Effects of aerobic activity on serum IgG concentration in male physical education students

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Abstract

The aim of this study was to investigate the effects of aerobic activity on Serum IgG concentration. Consequently, 10 male physical education students with age ranging from 21 to 24 years old and mean body mass index 22.22 kg m\(^2\) volunteered to participate in this study. Aerobic activity was performed on bicycle ergometer for 30 minutes at intensity of 70 to 75 percent of maximum heart rate. Blood samples were obtained from subjects before and after aerobic activity. Changes in serum IgG concentration in pre-test and post-test were analyzed by dependent t-test using spss software. The results showed that aerobic activity not significantly effect on Serum IgG concentration (p=0.357). This study concludes that sub maximal aerobic activity does not affect on serum IgG concentration and there is no concern for athletes and coaches that sub maximal aerobic activity can impair immune function.

Keywords: Aerobic activity, IgG, Immune system

Introduction

Physical exercise provides a challenge to homeostasis throughout the body. The immune system, like many other physiological systems, displays substantial perturbations in response to a single bout of exercise (1). Sports immunology and hormonology have developed over the recent years and the information obtained has revealed more links between such sciences as sports
sciences, medicine, immunology, pathology and behavioral sciences which will consequently contribute to the healthy life of humans and will prevent the hidden infectious diseases and their detrimental impacts (7). Exercise can have both positive and negative effects on immune function and susceptibility to minor illnesses. The relationship between exercise and susceptibility to infection has been modeled in the form of a “J”-shaped curve. This model suggests that, while engaging in moderate activity may enhance immune function above sedentary levels, excessive amounts of prolonged, high-intensity exercise may impair immune function. Although there is relatively little evidence available to suggest that there is any clinically significant difference in immune function between sedentary and moderately active persons, there is some fairly convincing epidemiological evidence that moderate habitual physical activity is associated with decreased infection incidence. Many studies have reported that various immune cell functions are temporarily impaired following acute bouts of prolonged, continuous heavy exercise, and athletes engaged in intensive periods of endurance training appear to be more susceptible to minor infections (2). There are numerous anecdotal reports relating infection to deterioration in sporting performance. Unexplained failures by top sportsmen are often attributed to recent or current infections (9). The influence of moderate and maximal exercise on the immune system is also important for the trainers and coaches who work with amateur and professional athletes. The mechanisms that result in increasing immune resistance will need to be further researched by looking at the cellular factors associated with the immune system (5). Factors like type, duration, intensity, and program of the exercise and the use of different subjects, various complex mechanisms including hormonal, metabolic and psychoneural stress are also known to have effects on the immune system (6).

Immunoglobulins are glycoproteins found in the blood and other bodily fluids which contain antibodies and are produced to protect the body against pathogens. IgG is the most abundant immunoglobulin found in the body comprising up to 50-80 percent of all the immunoglobulins. The average IgG in the blood serum of an adult is about 11 mg/ml. In normal people, most of the antibodies such as those against bacteria, viruses, parasites, fungi, soluble toxins and Rh antigens belong to the IgG group (1). Immunoglobulins levels in serum are part of the data used to assess the integrity of immune system functioning (4), and are essential to understanding the impairment and restorative processes occurring during exercise. The aim of this study was to investigate the effects of aerobic activity on Serum IgG concentration.

Methods

Subjects

10 male physical education students with age ranging from 21 to 24 years old and mean body mass index 22.22 kg m² volunteered to participate in this study. They gave written informed consent before participating in this investigation and met the following criteria: non-smokers; healthy and free of active infection and symptoms; medication-free; no medical history. Descriptive characteristics of the subjects such as weight, body mass index and body fat
percentage analysis by using a body composition analysis (ZEUS 9.9, making South Korea). Descriptive characteristics of the subjects are presented in Table 1.

