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Investigation of the salivary cortisol and testosterone during Futsal game

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Abstract

Background: Several studies show that doing high intensity activity lead to changes in anabolic and catabolic salivary hormone levels. The aim of this study was determined the levels of salivary cortisol and testosterone during futsal game on futsal players. Materials and Methods: Twenty two male futsal players from Iranian national league teams with age 24.09±2.28 yr, height 174.0±5.92 cm, weight 68.72±5.62 kg, BMI 22.71±1.66 kg/m^2 volunteered to take part in this study. Samples were collected before and after the first half, before and after the second half. General linear repeated measures (GL-RM) and Post-hoc Bonferroni test was used to comparing variations of within and between means phases. The level of significance was set at P≤0.05. Results: One session futsal game had a significant effect on salivary cortisol concentration (P<0.001). Hence, these changed have increased rather than to the baseline levels; the peak of this change was observed before the second half. Salivary testosterone levels during this period increased significantly (P<0.001). Conclusion: Futsal games leads to the salivary cortisol and testosterone levels increased significantly in futsal' male. In addition, a futsal game maybe leads to imbalance of anabolic to catabolic ratio in athletes.

Keywords: Salivary cortisol, salivary testosterone, Futsal game

Introduction

Two decades studies show that the high-intensity exercises cause changes in levels of anabolic and catabolic hormones (Kaye et al., 2005). Hence, cortisol (C) and testosterone (T) have been recommended as good markers of training stress. Indeed, the balance between anabolic hormones (T) and catabolic (C) may have important concepts for performance and recovery processes. The changes in testosterone and cortisol hormones are associated with physiology activity parameters such as intensity and length of training and the area of training condition (Chatard, et al., 2002; Filaire et al.,1998). Secrete hormones can change in response to the training, which increases in several hormones [e.g., cortisol, testosterone, epinephrine (adrenaline), testosterone] that are known to have immune-modulatory effects (Gleeson, 2007).

Previous research has established that acute exercise increases salivary cortisol levels (O'Connor et al., 1987; Rudolph et al., 1998). Therefore, Investigate levels of salivary cortisol levels are nowadays a common method to found out the effect of exercise on human physiology. Cortisol is a catabolic hormone that rescued from the adrenal cortex in reacts to the stress of training. Cortisol increases protein degradation and decreases protein synthesis in muscle cells and it can stimulates lipolysis in fat cells (Kraemer et al., 2005).

Salivary measures of cortisol have been shown to be a valid and reliable reflection of serum cortisol, (Obminski et al.,1997). Salivary cortisol of the stress response as it more accurately measures the amount of unbound cortisol compared to serum measures (Vining et al., 1983). There is also evidence to show that subjects show increased cortisol responses compared to less trained individuals (Luger, et al., 1987; Marthur et al.,1986). The salivary levels of cortisol and testosterone increase after acute exercise in humans (Kent et al.,1997; McGuigan et al., 2005). A study carried out in athletes by Joseph and colleagues (1996) in a study that he examined the effects of moderate physical activity in seven sedentary but otherwise healthy men aged 66 to 76 years, he concluded Serum testosterone increased 39%, sex hormone-binding globulin19%, total serum protein 13%, and the free testosterone index 23% during exercise. A recent study by Yazdanparast et al. (2009) showed that the there is no significant correlation between concentrations with salivary cortisol after exercise with high and low intensity, while they found a negative significant correlation between salivary cortisol concentrations after exercise with medium intensity. A second study by Kaye et al. (2005) yielded similar results thus expressing promise to its application of the rating of single set perceived exertion.

Testosterone is one of the key anabolic hormone in men and it can secreted by the Leydig cells of the testes (Brownlee et al., 2005). Like cortisol, acute exercise increases testosterone linearly once a specific intensity (Wilkerson et al.,1980). Moreira et al, (2009) concluded that the influence of intensive competitive training match alone appears to be minimal on salivary cortisol increases in top-level soccer adapted to this type of stress. Azarbayjani et al, (2011) noted that, no significant changes were observed for cortisol. However, testosterone increased at all sessions except for exercise on the cycle ergo meter at an intensity of 70% maximum heart rate.

Unfortunately, studies that determined the alterations in levels of salivary cortisol and testosterone due to acute exercise are also lacking. In the case of Futsal players, few data are available on testosterone and cortisol or testosterone: cortisol responses to performance and competition. Therefore, the aim of this study was to investigate the evaluation of the testosterone and cortisol release among Futsal players.

