercises for 8 years regularly has increased the Serum Cortisol level in women in ShahreKord, Iran. It seems that it caused by physiological stress and hormonal responses of women but it has no effects on the increase of Immunoglobulin A.

Keywords: Serum, Immunoglobulin, Cortisol, Morning exercises, Women.
Introduction

It is obvious that sport and physical activities are very important for health and fitness of individuals. Today, sport is important not just for athletes but also, for all people of society, because man is created animated and motion and activity are required for health. The world around us is full of infective factors which threaten human from all sides. The human body has required defense mechanisms to deal with these factors (1). In athletes, after doing strenuous and prolonged physical activities, Serum Cortisol increases and in special conditions, the high concentration of Cortisol prevents the production of antibody and the immune system weakens as a result of the increase of Serum Cortisol (2). Of course, regular exercises with moderate intensity have positive effect on the efficiency of the body, maintenance of health and prevention of illnesses. Also, physiological responses to physical activity are affected by the time of doing it during a day. However, the effects of the time of exercises on the immune and hormonal responses have been not completely understood (3). Cortisol is one of the most important steroid hormones that play an important role in the regulation of cardiovascular, immunological and metabolic functions. It also accelerates the gluconeogenesis, lipogenesis and lipolysis in the body. The researchers believe that the factors such as the intensity of exercises, changes of plasma volume and blood, changes of environment temperature and stress caused by activity and intensity of exercises affect the concentration of Serum Cortisol in athletes (4). In a study on 13 runners on a treadmill for 30 minutes, it increased the concentration of Serum Cortisol in blood. Generally, the relationship between Cortisol and metabolic intermediates, especially during doing exercises, has not been clear (5). The studies have shown that regular exercises with moderate intensity have positive effects on the efficiency of the body, maintenance of health and prevention of illnesses. Also, physiological responses to physical activity are affected by the time of doing it during a day. According to the researchers, the effect of the time of doing exercises on immune and hormonal responses is not completely clear (6,7). The results of studies by researchers showed that the concentration of Cortisol in handball players increases significantly after training, while these results were not obtained in other athletes, especially swimmers. The findings of mentioned studies implied that the type of sport, intensity of activity, hemodynamic conditions of swimming, heat stress and body condition, practicing in different situation of sport can effect on the concentration of Serum Cortisol (8). The reports indicate that the serum Immunoglobulin (Ig) isn’t changed relatively by light or strenuous exercises. In some endurance athletes with high performance, the concentration of Ig is low. Athletes with low level of Ig may be at risk of infectious diseases during doing strenuous exercises (9). There are equivocal findings about the levels of Immunoglobulin in athletes who are taking a break. For example, in Australian athletes, the levels of IgA, IgG and IgM are less than normal values as much as 10 percent (10). Generally, the type of sport and training program may effect on the increase of plasma volume and finally, cause the change in the serum concentration of proteins such as Ig (11). Serum Immunoglobulin levels may change after doing short- or long-term exercises. Of course, other researchers believe that no changes happens after doing endurance sports. For example, in cyclists, no changes have been observed in the serum concentration of IgA, IgG and IgM after biking for two hours (12).

Dissemination of the scientific findings and the development of health, culture and increasing awareness on the effects of exercises on health among people, especially women, has encouraged
people, especially women, to do physical activities. So, there is a question for researchers: Can doing morning exercises with physical activities with moderate intensity regularly strengthen the immune system of women? in other words, Can doing morning exercises change the Serum Cortisol level in women? Therefore, investigating the effects of doing regular morning exercises on some indicators on immune system in women of ShahreKord, Iran and the effects of morning exercises on the women’s immune and hormonal efficiency (Immunoglobulin A and Serum Cortisol) will be very important.

