The effect of 8-week's anaerobic intermittent exercises on the amount of fibrinogen, CRP and VO$_2$max in student athletes

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Abstract

Studies show that a severe exercise leads to changes on the surface of acute phase proteins. In today's industrial society cardiovascular disease is the main cause of death. This study focuses on the effect of 8-week anaerobic intermittent exercises on the amount of fibrinogen, CRP and VO$_2$max in student athletes. 10 of the university's team members with an average age of 22±3, height of 174±4.2 centimeters, and weight of 66±3.31 kilograms voluntarily participated in this study. The subjects participated in three weekly anaerobic intermittent exercises sessions for a period of 8-week. The fibrinogen, C-reactive protein (CRP) and VO$_2$max was measured before and after this period. Blood samples were collected before and after training sessions, after 12 hours fasting. The data was analyzed A paired t-test with $\alpha \leq 0.05$. Results showed the 8 week of anaerobic intermittent exercises caused a significant decrease in the subjects' fibrinogen and CRP levels and a significant increase in the level of VO$_2$max.

Keywords: CRP, fibrinogen, VO$_2$max, anaerobic intermittent exercises.

1. Introduction

Proteins that increase in the blood plasma and serum of humans and warm-blooded animals due to factors such as inflammation and necrosis are called acute phase proteins. Most of these proteins function in decreasing the amount tissue inflammation waste by getting rid of the source of inflammation, separating and disposing of injured tissue parts, and tissue regeneration. These proteins are part of the natural immune system and function before specific immunity. Researchers consider acute phase proteins as one of the criteria for evaluating health. One of the causes of death in today’s industrial world is the increase in cardio-vascular disease, such as artherosclerosis and heart attacks as a result of malnutrition, lack of environmental sanitation and inactiveness. This is why it has been predicted as the most common of human illnesses in the future.

Of the methods proposed by researchers is to measure inflammation warning index connected to cardio-vascular disease such as blood cholesterol levels, C-reactive protein (CRP) levels and plasma fibrinogen. The increase in

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VO2max is the maximum amount of oxygen used at the time of exhaustion. If activity exceeds VO2max, oxygen supply and consumption relatively increases compared to times training is not in progress. Research has shown that 6 months of training causes a 20% increase in VO2max. An increase in VO2max as a result of anaerobic speed training and power exercise has been reported as well, but this increase is less compared to resistance training. In previously sedentary people, training at 75% of aerobic power, for 30 minutes, 3 times a week over 6 months increases VO2max an average of 15-20% (6). However, this is an average and there are large individual variations with increases as wide ranging as 4% to 93% reported. This was originally put down to a simple issue of compliance but more recent research suggests that genetics plays a role in how well any one individual responds to endurance training program (Gormley, S. E et al, 2008).

Some researchers believe that the best way to reveal cardio-respiratory and muscle compatibility with sports is to estimate aerobic capacity or VO2max levels. The proper functioning of the oxygen transport system is estimated through the effect of cardiac output and artery and vein blood oxygen levels (a-vo2 diff). The difference between muscle artery and vein blood oxygen levels shows the amount of oxygen absorbed by tissue. VO2max is widely used by sports physiologists and is one of the main parameters in obtaining a person’s physical status. VO2max is affected by factors such as age, sex, weight, exercise type and Body Composition. Having high VO2max levels requires heart, lung and bodily systems to function as a whole (Wilmore, J. H et al, 2008).

The possible effects of constant aerobic training during different weekly training sessions with these indexes has always been of interest to researchers and various results have been reported. Considering the existing hypotheses pertaining the possible effect of routine exercise on the amount of CRP and fibrinogen and the effect of these indexes in preventing cardio-vascular disease, and because of the limited research on extreme and intermittent
exercise, this study will attempt to show if three weekly sessions of intermittent anaerobic exercise during an eight week period will have an impact on the fibrinogen, CRP and VO\textsubscript{2max} level of student athletes.

2. Methodology

2.1. Participants

This study is of applied nature and is semi-experimental. The participants were varsity volleyball and soccer players (N=82). For this study 10 of the players were chosen randomly, after which they signed consent forms. Using a questionnaire, the subjects made clear that they had no records of pain or surgery and that they were completely healthy. The participants had an average age of 22±3, height of 174±4.2 centimeters, and weight of 66±3.3 kilograms.

2.1.1. Measurement

The effect of 8-week's anaerobic intermittent exercises on the amount of fibrinogen, CRP and VO\textsubscript{2max} in student athletes was measured when performing the pre-test and, after 8 weeks of training, during the post-test.

