

ORIGINAL ARTICLES

The Effect of Aerobic and Anaerobic Exercises on Stress and Secretion of Cortisol in Young Male Soccer Players

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ABSTRACT

The objective of this research was to study the effect of aerobic and anaerobic exercises on stress and secretion of cortisol in young male soccer players. Cortisol is a stress hormone which is secreted in reaction to stress and highly affects carbohydrate, fat, and protein metabolisms and has a stimulating effect on central nervous system and circulatory system. In this research which was semi-empirical, of 250 soccer players with the average age of 16 to 19 years, 20 were chosen and divided into two groups of 10 subjects; an aerobic exercise group that performed a 2400-meter run test and an anaerobic exercise group that performed sprints (100, 200 and 400 meters). Hari's Stress Inventory was used for those players with high level of stress. In order to determine the concentration of cortisol, blood samples were collected from each group before and after aerobic and anaerobic exercises. Results were assessed at significance level of $p < 0.05$ and using t-test for dependent samples. The results showed that both an aerobic exercise session and an anaerobic exercise session significantly affect blood concentration and cortisol secretion and that these exercise sessions have no significant effect on the reduction of stress.

Key words: Cortisol, aerobic and anaerobic exercise, stress, soccer players.

Introduction

Exercise immunology has significantly developed during the last decade. Sports exercises, due to changing regulatory hormones of the immune system and creating hormonal and physiological adaptation, have become the center of attention. Sports exercises alter some of the aspects of immunity function and this alteration of function can be positive, negative or neutral. Epidemiological studies have revealed that heavy or prolonged exercise exposes athletes to upper respiratory tract infection. Such a disease is intensified due to temporary suppression of cell-mediated immunity functions and via the function of stress hormones such as cortisol or through altering the activity of leukocytes (Kendall, 1990; Macneil *et al.*, 1994; Kraemer, 1987; Baum *et al.*, 1996; Pizza, 1995).

One of the current problems in various societies, especially among youngsters, is psychological problem. Considering the fact that at different levels of skill performance, athletes face states such as losing necessary motivation, losing self-confidence, psychosomatic stress and specifically physiological and psychological fatigue, and consequently these factors deteriorate skill performance quality, applying relaxation techniques in the form of psychosomatic and psychological preparation is one of the most important achievements of contemporary research studies (Carron, 1990).

Adrenal gland is an endocrine gland which releases cortisol when affected by its stimulating hormone, that is, adrenocorticosteroid. This hormone profoundly affects stress, carbohydrate, fat, and protein metabolisms and has stimulating effect on central nervous system, circulatory system and inflammation (Gayton, 2005). There have been various studies regarding responses to stress and cortisol secretion with contradictory results.

In many of these researches it is shown that increase in the intensity of exercises leads to more secretion of cortisol and that concentration of cortisol decreases in sports exercises with moderate intensity and short duration (Silva, 1984).

Kiger (2000) showed that aerobic exercises have anti-depression and anti-anxiety effects and that adrenal gland is sensitive to the increase of exercise duration and this prolonged exercise consequently leads to increased secretion of cortisol. Researchers have revealed that strenuous exercise (more than 75% of maximal oxygen consumption) changes plasma and blood volume as well as body temperature and leads to mental pressures and consequently, affects the concentration of cortisol in athletes (Roemmrich, 1997).

In many of the researches carried out, exercise patterns in different sports include acute and short-term responses (Nieman *et al.*, 1995; Passelergue, 1999). Further, some researchers have studied cortisol secretion and concentration in athletes involved in running activity with a pressure more than 50% of $VO_2\text{max}$ (maximal oxygen consumption) and observed that after performing these exercises, secretion of cortisol, anxiety and stress significantly increased (Salmon, 2001).

Since it appears that soccer players and coaches do not have sufficient knowledge and information regarding the effect of physical activity and stress on the release of cortisol, it seems necessary to answer some of the related questions through this research.