Method

This study is experimental which was approved by Ethics Committee of Research and Technology Department of Islamic Azad University and then, performed in 2014. In this study, 32 women, aged 30 to 40 years old, who were sedentary at least 6 months before starting the study and had no history of chronic, cardiovascular, respiratory, infectious diseases, and hormonal disorders or drug sensitivity, were selected from ShahreKord, Iran and then, they were assigned to two test and control groups randomly. In order to collect data, after required coordination with women and other partners to exercises, required preparations were done. After selecting the subjects, at first, they were become aware of the research subject, its purpose and methodology and also its possible applications. Then, they signed the consent voluntarily to participate in the study and their health status and history in the past few months were studied by the use of questionnaire. Also, they were asked to refrain from using various drugs during the study as much as possible. General characteristics of women, including age, height and weight, were examined. Their ages were examined through questionnaire, their height was measured by the centimeter device with 1mm accuracy and their weight was measured in kilogram by a medical weighting device (model: sika 2000, made in Germany). The test group has done morning exercises at 6:00 o’clock, 3 times per week for 8 weeks and the control group had continued their normal lifestyle. The subjects of control group were asked to prevent any regular exercises for 8 weeks. A time per 2 weeks, during a coordination meeting, it was ensured that the control group didn’t do any exercises. On the other hand, the exercises program of test group was run at each session for 60 minutes. It means, after doing warm up for 15 min, 30 minutes of aerobic stretching and rhythmic exercises (a variety of running, a variety of jumps, ground movements, stretching movement and a variety of coordinated movements of hands and feet) from simple to difficult and from low intensity to high intensity were identified for each subject. It should be noted that to prevent fatigue, the exercises were done variously. To create happiness and avoid fatigue, various and light movements and exercises such as badminton and table tennis were done during doing exercises. The ambient temperature of the place for doing exercises was 13-15°C and its relative humidity was 15-20%. The place of doing morning exercises was located in the park fork women in ShahreKord, Iran. After doing morning exercises for 8 weeks, a day after the end of the program, at the specified hour in the morning, venous blood samples were taken from both groups as much as 10 cc as post-test samples and also, transferred immediately to the laboratory complex of ShahreKord Branch, Islamic Azad University. In the laboratory, the serum was separated from blood by using centrifuge and transferred in micro tubes and then, tested. The Immunoglobulin A of serum was tested by immunodiffusion method with the accuracy of 1.0 ng/ml and the use of Baharafshan kit made in Iran and Serum Cortisol was tested by radio-immunoassay (RIA) technique with the accuracy of 6.0 ng/ml and the use of
RADIM kit made in Italy. To determine the normality of the data, Kolmogorov-Smirnov test was used. All of data was analyzed by descriptive and inferential statistics (t-test) with the confidence level of 95% and the relationship between the levels of Serum Immunoglobulin A and Serum Cortisol was examined by Pearson’s correlation. Data analysis was performed by SPSS V.13 software.

**Results**

The general characteristics of studied women were listed in Table 1. According to the results, the mean age of test group was 32.25±2 years old, its mean weight was 60.5±3 kg and its mean height was 165±4.5 cm. in Control group, these indicators were 33.5±2 years old, 61±3 kg and 160±3 cm, respectively. There are no significant differences between two groups in terms of age, weight and height. The results showed that after doing morning exercises for 8 weeks, no significant statistical differences were observed between the mean concentration of Serum Immunoglobulin A of test group and the mean concentration of Serum Immunoglobulin A of control group (1.39±0.35 mg/dl in test group and 1.64±0.56 mg/dl in control group). Of course, there was a significant statistical difference between the mean concentration of Serum Cortisol of test group and the mean concentration of Serum Cortisol of control group (17.7±6.02 μg/dl in test group and 10.60±4.99 μg/dl in control group) (P<0.001) (Table2). According to the results, no significant correlation was observed between Immunoglobulin A levels and Serum Cortisol levels.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control group (mean± standard deviation)</th>
<th>Test group (mean± standard deviation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>33.5±2</td>
<td>32.25±2</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>61±3</td>
<td>60.5±3.5</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>160±3</td>
<td>165±4.5</td>
</tr>
</tbody>
</table>

Table2. Serum Immunoglobulin-A levels and Serum Cortisol levels of women in test and control groups after doing morning exercises, 2014