All the participants trained as planned. Venous blood samples were collected in the morning by specialized nurses, after a 12-hour fasting period, and after a minimum of 24 hours since the last physical exercise intervention. Participants were in a seated position and rested for ten minutes. The Bruce test was used to measure VO\textsubscript{2max} in the pre- and post-test. The Bruce Test is a commonly used treadmill exercise stress test. It was developed as a clinical test to evaluate patients with suspected coronary heart disease, though it can also be used to estimate cardiovascular fitness. Today, the Bruce Protocol is also one common method for estimating VO\textsubscript{2max} in athletes.

2.1.1.1. Procedure

The training program consisted of a 3-session, weekly training program in an 8 week period and was supervised by an Exercise Physiologist. The sample exercise program was 200×8 in 38 seconds with 1:16 minutes interval rest and 4×400 in 1:20 seconds with 2:40 minutes as interval rest. To enhance the participants’ physical abilities and preparation, light training activities were performed in the first week. The amount of training pressure was gradually increased from the second week onward. The number of repeats depended on the pressure of the activities during the training program.

2.1.1.1.1. Statistical Analysis

To examine the hypotheses, a paired t-test with \( \alpha=0.05 \) was used. Statistics were analyzed using SPSS ver.16.

3. Results

After comparing pre- and post-test results, it was concluded that 3 weekly sessions of intermittent anaerobic exercise for a period of 8 weeks affected the participants’ fibrinogen levels, demonstrating a significant drop in the post-test. CRP levels showed a significant decrease in the post-test during this period as well. Data analysis displayed that 8 weeks of intermittent anaerobic training caused a significant increase in the subjects’ VO\textsubscript{2max} levels in the post-test. This has been illustrated in table 1.

<table>
<thead>
<tr>
<th>variables</th>
<th>Per-test</th>
<th>Post-test</th>
<th>significance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>fibrinogen</td>
<td>222.917±17.84</td>
<td>219.763±17.06</td>
<td>0.022*</td>
</tr>
<tr>
<td>CRP</td>
<td>0.413±0.0266</td>
<td>0.411±0.0251</td>
<td>0.038*</td>
</tr>
<tr>
<td>VO\textsubscript{2max}</td>
<td>41.1±4.22</td>
<td>42.2±3.91</td>
<td>0.003*</td>
</tr>
</tbody>
</table>

4. Discussion and conclusion

Findings showed that 8 weeks of intermittent anaerobic exercise affected subject plasma fibrinogen, serum CRP and VO\textsubscript{2max}. Accordingly, plasma fibrinogen levels decreased significantly during this period. The reason can be attributed to the controlling of liver glycoprotein production after physical activity. Among the other reasons is a
decline in plasma volume and blood concentration. It can also be noted that exercise decreases inflammation by lessening the production of cytokines from fat tissue, increasing insulin sensitivity and decreasing weight. The findings of this study are similar to those of Tosetto et al (2011), Martins et al (2010) and Colak et al (2011), opposing Simpson et al (2006).

According to the findings, a drop in the participants’ serum CRP levels was noticed after 8 weeks of anaerobic training. This is accordance with Donges, C. E et al (2010), Alvarez-Sala L. A et al (2008) - Chae, H,W (2010) - but contrary to Meier-Ewert H. K et al (2001) · P. J. M. van den Burg, et al (2000), who claimed an increase in serum CRP as a result of exercise. Though the true mechanism of fibrinogen and CRP decrease due to intermittent anaerobic training is not clear, a drop in the CRP level, the production of which is either directly or indirectly controlled by the liver, is a type of adaptation method resulting from exercise and physical activities. A person’s fitness and the severity and type of exercise performed influence CRP levels. The differences existing in various studies on the matter are caused due to dissimilarities in the duration, severity and type of exercise. Because of the increase in the VO2max levels of those taking part in this study, it can be concluded that these kinds of exercises increase oxygen transfer by strengthening the cardio-vascular system. As mention earlier, oxygen transfer depends on the well-being of the cardio-vascular and respiratory systems. The findings of this study are similar to those of Breil, F. A. et al (2010), Gormley, S. E et al (2008), BerlingT J et al (2006), Chae, H.W (2010).

Due to the fact that this study showed a decrease in CRP and an increase in VO2max levels in the participants, and because anything that decreases inflammation indexes, decreases cardio-vascular complications, to lessen sudden death tolls and prevent cardiovascular complications, intermittent exercises are recommended as a part of physical fitness programs and leisure activities.

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References