Table 1: Descriptive characteristics of the subjects

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>S.D</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>21.6</td>
<td>1.07</td>
<td>20.0</td>
<td>24.0</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>177.5</td>
<td>6.55</td>
<td>169</td>
<td>192</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>69.98</td>
<td>7.39</td>
<td>54.5</td>
<td>78.10</td>
</tr>
</tbody>
</table>

**Aerobic activity**

Aerobic activity was performed on bicycle ergometer (Monark E839 made in Sweden) for 30 minutes. In this case, the subjects first 10 minutes as a warm-up began with 70 watts and 20 minutes with a steady heart rate of 70 to 75 percent of maximum heart rate rode. Speed of 60 rpm was riding across activities. In end three minutes of warm-up phase, power added until final minute at the end of the stage to warm up, the heart rate reached 70 to 75 percent of maximum heart rate.

**Blood sampling and blood analyses**

Whole blood samples were collected by venepuncture from an antecubital vein (5 ml) at before and after aerobic activity. Blood samples were placed at room temperature for 30 minutes to be completely clotted and centrifuged to separate serum. Serum IgG level were measured by using nephelometry which is based on the light scattering properties of antigen-antibody complexes in solution.

**Statistical analysis**

Descriptive statistics were used to calculate the mean and standard deviation. Changes in serum IgG concentration in pre-test and post-test were analyzed by dependent t-test using SPSS 18 software and levels significantly lower than 0.05 was considered.

**Results**

The results showed that aerobic activity not significantly effect on Serum IgG concentration (p=0.357). Serum IgG concentration in pre-test and post-test are presented in Table 2.

Table 2: Serum IgG concentration (g/l) in pre-test and post-test

<table>
<thead>
<tr>
<th></th>
<th>pre-test</th>
<th>post-test</th>
<th>t</th>
<th>p</th>
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<tr>
<td></td>
<td>12.08±2.61</td>
<td>12.55±1.76</td>
<td>-0.970</td>
<td>0.357</td>
</tr>
</tbody>
</table>
Discussion

In this study was observed 30 minutes sub maximal aerobic exercise on a bicycle ergometer no significantly effect on serum IgG concentration. This result is consistent with the results of Karacabey et al (2005), suggesting the no significantly change in the level of serum IgG concentration after aerobic exercise, while it is inconsistent with the results of Gunga et al (2002). Ganga results inconsistent with the present findings could be many reasons, including duration and intensity of activity. Subjects in the Ganga study were marathon runners, their mean activity duration was 2.7 hour but activity duration in the present study was 30 minutes. As well as, intensity of activity in Ganga study was maximal but intensity of activity in the present study was sub maximal (70 to 75 percent of maximum heart rate). Aerobic activity in Karacabey study was 30 minutes running on treadmill with intensity 60 to 70 percent of maximal oxygen uptake that is very similar with present study in terms of intensity and duration.

Factors like type, duration, intensity, and program of the exercise and the use of different subjects, various complex mechanisms including hormonal, metabolic and psychoneural stress are also known to have effects on the immune system. Under any kind of stress vasopressin stimulates the release of corticotropin-relasing factor, which in turn leads to the release of ACTH (6). During exercise, epinephrine is released from the adrenal medulla, and norepinephrine is released from the sympathetic nerve terminals. The expression of β-adrenoceptors on T, B, and macrophages in numerous species provide the molecular basis for these cells to be targets for catecholamine signaling (8). Changes in the immune functions due to acute exercise and training have been attributed to the increased secretion of cortisol, cathecholamine and the neuropeptides. During exercise when the max O₂ consumption exceeds 60% an increase in the epinephrine and cortisol concentrations occurs (6). Epinephrine concentrations were closer to those observed after treadmill walking at 50% VO₂ max (0.568 nmol/l) than those measured after running at 80% VO₂ max (1.29nmol/l) (1). This study concludes that sub maximal aerobic activity does not affect on serum IgG concentration and there is no concern for athletes and coaches that sub maximal aerobic activity can impair immune function.

References


