Haematological parameters of 2-year-old purebred Arabian racehorses in different periods of horse racing season

Abstract: Twenty-eight blood samples were collected from purebred Arabian racehorses. The results showed differences (p < 0.05) between some haematological and serum biochemical parameters in different periods of horse racing season.

Keywords: purebred Arabian racehorses, haematology and serum biochemistry parameters.

Introduction

Horse racing of purebred Arabian horses is an important part of international equestrian performance sport. IFAHR (The International federation of Arabian horse racing authorities) comprises more than 30 countries throughout the world. These are The Russian Federation, France, Germany, Belgium, United Arab Emirates, Qatar, Switzerland, United Kingdom, Austria, Holland, Saudi Arabia, Turkey, Poland and many more [8]. In most countries Arabian horses start their racing careers one year later than other breeds. Arabs can begin racing at the age of 3 because they develop slower than other breeds. Nevertheless in some countries (Russia, Qatar, Iraq, Sweden, Great Britain and some others). Arabian horses start racing at the age of 2. It is rather dangerous for a young immature organism [12].

In moderate climate in Russia horse-racing season continues from May to September [1; 11]. It’s a very dramatic period in the lives of 2-year-old race horses. Existing training programs imply rigorous exercise, the loading is very heavy. It can lead to dramatic effects, especially for horses that are not yet physically mature [12]. Good race performances are connected with extreme functioning of all horse organism systems. Adaptive sport changes can give greater chances of high race speed however it can provoke different functional illnesses. Overtraining, chronic microtrauma and other destructive changes can influence the tropism and the structure of different body tissues and organs. It can lead to trauma and diseases. If it happens before a horse achieves physical maturity, serious health problems can appear and be for life.

Haematological parameters are a very important part of complex body diagnostic. It is a sensitive indicator, since in most cases haematological and serum biochemical changes are determined by physiological alteration of organ systems [2, 333–334; 3, 409–414; 4, 391–398; 5, 29–30].

It is very important to frame a plan of horse training and performance, if you want to do it in a proper way, it is necessary to know the changes occurring in horse organism during the race season. There are three periods inside horse racing season: the beginning of a period (May – the first half of June), the middle (the second half of June – August) and the ending (September).

The purpose of the present study was to compare haematological and some serum biochemical values in different periods of race season.

Materials and Methods

Twenty eight blood samples were collected from 2-year-old purebred Arabian racehorses. The horses took part in Central Moscow Hippodrome races in 2012–2014 race seasons. Only clinically healthy animals were used. Blood samples were collected from each horse on the next morning (at 6 a.m.) after the racing.

Venous blood was analysed for hematocrit (HCT), hemoglobin (HGB), red blood cells (RBC), mean cell volume (MCV), mean cell haemoglobin (MCH), mean cell hemoglobin concentration (MCHC), platelets (PLT), white blood cells (WBC) and leucocytes; serum enzyme activities of creatine phosphokinase (CK), aspartate aminotransferase (AST), lactic dehydrogenase (LDH) and concentration of serum iron. An automated haematology analyzer MINDRAY BC-2300 was used to assess the parameters of complete blood cell count. Biochemical analyzer URIT — 8030 was used to assess serum biochemical values.

Statistical analysis was made with the help of statistics package SAS 9.4 и STATISTICA 10. Ultimate value of statistical significance level (p-level) 0.05.

Results and discussion

Our results show that some studied blood parameters have differences (p < 0.05) depending on the period of horseracing season (Table 1). The value of HCT, HGB, RBC, MCV MCHC, platelets and white blood cells did not vary during of racing season. Though red blood cell index — MCH (fig. 1) had maximal value in the beginning of season (May – the first half of June). Percentage of segmented neutrophil (Neut) was maximal during the middle period — 62.50 ± 1.54 % (fig. 2) which is more (p < 0.05) than in the beginning (48.63 ± 3.51 %) and in the ending (50.70 ± 2.98 %) of horse racing season. At the same time the percentage of lymphocytes (Lym) was minimal — 34.20 ± 2.00 % (fig. 3). These changes demonstrate stress leukocytosis which is associated with cortisol release in stressful situations. This hormone induces neutrophilia and lymphopenia. Neutrophilia derives from the mobilization of the marginal pool, the reduced ability to migrate from the blood to the peripheral tissues and the increased mobilization of the population of bone marrow reserve. Lymphopenia is the result of Lym sequestration from lymphoid tissues (Caracostas et al., 1981; Welles, 2000). This response can also be provoked by a great variety of pathological processes (Welles, 2000) [11, 584].
The activity of creatine phosphokinase and aspartate aminotransferase did not vary during the racing season. Serum LDH activity had maximal value (p < 0.05) in the middle and in the ending of horse racing season (Fig. 4). This enzyme is also used as indicator of skeletal muscle overtraining or damage during exercise [7, 389; 9, 77; 10, 432–433]. LDH catalyzes the conversion of lactate to pyruvic acid and back. Cells use it when oxygen is scarce. Lactic acid can damage muscle structure.
The level of serum iron was higher \( (p = 0.0173) \) — 37.66 ± 2.17 mmol/L during the middle period (fig.5). The most probable reason for that is supplementary feeding containing iron. So it should be avoided because iron deposit can have a very negative influence on different body processes \([6, 64–68]\).

The present study provides the evidence that the middle is the most exhausting period of horse racing season. Most of horse organism systems are functioning on the edge of their limits. That is why segmented neutrophil and LDH activity had such high values.

The studied racehorses show that the racing load is maximal in the middle. This is really important in practice especially for immature 2-year-old Arabian race horses because the same kind of test should be repeated from time to time during the race season.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean values ( (M ± m) )</th>
<th>p-level</th>
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<tbody>
<tr>
<td></td>
<td>The beginning ( (n = 8) )</td>
<td>The middle ( (n = 10) )</td>
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<tr>
<td>MCH, pg.</td>
<td>15.40 ± 0.17</td>
<td>14.92 ± 0.20</td>
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<tr>
<td>Neut, %</td>
<td>48.63 ± 3.51</td>
<td>62.50 ± 1.54</td>
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<tr>
<td>Lym, %</td>
<td>45.87 ± 3.11</td>
<td>34.20 ± 2.00</td>
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<td>LDH, U/L</td>
<td>301.00 ± 25.01</td>
<td>687.00 ± 100.45</td>
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<td>Serum iron, mmol/L</td>
<td>30.05 ± 1.89</td>
<td>37.66 ± 2.17</td>
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References: