Metabolic activity and the performance of ram hogs when consuming probiotic and sorption additives

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Abstract. The question arises of a rational method of feeding small cattle, which would ensure a high rate of their growth, development and production of meat products due to the fact that in recent years in Russia more and more attention has been paid to the development of sheep husbandry. It is economically feasible to use feed additives of various actions for this purpose, which determined the relevance of the topic of our study. The task was set to consider the effect of the sorbent Glauconite and the sorption-probiotic preparation Biogumitel in the diet of sheep of the Romanovskaya breed on the morphological and biochemical parameters of blood, as well as meat productivity. Scientific and economic experience was carried out in a farm located on the territory of the Volga Federal District of the Russian Federation on four groups of rams. Studies have shown that feeding the presented additives did not adversely affect the studied parameters. In addition, it was found that test rams gave higher reliable indicators of meat productivity when feeding Biogumitel and Glauconit supplements together at a dose of 0.1 g per 1 kg of live weight each. Further research is planned to be devoted to studying the quality of meat products, as well as adipose tissue of various localization.

1. Introduction
Sheep husbandry plays a significant role in providing the population of our country with food, as well as wool products. It is necessary to ensure that the necessary nutrients enter the animal body to get first-class meat and wool [1–3]. Meat products are in constant high demand and new types of meat products are being developed that meet current nutritional requirements and meet established quality and safety requirements [4–9]. The proper functioning of the digestive system and its symbiotic microflora has great influence on the assimilation of nutrients from the feed [10–12]. The task of full feeding is to give
animals all the necessary nutrients with the highest yield while not overloading the digestive tract, as the average capacity of the sheep’s stomach is 10.0% of the animal’s weight [13–16].

In practice, sheep are given a large amount of roughage, which contain a significant amount of fiber. This is due to the fact that such feeds as hay, straw, haylage are quite inexpensive feeds, thereby reducing the cost of daily allowance. The rumen microflora differs mainly in the poor species composition of the ciliates responsible for fiber utilization. Their number ranges from 252 to 674 individuals in 1 ml of cicatrical fluid. For comparison, it can be noted that the number of ciliates can reach from 53 thousand and up to 1 million ml in the rumen of cattle. Despite the low abundance, the fauna of sheep’s ciliates cannot be called oppressed, since there are many dividing and conjugating individuals especially in the rumen. The task of symbiotic microflora is to destroy the fibers of plant feed and carry out lysis from nutrients with the subsequent transformation into compounds more accessible to the body of the sheep. However, the symbiotic microflora may not be able to cope due to the large amount of fiber entering the feed, thereby reducing the amount of diet consumed and reducing the quality of the resulting products: meat, wool, milk. Various feed preparations such as pro and symbiotics are used in practice to reduce the burden on the digestive system [17–20]. This category of drugs has a direct effect on the quantitative composition of the rumen microflora using various mechanisms of exposure [21–25].

Prebiotics are a selectively fermentable ingredient that has a specific effect on the composition and amount of rumen microflora. Probiotics are microorganisms that have a positive effect on the scar fluid ecosystem. Symbiotics are a combination of pre and probiotics (medium + microorganisms). Sorbent additives are also used that reduce negative factors when feeding low-quality feeds In addition to drugs that affect digestion (mycotoxicoses, etc.) [25–27].

2. Materials and methods

The experiment was conducted on lambs with a population of 80 animals. Four groups of rams were formed, 20 animals in each. The diet of young animals of the 1st experimental group contained the Glauconite sorption mineral supplement at a dose of 0.10 g/kg of live weight, the 2nd experimental group included the Biogumitel probiotic supplement in the same dosage, and the 3d experimental group combined Glauconite and Biogumitel supplements. The control rams consumed only the main diet. The study of the composition of the feed, its residues was made according to generally accepted methods. Physiological control was carried out by taking blood samples from experimental animals for the content of red blood cells, white blood cells, hemoglobin, total protein and its fractions, as well as phosphorus, calcium, vitamin A using the appropriate generally accepted methods. Carcas traits were determined using the VIJ method by means of control slaughter of 3 rams from the group, in two age periods: 10 and 12 months.