<table>
<thead>
<tr>
<th>Group</th>
<th>Control group</th>
<th>Test group</th>
<th>Test group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(before doing exercises)</td>
<td>(after doing exercises)</td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>(mean± standard deviation)</td>
<td>(mean± standard deviation)</td>
<td>(mean± standard deviation)</td>
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</tbody>
</table>
Discussion

In general, exercises and physical activities are important factors in improving physiological and hormonal systems. Immune system has close relations with cardiovascular, nervous, respiratory and muscular systems. In present study, doing morning exercises have no significant effects on the Serum IgA of women. Serum immunoglobulin A is one of the most important types of Serum immunoglobulin and its natural function is very important for immune system. Of course, some studies have shown the increase of serum immunoglobulins after doing regular physical activities and exercises and mentioned that its reason was the more activities of the nervous sympathetic system (12). Also, in another study in 2004, it was reported that the levels of immunoglobulins in women who do more physical activities are higher than ones in women who do no physical activities. The level of IgA has increased in women after doing more physical activities which has been probably due to movement of immunoglobulin from its previous location to bloodstream. Also, in same study, the concentrations of IgA were measured before and after doing moderate exercises in the cases of the heat, dehydration and having sufficient water. The plasma IgA concentrations at rest, during and after doing exercises in the case of dehydration were significantly higher than ones in the case of having sufficient water that is due to the changes in plasma volume and the out of IgA from vascular reserves and also, body position and attitude of the arm during blood collection may affect the level of Serum IgA (13). However, comparative studies suggest that serum immunoglobulin levels in athletes at rest are not different from its level in non-athletes or its natural values but in the runners who do intense exercises and in elite athletes who participate heavy competition, the concentration of serum IgA and the production of antibody decreases (10,12). It has been reported that doing intensive exercises may not reduce the level of antibody and serum Ig by itself, but the combination of intense exercises and heavy competition may reduce the concentration of these substances (4). Another study performed on 60 different male and female athletes (swimming, athletics, cycling, football, basketball, tennis and triathlon) showed that during three months of intensive training, the level of Ig decreases (11). Of course, doing moderate exercises is associated with modest increase in the level of Serum Immunoglobulins. In a randomized study performed on 50 obese middle-aged women who were sedentary, in a program of moderate physical activity, i.e. five sessions of 45 minutes of brisk walking per week, they exercised with 60% of heart rate but they control group did not exercises. Comparing the results showed that after 6 and 15 weeks, the concentration of Serum IgA increases as much as about 20% in test group. Although the data analysis showed that in general, the significant increase has been observed in test group but no significant differences
has been observed between the concentrations of IgA in test and control groups at any time. Plasma volume does not change with exercises and an increase of serum IgA concentration can be associated to the changes of other parameters such as white blood cells, proliferation of lymphocytes or the number of lymphocytes (15). Increase of the response of IgA to infections in preventing infectious diseases caused by intensive sports is still not fully understood correctly. In women, exercising based on training program for 15 weeks reduces the incidence of upper respiratory tract infections and increases the levels of serum IgA. Increased concentrations of serum IgA is significantly accompanied with facilitating the resistance to upper respiratory tract infections and improving physical preparation. Of course, athletes and coaches believe that during intense exercises, heavy competition and additional training courses, athletes are more susceptible to certain diseases such as viral infections of upper respiratory tract. These observations are confirmed by the reports provided by the doctors treating athletes and also epidemiological studies on endurance athletes that their results show a higher prevalence of respiratory infections after the tournament. The increase of infections in non-athletes or those who practiced but did not race, cannot be seen (16-19). Some studies have shown that high intensity exercises reduces the IgA, increases the Cortisol concentration and eventually weakens the immune system (1,14). However, a number of other studies have shown that IgA concentration increases after endurance, strength and parallel exercises (20,21). The results related to serum immunoglobulin A are associated with the results of some studies on runners of different kinds of running in 2012 (12) and the individuals exercising in Gym hall in 2013 (22). The researchers of these studies observed that the IgA concentration hasn't changed after physical and fitness activities and doing different running, including 13km-soft running and even repeating regular physical activities and exercises doesn’t cause any alarming fluctuations in the Serum immunoglobulin level that is probably due to the changes in hormonal immune system and their adaptation with exercises before participating in the tests. Therefore, the exercises are considered as physiological stress which will alter the metabolic and neurocranial conditions and finally, effect on Serum immunoglobulin (17,23). Of course, there are different mechanisms related to the effects of exercises and physical activities on the levels of serum immunoglobulins and antibodies so that the difference in the secretion of antibodies, especially less than 10 percent, will lead to the changes in the concentration of serum antibodies that these changes can be caused by the difference between the internal and external vascular compounds. On the other hand, the lymph flow increases during doing exercises and physical activities and causes the changes in the amount of protein entering into bloodstream. Also, the half-life of serum immunoglobulin is different in different conditions, including intensity of exercises and physical activities and its duration that leads to the difference in the amount of antibodies and Serum immunoglobulin (14,15). Also, the number of lymphocytes circulating in the blood and lymph tissues, sensitivity of lymphocytes (cell receptor) and the concentration of lactate in the blood are considered as other significant factors affecting the amount of antibodies and concentration of Serum immunoglobulin. On the other hand, the interaction between the sympathetic androgenic nervous system and the immune system in different sport conditions and doing vigorous physical activities with stress increase the amount of adrenergic beta receptors in the membranes of lymphocytes and subsequently, the production and synthesis of antibodies and Serum immunoglobulins (15).
In this study, morning exercises training significantly increased the Serum Cortisol levels in women (P<0.001). This result is not consistent with the results of other researchers on runners aged 21 to 30 years old in extreme training conditions (7) and also Hocky players (24), in these studies, no significant difference has been observed between the Serum Cortisol levels of test group and control group. In this regard, psychological factors may probably impact on people participating in sport activities (24). This study is consistent with other studies in terms of the significant increase of Serum Cortisol level after doing exercises and physical activities (17, 21, 22). Of course, there are many factors causing the increase of Serum Cortisol level after doing exercises and physical activities that one of the most important factors is the increased secretion of hormones from the adrenal gland that stimulates pituitary – hypothalamus axis and increases the secretion of ACTH hormone from pituitary and finally, increases the secretion of Cortisol. So, during doing exercises and physical activities, the mentioned axis becomes active and increases the secretion of Cortisol. Cortisol is of the stressful hormones associated with the adrenal gland and therefore, different strenuous physical activities and sports cause the secretion of Cortisol. Of course, the exercise intensity plays an important role in the activation of pituitary - hypothalamus axis. The increase Serum Cortisol concentration depends on the type of exercises such as aerobic or anaerobic activities (21-24). Another possible reason of the change and increase of Serum Cortisol level in athletes is the relationship between the Serum lactate and Cortisol level that blood lactate concentration has increased at the end of the duration of doing exercises and physical activities and consequently, will cause the increase of Cortisol level during the break (22,23). There are numerous other factors effecting the increase of Serum Cortisol level after doing different physical activities that depend on the type, intensity and duration of exercises, heat pressure, relative humidity, differences between ground level and sea level, body condition, gender, changes in the amount of electrolytes in the body, individuals motivation, stressful activity, participating in global competitions and Olympic sports and even, taking supplements and vitamins, including vitamin C by individuals and athletes. These factors cause the increase of Serum Cortisol concentration (24).

**Conclusion**

So, given that sport and physical activities are considered as a psychological and physiological stress and cause the production and secretion of B lymphocytes through increased activity of metabolic and neurocranial factors and consequently, will increase the Serum Cortisol level, it is concluded that in the women of ShahreKord city, Iran, doing morning exercises hasn’t increased the Serum immunoglobulin levels (IgA) significantly which was probably associated with psychological reasons but there is a significant relationship between doing morning exercises and increase of Serum Cortisol.

**Acknowledgement**

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