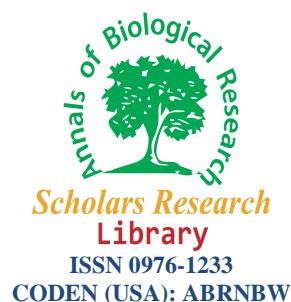




## Scholars Research Library

Annals of Biological Research, 2011, 2 (6):221-225  
(<http://scholarsresearchlibrary.com/archive.html>)



# The relationship between plasma levels of testosterone and cortisol concentrations with psychological overtraining symptoms in elite football referees

Mohsen Assarzadeh<sup>1</sup>, Mohsen Akbarpour Beni<sup>2</sup>, Davood Khorshidi<sup>3</sup>, Kamal Azizbeigi<sup>4</sup>

<sup>1</sup>Department of Physical Education and Sports Sciences, Mobarakeh Branch, Islamic Azad University, Mobarakeh, Iran

<sup>2</sup>Department of Physical Education and Sports Sciences, University of Qom, Qom, Iran

<sup>3</sup>Department of Physical Education and Sports Sciences, Saveh Branch, Islamic Azad University, Saveh, Iran

<sup>4</sup>Department of Physical Education and Sports Science, Faculty of Psychology and Education, Islamic Azad University, Sanandaj Branch, Sanandaj, Iran

---

## ABSTRACT

Overtraining syndrome is a chronic situation that results from long periods of high intensity or high volume work without rest periods. The purpose of this study was to determine the relationship between plasma testosterone and cortisol concentrations with psychological overtraining items (by Consensus group on overtraining of the Society Francoise de Medicine due Sport) in football referees. Thirty football referees ( $X \pm SD$ : 26.1 $\pm$ 3.19 y; 182 $\pm$ 4.21 cm; 72.4 $\pm$ 6.61 kg; 23.97 $\pm$ 1.72kg/m<sup>2</sup>; 51.21 $\pm$ 2.53 Vo<sub>2</sub>max) volunteered for the study during a rest day (24 hours without training). They were asked to complete the overtraining questionnaire contains 54 question requiring answers of "yes" or "no". Then plasma samples were taken at rest and immediately after a game of Isfahan premier league(Asia vision).The results of data analyses showed that the overtraining score from questionnaire correlates with cortisol concentration on rest day respectively ( $r=0.71$ ), and testosterone/cortisol ratio ( $r=-0.42$ ;  $p \leq 0.05$ ). Result show that, the questionnaire may be a useful tool for monitoring and preventing of overtraining syndrome.

**Keywords.** Cortisol, Testosterone, Psychological Questionnaire, Overtraining.

---

## INTRODUCTION

How to run exercise, type of training, scheduling training, and rest intervals between exercises are very important factors in designing training programs. Not to pay attention to this case may cause many problems in designing of training. One of these problems is overtraining [1].There is

many different definitions of overtraining from various sources. But most experts definite overtraining process as a heavy long-term exercise with low time of rest between sessions [1-3].

Overtraining is associated with various physiological, psychological, immunological and functional symptoms [4]. Overtraining, in case of not preventing, can keep away athlete from sport for months. One of the important physiological symptoms that indicates impact exercise and in other hand, one of the other symptoms of overtraining is anabolic or catabolic hormones concentration.

Therefore role of testosterone as an anabolic hormone and cortisol as a catabolic hormone is more important [1, 5, 6]. Results have shown that if the ratio between these two hormones for more than 30 percent reduce and this reduction continued, can cause injury for athletes [7].

Testosterone is an anabolic hormone that stimulates protein synthesis and is responsible for development and maintaining of tissue [8-10]. Cortisol is a catabolic hormone and in fact, is the most important anti-stress hormones in the body. But its increase in long-term causes problems which the most important of them are protein degradation and injuries for immune system [11, 12].

Laboratory methods that currently are used for evaluation of effect of exercise on the body are mostly expensive and need spending much time. This has caused these methods always are not used. In recent years in order to check physical and psychological status of players indirect methods are used that require spending less time. One of these methods is to use standard questionnaires that are designed in order to evaluate mental and physical condition of athletes [13, 14]. The designers are trying, with use of these kinds of questionnaire and answers given by players assess their condition physically and mentally.

Massou *et al* (2004), in a study tried to review the relationship between of results of psychological questionnaire and concentration of salivary **cortisol** and testosterone in professional rugby players in America. The results showed that there was a significant relationship between results of questionnaire and concentration of testosterone ( $p \leq 0 / 1$ ;  $r = -0 / 6$ ) whereas there was not significant relationship between results of questionnaire and concentration of cortisol [15].

On the other hand, Handziski *et al* (2006) according to previous research results and research findings announced that 10 to 30 percent of professional players of football had symptoms of overtraining at the end of the season. Their research results showed that players with some signs of overtraining had high level of cortisol and less muscle mass [16].

Note that direct methods involves spending a lot of time, so researchers try to define the correlation between the results of French association of sport medicine's psychological questionnaire of overtraining and the concentration of testosterone, cortisol and testosterone to cortisol ratio as physiological parameters in relation to physical pressure and overtraining in football referees[11].

