

The Relationship between Salivary IgA and Cortisol Concentrations and Psychological Overtraining Symptoms in Elite Soccer Players

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Abstract

This study is to investigate the relationship between salivary IgA and cortisol concentration and the data elicited through the administration of French society of sports medicine questionnaire of psychological overtraining symptoms in elite soccer players.

Accordingly, from among the Iranian premier league players, 30 participants with the mean and standard deviation of 24.1 ± 3.79 in years, 180 ± 7.29 centimeters in height, 75.2 ± 8.09 kg in weight, 22.97 ± 1.21 kg/square height in meter in body mass index, and 53.26 ± 2.79 milliliter per kilogram body weight per minute in aerobic power were selected voluntarily and purposefully as the sample. In the rest day following the exercise (24 hours with no exercise), the psychological overtraining symptoms questionnaire, including 54 "Yes/No" question items, were administered to the players. On the same day, three specimens of every player's saliva were taken at certain intervals (8:00 A.M., 11:00 A.M., and 5:00 P.M.). These specimens were used to measure the average concentration of cortisol during the day. In this sampling, IgA concentration was measured from the 11:00 A.M. specimen.

Subsequently, the data was analyzed using the descriptive statistical methods and Spearman rank correlation coefficient formula, which suggested a significant, positive relationship between the questionnaire results as the psychological overtraining index and cortisol concentration at 8:00 A.M. and 11:00 A.M., respectively ($r=0.71$; $r=0.62$; $r=0.61$; $p<.01$). However, there proved to remain a significant, negative correlation between the questionnaire results and IgA concentration ($r= -0.51$; $p<.05$).

The findings of the study suggest that the psychological overtraining symptoms questionnaire can be a positive tool in determining and preventing the overtraining phenomenon.

Keywords: Cortisol, Immunoglobulin A, Overtraining, Psychological overtraining questionnaire

Introduction

Many professional sportsmen spend a long time in different training camps and experience psychological and physiological pressures and stresses. Such pressures and stresses may exert unfavorable impacts on the sportsmen in the long run. Overtraining phenomenon is one these negative impacts which has been afflicted upon many professional sportsmen over the last years. Many experts believe the overtraining to be a long-term process caused by the lack of balance between heavy training sessions and the rest intervals[1,2,3]. Overtraining has certain symptoms and causes particular problems for the sportsmen including physiological, psychological, performance, and immunological problems [3].

If overtraining is not timely recognized and prevented, it may sweep the sportsmen away into slumps for months. However, the training experts have always been trying to come up with methods to control the training pressure to some extent; although, it is difficult to exercise an exact control over the training pressures due to some problems such as the extent of sportsmen preparation. One of the clinical methods used to investigate the sportsmen status regarding the extent of training pressure and physiological response to it is the examination of variations in the sportsmen's endocrine secretion and immune system. In this regard, cortisol as the most important catabolic hormone and immunoglobulin A (IgA) play a crucial role. Some experts have asserted that the concentration of cortisol and IgA would vary in response to exercises and psychological-physiological pressures. This variation causes an increase in cortisol but a decrease in IgA

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concentration, which may be considered as one of the important symptoms of overtraining in the long chronic run [1, 4, 5].

The chronic overconcentration of cortisol, as a stress hormone belonging to the glucocorticoid family, may damage proteins and cause a harm to the immune system [6, 7, 8]. IgA is the dominant antibody found in the epithelium-immune system, which functions as the major influential factor in the host defense against pathologic organisms. It is argued that heavy exercise may decrease immunoglobulin concentration and leave the body susceptible to damage. This damage can particularly affect the upper respiratory tract (URT)- [3]. On the other hand, clinical methods generally require much time and expenditure. That is why these methods are not always viable. Experts are seeking methods to yield similar outcomes with less time and expenditure. In recent years, they have developed a method which draws on the account the athlete gives regarding his psycho-physiological status. Utilizing this method requires such instruments as questionnaires and standard norms particularly designed for this purpose [10,11]. To be assured of the outcomes of these questionnaires and norms, experts have conducted studies on the extent of the relationship between the outcomes of these instruments and more precise indices dealing with training pressure and overtraining.

Maso et al. (2002) in their study on the professional rugby players found a significant, negative correlation between the results of psychological overtraining symptoms questionnaire and testosterone concentration [1]. Marita et al. (2003) found a significant, positive correlation between the results of psychological overtraining symptoms questionnaire and Hamilton depression symptoms, and cortisol concentration [12]. On the whole, many studies have affirmed that long, heavy exercise and psychological tensions and pressure may result in an increase in cortisol concentration but a decrease in immunoglobulin concentration, which may eventually weaken the immune system, as one of the overtraining symptoms [12,13]. With regard to the aforesaid, it is essential to develop methods through which to examine the pressures imposed by training on the players so that some contingent problems like overtraining may be avoided.

