The effect of win-loss situations of a soccer match on mucosal immune responses in male soccer players

Ayub Mahdivand1*, Babisan Askari2, Somayeh Dehghani3, Alireza Darvishpour Faragheh4, Mehdi Soleimani5, Fatemeh Javdan6, Khatoun Tahmouresi7

1- Sama technical and vocational training college, Islamic Azad University, Qaemshahr branch, Qaemshahr, Iran
2- Department of physical education, Islamic Azad University, Qaemshahr branch, Qaemshahr, Iran
3- Department of physical education, Marvdasht Branch, Islamic Azad University, Marvdasht, Iran
4- Department of physical education, fars science and research branch, Islamic Azad University, fars, Iran
5- Ph.D student in sport physiology, exercise physiology research center, Baghiatollah University of Medical Science, Tehran, Iran
6- Department of physical education, Marvdasht Branch, Islamic Azad University, Marvdasht, Iran
7- Department of physical education, fars science and research branch, Islamic Azad University, fars, Iran

*Corresponding author: Email: ayub.mahdivand@gmail.com

Abstract

The purpose of this study is to determine the effect of win-lose situations on salivary IgA, cortisol and total protein and sub-indices such as saliva flow rate, IgA secretion rate and the ratio of Pro/ IgA in male soccer players. Among the football teams of First league of Iran, two teams was chosen purposefully with average (age 22±2 yr, VO2max 51.1±3.3 ml.kg-1.min, Rest HR 62±5 Beat min^{-1}) to participate in this research. Non-stimulated saliva samples of subjects were collected at three time periods, before, immediately and 24 hours following the competition. Subjective ratings of perceived exertion (RPE) were assessed using the Borg Scale before and after the exercise. Data analyses were statistically analyzed by bonfferoni test, repeated measure of ANOVA and t-test using SPSS16 and Excel (2007) at p<0.05. Findings have shown that there is no difference in the amount of saliva flow rate changes, IgA concentration and salivary total protein between two winner and lost teams immediately and 24 h following the soccer match(P<0.05). There have found no significant difference in salivary cortisol between win and lost teams immediately following the match, while 24 h following the match it was significant. There was a significant decrease in salivary IgA secretion rate and IgA/Pro ratio immediately following the match between two teams, but 24 h following it there have found no significant difference between two teams(p=0/21). Subjective ratings of perceived exertion (RPE) have an increase following the match in both teams, which was higher in lost team compared with winner team. It is concluded that psychological conditions following the match result and performing heavy and severe physical exercises have a close relation with repression of mucosal immune function.

Key words: Mucosal immune system, saliva, immunoglobulin, cortisol, Rating of Perception Exertion

Introduction

Today, the role of the mucosal immune system as one of the most influential factors within the field of physical activity and sport has increasingly become important, since the weakening of this system influence the ability of the athlete for training and competition (Askari, 2011). Mucosal immune system
as one of the immune system plays an important role in maintaining the health of the respiratory tract especially upper respiratory tract, and has long been considered as a major topic of exercise immunology studies (Aghaalinjad, 2006). Football is such an activity that can have many negative effects on mucosal immune parameters of soccer players both in regards to intensity and severity of activity and also psychological pressures of winning or losing at race. Evidences indicate the effect of prolonged and intense exercises and mental stresses on reduction of body resistance and as a result the damage of immune system (Ashtarani, 2005). Research studies have shown that stress, whether physical or mental, caused changes in heart function; immune system and stress hormones secretion. These changes can lead to unpleasant consequences, and therefore must be controlled (Vaezmosavi, 2007). Mason (1988) stated that psychological factors and daily activities such as exercises are associated with the secretion of catecholamines. Kugler (1996) in a study of the impact of competitive stress on the salivary cortisol and salivary IgA in soccer coaches, and mentioned that excitement and tension in coaches was higher during the competition and the highest concentrations of cortisol secretion was between two halves, a 100 percent increase which was related to the decrease of salivary IgA secretion. One component of the mucosal immune system is immunoglobulin A, which plays a very vital role in creating immunity at body mucosal surfaces and resistance against the upper respiratory tract infections (Ashtarani, 2005; Mackinnon, 1992). Researchers believe that physical exercises, heavy training and high stressed competitions influence the immune system and consequently cause an increased risk of infections at athletes, including infections of the upper respiratory tract (Ashtarani, 2005; Fahlman, 2005; Mackinnon, 1992).