## MATERIALS AND METHODS

### Participants

This research was descriptive. Community survey includes 30 referees( $X \pm SD$ :  $26.1 \pm 3.19$  y;

182±4.21 cm; 72.4±6.61 kg; 23.97±1.72kg/m<sup>2</sup>; 51.21±2.53 Vo<sub>2</sub>max) in the Premier League of Isfahan (VISION OF ASIA) 2010. Referees, as purposeful and available statistical sample selected. It should be noted none of the referees are disorders hormone and did not use hormonal drugs. After coordinating with the authorities of Isfahan football association, referees completed related consent letter and measurement was taken. Mean and standard deviation of age, height, weight, index body mass and aerobic power of referees have been shown in table number 1.

**Table 1. physiological and anthropometrical aspects of subjects (N=30)**

Age (year)	Height(cm)	Weight(kg)	BMI( kg/m <sup>2</sup> )	VO <sub>2</sub> max
26.1±3.19	182±4.21	72.4±6.61	23.97±1.72	51.21±2.53

### **Physiological Measurements**

To measure height and weight, a digital scale and a tape were used. Body mass index was calculated by placing the numbers related to height and weight in the equation (squared height in meter/ weight in kilogram)

### **Calculated Maximum oxygen consumption**

To estimate maximum aerobic power of athletes was conducted Bruce protocol.

### **Psychological questionnaire of overtraining**

In the same day that samples were taken, the questionnaires of overtraining were given to the subjects. This questionnaire is a standard made by French association of sport medicine and has been used in several researches [1, 17]. This questionnaire includes 54 question in form of “YES/NO” and number of ‘yes’ was considered. After the brief speech about research objectives, referees were asked to fill the questionnaire accurately and honestly. All the matches were important matches from premier league of Isfahan league (VISION OF ASIA).

### **Blood Sampling**

First samples (venous blood samples) were taken from their forearm in a seated position one day before matches (rest condition) in their hotel and away from the stressful conditions of training and competition were taken. Second sampling was taken immediately after match. Immediately after each phase sampling, tubes transferred to specialized medical and pathology laboratory. Samples in the laboratory were frozen at -20 degrees Celsius.

### **Biochemical Measurements**

To determine the amount of cortisol, kit of Boster immunoleader, made in China and to determine the amount of testosterone, kit of Boster immunoleader, made in China was used. Methods used to identify Was ELISA.

### **Statistical methods**

Finally the data according to objectives of research were collected and the data of descriptive statistics and coefficient Spearman correlation were analysed with software of SPSS version 17.

## **RESULTS**

The results of data analyses showed that the overtraining score from questionnaire correlates with cortisol concentration on rest day respectively ( $r=0.71$ ), and testosterone/cortisol ratio ( $r=0.42$ ;  $p<0.05$ ).table number 2 shows the correlation between testosterone, cortisol and testosterone/cortisol ratio in rest day and immediately after football match with results of questionnaire.

Table 2. The relationship between results of questionnaire and testosterone, cortisol and testosterone/ cortisol ratio

Hormone		Coefficient of correlation	Level of signification	Result
TESTOSTERONE	REST	0.42	P<0.015	†
	MATCH DAY	0.35	P<0.052	
CORTISOL	REST	0.71	P<0.001	†
	MATCH DAY	0.62	P<0.001	†
T/C <sup>1</sup>	REST	-0.42	P<0.002	†
	MATCH DAY	-0.30	P<0.098	

*1- Testosterone/Cortisol Ratio*

*† Denote significant correlation (p<0/05)*

### Evaluation of results of overtraining questionnaire

Average of score resulted from overtraining questionnaire was 19.8, maximum score 24 and minimum 12. In massou's research average of scores was 9.5.

## DISCUSSION

The purpose of this study was to define the relationship between testosterone, cortisol and their ratio with resets of overtraining questionnaire in football referees. Various studies have shown that heavy exercise without adequate rest intervals and stress caused by sports in long term cause changes in physiological status, immunological, psychological, and functional of referees that eventually referees will drop function [1, 16, 18]. In these conditions, concentration of hormones change and body go into catabolic condition.

Gabriel and colleagues (1995) in their study associated with hormone changes during more exercise, observed significant increase and decrease respectively in concentration of cortisol and testosterone [4]. As we said, the phenomenon of over training causes changes in mental status of athletes.