3. Results

Feeding test sheep was organized in accordance with detailed standards, taking into account the physiological state and level of animal productivity. The diet in the stall period of the experimental sheep consisted of grass and grass hay - 0.2 kg, clover hay - 0.2 kg, grass clover flour - 0.19 kg, corn silage - 2.8 kg, barley - 0.22 kg, oats - 0.22 kg, dicalcium phosphate - 5.5 g, elemental sulfur - 1.5 g. In addition to the main diet, animals of the first experimental group received Glauconite at a dose of 0.1 g per 1 kg of live weight. The rams of the second experimental group received the preparation Biogumitel in a dosage of 0.1 g per 1 kg of live weight. In the 3 experimental group, both previously presented drugs were present. Calculation of the fed diet was carried out using the “Ration 2+” program, which allows not only to compile the diet, but also to analyze it [14, 23]. Sorption preparations fed with the diet showed a positive effect on changes in the morphological and biochemical parameters of blood (table 1).
Table 1. Morphological blood parameters of experimental rams.

| Index             | Group          | control | 1 experienced | 2 experienced | 3 experienced |
|-------------------|----------------|---------|--------------|--------------|--------------|
| Erythrocytes, 10^{12}/l |                | 7.02±0.07 | 7.44±0.12\(^a\) | 7.78±0.11\(^c\) | 7.86±0.10\(^c\) |
| Hemoglobin, g/l   |                | 98.39±0.42 | 99.97±0.33\(^a\) | 100.38±0.55\(^a\) | 100.58±0.35\(^b\) |
| Whitebloodcells, 10^9/l |              | 8.79±0.12 | 8.21±0.13\(^b\) | 7.83±0.07\(^c\) | 7.52±0.13\(^c\) |

\(^a\) – P≤0.05;  
\(^b\) – P≤0.01;  
\(^c\) – P≤0.001.

The number of red blood cells in the 1st experimental group increased by 5.98% (P≤0.05), in the 2nd experimental group by 10.82% (P≤0.001) and in the 3rd group by 11.96% (P≤0.001). Red blood cells in their composition have an iron-containing protein - hemoglobin, which is responsible for the transportation of oxygen to the body’s tissues. Given the fact that the level of red blood cells in experimental animals increased, the amount of hemoglobin also increased. Animals of the 1st experimental group showed an increase in the studied parameter by 1.60% (P≤0.05), the 2nd experimental group by 2.02% (P≤0.05) and the 3d experimental group by 2.23% (P≤0.001). The level of leukocytes in all experimental groups tended to decrease. As noted above, the 2nd and 3rd experimental groups received the preparation Biogumitel, which included probiotic strains of Bacillus subtilis bacteria. A number of studies have found that Bacillus subtilis bacteria produce substances that have immunomodulatory properties. One of the synthesis products is low molecular weight compounds - cytokines that have a direct effect on the cells of the immune system, acting as peculiar regulators: the concentration of cytokines affects the interaction of individual parts of the immune system, and therefore the general state of immunity. Therefore, feeding Biogumitel to the 2nd and 3d experimental groups had a regulatory effect on the cellular and humoral immunity of animals. The decrease in the number of leukocytes in the 2nd experimental group was 10.92% (P≤0.001), and 14.44% (P≤0.001) in the 3rd experimental group. The decrease in the number of leukocytes in 1st experimental group was at the level of 6.59% (P≤0.01). It should be noted that the decrease in the number of leukocytes was within the lower boundary of the physiological norm (from 6 to 16*10^9/l).

Thus, a decrease in the number of leukocytes in the experimental groups showed that, with changing weather conditions (lowering the temperature), young animals showed a more labile response than the rams of the control group, which in turn indicates a better manifestation of adaptive plasticity.

Conducted biochemical studies of blood of rams of the Romanovskaya breed showed significant changes in protein metabolism (table 2).

Table 2. Biochemical blood parameters of experimental rams.

| Index             | Group          | control | 1 experienced | 2 experienced | 3 experienced |
|-------------------|----------------|---------|--------------|--------------|--------------|
| Total protein, g/l |                | 61.53±0.39 | 62.25±0.50 | 63.17±0.96 | 63.93±0.60\(^b\) |
| Albumin, g/l      |                | 22.40±0.40 | 22.77±0.17 | 23.18±0.89 | 23.52±0.68 |
| Globulins, g/l    |                | 39.07±0.41 | 39.48±0.40 | 39.66±1.29 | 40.02±0.93 |
| α - globulins, g/l |                | 12.29±0.20 | 12.35±0.07 | 12.40±0.10 | 12.44±0.09 |
| β - globulins, g/l |                | 7.06±0.04 | 7.20±0.03\(^a\) | 7.25±0.03\(^b\) | 7.29±0.03\(^b\) |
| γ - globulins, g/l |                | 19.72±0.52 | 19.93±0.30 | 20.00±1.38 | 20.29±0.90 |
| Calcium, mmol/L   |                | 12.12±0.05 | 12.14±0.06 | 12.16±0.04 | 12.17±0.05 |
| Phosphorus, mmol/L |                | 6.65±0.04 | 6.67±0.02 | 6.68±0.02 | 6.70±0.03 |
| Vit. A, mmol/l    |                | 2.74±0.07 | 2.77±0.03 | 2.79±0.06 | 2.81±0.05 |

