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Effects of Official Basketball Competition on the Levels of Salivary Cortisol and Immunoglobulin (A) among female children

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Abstract

Aim: The purpose of the study was to investigate the effect of Official basketball competition on the levels of Cortisol and Immunoglobulin A among pre pubertal girls of 10-11 years old.

Method: The statistical population of the study consisted of 12 female basketball players with an average age of (10.58 0.15 years).Collection of the salivary specimen was conducted in accordance with the standard procedures, before and immediately five minutes after the competition. Cortisol concentration and Salivary IgA level were measured, using ELISA quantitative method. Statistical analysis was conducted using the dependent t-Test.

Results: the results revealed that an official basketball competition increases cortisol and salivary IgA concentrations, significantly ($p \leq 0.00$).Regarding the results of the analysis, one may conclude that sport competition is likely to affect physiological responses of the children and juvenile's immune systems.

Conclusion: It worth to note that despite widespread participation of children and juveniles in competitions and sport events, little researches have been conducted on their immunological factors and stress hormones in response to stressful conditions dominated over the competitions and sport events. Even insufficient information and data achieved through investigations are necessary and useful in evaluation of this age group, concerning their hormone responses to the competitions and sport events.

Keywords: Salivary cortisol; Salivary immunoglobulin; Basketball competition; Stress; Children

Introduction

Human body is influenced by various systems functions. Exercises with different duration and intensity lead to various responses in the systems. Exercise transforms the body immune systems, seriously. Natural function of the immune system is very crucial. The most important function of the system is protecting body against infectious diseases [1].

The children and juvenile's common movement patterns consist of short and fast activities. Studies on the children's exercises showed that they are interested in short, severe and competitive exercises until the age of 14. However, after the age of 14, they experience a significant decrease of exercise hours during a day [2,3] Despite of the children and juvenile's participation in short and intensive exercises as well as competitions, there are little studies on their physiological responses to the activities [4].

Exercise causes major changes in the levels of some hormones such as catecholamine, growth hormone and steroids, especially cortisol compared with those at rest condition [5].

Among hormones, cortisol is the main body catabolic hormone with different response to various sport exercises. Cortisol is a catabolic hormone secreted by the adrenal gland, which is of great role in metabolism and immune system function [6]. It is also a powerful anti-inflammatory agent, which helps the body to deal with stress [7]. Studies show that cortisol concentration has a linear relation to the exercise duration and intensity. Exercises with VO2max intensity of 60-70% and higher lead to increase of cortisol secretion [8].Therefore, it is assumed that basketball competition with VO2 max intensity of 60-70% increases the athlete's cortisol level. Earlier studies proved that cortisol increases during exercise and the major changes occur after the activities [9].

Immunoglobulin A(IgA) plays a predominant role in secretions of mucosal immune system. IgA prevents replication and attachment of pathogenic microorganism and also is able to neutralize toxin and viruses [10]. The levels of secretory IgA correlate more closely than do serum antibodies or other immune parameters [11]. It is considered as the first defense line of the body [12]. The findings of the studies emphasized that sport activities and exercise change the salivary Immunoglobulin A level. The type and direction of the changes depend on the intensity, duration and amount of the exhaustive exercise [13]. According to the studies, moderate exercise

increases the Immunoglobulin A concentration, while stressful and intense exercise reduces the concentration [14]. Unfortunately, there are little studies on the children and juvenile's immune system response to the intensive exercises and sport competitions. Thomas Ne et al. showed that aerobic exercises in the boys of age 15-16 years old did not change the amount of salivary Immunoglobulin A [15], and Niemen et al. reported reduction of salivary Immunoglobulin A concentration among the juveniles with continuous tennis competitive exercises [16]. Basketball is a stressful and intensive aerobic competition for children, which is played in four 8-minute quarters, at children level. Due to the rules of children basketball, all 12 team members must play on the field. Therefore, it seems that presence of the children in such a stressful competition leads to changes in their immune system functions as a physiological consequence [17]. Most studies reveal that intense and long exercises and severe stress out of competition affect the immune system, significantly [18]. Some researchers studied the competitive stress effect on cortisol and salivary immunoglobulin A among the soccer coaches, but they found no meaningful correlation between cortisol and salivary immunoglobulin A, i.e. suppression effect of the salivary cortisol on salivary immunoglobulin A is a long-term effect and it is of no impact in short-term [19]. There are little information about response of stress hormones and immunological factors to short-term intense exercises and competition in this age group. Regarding the contradictory results about the levels of salivary immunoglobulin in various people and restricted researchers on exercises effect on the children molecular immunity system, we decided to study the changes in salivary immunoglobulin A and cortisol levels among the pre pubertal female basketball players of 10-11 years old, after physiological stress of a competition.