In recent years, the use of tools that could be clarified symptoms of overtraining has been developed. The questionnaire used in this research is one of them [19-21]. Ben Haddad et al (1999), after using of this questionnaire declared that it is a suitable tool for athletes susceptible to have overtraining symptoms. They did their research on many football, volleyball and karate players and showed a positive and significant relationship ( $P \leq 0 / 05$ ;  $r = 0 / 38$ ). Meanwhile, the results of their research showed that athletes with symptoms of overtraining have less iron, ferritin and IGF1BP. Results of cortisol of this study were most consistent with findings in previous research ( $p \leq 0 / 05$ ) [7, 22, 23]. However these results were in contraire with results of Massou et al (2002) in rugby players [15]. It seems these sports were different mentally or physically (rugby or football)[9, 11, 15]. Increase of cortisol may be due to over activity of hypothalamus - pituitary - adrenal axis. Heavy exercise can increase over activity of hypothalamus - Pituitary - adrenal axis and ultimately increase chronic cortisol concentrations in the body [19]. Also, various studies have shown there is significant relationship between the concentration of cortisol immediately after rising from sleep and stress conditions in body [13, 24]. According to previous research and the results obtained in this study, it seems physical and mental stress change concentration of cortisol and finally may increase concentration of cortisol chronologically. On the other hand, the results of this study showed that there was meaningful and positive relationship between results of the questionnaire and concentration of testosterone only at rest. Loc et al (1995) stated testosterone concentrations in response to exercise can increase or decrease [5]. Ratio of testosterone /cortisol is one of the most valid indicators of overtraining. In fact, this ratio is representing of catabolic or anabolic

condition in body. This ratio reduces when overtraining occurs. In fact, the results of this study were aligned with results of previous studies has been done in this area [1, 5, 7, 16, 25]. There was significant relationship between ratio of testosterone/ cortisol at rest and results of questionnaire. Result show that, the questionnaire may be a useful tool for monitoring and preventing of overtraining syndrome.

### CONCLUSION

Finally, given the high correlation for results of overtraining questionnaire and cortisol concentration at rest, we can conclude that questionnaire of overtraining is an appropriate a suitable tool for predicting of overtraining syndrome. On the other hand, according to these results, it can be concluded that for determining the amount of exercise pressure in athletes and referees evaluation of testosterone/cortisol ratio is valid and useful.

### REFERENCES

- [1] Marita, P., Dirk, H., Jens, C., Sonia, J. , *Psychosomatic Medicine*, **2003**. 65: p. 92-99.
- [2] Adlercreutz, H., et al., *Int J Sports Med*, **1986**. 7 Suppl 1: p. 27-8.
- [3] Benhadad, A., Bouix, D., Khaled, S., *Clin Hemorheol Microcirc*, **1999**. 20: p. 117-125.
- [4] Urhausen, A., H. Gabriel, and W. Kindermann, *Sports Med*, **1995**. 20(4): p. 251-76.
- [5] Lac, G., Passelergue, P., Robert, A. , *Science et Sports.*, **1995**. 10: p. 157-158.
- [6] Zehsaz, f.A., m.a. Farhangimaleki,n. & Tiidus,p, *European Journal of Sport Science* **2011**. 11(3): p. 183-190.
- [7] Jean, A., Milagros, C., Yunsheng, M., George, W., *Neuroendocrinol lett.*, **2005**. 26(4): p. 355-360.
- [8] Alves, R., Costa, L., Samulski, D. (2005). , *Med sport*, **2005**. 12(5).
- [9] Kraemer, W.J., *J Strengh Cond Res*, **1997**. 11: p. 131-142.
- [10] Schelling, x.C., j . Terrados,n, *Hormonal analysis in elite basketball during a season*. Revista de Psicologaa del Deporte, **2009**. 18: p. 363-367.
- [11] Amiri, e., Pirani,h, Esfahani,m, *Iranian Journal of Health and Physical Activity* (2011) 2 (1), 20-24 **2011**. 2(1): p. 20-24.
- [12] Checkley, S., *Br Med Bull*, **1996**. 52(3): p. 597-617.
- [13] Kraemer, W.J., et al., *Eur J Appl Physiol*, **2001**. 84(1-2): p. 13-8.
- [14] Fry, R.W., A.R. Morton, and D. Keast, *Sports Med*, **1991**. 12(1): p. 32-65.
- [15] Maso, F., Lac, G., Filaire, E., Michaux, O., Robert, A., *Br. J. Sport Med*, **2004**. 38: p. 260-263.
- [16] Handziski, Z., et al., *Bratisl Lek Listy*, **2006**. 107(6-7): p. 259-63.
- [17] Buono, M.J., J.E. Yeager, and J.A. Hodgdon, *J Appl Physiol*, **1986**. 61(4): p. 1337-9.
- [18] Monnier, J.F., et al., *Clin Hemorheol Microcirc*, **2000**. 22(4): p. 277-86.
- [19] Costa, L., Samulski, D.M.. *Rev Bras Ciencia e Movimento*, **2005**. 13(2): p. 123-134.
- [20] Kellmann, M., Kallus, K.W., *Recovery stress questionnaire for athletes: user manual*. **2001**, Champaign (IL): Human Kinetics.
- [21] Yehuda, R., et al., *Biol Psychiatry*, **1996**. 40(2): p. 79-88.
- [22] Hartmann, U. and J. Mester, *Med Sci Sports Exerc*, **2000**. 32(1): p. 209-15.
- [23] Maes, M., et al., *J Affect Disord*, **1986**. 10(3): p. 207-14.
- [24] McKenzie, D.C., *Can J Appl Physiol*, **1999**. 24(1): p. 66-73.
- [25] Budgett, R., *Br J Sports Med*, **1998**. 32(2): p. 107-10.