Saliva flow rate, salivary total protein, and cortisol, secretion of IgA as well as IgA/Pro ratio in saliva are used as the determining indices of mucosal immune status, thus further researches should also be done on these factors (Mackinnon, 1992). Of course, the findings of different researches vary according to various factors like the type of participants, type of sport, level of fitness, nutrition and Etc. Sari-Sarraf (2007) in a study of the effect of a single session and intermittent simulated football on mucosal immune parameters, stated that concentration of IgA, salivary protein, cortisol, IgA/Pro ratio have increased following exercise compared with base rate and the secretion rate of IgA and salivary flow rate was reduced. Among the reasons cited in these two studies was psychological pressures which is considered as one of the factors affecting on cortisol hormone secretion from the adrenal cortex. On the other hand, other researchers such as (Nakamura,2006; Walsh, 2004; Nieman , 2006; Akimoto, 2003) in other fields of sports have mentioned the reduction of saliva flow rate, secretion rate of IgA, IgA/Pro ratio and increased concentration of cortisol and salivary total protein. Nakamura (2006), by controlling daily changes of IgA and symptoms of URTI in 12 university soccer players during 2 month have reported that the salivary flow (31%) and secretion rate of IgA was reduced about 20 percent. Akimoto (2003) in a study have reported the reduction of salivary IgA and salivary cortisol concentrations increase among female professional soccer players during the soccer match. Moreira (2009) studied the effect of a soccer match on salivary cortisol concentration on the players of two professional football teams and mentioned that salivary cortisol concentration was increased following the match, but this change was not significant between two teams. They said that the intensity of exercise is not an enough factor for the suppression of immune system function. And also they have found no significant differences in the RPE (perceived exertion) between two teams, which shown that there is not any relation among the changes of cortisol, IgA and RPE changes. Kim Wong (2010) in a study have compared the responses of salivary cortisol and immunoglobulin in elite male and beginner female golfers in two state of competition and training and concluded that the levels of salivary cortisol were higher in competition conditions in elite male golfers, but this proportion was the same between female golfers. Salivary immunoglobulin levels in elite male golfers at race were higher than the levels measured during training, but no difference was observed in women. According to these researchers, gender differences may play an important role in the immune response type (Kim Wong, 2010). Thus, given the importance of football in today societies in terms of current economic, political, social issues, and also because it is considered as one of the heavy sports, it could have physiological effects on players.

The purpose of the present study is to investigate the effects of two win-lose situations in a football match on mucosal immunological response parameters (immunoglobulin A, cortisol, salivary total protein, salivary flow rate, and IgA secretion rate and IgA/Pro ratio) of male football players.
Materials and Methods

Participants

Given the nature and purposes of the study, the present research is a quasi-experimental study. Population included Football teams of First league of Iran. Among these teams, two soccer teams with 22 players were deliberately selected. Subjects were with an age range of 18 to 27 years. After completing the consent form and questionnaire of medical-sport knowledge and describing the research process to the participants, it was recommended that participants refuse any type of heavy physical activity, medications, dietary supplements, coffee, tea, smoking and cocoa within 48 hours before the test and 24 h after the test until salivary sampling was completed.

Measurement Tool(s) and saliva sampling Procedure:

The participants’ anthropometric characteristics including age, height, weight, hypodermic fat and body mass index were measured a week before the main test (Match). The shuttle Run test was used to estimate the players’ maximum oxygen consumption (VO2max)-(Table1). Before and after the match, in order to rate Perception Exertion (RPE) at rest times, the participants were given some forms containing Borg scale, and respond to Borg scale according to the difficulty of the activity(2). Then participants attend in a friendly soccer match, who had a special sensitivity between two teams, in real terms for 90 min. Initial salivary sample collected 15 min before the start of the match at rest time, the second one immediately after the match and the third 24 h following the match. It should be noted that due to the need of non-stimulated saliva, samples were collected after participants wash their mouth and for 4 min. Immediately after being collected the samples were transferred to the laboratory in particular 25 ml containers in order for measuring mucosal immunity indexes. The amount of consumed water for all subjects in this study was 75 cc. To test the dependent variables (IgA, total protein, cortisol) respectively laboratory methods of ELISA monoxide diffusion, Biochemical Photometry and ELISA) have been used. RPE was also measured with Borg scale before and after the match.

Statistical Analysis:

To investigate the homogeneity of baseline data and evaluate the differences between sample and the population Shapiro–Wilk was used. Then as there was found no significant difference in studied indices between two winner and loser teams before the soccer match, to determine the effects of a soccer match on the measured indices, the statistical procedure of Repeated measure of analyze of variance was used, in which all 22 players was studied as a group, in case of differences between the three time periods (sampling) will be used. Finally, to determine differences in responses of IgA, cortisol, salivary total protein and other indices, between winning and losing teams, independent t-test is used. All the statistical analyses were performed using SPSS16 at (P<0.05).

Table1: Individual traits of the participants for two groups loss and winner group (n=22)

<table>
<thead>
<tr>
<th>Measured indices</th>
<th>SD ± Mean</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>20.8 ± 2</td>
<td>21.2 ± 2</td>
</tr>
<tr>
<td></td>
<td>± 5.8</td>
<td>178.5 ± 6.6</td>
</tr>
<tr>
<td></td>
<td>176.1</td>
<td></td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>75.8 ± 9.2</td>
<td>75.3 ± 7</td>
</tr>
<tr>
<td>Body fat percentage (%)</td>
<td>17.8 ± 4.6</td>
<td>17.2 ± 4.2</td>
</tr>
<tr>
<td>Body mass index (Kg/m2)</td>
<td>24.3 ± 2</td>
<td>24.9 ± 2.2</td>
</tr>
<tr>
<td>Maximum oxygen consumption (ml/kg - 1/min -1)</td>
<td>49.2 ± 3.6</td>
<td>52 ± 3</td>
</tr>
<tr>
<td>Resting HR (beat.min -1)</td>
<td>63.3 ± 5.4</td>
<td>61.7 ± 6</td>
</tr>
</tbody>
</table>

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Results

According to ratings of perceived exertion (RPE) football players of both teams before and after the match, it showed that RPE changes in both teams is equal to some extent. As you observe in Figure (1) and table (2), ratings of perceived exertion after the race was significantly higher compared with before the race, which was more significant in loser group (P<0.05). In fact, it can be said that the sense of perceived exertion after the match was higher compared with what the players expected before the match. And also perceived exertion of match in winner team was lower at both before and immediately after the race than the losing team. This difference may be due to physical and psychological stressor.

![Figure 1: The mean changes in Borg index before and after the match](image)

<table>
<thead>
<tr>
<th>Borg index</th>
<th>Team won</th>
<th>Team lose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>12.2</td>
<td>13.1</td>
</tr>
<tr>
<td>Immediately after</td>
<td>13.3</td>
<td>15.2</td>
</tr>
</tbody>
</table>

Table 2: ratings of perceived exertion of subjects

<table>
<thead>
<tr>
<th>Index measures</th>
<th>pre-test mean</th>
<th>post-test mean</th>
<th>subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borg index</td>
<td>13.3</td>
<td>15.2</td>
<td>Team lose</td>
</tr>
<tr>
<td>Borg index</td>
<td>12.2</td>
<td>13.1</td>
<td>Team won</td>
</tr>
</tbody>
</table>

The results also indicate that no significant difference in relation to changes of salivary flow rate (p=0.30), total protein concentration (p=0.48) and salivary IgA (p=0.21) immediately and 24 hours after a football match between the two winner and loser teams. There found no significant difference in cortisol levels between the two winner and loser teams immediately after the match (p=0.06), whereas 24 hours after the race it was significant (p=0.000). There was also a significant decrease in the secretion rate of IgA (p=0.006) and IgA/Pro ratio (p=0.003) immediately after the match between two teams, but 24 hours after the match, there was no significant difference (p=0.29) (table 3).

![Table 3: Mean and standard deviation of the research variables for winning teams (n=11) and losers (n=11) before, immediately after and 24 hours after the match](image)
Discussion and Conclusion

Results of the study by (Brain, 1990) showed that winning or losing is among the factors that can affect hormone levels and human immune system behavior. So that the increased sensitivity of the play and marginal pressures cause the secretion of cortisol hormone suppressor. Competition stress is a strong stimulation that is added to match physical stresses (Mackinnon, 1990). According to the findings on the effect of psychological stress on the immune system, the physical strain associated with these factors can affect the mucosal immune. Results of the present study shown that:

1: there was no significant difference in salivary flow rate changes immediately and 24 hours after soccer match between the two winner and loser teams; In other words, changes in salivary flow rate in winner and loser teams were consistent, that at first a decrease was observed in salivary flow rate before the match until the end of the match, but 24 h after the match there was an increase in salivary flow rate. (Sari-Sarraf, 2007; Williams, 2004; Wash, 2004 and Nieman, 2006) have reported a reduction in salivary flow rate following prolonged and severe activity, While Blannin (1999) reported no significant change in salivary flow rate following prolonged and severe activity (cycling race); this discrepancy can be due to the differences in the nature of activity, hydration, stress and the exercising environment.

