HEMATOLOGICAL AND BIOCHEMICAL PARAMETERS IN ROMANIAN JUNIOR FOOTBALL PLAYERS

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Received: 1 February 2010 Modified 6 February 2010 Accepted 12 February 2010

SUMMARY

Twenty-two junior footballers were evaluated at the beginning (T1) and at the end of competition season (T2) in respect to the responses of their hematological and biochemical parameters to the football specific training program and high level competition season. Hematocrit and serum magnesium level were significantly decreased from T1 to T2 and the monocytes were significantly increased. We consider that these results occurred due to plasma volume changes and magnesium loss in accordance to the specific characteristics of the football competition season.

Keywords: hematological and biochemical parameters, junior football players.

INTRODUCTION

Training is one of the used methods to improve the exercise performance, but too much intensive training and competition may also cause some adverse effects on the health
The health benefits of engaging in regular physical activity are widely known: enhanced cardiorespiratory fitness, increased muscular strength and endurance and favorable cholesterol and other profiles. Nevertheless, particularly in youth sports programs, the competitive sport imposes substantial energy, mechanical, mental and emotional burdens on the human. This reflects, among other things, on a number of biochemical and hematological properties, which display significant differences between athletes and non-athletes in blood samples collected at rest.

Some studies demonstrate the presence of oxidative stress and muscular damage in physiological conditions in sportsmen revealed by an increased formation of free radicals in young subjects in sporting competition and a strong decrease in some trace elements such as calcium and magnesium [1-8].

Many trace elements participate in physiological and biochemical events in the human body, especially being active in lipid and protein metabolism. From this point of view, it becomes important to observe whether training and competition affect the functions of these elements or not. For example, strong changes in plasma or serum trace elements have been noticed revealing magnesium insufficiency [4-7], increased renal calcium excretion and also increased intestinal calcium absorption [8]. Anyway, for these elements the published data are often contradictory regarding the translation of their concentrations into physiological effects.

Most prominent among investigated hematological parameters for sportsmen are: hemoglobin (HGB), hematocrit (HCT), mean corpuscular volume of erythrocyte (MCV), mean volume of thrombocite (MPV), mean corpuscular hemoglobin concentration (MCHC), mean corpuscular hemoglobin (MCH), leukocytes (WBC), eosinophils (EOS), lymphocytes (LYM), monocytes (MON), granulocytes (GRA) and platelets (PCT). Also, the most investigated biochemical parameters are the serum content of calcium ([Ca]), magnesium ([Mg]), glucose, creatinine and urea.

The aim of this study is to investigate the haematological and biochemical parameter values of junior Romanian football players and to emphasis the effects of football playing at competition level on these parameters.
Methodology

The study subjects were 22 male football players aged 16-19 years, all of them being members of the same team FC Politehnica 1921 Timisoara and competing at national level. The footballers were previously informed of all experimental procedures and provided a written consent which was also approved by the Club Ethics Committee. Subjects were evaluated at the beginning (test T1, 02.09.2008) and at the end (test T2, 03.07.2009) of the training and competing period. They were instructed to not engage in strenuous activity the day before the measurements and to maintain routine regarding their training, sleeping and diet. The subjects do not take nutritive supplements in order to improve their hematological and biochemical parameters.

The blood samples have been collected at rest at 7:30 a.m. via the median antebrachial vein into vacutainer tubes containing the anticoagulant EDTA. The hematological (HGB, HCT, MCV, MPV, MCH, MCHC, PCT, WBC, LYM, MON, GRA, EOS) and biochemical (serum content of calcium, magnesium and creatinine) parameters were analyzed in automated equipment (which is checked daily by internal quality protocol and monthly by an external protocol as the Romanian law requires) approximately 2 hours after blood drawing.

All the investigated hematological and biochemical parameters were than compared to the standard values presented in specific literature and than they were the subject of a statistical analysis. In order to analyze the statistical significance between the mean values for the two tests we have used both Student and one-way ANOVA statistical tests implemented under ORIGIN7 program.

Results

The mean values of the investigated hematological parameters are presented in the Table I (which also contains the references values for these parameters) and the histograms of investigated biochemical parameters are presented in the Figures 1-3.
Tabel I. The average values of the investigated hematological parameters compared to the reference values

