



Pelagia Research Library

European Journal of Experimental Biology, 2013, 3(2):13-17



Effect of national preparation training on salivary testosterone, cortisol, and some psychological factors on Iranian female rowers

Maedeh Mansoubi¹, Shahla Hojjat^{1*} and Masoumeh Shojaei²

¹Department of Physical Education, Islamic Azad University, Karaj Branch, Iran

²Department of Physical Education and Sport Sciences, Alzahra University, Iran

ABSTRACT

The purpose of this research is to study the effect of performing intensive exercise on the salivary testosterone and cortisol and determining the accuracy of its mental performance. Seventeen rows participants selected among National Iranian Females Boat Race Team called: " Iranian Rowing". Their average age is between 19.66 and standard deviation 2.95 years old. Those whom were going to attend in a world championship race camping game team. Primarily attendance asked to answer 2 questionnaires during six month preparation camp. At the beginning and at the end of camping athletes' woman are asked to answer OMSAT 3 (professional mental skills question) and over training questionnaire. Then collect a sample of their saliva at 2PM and 7PM to evaluate Testosterone and cortisol quality. Statistical analysis has even more variables to compare the effect of a period of intensive training variables measured were used. Data were analyzed using $p=0.05$ was considered significant. The result of our experiments specifies between saliva density ($p=0.01$, $t_{(16)}=4.513$) saliva testosterone ($t_{(16)}=4.845$, $p=0.001$) and over training before and after the exercise ($p=0.05$, $t_{(16)}=-3.882$). But no significance psychological skill differences have seen during these exercises courses. Concerning these observation and achievement we came to conclusion that during national rowing team preparation exercise would effected on athletic woman testosterone and saliva cortisol hormones and over training.

Key words: testosterone, cortisol, OMSAT, overtraining

INTRODUCTION

Almost any types of stress, whether physical or nervous, causing immediate and significant increase in Adrenocorticotrophic Hormone (ACTH) by the anterior pituitary gland followed by a large increase in cortisol and adrenal cortex secretion up to 20 times within a few minutes. Cortisol often doesn't release active and major proteins such as muscle contraction and neuron cells proteins, unless nearly all other proteins are released. This preferential effect of cortisol on the release of unstable proteins may provide the amino acids to make the crucial, necessary materials for the required cells [1]. Pain stimuli caused by physical stress and the pathology, primarily are sent through the brain stem to the top and then go to the hypothalamus colliculus and within a few minutes the whole control procedures lead to secretion of large amounts of cortisol into the blood. Mental stress can either cause secretion of Adrenocorticotrophic Hormone with the same rate [2]. Testosterone is also one of the most important steroid hormones that have been observed with some behavioral characteristics such as aggression, depression and

sexual characteristics with significant relationships. In general, participating in sport activities can cause obtaining a large amount of sensory inputs. This data stimulate the two major axis of a hormone called the hypothalamus-parasellar and the hypothalamus-Pituitary- adrenal gland. Following this hormonal changes brain neurotransmitters are also affected and behavioral changes are likely to occur through it [3].

Studies have shown that intense physical activities lead to reducing anxiety and depression and increasing self-confidence and self-esteem. We can say that exercising increases our sense of psychological well-being and thus will have a positive impact on our mental health. On the other hand, competitive sports, for example when a person loses the game or doesn't play as he expected may also cause anxiety, depression and aggressiveness. Besides, improving athletic performance is relevant to psychological factors including anxiety, concentration, confidence, motivation, mental preparation and the like issues. A key point in improving athletic performance is that the mind affects the body. So our feeling will have a profound effect on our physical performance. In competitive sports, the competitors are often of similar skill level and the only difference is in their mental preparation [4].

Adler Crutz et al. (1986) revealed the consistency ratio of testosterone and cortisol levels depending on the amount of training and physical stress [5]. Moya- Albiol et al. (2001) and Salvador et al. investigated the amount and severity of training on testosterone and cortisol amount in both racing and non-racing conditions in basketball players and reported the increased cortisol levels after training [6,7]. Helen. S. Bateup et al. (2002) measured the salivary cortisol and testosterone level and its relationship with psychological factors in elite female rugby players before and after the game and observed significant differences in salivary cortisol and testosterone levels before and after the game [8]. Arena et al. (2002) measured the increased training time and hormonal and behavioral changes and revealed that the increased training time in sport women causes severe hormonal changes and the increased stress and anxiety and extreme rising of body temperature [9]. Maso et al. (2004) measured the salivary testosterone and cortisol levels by factoring the overtraining issue in rugby players and reported a significant difference [10]. In the year 2006 Justin carre et al. compared these two hormone level amounts with elite hockey players' physical activity and reported rising level amounts of this hormone with longer physical activity [11]. Giovanni dos santos (2006) compared overtraining with changes in hormone levels and concluded that overtraining can increase hormone levels and reduce the performance [12]. Considering that the elite boatmen are under great pressures and since there are inconsistencies in the researchers' findings, so this question has always been available that what impact does a period of intensive training leave on salivary testosterone and cortisol and psychological factors in elite boatwomen?

