The influence of duration of long-distance road cycling on the amounts of immunoglobulin A & G in blood of professional cyclists

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ABSTRACT

Scope and Purpose: Athletes are susceptible to upper respiratory tract infections during intensive trainings, as well as during the first or the second week after participating in the long-distance road cycling competitions. Therefore, the influence of duration of such cycling on amounts of immunoglobulin in blood of cyclists was studied in this research. Materials and Methods: 16 professional cyclists between the ages 17_20 and with the average height and weight of 168 cm and 59 kg, respectively, were divided into two groups of eight. The first group was riding for 1 and the second one for 3 hours. To measure the amounts of IgA and IgG, the blood samples of these two groups were gathered both before and immediately after the activity. The data were then analyzed through a correlated T-test and an independent one. Results: The findings showed that there was not a significant reduction in the secretory immunoglobulin A and G in the first group considering the samples before and after the activity (α = 0.05). But there existed a significant reduction of secretory immunoglobulin A and G for the second group after the 3-hour activity (α = 0.05). Discussion: According to these results, there is a significant fall in the levels of immunoglobulin A and G right after the long-distance cycling of higher duration and the athletes may be susceptible to upper respiratory tract infections during intensive trainings as well as the first or the second week after participating in the long-distance competitions.

Key words: Immunoglobulin A; Immunoglobulin G; Long-distance cycling; Upper respiratory tract infection

Introduction

Nowadays there is a great attention to the quality of life and health, and efforts to promote health and disease prevention are priorities. In recent years, the importance of exercise in our daily lives is increasing rapidly. The relationship between exercise and the immune system is an issue that has attracted the interest of physiologists and Immunologists. Immune system is one of the vital systems that its proper function guarantee the health and if it is not functioning properly, it would be impossible to survive. Immunoglobulin is a glycoprotein found in blood and other body fluids that contains antibodies to protect the body against pathogens. There are five categories of major antibody include: $^{1}$IgM, $^{2}$IgA, IgG, $^{3}$, $^{4}$IgD, $^{5}$IgE. IgG is bivalent antibody that contains 75% natural human antibodies. [27] Secretory immunoglobulin A (IgA) A is the predominant Immunoglobulin in mucosal secretions. And most effective line of defense against pathogenic microorganisms that cause upper respiratory tract infection (URT) [4,38,52,55]. Naturally, numerous factors can strengthen or weaken this vital organism. Among these factors exercise is very important. Because the prosperity of machinery life and increase stressors resulting from this kind of life increases the various cardiovascular and hematologic diseases in this regard, many researchers have been proposed the effect of sport and physical activity as one way to boost the immune system [3]. After an acute exercise temporary changes occurs in immune function (for example respiratory burst of neutrophils, lymphocyte proliferation, monocytes). Usually continues 3 to 24 hours after the last heavy workout meal and then goes back to the initial state and usually continues depending on the intensity and duration of exercise [13, 18]. So in the actual resting, immune function between athletes and non-athletes are broadly similar. In the effect of heavy exercise muscle tissues are injured and important nutrients are consumed. Result of these events is impaired healing ability, decreasing the body’s defense against infection, both of which reduce the ability of practice and competition [5]. Impact of exercise intensity on salivary IgA concentration and secretion has been shown. The salivary IgA reduced associated with long-term high-intensity exercise. While the concentration of salivary IgA in the response to short-term, moderate-intensity exercise moderately increase [4, 13, 18, 25, 36, 52, 54, 55]. In a study on

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cyclists done for 2 hours and with 55% of maximum power, there was no change in levels of salving SlgA and show that salivary IgA concentration in the response to short-and medium-intensity approach does not vary [53]. Moderate endurance exercise caused no change in the total number of granulocytes, monocytes, lymphocytes and serum immunoglobulin levels. On the other hand tedious exercise may reduce above factors especially when exercise is associated with or competition or environmental stress [10]. The obtained data supports the idea that athletes during periods of intense and heavy exercise and also in the period of 1 to 2 weeks after participation in long-distance competition are at risk of upper respiratory tract infections [5, 7, 23, 36, 40, 50 and 52]. In practice it has seen that professional athletes, especially during the season of practice and competition, are more prone for diseases such as upper respiratory infections, including colds and sinusitis [5]. Babai et al (1382) studied the effect of intense aerobic activity to the border of fatigue (90% of maximum heart rate) and reported significant decrease in IgA and IgG serum levels after activity [3]. While Hamedi Nia and Askari (1384) evaluate the effect of physical exercise on some parameters of the immune system of students and did not observe a significant reduction in safety levels. [22] Falman et al (2005) have done a research on American college football players the result of this study show lower levels of salivary SlgA concentration and decreasing salivary SlgA secretion and an increase in upper respiratory tract infection [9]. Klaus et al (2003) in a study concluded that acute and chronic exercise can increase viral infections in the days and weeks after the workout [39]. Tharp and Barnes (1990) reported in a study that after four two-hour training session serum IgA levels were reduced by about 10%. With increasing exercise intensity, the level of serum and salivary IgA after exercise at the end of the session showed a decline about 25%. This results show that total effects of daily intense exercise with repeated sessions may have a significant impact on IgA levels [3]. Although the exercise has known effects on components of the immune system and infection but the main reason for this effect has not been completely understood. If we consider exercise as a stimulus that affects the immune system it is necessary to know which exercises and with what intensity, duration, and distance affects the system. Most research has been done so far in this case was in controlled laboratory conditions. While in present study researcher examine the effects of road long-distance cycling time on the athletes’ blood immunoglobulin level. And try to apply the real and environmental conditions (competition) in this study. Therefore changes in the immune system should be evaluated to do appropriate action to protect the health of athletes that is one of the main objectives of physical education.