<table>
<thead>
<tr>
<th>Test/Parameter</th>
<th>Test T1</th>
<th>Test T2</th>
<th>Significant statistical difference (p&lt;0.05)</th>
<th>Reference values</th>
</tr>
</thead>
<tbody>
<tr>
<td>HGB (g/dL)</td>
<td>15.1±1.28</td>
<td>14.63±0.61</td>
<td>NO</td>
<td>11.5÷17</td>
</tr>
<tr>
<td>HCT (%)</td>
<td>43.66±1.35</td>
<td>41.50±1.58</td>
<td>YES</td>
<td>35÷51</td>
</tr>
<tr>
<td>MCV (fL)</td>
<td>84.88±3.51</td>
<td>82.92±2.06</td>
<td>NO</td>
<td>80÷100</td>
</tr>
<tr>
<td>MPV(fL)</td>
<td>6.61±1.29</td>
<td>6.68±1.23</td>
<td>NO</td>
<td>6÷10</td>
</tr>
<tr>
<td>MCH (pg)</td>
<td>29.67±1.83</td>
<td>28.52±0.69</td>
<td>NO</td>
<td>27÷32</td>
</tr>
<tr>
<td>MCHC (g/dL)</td>
<td>34.97±1.11</td>
<td>34.49±0.42</td>
<td>NO</td>
<td>32÷36</td>
</tr>
<tr>
<td>WBC.10^9 (g/L)</td>
<td>7.21±1.28</td>
<td>6.64±1.38</td>
<td>NO</td>
<td>5÷10</td>
</tr>
<tr>
<td>PCT (%)</td>
<td>0.15±0.04</td>
<td>0.16±0.03</td>
<td>NO</td>
<td>0.08÷1</td>
</tr>
<tr>
<td>LYM (%)</td>
<td>35.82±7.96</td>
<td>34.76±5.81</td>
<td>NO</td>
<td>25±35</td>
</tr>
<tr>
<td>MON (%)</td>
<td>5.33±1.23</td>
<td>7.00±1.38</td>
<td>YES</td>
<td>1±9</td>
</tr>
<tr>
<td>GRA (%)</td>
<td>58.86±8.41</td>
<td>58.53±6.31</td>
<td>NO</td>
<td>55÷75</td>
</tr>
<tr>
<td>EOS.10^9 (g/L)</td>
<td>0.7</td>
<td>0.7</td>
<td>NO</td>
<td>0÷0.7</td>
</tr>
</tbody>
</table>

![Figure 1. The histogram of the serum calcium content](image)

The reference values for the investigated biochemical parameters are: 8.4÷10.4 mg/dL for the serum calcium content [8], 1.6÷2.3 mg/dL for serum magnesium content [9] and 0.8÷1.5 mg/dL for the serum creatinine content [10]. Almost all the registered values for the serum calcium content were in the limits of the reference values both before and after the training and competing period.

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Figure 2. The histogram of the serum magnesium content

For the serum magnesium content we notice a considerable decrease after the training and competing period and the serum creatinine content is close to the minimum normal value for a big part of subjects for the both T1 and T2 tests.

DISCUSSIONS AND CONCLUSIONS

In spite the HCT and MON, the other investigated hematological parameters remained in the same range for the two tests. The HCT value is decreased and the MON value is increased and this observation is in good correlation with other published data.
showing that endurance training causes a decrement in hematocrit [5, 12-14]. There are also published data revealing plasma volume reduction in response to chronic exercise for Brazilian soccer players [13] or that there are no alterations in the hemoglobin and hematocrit during different periods of training [15].

Leukocytes, lymphocytes and eosinophils were stable during the study, but monocytes were increased. The published data reveal that the intense and prolonged exercise training usually does not affect the immune system [13, 16-18]. The increase in monocytes could be an isolated result, the registered values are in the reference interval and they may not be considered as an indicative of disease. Also, reference values of hematological and biochemical variables specific for sportsmen have rarely been defined, and those used for the general population are also applied to them. The use of reference intervals based on general populations is not recommended in sports medicine, to avoid misinterpretation of data and also additional, unnecessary investigations.

The differences between our results and those mentioned above could occurred because of the characteristics of the training programs. The training program used for this team which includes the development of specific physical capacities (endurance, strength, sprint, power and jump) is most responsible for the alteration in monocytes and hematocrit. We must mention here that we did not take into consideration the ambient temperature, the relative humidity and the liquid ingestion that may cause hypohydration and influence the plasma volume adaptation to exercise with direct consequences for the hematological parameters.

Regarding the biochemical parameters, there are significant differences in the serum magnesium level, which is strongly decreased after the competing season. The registered values of serum magnesium after the competing season are usually lower than the minimum reference values. It is an important observation as magnesium is regarded as a substance increasing the physical performance magnesium insufficiency may negatively affect the energy metabolism and physical work capacity [19]. During strenuous exercises, magnesium can be lost in sweat [20] and urine [3] and even the use of magnesium supplements was not effective in preventing magnesium insufficiency during a athletes [22].

The concentration of creatinine in serum is the most widely used and commonly
accepted measure of renal function [23] and muscle injury [24] in clinical medicine. The common reference interval for creatinine in the general population corresponds to 0.7–1.3 mg/dL for adult males [3]. A few published data reveal high creatinine values for athletes, near or higher than 1.3 mg/dL [23, 25] and these higher values are not caused by training or extreme effort [24-26], but they are due to the fact that sportsmen usually have a higher muscle mass. In our case, the registered values of creatinine are close to the minimum of the reference value for the adult males indicating a normal renal function.

In conclusion, our research showed that the specific football training program led to a decrease in hematocrit and serum magnesium level and an increase in monocytes from T1 to T2. We explain these findings by the changes in the plasma volume and the magnesium loss due to the characteristics of the football training program and the high level competition season.

References