MATERIALS AND METHODS

The present study deals with examining the effects of an intensive training course on salivary testosterone and cortisol and some of the psychological factors. But due to lack of complete laboratory conditions to control all the factors and due to constraints such as the participant's lack of sleep control, the study method is semi-empirical. The study population consisted of all present boatwomen in national Iranian rowing team. The sample population consisted of 17 boatwomen of national Iranian Rowing team with mean age of $19/66 \pm 2/59$ that were being in Iran national team camp to prepare.

The independent variable in this study is an intensive training course and the dependant variables are salivary testosterone, salivary cortisol, overtraining, target switching, confidence, commitment, response to stress, relaxation, target switching, confidence, commitment, response to stress, relaxation, fear control, refreshing ,concentration, re-concentration, visualization, mental practice and the game plans.

The equipment and instruments used in the study are as follows:

1-5 cc disposable syringe.

2-Microtube 5/1mL.

3-ELISA kit for the salivary cortisol measurement.

4-ELISA kit for the salivary testosterone measurement.

5-A standardized questionnaire of psychological factors measures early symptoms of overtraining which includes 54 questions that are answered with yes or no and clinical signs of overtraining. It was prepared by the medical community in France in 1993 and its validity has been registered.

6-The OMSAT 3 questionnaire that its validity and reliability was confirmed at the University of Ottawa, Canada by dr. John Salmla and dr. Natalie Durand Bush, which includes 48 questions with 7 options associated with 12

psychological factors (target switching, confidence, commitment, response to stress, relaxation, fear control, refreshing, concentration, re-concentration, visualization, mental practice and the game plans).

The data collection method in this study is as follows, 17 players of Iranian women boating team who spend time in training camps to dispatch to world Czech championships, participated in this study. Their mean age was $59/2 \pm 66/19$ years. Before the fulfillment, the data or the information that was relevant to the purpose and the study method was given to them and they announced that they are willing to work for this study. The data collection was carried out in two time periods. The first time period or the pre-test was conducted to measure the basic level of the athletes in the first weeks of the camp and the second time period or the post test was conducted in the last week of trainings just before dispatching to the tournament took place. All samplings were done equally and in place by the examiner. The boating (rowing) training program was so that all the participants had equal place, nutrition and training conditions. All these people show up three times a day in the morning (9-7) and noon (14-12) and afternoon (7-5) for two hours each time in the trainings. During this training time they were paddling an average of 30 kilometers. Only one session per week the morning training was replaced with running along the beach and the afternoon trainings 6 times a week were replaced with bodybuilding trainings that three sessions of it were strength training combined with weight training and the other three sessions were the speed training. At first, all this training was done by the national team head coach and the players didn't have a fitness instructor and after the coach dismissal, these trainings were followed the same way by the team coach. These players followed their training so on holidays and were continued continuously for 6 months until the tournament.

The salivary cortisol and testosterone measurement in two basic and final stages of national women rowing training camps was done in coordination with rowing Federation. To avoid the circadian rhythm effect and due to high amounts of cortisol normally in the morning, the player's saliva samples were taken not stimulated in two stages, at 2:00 PM and at 7:00 PM. For this purpose, in each of the stages after a mouth rinse with water, the volunteers keep the saliva in their mouth for 1 to 2 minutes and then poured it into a Petri dish, Saliva was then transferred by syringe to a disposable microtube and immediately after the sampling, the microtubes were frozen at a temperature of -20°C afterwards the ultimate sampling were centrifuged at 10,000 rpm for 10 minutes Until all bits of food and solids are separated from the the samples. A high speed centrifuge is used due to concentration of the saliva samples. And finally this clear solution was tested and the cortisol and testosterone hormone levels of each sample were determined by the lab.