Research Method:

The present research is semi-empirical and the statistical population of this research includes soccer players of Ardabil Province with average age of 16 to 19 years. Thus, of 250 soccer players, 20 subjects with a high level of stress were randomly chosen. We used Hari's Stress Inventory in this research. In order to collect data, first the subjects filled out the questionnaires; then, they were divided into two groups of 10 subjects and blood sample test was performed to examine the concentration of cortisol.

After blood sample collection, the first group performed the aerobic test of running over the distance of 2400 meters with the intensity of 75% of $VO_2\text{max}$ and up; the second group performed the anaerobic test which included sprints over distances of 100, 200 and 400 meters, again with the intensity of 75% of $VO_2\text{max}$. At the end of the tests, blood samples of the two groups were collected again and the subjects filled out the questionnaires for the second time. In order to examine the statistical results of this research, t-test for dependent samples at significance level of $p < 0.05$ was applied and the data was analyzed using SPSS software.

Results:

An aerobic exercise session has a significant effect on reduction of cortisol concentration in young soccer players.

Table 1: The effect of an aerobic exercise session on cortisol concentration in young soccer players.

Statistical Indices Groups	Number of Subjects	Standard Deviation	Value of t	p
Pre-test of soccer players, performing aerobic exercises with cortisol concentration	10	6.32	2.347	0.0041
Post-test of soccer players, performing aerobic exercises with cortisol concentration	10	5.87	1.981	

The above table shows that considering the significance level being less than 0.05 ($p = 0.0041$), an aerobic exercise session has significant effect on reducing cortisol concentration.

An anaerobic exercise session has a significant effect on reduction of cortisol concentration in young soccer players.

Table 2: The effect of an anaerobic exercise session on cortisol concentration in young soccer players.

Statistical Indices Groups	Number of Subjects	Standard Deviation	Value of t	p
Pre-test of soccer players, performing anaerobic exercises with cortisol concentration	10	5.73	2.714	0.0028
Post-test of soccer players, performing anaerobic exercises with cortisol concentration	10	4.39	2.112	

The above table shows that considering the significance level ($p = 0.0028$), an anaerobic exercise session has significant effect on reducing cortisol concentration.

Table 2: An aerobic and anaerobic exercise sessions and reduction of stress in young soccer players.

Statistical Indices Groups	Number of Subjects	Mean	Value of t	p
Pre-test of aerobic exercise group with stress	10	42.81	3.24	0.062
Post-test of aerobic exercise group with stress	10	39.98	2.98	
Pre-test of anaerobic exercise group with stress	10	45.12	3.19	0.057
Post-test of anaerobic exercise group with stress	10	41.18	3.44	

The above table shows that considering the significance level in the aerobic exercise group ($p=0.062$), an aerobic exercise session has had no significant effect on reducing stress. Further, significance level in the anaerobic exercise group is 0.057, indicating that anaerobic exercise session has had no significant effect on reducing stress.

Discussion:

As mentioned throughout this research, an aerobic exercise session has a significant effect on reducing cortisol concentration and this conclusion is consistent with the studies of Kraemer, Lehmann, Neiman and Passelergue and is not consistent with the results of Kiger. Moreover, anaerobic exercise session has a significant effect on reducing cortisol concentration and this finding is consistent with the researches of Salmon, Silva, and Weinberg and is again inconsistent with Kiger's results.

Considering the results of the present research and the studies of other researchers we can say that various researchers have conducted different exercises; for instance, Kiger's research was based on another exercise pattern with different intensities and in several levels while in the present research, we emphasized on only one exercise session. Thus, we can conclude that the effect of stress hormones (cortisol and epinephrine), as mediators caused by stimulation due to sports exercises, affects the number and distribution of leukocytes in the blood and in various body organs such as spleen, liver and bone marrow. Despite complex relationship, it has been proven that changes in these hormones due to sports activities may lead to changes in cellular processes. Furthermore, the intensity, duration and repetition of exercise sessions play an important role in changing hormone concentration.

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