Materials and Methods

This study was semi-experimental with time series. Samples were collected in four phases which were as follows: Before the first half, immediately after the first half, before the second half and immediately after the second half on experimental group. Twenty two futsal players from Iranian national league teams volunteered to participate in this study. The physical characteristics participants show as mean ± standard deviation in table 1. According to self-testifying questionnaire; they had not have diseases such as the common cold, influenza, sore throat, coronary sweating, diabetes, kidney and thyroid malfunction. After the approval of its standards; they filled up the participation and co-operation agreement form, which allowed them to be the subjects of the study. Furthermore, before starting the game, a full verbal and written description of all procedures and requirements of the study was given to all subjects.

Table 1. Physical characteristics of the participants (n=22)

Variables	Mean (standard deviation)
Age (yr)	24.09 ± 2.28
Height (cm)	174.0 ± 5.92
Weight (kg)	68.72 ± 5.62
Body mass index (kg/m2)	22.71±1.66
Futsal play history (yr)	4.84± 0.80

Anthropometric measurements

The body weight and height were measured by the same person using an electronic balance with stadiometer (SECA-Germany). The body mass index (BMI) (calculated as weight (kg)/height^2 (m^2)) was also estimated.

Competitive games protocol

As a warm up, 10 min general warm up (walking, stretching and movement exercise); 10 min special warm up (Start short and fast movements with the ball and 10 speed starts 10 to 15 m). Then, the players participated into the one of the Futsal Supper League games; (Two half 20 minute and 15 minutes rest time between two half).

Saliva sampling

Before saliva collection, subjects were required to rinse out their mouths for one minute with water to remove any substances such as chlorine that may affect on salivary cortisol levels. Unstimulated saliva samples were collected by plastic containers (20 ml) in four phases; before the first half (warm up), immediately after at the end of first half, before the start of the second half (15 min after rest time), immediately after at the end of second half (end of the game). Immediately after sampling, samples were frozen and stored at -20°C. Then, by Gamma Counter method (Immunoradiometric Assay- Binding Site kit from U.K) was measured salivary cortisol and testosterone concentration.

Statistical analysis

Descriptive statistics including means and standard deviations for the outcome variables of interest were computed. After checking the data distribution normalcy using explore Kolmogorov-Smirnov test and homogeneity of variance method; they were analyzed using ANOVA with general linear repeated measures (GL-RM). Post-hoc Bonferroni test was used for comparing different phases. The level of significance was set at $P \leq 0.05$. All statistical analyses were performed by SPSS (SPSS Inc., Chicago, IL) version 11.5.

Results

According to the (Table 2), our results show the variation of salivary cortisol levels in during phases of the game were significantly ($F=12.88$; $P<0.001$). Salivary testosterone levels during phases of the game were increased significantly ($F=21.42$; $P<0.001$).

Table 2: Competition of Salivary cortisol and testosterone levels during phases of the game in male Futsal (n=22)

Variables	Phases (1,2,3;4)*				GLM -RM	
	BFH (1) (M±SD)	AFH (2) (M±SD)	BSH (3) (M±SD)	AFH (4) (M±SD)	F	Sig.
Cortisol-S (ng/ml)	3.02±1.31	3.71±1.84	4.27±1.97	3.40±1.69	12.88	<0.001†
Testosterone-S (ng/ml)	97.45±36.0	113.4±49.6	116.2±45.2	143.7±57.6	21.42	<0.001†

* 1: Before-first half (BFH), 2: After first half (AFH), 3: Before-second half (BSH); 4: After second half (ASH)

†A significant level P<0.001 *Data presented as mean ± standard deviation (M±SD)

According to the (Table 3), this study shows that the Pair wise Comparisons of Salivary cortisol levels in before with after first half were significant (P≤0.050), before-first half with before-second half were significant (P≤0.001) and before with after second half were significant (P≤0.001). Also, Salivary testosterone level was significant at all phases of the game [before with after-first half (P=0.030), before-first half with before-second half (P=0.014), before-first half with after-second half (P<0.001), after-first half with after-second half (P<0.001) and before-second half with after-second half (P<0.001)], with the exception of the after-first half with before-second half (P>0.05).