In both stages that saliva samples were taken, the players answered the overtraining and the OMSAT standardized questionnaire, to achieve this goal, the objectives of the study were explained to the players and also the participants were ensured of the confidentiality of the results of the questionnaire and they were asked to answer to the questions with sincerity, and they answered separately to both overtraining and OMSAT questionnaire.

RESULTS

Descriptive statistics (mean, SD) was used for data analysis in this study, a Kolmogorov-Smirnov test was used for the test of natural data distribution and a dependant t-test was used for the analysis of psychological factors. Table 1 indicates descriptive statistics of all variables.

Table 1. Descriptive statistics of all variables measured in the sample group

Statistic group variable	mean		Standard Deviation	
	Pre-test	Post-test	Pre-test	Post-test
Cortisol concentration	3.652	12.815	8.938	19.519
Testosterone concentration	9.921	3.597	12.638	4.322
Psychological over-training	5.689	4.313	9.388	16.117
Basic skills	7.201	6.764	75.882	74.000
Psychosomatic skills	9.849	12.910	81.588	84.277
Cognitive skills	16.687	16.284	110.117	109.388

Table 2 shows that results of paired t test to compare pretest and posttest of salivary Cortisol and testosterone. As a result there are significant differences between pre-test and post test of salivary Cortisol and testosterone.

Table 2. Comparing the average pre-test and post test of dependent variables

Statistic test	Mean difference	SD	t	df	p
salivary cortisol	-11.441	10.452	4.513	16	P<0.001
salivary testosterone	8.150	6.935	4.845	16	P<0.001

According to table 3 there is a significant difference between pre-test and post test mental overtraining, but no significant differences between subscales of mental skills.

Table 3. Comparing the average pre-test and post test mental overtraining and mental skills

Statistic variables	Mean difference	SD	t	df	p
mental overtraining	-6.823	7.247	-3.882	16	0.001
Goal setting	-0.058	2.461	-0.099	16	0.923
self-confidence	0.294	1.686	0.719	16	0.483
commitment	1.705	3.157	2.227	16	0.061
response to stress	0.058	4.022	0.060	16	0.953
relaxation	-0.823	3.283	-1.034	16	0.316
fear control	1.764	4.643	1.567	16	0.137
refreshing (tonic)	-0.647	3.757	-0.710	16	0.488
concentration	-0.0352	4.122	-0.353	16	0.729
reconcentration	-0.117	2.571	-0.189	16	0.853
imagery	1.411	3.373	1.725	16	0.104
Mental practice	-0.0882	-3.259	-1.104	16	0.286
game plan	-0.294	3.980	0.305	16	0.765

DISCUSSION AND CONCLUSION

Results from this study showed that an intense training course leads to increased cortisol and a corresponding testosterone decrease, as well as decreased ratio of salivary testosterone to cortisol. Faylr et al. (2011) studies that had examined the relationship between salivary testosterone and cortisol concentrations and the team performance by psychological indices during the tournament season of professional football teams, revealed that the results of a questionnaire that measures psychological indexes is associated with hormone concentrations, so that with increased depression and stress, the salivary cortisol levels was increased. And Marietta et al (2003) concluded that there was a positive and meaningful correlation between the cortisol levels and depression symptoms and interpersonal stress [13,14]. Mac Gygan et al. 2004 studies the salivary cortisol changes with regard to training intensity and showed that during high intense training, this hormone level was significantly increased but lower-intensity training had no effect on this hormone level [15]. According to the mentioned studies in which Psychological indicators were measured to be part of early mental signs of over-training, it can state that the results of these two studies are consistent with this study results. Connor et al. 1989 who studied the professional women swimmers' salivary cortisol levels and their moods during two periods of time, showed that in over-training course, the high cortisol levels was significantly associated with the mood that was assessed by the questionnaire.

Hendzisky et al. 2006 had shown in their studies that in late tournament season in which players are under physical and psychological pressures, the cortisol concentration level is increased. Over-training can indicate changes in cortisol as physiological indicators of over-training well [16]. The results were not consistent with Yohannes et al 1995; they didn't see any significant difference in athletes who were affected by over-training phenomenon [17]. Moreover they didn't comply with Masouv et al. (2004) findings. They didn't observe any relation between over-training and salivary cortisol concentrations either. However, the training type and the pressure caused by it affect the cortisol secreting.