Methodology

Subjects

The subjects of the research consisted of 12 female basketball players with an average age of (10.58 0.15 years), height (149.5 9.97 cm), weight (41.86 9.6 kg), body fat percent (18.24 4.72) and BMI (18.9 1.88 kg.m^3). During the week the participants trained 14-16 hours/week (11-12 hours of basketball and 3-4 hours of Weight-bearing exercises Gym).thus training volume (defined as hours per week)was decrease during the competition week by an average 25%.salivary samples were collected from an official final competition officially recognized by the national basketball federation and Department of Education. It was conducted according to the international federation regulations. The competition began at 10 am, ended at 11:30. Each competition contains 4 quarters which each quarters lasted 10 minutes. The subjects and their parents singed the consent form before the study. The form contained explanation of the research purpose, method, probable benefits and difficulties as well as guidance to answer the probable questions and results application.

Measurement of body composition and anthropometry

Body composition and anthropometric features of the subjects were measured to determine fat percent. In this regard, we applied a UK made caliper harpenden with a five-point measurement of the skin fold in the arm triceps, shoulder, chest, abdomen and thighs [19].Then, the subject's heights were measured using the height gauge with precision 0.01 cm (Seca model made in Germany) and their body mass index (BMI) by digital laboratory scale (Seca model made in Germany) with precision 0.05 kg.

Sexual maturation

The subject's biological maturity status was evaluated self-assessed based on the questionnaires defined by Tanner [20-22], Tanner staging is an acceptable method to assess sexual maturity in pediatric samples [23,24]. Individual and parents reports emphasizing on their prematurity period.

Competition anxiety

Competition anxiety was measured by self-reported using the Sport Anxiety Scale 2 (SAS-2), that is a multidimensional measurement of somatic and cognitive trait anxiety for children in sport performance [25]. Subjects were asked to fill the SAS-2 twice In order to make an ensure consistency in the responses, once 48h before the competition at control days and on the day prior to competition.

Salivary measurement

The subject's diet and rest were controlled 48 hours before sampling. They were asked to brush their teeth and not to consume any food and drink except water for one hour before saliva sampling. Three milliliters of whole unstimulated saliva was collected immediately 5 minutes before and after competition. After collection, the samples immediately were kept in ice .once all samples were submitted to research team, The samples were centrifuged at 300×g for 14 minutes, in order to homogenization, then stored at -80°C for analyze. The ELISA method was used to measure salivary cortisol and IgA density. The measurements were read three times to achieve results that are more precise. For measuring IgA and salivary cortisol, researcher purchased an immunoturbidometery test instrument (Parsazmun Tehran, Iran) with sensitivity 1 ng.ml; and a cortisol Saliva, ELISA diagnostics tool (Biochem, Canada Inc., Ontario Canada) with sensitivity 1.0 ng.ml. The ELISA method was applied in the upper part of the tube, after centrifuging in order to measure salivary IgA and cortisol concentrations.

Statistical analysis

Differences of the mean concentrations of salivary IgA and cortisol before and after competition were analyzed using the dependent t-test. Data analysis were conducted using SPSS 22 software and meaningfulness level was determined for the research data as $p \leq 0\text{-}05$.

Findings

Demographic indicators of the present study were age, height, weight, body fat and BMI (table 1). In addition, table 2 shows information on comparison between salivary IgA and cortisol, before and after competition.

Table 1: The subject's features.

BMI	Average SD
Weight (kg)	41.86 ± 9.6
Height (cm)	149.5 ± 9.76
Age (years)	10.58 ± 0.15
Body fat (percent)	18.24 ± 4.72
BMI (kg.m^2)	18.9 ± 1.88

As shown in the Table 2 and Figures 1 and 2 there appears a significant difference between cortisol and IgA concentrations before and after competition.

Table 2: Salivary IgA and cortisol concentrations before and after competition.

Variable	Before competition			After competition		
cortisol	Average	t	P	Average	t	P
	10.07	5.87	0.00	20.06	5.97	0.00
IgA	30.03	7.23		32.03	7.59	

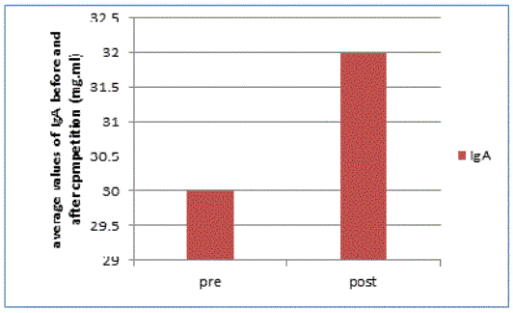

Figure 1: Salivary IgA concentration before and after competition.

