Impact of Doing Regular Exercise on Blood Erythrocytary Parameters

Ibrahim Şahin

Aksaray University School of Physical Education and Sports Turkey

Submitted: Oct 8, 2013; Accepted: Nov 11, 2013; Published: Nov 23, 2013

Abstract: This study was conducted in order to compare blood erythrocytary parameters in athletes who have been doing sports in various branches for at least five years and sedentary university students. The study covered 28 male athletes at the age of 19-20 doing sports in various branches and 21 sedentary male university students-49 in total. Having received a briefing about the tests, volunteers were measured for their physical measurements such as body height and body weight as well as their blood lipid levels. Volunteers were lectured not to take in any food or drink after 10:00 PM before the day when their blood samples would be taken. Blood samples were taken at 8:00-9:00 AM in the laboratory. Blood samples of the participating volunteers that were taken from the forearm antecubital area into 5 ml EDTA tubes in line with the hygiene rules were analyzed by means of an auto-analyzer in the central laboratory for blood erythrocytary parameters such as erythrocyte (RBC; Red Blood Cell), Haemoglobin (HBG), Haematocrit (HCT), Mean Red Blood Cell Volume (MCH), Mean Cell Haemoglobin (MCH), Mean Cell Haemoglobin Concentration (MCHC) and Red Blood Cell Distribution Width (RDW). The independent t-test was applied to define the differences between the groups. Level of significance was taken as 0.05. The study revealed that there was not a significant difference between the groups in terms of body height, body weight and body mass index (p>0.05) whereas the difference in blood erythrocytary parameters such as RBC, HBG, HCT, MCH, MCH, MCHC and RDW was significant (p<0.05). As a conclusion, we consider that, in volunteers of the same age group, athletes’ having higher red blood cells compared to sedentary subjects can be attributed to the activity level of athletes.

Key words: Athletes - Exercise - Blood erythrocytary

INTRODUCTION

An in-depth analysis of human body tells us that it is a perfect being with special attributes. Physical attributes of human beings are adversely affected due to a sedentary life style. However, physical and physiological capacities improve significantly through regular exercises. Studies have shown that exercise has positive impacts on physical, physiological, psychological and motor attributes [1]. It is a general finding that long-term regular exercises have an impact on the organism [2] and haematology, within the blood biochemistry that reflects any change in the organism, is subject to such a positive impact [3]. An analysis of the literature on this topic reveals that there is not a full consensus on how exercise impacts haematology and there are some studies indicating an increase [2, 6, 7] and decrease [8] in haematological parameters after exercise despite the others suggesting no change in the levels of haematological parameters [9]. Such differences are reported to be stemming probably from the experimental methods, timing of experiments, the type of exercise, age and gender of subjects, magnitude, duration and frequency of exercise as well as physical and physiological condition of the participating subjects [6, 10].

This study was conducted in order to compare blood erythrocytary parameters in athletes who have been doing sports in various branches for at least five years and sedentary university students.

MATERIALS AND METHOD

The study covered 49 male volunteers-28 male athletes (S) with an average age of 19,64±0,55 years doing various team sports and 21 sedentary male athletes (S) with an average age of 19,64±0,55 years doing various individual sports.
university students ($S$) with an average age of 19.71±0.56 years. Subjects were selected among those who do not take regular medication or consume the drinks that may cause addiction and were not given any exercise program. The ID information was taken as basis in finding the ages of subjects. Having received a briefing about the tests, volunteers were measured for their physical measurements such as body height and body weight as well as their erythrocytary parameters. Their body height was measured bare-foot by means of a Holtain Ltd-branded height measuring device (sensitivity: 0.01 cm) in centimetre terms while body weight was measured in kg terms by means of an electronic weighing machine. The formula, Body Weight (kg) / Height (m$^2$), was used in finding the body mass index. Volunteers were lectured not to take in any food or drink after 10:00 PM before the day when their blood samples would be taken. Blood samples were taken at 8:00-9:00 AM in the laboratory. Blood samples of the participating volunteers that were taken from the forearm antecubital area into 5 ml EDTA tubes in line with the hygiene rules were analyzed by means of a blood counting device (branded as architect) in the central laboratory for their haematological levels such as red Blood Cells (RBC), Haemoglobin (HBG), Haematocrit (HCT), Mean Red Blood Cell Volume (MCH), Mean Cell Haemoglobin (MCH), Mean Cell Haemoglobin Concentration (MCHC), Red Blood Cell Distribution Width (RDW).

