Adaptive and productive effects when using bacteria of the genus bacillus as the basis of a feed additive on a rabbits model

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Abstract. When analyzing the effect of a feed additive based on bacteria of the genus Bacillus on adaptive and productive effects on rabbits, it was found that the most effective dosage is 2 g per rabbit for 30 days. There was an increase in the live weight of rabbits by 5.1% and the slaughter yield by 7.5%. The effect on the biological value of rabbit meat was manifested by an increase in the protein content and amounted to 25.12±1.11 g per 100 g, the fat content in the muscles decreased by 33.8% compared to the control group, which indicates higher dietary properties of rabbit meat in the experimental groups.

1. Introduction
The rabbit industry is one of the main sources of supply of dietary meat to the population. Rabbits are characterized by precocity, high fecundity and significant potential for use in the food industry. The diet of animals is a key factor that determines the composition of meat, so getting high-quality products is possible with the organization of balanced feeding and maintenance [1].

The health and productivity of animals depends on many factors, one of which is the state of the symbiotic microflora inhabiting the gastrointestinal tract [2]. An unbalanced diet, the provision of low-quality animal feed, and the unjustified use of antimicrobial and other medicines in veterinary practice lead to a violation of the normal microflora of the digestive canal, which provokes the development of diseases and reduced productivity [3].

With the large-scale use of antibiotics to increase the yield of products, the rapid formation of antibiotic-resistant strains of microorganisms, including those dangerous to humans, occurs. Preventive antibiotic therapy leads to a violation of the microecological balance of the intestinal microflora, which contributes to the dominance of pathogenic microorganisms and accelerates the development of mutations of opportunistic flora that acquire toxic properties [4, 5]. After numerous studies, many antibiotics were banned in Europe. However, it should be understood that a complete rejection of antibiotics in the Russian Federation is now impossible. In this regard, all over the world and in Russia there is a need to look for an alternative to antibiotic drugs. Today the increase in production of organic agricultural products is possible by using fodder biologically active additives (probiotics, prebiotics,
synbiotics) that contribute to the normalization of quantitative and qualitative microflora of the digestive tract of animals and can be an alternative to antibiotic feed additives. The development of approaches to optimizing metabolic processes in animals through the use of feed additives, including probiotic ones, contributes to the preservation of livestock, reducing feed conversion, improving digestive processes, preventing diseases of the gastrointestinal tract, increasing non-specific resistance, activating metabolism, and increasing growth and productivity [6, 7]. The use of probiotic additives in the cultivation of animals, including rabbits, contributes to the production of safe and environmentally friendly products, since probiotic producers and their metabolites are safe for the environment and do not accumulate in the organs and tissues of animals [8, 9].

One of these additives is a feed additive containing a complex of live spore – forming bacteria of the genus Bacillus, lysates of lactic acid bacteria and yeast – saccharomycetes, sorbed on plant fibers.

The aim of the study was to determine the effectiveness of the feed additive in rabbit breeding. The objectives of the study were to determine the optimal dose of the feed additive and its effect on the dynamics of growth and development of rabbits, as well as to evaluate the effectiveness of the use of the feed additive on the productive qualities of rabbits.

2. Materials and methods
Experimental studies were conducted on rabbits of the "Soviet chinchilla" breed in the conditions of a personal farmstead in the Moscow region.

The study was conducted on 24 rabbits aged 45 days, divided into 3 groups of 8 heads each:
Group 1 (experimental) – feed additive was administered orally at a dose of 2 g per rabbit for 30 days;
Group 2 (experimental) – feed additive was administered orally at a dose of 5 g per rabbit for 30 days;
Group 3 (control) – intact, feed additive was not used.

The study groups included rabbits weighing 2.3-2.5 kg. All groups were formed according to the principle of analogous groups by gender, age, and average live weight.

Rabbits were kept in groups in cages. Feeding and watering of rabbits was carried out according to the scheme used in a personal subsidiary farm, and met the physiological needs of animals. Granulated feed was used as the main diet. Animals of all experimental groups received food without restrictions. Feed consumption and consumption were recorded daily. Drinking was carried out from nipple drinkers without restrictions.

Before starting the study, rabbits were weighed, their physiological parameters were evaluated, and hematological parameters were examined. Blood was taken from the ear vein. The effectiveness of the feed additive was evaluated by live weight gain and hematological parameters. To study the productivity of rabbits at the end of the experiment, a control slaughter was carried out after a 12-hour starvation diet and 5-hour exposure without drinking 4 heads from each group. Meat qualities of rabbits were evaluated by such indicators as live weight, slaughter weight and yield of slaughter weight.

