BODY WEIGHT, HAEMATOCRIT VALUE, HAEMOGLOBIN CONTENT AND SELECTED BLOOD BIOCHEMICAL PARAMETERS IN 5-MONTH-OLD POLISH LONGWOOL LAMBS, IN RELATION TO SEX

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The aim of the studies was to determine the influence of sex on the level of selected blood haematological and biochemical indices in 5-month-old Polish Longwool lambs. The studies pointed to higher levels of the Ht indices and Hb content (P≤0.01), activity of ALT and AST transaminase, Mg, Fe, total iron binding capability and total protein (P≤0.01), and a lower level of Cu (P≤0.01) in the blood serum of male lambs.

Key words: Polish longwool sheep, body weight, blood indices, enzyme, Mg, Fe, Cu, lambs, sex

Haematological and biochemical studies of blood in sheep are carried on in many aspects. The most frequent ones are physiological state and health of sheep, season of the year, breed and utility type, evaluation of the adaptative capabilities of blood cellular and humoral systems in the early postnatal period (1,2,3,4,5,6,7,11,19), and others.

However, there is not too much said about the influence of sex on blood biochemical indices in the local population of sheep. Due to scarce reference data in the relevant literature on diagnostic studies performed in flocks of local breeds that have undergone modifications and transformations in recent years as a result of cross-breeding, it was decided to perform studies aimed at determining the influence of sex on the level of certain haematological and biochemical indices in a large population of lambs of the same breed at the age when steroid hormones become significant in achieving sexual maturation in this livestock species. It seems that sex included into diagnostic studies should contribute to more accurate evaluation of the results of the biochemical analysis performed.
Material and Methods

Studies included 2697 lambs of both sexes aged 5 months. They came from a flock of Polish Longwool sheep owned by the State Animal Breeding Centre at Bobrowniki. All lambs, i.e. 1305 ram lambs and 1392 ewe lambs, were kept under uniform conditions and fed the same fodder. Approximately 14 days before blood sampling the feeding rations contained the following components: hay, ground oat grain and legumes, and maize silage. The feeding ration was balanced in respect to energy and protein according to age and sex. The weigh of lambs was checked on the regular basis beginning from their birth up to the age of 5 months. The mean body weight at the age of 152 days and the body weight gains for ram lambs and ewe lambs in the selected periods are presented in Table 1.

Blood samples from lambs were collected only once at the age of 5 months. They were collected from the external jugular vein, in the early morning hours before feeding, in neutral thermal conditions. The haematocrit index (Ht) and the haemoglobin content (Hb) were determined in all samples. The total level of protein, and the activity of ALT and AST transaminase were determined in the blood serum. Furthermore, levels of magnesium (Mg), copper (Cu) and iron (Fe), with total iron binding capability (TIBC), were also determined. These indices were determined by the methods used in veterinary diagnostic tests described previously (1,12,13).

The obtained values were expressed in units appropriate for a given method according to International System of Units (SI). The statistical analysis within sexes was performed with the help of multiple factor analysis of variance (ANOVA) based on the least squares method using the LSMLMW computer programme [9]. The following sources of variation were considered in the calculation model: age on day of blood sampling, year of birth and type of birth; however, they were found to be insignificant, and thus omitted in further studies. The findings are composed in tables, in which are given the least squares means (LSM) and standard error (SE).

Results

A significantly higher (P≤0.01) value of Ht index as well as Hb content were observed in blood of ram lambs. This was also accompanied by a higher content of total protein, by 0.6 g/l, in their blood serum (P≤0.01). The activity of ALT and AST transaminase in the blood serum of ram lambs under the study was significantly higher (P≤0.01). The level of magnesium was extremely equalized in the blood serum of lambs of both sexes, amounting to 0.89 mmol/l ± 0.00 for ram lambs and 0.84 mmol/l ± 0.00 for ewe lambs (P≤0.01). The iron level determined in the study and the total iron binding capability were higher in the blood serum of ram lambs when compared with these values found in ewe lambs at the same time by 1.76 µmol/l and 5.96 µmol/l, respectively, for Fe and TIBC. The level of copper determined in the blood serum of ewe lambs exceeded that found in the blood serum of ram lambs by 1.12 µmol/l (P≤0.01).
Table 1
Haematological and biochemical indices analysed in blood of lambs according to sex (LSM, SE).

<table>
<thead>
<tr>
<th>Index</th>
<th>Ram lambs n = 1305</th>
<th></th>
<th>Ewe lambs n = 1392</th>
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<tbody>
<tr>
<td></td>
<td>LSM</td>
<td>SE</td>
<td>LSM</td>
<td>SE</td>
</tr>
<tr>
<td>Haematocrit (l/l)</td>
<td>0.322&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.011</td>
<td>0.317&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.011</td>
</tr>
<tr>
<td>Haemoglobin (mmol/l)</td>
<td>6.87&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.03</td>
<td>6.56&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.03</td>
</tr>
<tr>
<td>Total serum protein (g/l)</td>
<td>54.24&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.18</td>
<td>53.64&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.18</td>
</tr>
<tr>
<td>ALT (U/l)</td>
<td>9.19&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.12</td>
<td>7.93&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.11</td>
</tr>
<tr>
<td>AST (U/l)</td>
<td>38.11&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.17</td>
<td>37.11&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.16</td>
</tr>
<tr>
<td>Mg (mmol/l)</td>
<td>0.89&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.00</td>
<td>0.84&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.00</td>
</tr>
<tr>
<td>Fe (μmol/l)</td>
<td>30.29&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.20</td>
<td>28.53&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.21</td>
</tr>
<tr>
<td>TIBC (μmol/l)</td>
<td>94.95&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.68</td>
<td>88.99&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.68</td>
</tr>
<tr>
<td>Cu (μmol/l)</td>
<td>10.89&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.05</td>
<td>12.01&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.05</td>
</tr>
</tbody>
</table>

<sup>a</sup> - P ≤ 0.05;  <sup>A</sup>- P ≤ 0.01.