These results were consistent with Fayler et al. 2001 study that studies the Correlation between salivary testosterone and cortisol concentration level and the team performance with psychological indicators during professional football tournament season [13]. They stated that there was a significant relationship between testosterone concentration and psychological indicators during the tournament season of professional football team. The results comply with the results of Masouv et al 2004 study on testosterone in rugby players. They revealed a significant relationship between over-training psychological indicators with testosterone concentration at 8 and its mean throughout the day. King et al. 2005 have also achieved similar results to those obtained results. They concluded that testosterone level has a

positive significant relationship with stress in normal men and women. They stated that the assessment of testosterone levels can be used to check the mental conditions and stress [2]. This similarity could be due to similar physical training types. Frye et al. study 1998 on "adrenal – pituitary responses to high intense over-training" didn't comply. The common testosterone and free testosterone levels of over-training group didn't change [18] and didn't comply with Gonzalez et al. studying on the relationship between hormonal responses and winning and losing terms and its relationship with psychological indicators of professional basketball players. They also concluded that there was no significant relationship between testosterone levels and psychological state of athletes after the tournament and the testosterone concentration level couldn't be a respond to winning or losing terms [19]. This dissimulation can be related to the athletes' genders and to the training type. In 2003 Elumi et al. showed in a study on salivary cortisol and testosterone level and cortisol ratio during the tournament and during the recovery after the tournament, that during the tournament the cortisol level rapidly increased and testosterone level slowly decreased and during the recovery the cortisol level was much lower and the testosterone level was much higher than the competition time and the ratio of testosterone to cortisol stayed high for 5 days [14]. the study findings at the tournament are consistent with the present study results, that can be due to players' mental condition that they are in similar mental status to race conditions during the preparation time for world tournaments but it is not consistent with the recovery period in which the mental and physical condition of players is quite different from the present study. This studies the national team training effects on 12 psychological factors (goal switching, confidence, commitment, response to stress, relaxation, fear control, tonic(refreshing), focus, refocus, mental visualization and mental practice) that none of the psychological factors didn't show any significant difference based on the results of the questionnaire. Calmels et al. studies 1998 are not consistent with the present study. They revealed that mental practice increases the elite gymnasts and all this training affects all the psychological factors except the commitment [20]. This may be due to lack of players' mental training different training conditions and lack of sports psychologist in Iranian national women rowing team.

REFERENCES

- [1] Bono EG, et al. *Hormones and behavior* **1999**; 35: 55-62.
- [2] Hall CR. *Journal of Sport Sciences* **2009**; 1: 1-11.
- [3] Bono EG, Albiol LM. *Journal of Psychophysiology* **2002**; 16: 158-166.
- [4] Brown Lee K K, et al. *Journal of Sport Science and Medicine* **2004**, 3; 8-15.
- [5] Tietz N, Ed. **1990** . Clinical to laboratory tests. 2 end Ed. Philadelphia, W.B. Saunders. Co.
- [6] Salvador A, et al. *Psychoneuroendocrinology* **2003**; 28: 364-375.
- [7] Albiol LM, et al. *International Journal of Psychology* **2001**; 40: 47-59.
- [8] Bate up SH, et al. *Evolution and Human Behavior* **2002**; 23: 181-192.
- [9] Arena B, Maffulli N. *Sports Medicine and Arthroscopy* **2002**; 10: 10-14.
- [10] Maso F, et al. *Br. J Sport Med* **2004**; 38: 260-263.
- [11] carre JM, et al. *Psychology and Behavior* **2006**; 89: 392-398.
- [12] Carre JM, *Hormones and Behavior* **2008**; 54: 403-409.
- [13] Maravelias C, et al. *Toxicology Letters* **2005**; 158: 167-175.
- [14] Elloumi M, et al. *Eur J Appl Physiol* **2003**; 90: 23-28.
- [15] McGuigan MR, et al. *Journal of Sport Science and Medicine* **2004**; 3: 8-15.
- [16] N Matos, Winsley R J. *Journal of Sport Science and Medicine* **2007**; 6: 353-367.
- [17] Durand-Bush N, Salmela JH & Green-Demers I. *The Sport Psychologist* **2001**; 15: 1-19.
- [18] Vaughan JL, et al. *Journal of Athletic Training* **2004**; 39: 71-76.
- [19] Urhausen A, Kindermann W. *Sport Med* **2002**; 32: 95-102.
- [20] Calmels C, Fournier J, Durand-Bush N, Salamela J H. *Gym Technic* **1998**; 25: 6-12.