Statistical processing was carried out taking into account the reliability of data (p ≥0.05) using the method of variation statistics using the Microsoft Excel program.

3. Result and discussion
As a result of studies on rabbits, it was found that the feed additive is well tolerated in various doses – from 2 to 5 g. During the clinical examination of experimental rabbits, physiological parameters were normal, no deaths were noted. Indicators of temperature, pulse and respiration in animals of the control and experimental groups were within the physiological norm for this type of animal.

Data analysis showed that rabbits of the 2nd experimental group had the highest growth rate. It was found that the use of feed additives contributed to an increase in live weight gain by 5.1% in rabbits of the 1st experimental group and by 3% in the 2nd experimental group compared to control animals (table 1).
Table 1. Dynamics of rabbit body weight (n=8).

| Group                  | Body weight, g | Average daily weight gain, g | Dressed weight, g |
|------------------------|----------------|-----------------------------|------------------|
|                        | beginning of the experience | end of experience |                      |
| 1 group (experience)   | 2447±5.7       | 2987±8.7                    | 1935.6±9.6       |
| 2 group (experience)   | 2486±6/3       | 2928±10.5                   | 1841.7±6.9*      |
| Control                | 2491±4.9       | 2843±9.4                    | 1526.7±7.3       |

*a P ≤ 0.05.

When analyzing hematological parameters, it was found that the blood parameters of rabbits of the experimental groups that received a feed additive in different doses did not have significant differences with the control animals (table 2).

Table 2. Hematological indicators of rabbits (n=8).

| Indicator          | Day 1 – start of the experience | 30th day of experience | 1 group (experience) | 2 group (experience) |
|--------------------|--------------------------------|------------------------|---------------------|---------------------|
| Hemoglobin, g/l    | 117.1±3.4                      | 118.3±4.1              | 121.5±7.71          | 119.9±1.7          |
| Erythrocytes, 10¹²/l| 4.91±0.41                      | 4.99±0.17              | 5.08±0.18*          | 5.03±0.12          |
| Leukocytes, 10⁹/l  | 5.57±0.11                      | 5.76±0.21              | 5.69±0.09           | 5.90±0.61          |

*a P ≤ 0.05.

It was also found that the biological value of meat changed under the influence of feed additive. In the experimental groups that received a feed Supplement, the protein content in muscle tissue is higher compared to the control group (table 3).

Table 3. Chemical composition of rabbit meat (n=8), g/100 g.

| Indicator  | Groups | 1 group (experience) | 2 group (experience) |
|------------|--------|----------------------|----------------------|
| Dry matter | Control| 37.23±2.31           | 35.52±1.84           | 36.09±1.73         |
| Protein    | Control| 22.01±1.07           | 25.12±1.11*          | 24.38±0.76         |
| Raw fat    | Control| 14.16±1.06           | 13.37±0.88           | 10.67±0.95*        |
| Raw ash    | Control| 1.06±0.09            | 1.03±0.06            | 1.04±0.05          |

*a P ≤ 0.05.

The highest protein content was observed in the meat of rabbits of the 1st experimental group (25.12±1.11 g per 100 g), which received a feed additive at a dose of 2 g. Quantitative indicators of fat in the muscles of rabbits of the experimental groups decrease relative to the control analogues – in the 1st group by 33.8%, in the 2nd group by 24.6% (P ≤ 0.05). All this points to higher dietary properties of rabbit meat in the experimental groups.

4. Conclusions

As a result of studies on the tolerability and effectiveness of the use of feed additives in various doses on rabbits, no systemic changes in the animal body were noted. Physiological indicators for the entire period of observation were within the limits of the standards typical for this type of animal.

Against the background of the introduction of feed additive in animals of the 1st and 2nd experimental groups, compared with control animals, there was an increase in live weight by 5.1% and 3%, respectively. In rabbits of the experimental groups, the dressed weight was also higher than in the control group – by 7.5% in group 1 and by 5.6% in group 2.
Hematological parameters in rabbits of all groups were within the physiological norm and did not have significant differences.

When using a feed additive, the biological value of rabbit meat increased. In the muscle tissue of rabbits of the experimental groups, the amount of protein increased against the background of a decrease in fat. The maximum effect on improving the quality of rabbit meat and its nutritional values in the group that received the feed additive at a dose of 2 g per rabbit for 30 days.

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