The data were evaluated through the IBM SPSS Statistics package software. The Shapiro-Wilk test was applied to see whether or not the data were regularly distributed. The measurement results were presented as arithmetic average ($\bar{x}$) and standard deviation ($S_D$). The T-Test for Independent Groups was used for comparison of the groups. Level of significance was taken as $p<0.05$.

**RESULTS**

As we analyzed Table 3, we observed that physical measurement values such as height and body weight were higher in sedentary subjects and the difference was significant ($p<0.05$).

When we analyze Table 4 and Graphic 1, we see that erythrocytary parameters such as Red Blood Cell (RBC), Haemoglobin (HBG), Haematocrit (HCT), Mean Red Blood Cell Volume (MCH), Mean Cell Haemoglobin (MCH), Mean Cell Haemoglobin Concentration (MCHC) and Red Blood Cell Distribution Width (RDW) are higher in athletes, which is a significant difference ($p<0.05$).
Table 4: Distribution of Participating Groups according to Erythrocytary Parameters

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group</th>
<th>n</th>
<th>Mean</th>
<th>S_d</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBC</td>
<td>S_1</td>
<td>28</td>
<td>5.27</td>
<td>0.54</td>
<td>2.091</td>
<td>0.042</td>
</tr>
<tr>
<td></td>
<td>S_2</td>
<td>21</td>
<td>4.97</td>
<td>0.43</td>
<td>2.160</td>
<td>0.023</td>
</tr>
<tr>
<td>HGB (g/dL)</td>
<td>S_1</td>
<td>28</td>
<td>14.87</td>
<td>1.96</td>
<td>2.355</td>
<td>0.023</td>
</tr>
<tr>
<td></td>
<td>S_2</td>
<td>21</td>
<td>13.69</td>
<td>1.38</td>
<td>2.474</td>
<td>0.008</td>
</tr>
<tr>
<td>HCT (%)</td>
<td>S_1</td>
<td>28</td>
<td>46.16</td>
<td>6.75</td>
<td>2.790</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>S_2</td>
<td>21</td>
<td>41.52</td>
<td>4.04</td>
<td>2.988</td>
<td>0.009</td>
</tr>
<tr>
<td>MCH (pg)</td>
<td>S_1</td>
<td>28</td>
<td>28.96</td>
<td>1.99</td>
<td>2.740</td>
<td>0.013</td>
</tr>
<tr>
<td></td>
<td>S_2</td>
<td>21</td>
<td>27.04</td>
<td>2.90</td>
<td>2.599</td>
<td>0.013</td>
</tr>
<tr>
<td>MCHC (g/dL)</td>
<td>S_1</td>
<td>28</td>
<td>32.22</td>
<td>2.02</td>
<td>-2.568</td>
<td>0.013</td>
</tr>
<tr>
<td></td>
<td>S_2</td>
<td>21</td>
<td>33.63</td>
<td>1.72</td>
<td>-2.630</td>
<td>0.000</td>
</tr>
<tr>
<td>RDW-CV (%)</td>
<td>S_1</td>
<td>28</td>
<td>13.74</td>
<td>0.70</td>
<td>4.764</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>S_2</td>
<td>21</td>
<td>12.23</td>
<td>1.46</td>
<td>4.349</td>
<td>0.000</td>
</tr>
<tr>
<td>RDW-SD (fL)</td>
<td>S_1</td>
<td>28</td>
<td>44.83</td>
<td>8.93</td>
<td>8.185</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>S_2</td>
<td>21</td>
<td>28.33</td>
<td>2.61</td>
<td>9.258</td>
<td>0.000</td>
</tr>
</tbody>
</table>