2: Results show that in lost team, concentration changes of IgA prior to the race until 24 hours after the match have an increasing trend, but in winning team it was associated with ups and downs, in this case the variation of IgA was upward before the race and after the race, but then the trend has been downward. Overall, there was no significant difference in changes of IgA concentration immediately after and 24 hours after a soccer match between two winning and losing teams. Sari-Sarraf, 2007; Williams, 2004; Blannin, 1999; Dimitriou, 2002), have expressed the increasing concentrations of salivary IgA with activity. While researchers such as (Gleeson, 2004; Tomasi, 1982; Nieman, 2002; Mackinnon, 1990-1992), have reported a decrease in the concentration of salivary IgA, which was probably due to differences in physical fitness and the type of exercise program.

3: Results of the study on salivary cortisol show that in winner group cortisol concentration before the race until 24 hours after the match had an upward trend, however in lose group cortisol changes before to after match has an upward trend , but 24 hours after the match it has been declining, but it didn't reach to the baseline. In general, there was no significant difference with regard to changes in cortisol levels immediately after the soccer match between the two winners and lose teams. But 24 hours after the race there observed a significant difference between the two teams. In many studies, such as ( Moreira, 2009, Sari-Sarraf, 2007; Akimoto, 2003; Nieman, 2000), it has been reported that exercising causes the increase of cortisol concentration. One of the mechanisms that explain this issue is the increase in hormone secretion by stimulating the hypothalamus-pituitary-adrenal axis, by which ACTH secretion from pituitary is increased, and the increase of ACTH secretion is the most important factor for stimulating cortisol secretion (Rajabi, 2006).

4: The results of this study on salivary total protein have shown no significant differences in relation to changes in salivary total protein immediately after, and 24 hours after a soccer match between the two winner and lose teams. The chart of this index generally at three times before, immediately after and 24 hours after the race has an increasing trend. In most studies, an increase was reported in salivary total protein concentration after exercise (Aghaalonejad, 2006; Blannin, 1999; Sari-Sarraf, 2007; Walsh, 2004).

5: The result of the study for IgA secretion rate in this case is that both winner and lose teams are consistent with each other. At first, changes of IgA secretion decrease before and after the race, but 24 h after the soccer race, it increased. Finally, there was no significant difference in relation to changes in IgA secretion immediately after the soccer match between the two winner and lose teams, but 24 hours after the race, no significant difference was observed between two teams. (Fahlman, 2005; Nakamura, 2006; Nieman, 2002; Sari-Sarraf, 2007) have reported a significant decrease in IgA secretion rate after one American football season. In contrast, other researchers such as (Akimoto, 2003; Sari Sarraf, 2007 and Blannin, 1999) stated that prolonged and intense exercise causes the increase of IgA secretion. One of the reasons that cause to measure the secretion rate of IgA together with IgA concentration rate is that salivary secretion depends on the function of autonomic nervous system and this parameter in influence by the duration and intensity of activity can change. During exercises specially prolonged and severe activities, sympathetic stimulation of salivary glands increase the degree of vascular contraction and factors such as circadian rhythm alterations which carried out with nerves may affect salivary secretion (Rajabi, 2006).
6: The last results of the present study was that IgA/Pro changes were consistent in both winner and lose teams, which was decreasing before and after the race, and there was a significant difference in relation to IgA/Pro changes immediately after the soccer match between the two winner and lose teams, but 24 hours after the race no significant difference was observed between these two teams. In some studies, including (Nieman, 2002), it was said that this ratio decrease after prolonged and intense activities, and in contrast researches such as (Sarir-Sarraf, 2007) have reported this ratio increase following prolonged and intense activities. Body activity increases sympathetic nerve function, and the activity increase of (beta) sympathetic receptors in salivary gland can be one of the reasons for higher increase of salivary protein concentration following the activity. In general, according to the studies it was found that physical activity is one of the influential factors in the change of immune system work process, which depends on intensity, duration, diversity of sport fields, training features, specific responses to training and competitions, environmental and psychological factors, environment temperature, exercise plan, fitness status of individual, autonomic nervous system, stress hormones and methods of measurement (Ashtarani, 2005). Despite the extensive researches done in the last two decades, there is still no clear answer to several question of the effect of different activities on immune system function. In general we can say that the hypothesis that the psychological condition resulting from the outcome of the match and performing heavy and intense exercise is associated with mucosal immune function repression is confirmed.

References