Table 2
Mean body weight of lambs and body weight gains in selected periods (LSM, SE).

<table>
<thead>
<tr>
<th>Periods of weighing (days)</th>
<th>Daily gain [ kg ]</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Ram lambs n= 1305</td>
</tr>
<tr>
<td></td>
<td>LSM</td>
</tr>
<tr>
<td>0 - 28</td>
<td>0.310&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
<tr>
<td>28 - 100</td>
<td>0.129&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
<tr>
<td>28 - 152</td>
<td>0.145&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
<tr>
<td>100 - 152</td>
<td>0.154&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
<tr>
<td>0 - 152</td>
<td>0.175&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
<tr>
<td>Body weight on day 152</td>
<td>31.4&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>A</sup>- P ≤ 0.01.
Discussion

The studies performed showed that sex of Polish Longwool lambs was the dimorphism producing factor as far as the standard values of haematological and biochemical blood indices estimated were concerned. Reasons for differences in the value of Ht indicators, Hb content and the level of total protein in the blood serum of lambs of both sexes at the age of 5 months presented in Table 1 should be suspected of the activity of steroid hormones. This happens most likely because during sexual maturation, between the 90th and 150th day of life of ram lambs, extremely strong changes in the reproductive system are observed (23,24), which is caused by the early sexual differentiation of gonads (16,17) and the secretion of testosterone (15) producing large cytological changes in the testicles (18). These changes are followed by somatic development of animals, and testosterone, influencing the body weight and daily weight gains (8), activates the protein metabolism, which is manifested in the blood metabolic profile.

Another reason for giving a statistically significant lower value of Ht index and Hb content in ewe lambs may lies in the secretion of estrogens, which constitute one of seven inhibitors of erythropoiesis (10), restraining the activity of marrow and reducing the number of erythrocytes and trombocytes.

The Polish Longwool sheep, including a flock coming from Bobrowniki due to the participation of Pomeranian breed and mutton-wool Texel sheep in its genotype (4), belong to a group of early-maturing sheep. It results from the previous studies conducted on the Kent and Blackheaded lambs that the Hb content and the activity of ALT and AST transaminase enzymes increases together with age (2), and may point at intensification of the protein metabolism (14). Also the level of total protein in the blood serum of mutton-wool lambs (including crossbreds with a high participation of Suffolk sheep in their genotype) was also higher when compared with animals representing other utility types (3,5). These findings corroborate a biological rule that higher body weight is found in ram lambs.

The level of Mg in the blood serum of 5-month-old ram lambs of Polish Longwool sheep was by 0.05 mmol/l higher than this value found in ewe lambs, and proved to be statistically significant (P≤0.01) with such a large number of animals. A higher level of Mg in the blood serum, exceeding 1 mmol/l, was observed in the first week of life when lamb feeding is based on milk of their mothers (5).

A statistically higher level of iron in the blood serum of ram lambs may contribute to higher daily gains of body weight and higher growth rate of that group of lambs. Iron is a crucial element in the processes of tissue oxidation, and cytochromes and non-heme iron compounds found in mitochondria are necessary for the process of oxidative phosphorylation and energy production. It was found in the studies on the influence of prenatal doses of iron on blood indices and the body growth weight in lambs of different breeds that all animals with intensive development during the juvenile period, ram lambs and lambs from twin births, were distinguished by their higher daily gains, and their demands for that mineral component were also higher. This is explained by lower amount of milk and additional demand for iron. The influence of iron injections on daily gains was
higher in Rhôn breed compared with lambs of Merino sheep, though the latter showed clearly higher growth of body weight during the experiment (22).

Single application of Fe with Ferrodex preparation or Ferrodex combined with vitamins A + D₃ positively affected body weight gains, number of erythrocytes, value of Ht index and Hb content in the blood of Polish Merino lambs in the period from 5 days of life to the age of three months (21). Also the value of total iron binding capability (TICB) estimated in these studies depended on the sex of lambs (P≤0.01), and corresponded with the data obtained earlier and linked with the phenotype of the potassium level (12).

Reasons for a higher level of Cu in the blood serum of ewe lambs in comparison with the content of that element in the blood serum of ram lambs (P≤0.01) should be suspected in the influence of estrogens. These hormones, apart from such factors as age, pregnancy and the quantitative ratio of copper absorbed by animals to molibden and sulphates, affect copper level in the blood serum (20).

Summarizing, one should state that differences in the level of the examined haematological and biochemical indices and certain elements determined during these studies and illustrating a different character of metabolism in both sexes, lie in the hormonal balance of lambs’ organism. There is thus a need to consider sex in diagnostic and clinical practice. This shall make clinical diagnosis of diseases easier, thereby rendering possibilities for better prophylaxis and efficient treatment.

References