Materials and Methods

The study includes two experimental groups that due to the lack of all confounding and effective variables and the lack of a control group is quasi experimental. These two groups of individuals are selected randomly. Subjects are 16 cases of young national cycling team of men between the ages of 17 and 20 years old that all have cycling at state level championships and international competitions. Average height and weight of the subjects, respectively is (168 and 59). This test in environmental conditions and in the road of Kerman - Mahan was done in the form of went back. Subjects at 9 am were present at the test site and after describing the goals and methods of research (details of tests and the way to blood sampling) and obtain written consent (consciously) of them, with the coach, volunteers were ready to participate in the study. At 10 am with the presence of laboratory curator blood sampling began from volunteers and 3 ml of blood was taken from all subjects. (Pre-test) Subjects were randomly assigned to groups I and II (without informing subjects). Both groups start to practice at 11 am, the temperatures in that day was 19 ° C and humidity was 15%. Cyclists continued their training with average speed of 5/32 km per hour. After one hour 8 people of subjects were excluded randomly from exercise. And after 10 minutes second blood samples were taken (post-test). While the rest of cyclists continued their practice without interruption the second group was terminated the practice after 3 hours and by 91/47. Average and maximum speed were recorded 32/5 and 59/1 miles per hour. (by Polar device that is installed on the bike). The blood samples were taken from second group 10 min after termination of exercise. (Post-test). During the exercise, fluids (water) and sugar (date palm) were given to subjects. In this study to obtain IgG, IgA in each step we need 3 cc blood samples a total of 6 cc of blood was taken from each subject. Blood sampling was performed by a laboratory technician and blood samples were maintained in special tubes and after each step and before blood coagulation being transported to the lab and were immediately centrifuged and the serum separated from the blood and frozen at a temperature of - 29 ° C. and next day IgG, IgA were measured. For data analysis, descriptive and inferential statistics were used. In descriptive statistics Excel software was used, and in inferential statistics T of independent groups at the level of 0/05 and SPSS software were used. Using independent T test compare the one our exercise and three hour exercise, examine the blood levels of immunoglobulin A and G in athletes. In this study, exercise duration is considered independent variable and extent of immunoglobulin A, G change has been considered as the dependent variable.
Results:

Secretory immunoglobulin A and G variable description (test one hour and three hours of training). In Table (4-1) for the pre-test and post-test mean and standard deviation, minimum, maximum data are presented.

Table 4-1: index of central tendency and dispersion of secretory immunoglobulin A and G of one or three hour training between subjects

<table>
<thead>
<tr>
<th>Row</th>
<th>Variable</th>
<th>Group</th>
<th>Time</th>
<th>The mean ± standard deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IgA Mic gm/mlt</td>
<td>peri</td>
<td>1 hour</td>
<td>168.39±30.82</td>
<td>930/03</td>
<td>227/75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>post</td>
<td>1 hour</td>
<td>135.63±47.10</td>
<td>43/00</td>
<td>192/00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>peri</td>
<td>3 hours</td>
<td>182.25±28.36</td>
<td>126/00</td>
<td>111/00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>post</td>
<td>3 hours</td>
<td>155.60±65.29</td>
<td>220/00</td>
<td>188/00</td>
</tr>
<tr>
<td>2</td>
<td>IgG Mic gm/mlt</td>
<td>peri</td>
<td>1 hour</td>
<td>1156.83±148.28</td>
<td>946/15</td>
<td>1456/93</td>
</tr>
<tr>
<td></td>
<td></td>
<td>post</td>
<td>1 hour</td>
<td>1142.03±279/22</td>
<td>714/00</td>
<td>1520/00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>peri</td>
<td>3 hours</td>
<td>1230.88±159/21</td>
<td>983/00</td>
<td>1516/00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>post</td>
<td>3 hours</td>
<td>1074.63±201/31</td>
<td>706/00</td>
<td>1391/00</td>
</tr>
</tbody>
</table>

Table 4-2: dependent T-test of long-distance cycling for one and three hours on the level of immunoglobulin A and G

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean differences</th>
<th>T statistics</th>
<th>Freedom degree</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 hour IgA</td>
<td>-32.76</td>
<td>1.36</td>
<td>7</td>
<td>0.22</td>
</tr>
<tr>
<td>3 hours IgA</td>
<td>-27.25</td>
<td>3.22</td>
<td>7</td>
<td>0.01</td>
</tr>
<tr>
<td>1 hour IgG</td>
<td>-14.83</td>
<td>0.13</td>
<td>7</td>
<td>0.90</td>
</tr>
<tr>
<td>3 hours IgG</td>
<td>-152.25</td>
<td>5.48</td>
<td>7</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Table 4-3: Independent T-test of long-distance cycling for one and three hours on the level of immunoglobulin A and G

Discussion:

Before addressing the topic of discussion, it should be noted that most long-distance cycling were held in roads and environmental conditions have a significant impact on athletic performance, while most research has been done on cyclists immune system were held in laboratory and away from real race conditions. In this study we investigate the effect of endurance training on cyclists’ blood immunoglobulin levels in racing conditions and in the road. Therefore, this study can be considered as a new study. As was observed, short-term endurance cycling for one hour didn’t reduce the levels of immunoglobulin A and G in blood.

Research results are consistent with [9, 12, 22, 29, 32, 35, 48, 41, 51] and are contradicted with [11, 25].

Submaximal exercise is often associated with increased serum immunoglobulin but its pattern is different between athletes and non-athletes partly related to changes in plasma volume. Acute moderate exercise such as walking 45 minutes causes transient increase in serum immunoglobulin levels and any changes in plasma volume. This increase is likely a result of the contribution of extra vascular protein accumulation and increased lymphatic flow [41]. Salivary IgA concentrations in response to short-and medium-intensity approach do not vary [53]. Regular exercise in severe levels can cause suppressed mucosal immune parameters. While moderate intensity exercise may have positive effects. Degree of immune suppression and recovery after exercise is associated with exercise intensity, exercise duration and training volume [15]. Long-distance cycling for three hours decreased levels of immunoglobulin A and G in the blood. The results consistent with investigations [4, 8, 9, 11, 12, 14, 22, 25, 28, 29, 31, 33, 27, 41, 42, 46, 48, 49, 52], and is inconsistent with [16, 51]. Severe aerobic activities to fatigue border have significant effect on blood serum immunoglobulin A and G. The obtained data are likely cause to increase Cortisol, other hormones, and the activity of glutamine following exercise [3]. Has been proven that prolonged endurance exercise is associated with muscle
damage and localized inflammation and antibodies may be used to help macrophages in dispose of muscle cell breakdown products [41]. Salivary flow and IgA rate is significantly lower in elderly than young people. Salivary IgA secretion rate is independent from total salivary secretion protein and also there is individual variation within a particular age group and the stress and daily events have an effect on IgA secretion rate. Immunoglobulin (IgA) A is as the predominant immunoglobulin in mucosal surfaces as a first line of defense against microbial attacks. Recent studies suggest that secretory IgA concentrations during the day due to various factors such as diet, daily exercise and mood are different [34]. Reduction of salivary flow is because of dehydration, evaporation, and increased pulmonary ventilation during operations which directly reduces plasma volume, and as a result reduced flow of saliva. Physical activity also narrows the blood vessels and reduces blood flow of salivary glands. Mucosal surface changes due to the severe breath during activity, as well as other possible reason are the reduction of salivary IgA. It seems that salivary IgA levels to some extent influenced by repressive hormones such as catecholamine. Because controlling release of epinephrine and nor epinephrine from sympathetic nerves and blood vessels to constrict affected B lymphocytes migration secreting IgA under oral mucosal. Due to increased blood concentrations of catecholamines in the activity stream, is expected to reduce the migration of these cells decrease and finally the salivary IgA decreases [25, 30]. Overall, although physical activity of high intensity decreased immunoglobulin A, G, but physical activity with low intensity did not have significant meaning [4, 13, 18, 25, 36, 52, 54, 55]. Exercise as a stressor, according to the intensity, duration, distance and frequency, affect immune function. Severe activity tiring reviews and its effect on immune system can provide valuable and useful information on how to design and implement physical activity, to the researchers, coaches and athletes [3]

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