In this study, the researchers aim at investigating the relationship between some of the overtraining symptoms, cortisol concentration, and Immunoglobulin A (IgA) concentration in elite soccer players. In this regard, the psychological overtraining symptoms questionnaire is used.

Method

Participants

The present study is a descriptive one in general and a correlational in particular. The population was all the soccer players in the Iranian premier league. Using quota sampling method along with availability, 30 elite soccer players were chosen as the participants. None of the players were suffering hormone disturbances, and they used no hormone drugs at that time. The measurements were conducted subsequent to the agreements built up with their club officials and the completion of informed consent by the players. The saliva specimens were collected while the sportsmen were at rest in their hotels with no stressful training or match pressures. Other corresponding variables including height, weight, body mass index and maximum aerobic power measurements were consistent with their Bruce protocol.

Saliva specimens

On the day off (24 hours with no exercise), the players' non-stimulated salivary specimens were taken at three intervals, 8:00 A.M., 11:00 A.M., and 5:00 P.M. The specimens were taken at three stages to help avoid the effect of circadian rhythm and other factors such as eating on the secretion of cortisol. Moreover, taking specimens at three stages would reveal the daily cortisol variation rhythm in the elite soccer players [1, 14]. Subsequently, the IgA concentration was examined in the 11:00 A.M. specimen. Immediately after collecting the specimens at each stage, the tubes were sent to a specialized medical and pathology clinic¹. In the clinic, the specimens were frozen to -20 degrees centigrade. To check the cortisol concentration in the specimens, the Italian RADIM kit was used while the IgA concentration was measured by Demedicate kit. In this regard, ELISA method was used for the diagnosis.

Psychological overtraining symptoms questionnaire

The Psychological overtraining symptoms questionnaire was given to the players on the same day that their salivary specimens were collected. As a standard questionnaire, it is developed by the French Society of Sports Medicine and used frequently by the researchers [1, 2, 15]. The questionnaire involves 54 "Yes/No" question items in which the scoring is based on the number of "Yes" answers [1,16]. To administer the questionnaire, the objectives of the study were clarified to the players first. Then they were asked to honestly fill out the questionnaire. Although the

questionnaire is a standard one, to ascertain the accuracy of outcomes, its validity was discussed with psychology and physical education experts. The questionnaire's reliability was calculated through using Cronbach's alpha coefficient which yielded an $r=0.95$. All the measurements were done in the league mid-season.

Data analysis

Eventually, according to the objectives of the study and the rank-ordered nature of the collected data, descriptive statistics and Spearman Rank Correlation Coefficient were used to analyze the

data. In this regard, SPSS 14 was utilized.

Results

Table 1 illustrates the mean and standard deviation of the players' age, height, weight, body mass index, and maximum aerobic power. Table 2 illustrates the daily average of cortisol concentration and average IgA concentration at different sampling hours. Table 3 demonstrates the correlation between cortisol and IgA, and the results of Psychological overtraining symptoms questionnaire.

Table 1: The participants' physical and physiological profile

Maximum aerobic power Milliliter per kg per min	Body mass index Kg/square height (m)	Weight (kg)	Height (cm)	Age
53.26 ± 2.79	22.97 ± 1.21	75.2 ± 8.09	180 ± 7.29	24.1 ± 3.79

Table2: Cortisol and IgA concentration at different sampling hours

Immunoglobulin A (IgA) Milligram/liter	Cortisol Nanogram/milliliter	Variables Measurement hours
	12.29 ± 5.5	8:00 A.M
235.43 ± 59.6	10.5 ± 4.5	11:00 A.M
	9.07 ± 4.6	5:00 P.M
235.43 ± 59.6	10.62 ± 1.6	mean

Table 3: The correlation between the questionnaire results and average cortisol and IgA concentration

Variables	Correlation coefficient	Level of significance	Result
Cortisol			
8:00 A.M	0.71	P<0.05	
11:00 P.M	0.62	P<0.05	*
5:00 P.M	0.32	P<0.05	*
Mean	0.61	P<0.05	---
			*
IgA	0.51	P<0.05	*

*significant

Analyzing the results of psychological overtraining symptoms questionnaire

The administration of the psychological overtraining symptoms questionnaire to the participants in this study yielded a Mean of 11.9 (M= 11.9), the highest score being 19 and the lowest 7. In their study on the rugby players, Maso et al. (2002) used this scale and found a Mean of 9.5 (M=9.5) and yet in another unpublished study in 2000, they reported a Mean of 8.9 (M=8.9)- [1].