Table 3: Pair wise Comparisons of Salivary cortisol and testosterone levels during phases of the competition

Variables	Post hoc Test (Bonferroni)				
	Phases (1,2,3;4)*		Mean Difference	Std-Error	Sig.
Cortisol-S (ng/ml)	BFH (1)	AFH (2)	-0.695	0.239	0.050†
	BFH (1)	BSH (3)	-1.250	0.223	<0.001†
	BFH (1)	ASH (4)	-0.377	0.184	0.317
	AFH (2)	BSH (3)	-0.555	0.250	0.227
	AFH (2)	ASH (4)	0.318	0.206	0.825
	BSH (3)	ASH (4)	0.873	0.123	<0.001†
Testosterone-S (ng/ml)	BFH (1)	AFH (2)	-16.000	5.103	0.030†
	BFH (1)	BSH (3)	-18.841	5.456	0.014†
	BFH (1)	ASH (4)	-46.295	7.292	<0.001†
	AFH (2)	BSH (3)	-2.841	5.965	1.000
	AFH (2)	ASH (4)	-30.295	5.631	<0.001†
	BSH (3)	ASH (4)	-27.455	5.535	<0.001†

* 1: Before-first half (BFH), 2: After first half (AFH), 3: Before-second half (BSH); 4: After second half (ASH)

†A significant level P≤0.05

Discussion

The purpose of this study was determined the levels of salivary cortisol and testosterone during futsal game on futsal players. In the present study, salivary cortisol levels towards the end of period of the game were increased significantly. The results of the present study show that serious exercise increased the levels of salivary cortisol; this founding supported the previous observations that exercise changes the levels of salivary cortisol (O'Connor et al., 1987; Rudolph et al., 1998; Zamzy et al., 2010). Rudolph et al (1998) showed that salivary cortisol increased from baseline to the 29th minute of exercise and then decreasing to 30 min post-exercise. O'Connor et al., (1987) have reported that salivary cortisol levels immediately before and 5 min following the assessment of VO2max, and there was a significant; increase in post-VO2max test compared to pre-test. The findings of the our study are inconsistent with studies demonstrating that cortisol not changed to response exercise (Attarzadeh Hosseini et al., 2011; Pantelidis et al., 1997). Attarzadeh Hosseini et al (2011) showed that the levels of the serum cortisol during preparatory period had a significant decrease; while, testosterone to cortisol ratio increased significantly during this period. Pantelidis et al., (1997) suggested that short-term sports activities do not have a significant effect on saliva cortisol concentration. The reason why the current findings and Attarzadeh Hosseini's findings disagree is that the distinction between intensity, period and sort of exercise, exercise environmental conditions, diet of the individuals and changes in cortisol concentration, since these factors have an effect on testosterone concentration. There are different mechanisms that describe the reason of saliva cortisol concentration increase after exercise. One of these mechanisms is hormone secretion increase through stimulation of the Hypothalamus. The hypo-adrenal axis leads to Adrenocorticotropic hormone (ACTH) secretion increase from the pituitary gland, and as we know, increase of ACTH secretion is the most important factor for stimulating cortisol secretion (Guyton et al., 1996). Another mechanism that affects cortisol hormone secretion from the layers of the adrenal cortex is mental stress. The results of the present study show that serious exercise increased the levels of salivary testosterone; this founding supported the previous observations that exercise changes the levels of salivary testosterone (Kvorning et al., 2006). In a previous study Kvorning et al. (2006) noted an Intense exercise lead to the increase in salivary cortisol and testosterone concentration however only when maximal isometric unilateral knee extensions was performed.

The findings of the present study are inconsistent with studies demonstrating that testosterone not changed to response exercise (Erskine et al., 2007). Erskine et al., (2007) noted that no significant changes were identified in salivary testosterone and cortisol concentration. Both Cardinale et al., (2006) and Di Loreto et al. (2004) did not find any acute changes in cortisol and testosterone in healthy subjects. Some of the researchers suggested that volume, intensity changes and exercise on land do not have an effect on the testosterone concentration (Tanaka, et al., 1993). Testosterone is an adrenal steroid that is secreted during periods of stress. It is released episodically and at the same time with cortisol in response to stress. It has been shown to have anti-glucocorticoid effects in several tissues, including the brain (Browne et al., 1992).

In fact, a recent study found a small augmentation of the exercise-induced increase in testosterone concentration once growth hormone secretion was suppressed by octreotide (Vasankari et al., 1995). A rise in catecholamine secretion levels throughout exercise is also well documented (Mazzeo, 1991). Some investigators have mention that catecholamines stimulate testosterone production during exertion (Jezova et al., 1981) since β-receptor blockade with propanoic inhibits the testosterone response to exercise (Jezova et al., 1981) and since isoproterenol added to to Leydig's cell cultures (Anawke et al., 1986) or infused into the spermatic artery in rats (Eik-Nes, 1969) increases testosterone synthesis.

Conclusion

The present research findings show that a Futsal games leads to a significant increase in the salivary cortisol and testosterone concentration. In addition, a futsal game maybe leads to imbalance of anabolic to catabolic ratio in athletes.

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