\(^a\) – P≤0.05;  
\(^b\) – P≤0.01.
The amount of total protein was higher in animals of the experimental groups. In the 1st experimental group this indicator increased by 1.17%, in the 2nd experimental one by 2.66% and in the 3rd experimental one by 3.90% (P≤0.01). The rams of the experimental groups showed the following increase in the number of albumin compared to the control group: 1.65%, 3.48% and 5.0%. The conducted intergroup analysis on the content of globulins showed the superiority of the experimental rams over the control ones (1.04%, 1.51%, 2.43%). The studies showed an increase in the number of globulins in experimental animals, and then their fractional component increased accordingly. The number of α-globulins increased in the 1st group by 0.49%, in the 2nd group by 0.89% and in the 3rd group by 1.22%. It was found that the β-globulin fraction had a significant increase. The number of β-globulins in the 1st experimental group increased by 1.98% (P≤0.05), in the 2nd experimental group by 2.69% (P≤0.01) and in the 3d experimental group by 3.26% (P≤0.01). The content of γ-globulins tended to increase in animals of all the studied groups, which is explained by the mobilization of the body's defenses in the winter. The studied protein fraction in experimental rams increased by 1.06%, 1.42%, 2.89%, respectively. Studying mineral metabolism, it was found that the animals of the experimental groups had a slight superiority over the control of the content of calcium and phosphorus in the blood serum. The intergroup difference did not exceed 1.0%. The content of vitamin A in the serum of experimental rams was higher compared with animals in the control group. The level of retinol in group 1 increased by 1.09%, in group 2 by 1.82% and in group 3 by 2.55%. The most complete assessment of meat productivity and the features of its formation can be made only by the quantity and quality of meat products obtained after slaughter of animals, at the age of 12 months (table 3).

Table 3. Meat productivity of experimental rams, 12 months.

| Index                  | control          | 1 experienced | 2 experienced | 3 experienced |
|------------------------|------------------|---------------|---------------|---------------|
| Slaughtermass, kg      | 39.60±0.029      | 41.42±0.036c  | 42.45±0.028c  | 43.31±0.042c  |
| Slaughterweight, kg    | 19.05±0.030      | 20.09±0.037c  | 20.89±0.035c  | 21.70±0.055c  |
| Slaughteryield,%       | 48.10±0.043      | 48.50±0.057   | 49.20±0.057   | 50.10±0.079   |
| Carcassweight, kg      | 18.61±0.020      | 19.60±0.028c  | 20.34±0.032c  | 21.05±0.042c  |
| Mascarayield,%         | 47.00±0.018      | 47.33±0.036   | 47.91±0.043   | 48.60±0.050   |

c – P≤0.001.

Rams, consuming together sorption and probiotic additive were characterized by the greatest pre-slaughter mass. This indicator was higher in the 1st experimental group by 4.59% (P≤0.001), in the 2nd experimental group by 7.20% (P≤0.001), in the 3d experimental group by 9.37% (P≤0.001) compared with the control group. A similar pattern is established by the mass and output of the hot carcasses. The slaughter mass of rams of the 1st experimental group increased by 5.46% (P≤0.001), 2nd experimental group by 9.66% (P≤0.001) and 3d experimental group by 13.91% (P≤0.001). The slaughter yield was respectively higher in the experimental groups: in the 1st group by 0.40%, in the 2nd group by 1.10% and in the 3rd group by 2.0%, and the mass of hot carcass by 5.32%, 9.30%, 13.11% (P≤0.001). The obtained data on meat productivity indicate high slaughter rates of rams of all experimental groups.

4. Conclusion
Thus, the introduction of Glauconite and Biogumitel into the ration of animals allowed the rams of the Romanovskaya breed to increase meat productivity. In the course of studies, it was found that animals treated with both drugs showed better results than those who received them separately. The fed preparations had a synergistic effect on the body of the rams of group 3, which was proved by hematological studies. An increase in the amount of total protein and its fractions in experimental animals 2 and 3 clearly demonstrated that the administration of a probiotic separately and in conjunction with a sorbent not only affects the level of protein supply, but also increases the body's defenses due to an increase in the number of γ-globulins that transport various antibodies.
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