DISCUSSION AND CONCLUSION

In this study aiming at comparing blood erythrocytary parameters in athletes who have been doing sports in various branches for at least five years and sedentary university students in the same age group, it was observed that erythrocytary parameters of athletes were higher than that of sedentary students. It is supported by the literature that the difference is due to the physical activity level of athletes [4]. Despite the fact that there are contradictory results coming from the studies on blood cells, a comparison of the findings of this study with the findings of other studies on this topic helped us see differences and similarities.

In this study, values concerning erythrocytary parameters were found to be higher in athletes. There can be a slight decrease in blood volume due to the fluid loss [2]. Athletes in intensive exercise programs are characterized by a decrease in their Haemoglobin and Haematocrit levels, which is also considered as athletic anaemia [11]. Magazanik et al. studied chronic effects of exercise and found a decrease in red erythrocytary parameters [12]. Nieman et al. stated that there was an increase in haemoglobin values of sedentary subjects after exercise [13]. Ünal found out a significant increase in haemoglobin values of subjects after an eight-week aerobic exercise program [14]. Arslan et al. reported that Haematocrit and red blood cell values of elite athletes were higher than that of the control group [15]. Patlar and Keskin found out that sub-maximal exercise had a significant impact on WBC, RBC, HGB and HCT levels [16].

In reality, competitive professional athletes use much longer training periods divided in sub-phases aimed at specific goals. So far, only our recent studies have presented the changes in purine metabolism in a 1-yr training cycle in middle- and long-distance runners, taking into consideration the quantity and quality of training loads [17].
In the present study, we demonstrated a considerably lower resting and post-exercise plasma concentration of Hx in highly trained sprinters than in triathletes in four characteristic training phases of the 1-yr cycle. In both groups, a significant decrease in plasma Hx concentration in the competition phase and a considerable increase in the transition phase were observed suggesting reduced Hx release from muscle into plasma. It was also found that the resting erythrocyte HGPRT activity increases in the competition period, when athletes incorporate more high-intensity exercise in their training and declines in the transition (detraining) phase. Sprinters showed higher HGPRT activity in all examinations [18].

Although this study showed a significant difference between athletes and sedentary subjects in terms of MCHC levels, Rietjens et al. [19] conducted a study on eleven Olympic athletes and found no significant change in MCHC parameters of subjects in pre-season and post-season periods. Ercan et al. figured out an increase in post-exercise red blood cell count compared to the pre-exercise level in long-term endurance run [7].

Ibiş et al. did not find any significant change in any haematological value after aerobic exercise while they found non significant increases in Hb, Hct and WBC values right after anaerobic exercise and significant decreases in 24 hours thereafter. When we compare the same time periods of the two exercises, decreases and increases in anaerobic exercise were found to be more significant. They also reported that intensive exercise has more impact on haematological parameters than moderate exercise does, which is due to the change in Haematocrit level associated with the decreased blood plasma volume during and after exercise [20].

Ricci et al. stated that haematological parameters went down after chronic exercises [8]. Çakmakçı conducted a study on taekwondo players and stated that there was not a significant difference in haemoglobin and Haematocrit parameters in pre-camp and post-camp blood samples [21]. Kara et al. suggested that there was not any statistically significant difference in haemoglobin, Haematocrit and red blood cell values of elite athletes in two different branches [22].

Findings of Arslan et al. [15] and Dinçer et al. [23] support our findings. It is considered to be the level of physical activity that ensures that the erythrocytary parameters of athletes are higher than those of sedentary people.

As a conclusion; although increasing and decreasing values were found in blood haematological levels of the participating subjects, most of the variables fall within the normal reference ranges and the significant difference between the two groups is deemed to be rising from the physical activities conducted and the life qualities of individuals.

REFERENCES