Discussion

The study was conducted to investigate the relationship between salivary cortisol and IgA concentration, and the results of psychological overtraining symptoms questionnaire in elite soccer players.

Many studies have affirmed that taking heavy exercises without appropriate rest intervals along with sports competition stresses may bring about alterations in the athletes' physiological, immunological, psychological and performance status, as a result of which the athletes may suffer

slumps [1,17,18]. This is caused by alterations in the internal bodily systems and in response to psycho-physiological stresses and pressures the most important of which include the negative adaptation of endocrine and immune systems. Some of the symptoms of this negative adaptation include an increase in cortisol concentration and a decrease in immunoglobulin.

As explained earlier, the overtraining may cause alterations in the athletes' psychological status as well. However, it has not yet been understood whether or not the athletes with psychological overtraining symptoms suffer the physical overtraining too. In recent years, the researchers have paid more attention to the instruments by which they can measure the exercise psychological pressures exerted upon the athletes. Standard questionnaires, developed to fulfill this aim, are one of the most influential instruments in this regard [11,19,20]. Benhadad et al. (1999) suggest that the psychological overtraining symptoms questionnaire can be an appropriate instrument for diagnosing the overtraining symptoms in the athletes who perform heavy exercises. In their study, they focused on some professional soccer players, volleyball players, and Karate players. They witnessed a significant, positive correlation between the questionnaire results, athletes' blood viscosity and plasma, as well as Hematocrit concentration respectively ($r=0.41$, $p<0.02$; $r=0.38$, $p<0.05$; $r=0.51$, $p<0.01$) [5, 24]. Also, they suggested that the athletes with overtraining symptoms had less iron, ferritin, and IGF attached to proteins [2].

The present study demonstrated a significant, positive correlation between the results of psychological overtraining symptoms questionnaire and cortisol concentrations at 8:00 A.M. and 11:00 A.M., and average cortisol concentration ($r=0.61$, $p<0.01$, table 3). The findings also demonstrated a significant, negative correlation between the results of the questionnaire and IgA concentration ($r=0.51$, $p<0.01$, table 3).

The findings of the present study concerning cortisol were consistent with those of many preceding studies [12, 21, 22] though inconsistent with Maso et al. (2002) who studied the rugby players [1]. This inconsistency seems to be due to the particular characteristics of rugby, exercise type, and psycho-physiological peculiarities of individual players. The hyperactivity of hypothalamus-hypophysis-adrenal axis may cause an increase in the secretion of cortisol. Heavy endurance exercise in the long run may stimulate hyperactivity in the hypothalamus-hypophysis-adrenal axis and eventually cause a chronic cortisol overconcentration in body [23]. Also, various

studies have confirmed that there is a significant correlation between cortisol concentration immediately after waking-up and bodily stress conditions [24,25]. According to the findings of the preceding studies and those of the present one, it seems that cortisol concentration may vary due to psycho-physiological pressures, which may eventually result in a chronic increase in cortisol concentration. The degree of correlation between the results of the questionnaire and the daily average of cortisol concentration would signify the relationship between psycho-physiological stresses and cortisol concentration.

Besides, the findings proved a significant, negative correlation between the results of the questionnaire and IgA concentration. Klentrou (2002) contends that heavy exercise may decrease immunoglobulin concentration and exposes the body to health risks particularly in the upper respiratory tract, while medium-intensity physical activities may lead in the IgA concentration increase which consequently decreases infection risks [26]. Gleeson (1999) maintained that heavy swimming exercise in the long run may cause a significant decrease in immunoglobulin concentration in professional swimmers [27].

Many studies, carried out on the relationship between the exercise pressure and the immune system performance, have confirmed that the heavy long-term physical activities and the lack of balance between the exercise pressure and rest intervals- as the athletes may experience in overtraining- would repress the immune system and eventually make the athletes vulnerable to infection. Indeed, recent studies proved a significant correlation between the exercise pressure and vulnerability to infection in endurance sports athletes [28,29]. The findings of the present study seem to be consistent with those of the preceding studies since the researchers found a significant, negative correlation between the questionnaire results and IgA concentration. Accordingly, the athletes with higher levels of psychological overtraining symptoms- as discovered by the interpretation of the questionnaire results- had less salivary IgA concentration.

Conclusion

With regard to the high correlation between the questionnaire results and cortisol concentration at 8:00 A.M., and the daily average of cortisol concentration as well as the significant, negative correlation between the questionnaire results and IgA concentration, the psychological overtraining symptoms questionnaire may be thought of as an

effective instrument to diagnose and prevent the athletes' overtraining disorder.

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