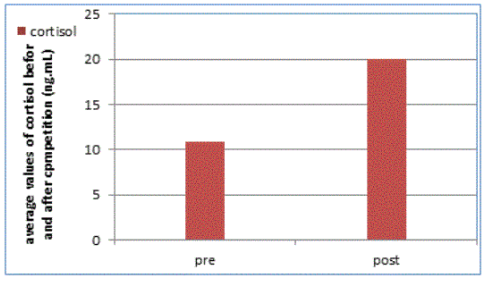

Figure 2: Salivary cortisol concentration before and after competition.

Discussion and Conclusion

The results of the study revealed that sport competition affects the salivary immunoglobulin A and cortisol concentrations before and after competition, among the girls of 10-11 years old, significantly.

Researches on salivary cortisol concentration in official competitions show that the hormone increases considerably in response to competition [26]. Studies on the nature of children basketball competitions show that competitive stress and excitement levels accompanied by the competition are among the main effective factors in cortisol secretion [27]. SedqRuhi et al. investigated the effect of official basketball competition on the testosterone and serum cortisol among 22 young female basketball players. The results showed a meaningful increase of the two elements after competition. They concluded that an official competition with the physical and mental challenges devoted to the basketball increases women's hormone changes [28]. Kaparaniket et al. studied 10 years old children and reported that their salivary cortisol activity increases significantly before and immediately after Taekwondo competition [29].The energy system involved in children basketball is aerobic and regardless of the stress they experienced during the competition, it seems that the subjects have endured high physical pressure with the intensity at the threshold of the cortisol secretion stimulation. On the other hand, the incidence of hypoxia and lactate accumulation is possible in such activities. Stopniki et al. believe that increase of cortisol during competition depends on the body involvement accompanied by lactate production [30]. According to the

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findings of this research and those of other studies, we may point to physical and mental dimensions of the cortisol increase.

Although there are little studies on children and juvenile immune system, many studies have reported reduction of salivary immunoglobulin A reduction in short and intense exercises [31]. Niemen et al. have reported that 1.5 hours after Marathon race, concentrations of salivary IgA and the ratio of salivary IgA to protein reduced 21 and 31percent, respectively [32]. Some studies did not refer to any changes in salivary IgA concentration [33,34]. Kutch et al. measured the amount of IgA response to an intense rugby competition among the male adults and observed no considerable change in IgA levels before and after the competition [35]. Hi et al. examined the salivary IgA and cortisol levels among the basketball players in a racing season and showed a reverse correlation between salivary cortisol and mucosal immunity of the players, and increase of salivary cortisol level as well as reduction in salivary IgA concentration [36]. These contradictory findings depend on various factors including expression of salivary immunoglobulin A, individual nutrition and exercise and the way exercises are conducted. The hypothesis of the research was that competition increases physiological stress, and that the change will affect the children basketball player's secretory immune system, negatively. However, the results of this study showed no relationship between the current stress and salivary IgA. Tarp suggested that heavy and stressful basketball exercises affect pre pubertal male salivary immunoglobulin A, significantly. He also showed that exercises in this age group do not yield loss in immune system function, but increase salivary IgA levels [37]. Siselk et al. suggested that stress is not as effective as heavy body activities on secretory immune system [38]. On the other hand, Flair et al. found no meaningful relation between stress and salivary IgA levels in children competitions [39]. Exploration of the nature of this relation among the children, especially child athletes requires more studies.

In our study, significant changes in salivary Immunoglobulin A have been reported, before and after competitions. This finding is in conformity with those of Tarp and Algero et al. [37,40]. One may conclude that the consistent results are due to the subject's age group sameness.

According to the present study, intensity threshold and sport activity duration are efficient in immunological and hormonal responses [41]. Increase of salivary immunoglobulin A and cortisol levels in our study indicates the sufficiency of basketball competitions to provide immunological and hormonal responses in the body. The finding also suggests that Official basketball competition affects the 10-11 years old girl's immune system function; and that the system is influenced by exercise and competition, but the responses are different among children and adults. It is likely that the participant's hormonal and immunological patterns have been influenced by earlier regular exercise and rest periods. It is suggested that the children official competitions to be held with regard to the stress levels and immune systems function.

In this study, the ethical issues did not let us to use the more offensive assessment such as blood sampling and we did not use X-ray for dental examinations. The other limitation of this study which limited us was to measure the exact load of training time. Further study is needed to determine the training load and effect of that on this age group.

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