

Prospects for the use of probiotic dietary supplements in compound feed for young rabbits

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Abstract. The effectiveness of the feed additive "Enzimsporin", which has probiotic properties, was assessed in the process of fattening young rabbits of the hybrid breed "Hikol" in the industrial conditions of a rabbit breeding complex. The experiment was conducted in 2024 at the Lipetsk Rabbit LLC, where groups of clinically healthy animals were formed, selected at the age of 30 days after separating from female rabbits using the pair-analog method. The control individuals received standard compound feed, while the experimental groups used the same compound feed with the addition of "Enzimsporin" in the amount of 0.6 kg / t and 0.8 kg / t. The results showed a positive effect of the additive on growth and weight characteristics. By the 90th day of the experiment, the rabbits of the third group exceeded their relatives from the control group by 319 g (12.94%), and also exceeded the animals of the second group by 148 g (6.00%). The slaughter weight of carcasses of rabbits of the third group consuming compound feed with the introduction of 0.8 kg of the probiotic preparation "Enzimsporin" per 1 ton of compound feed exceeded this indicator relative to the control group by 264 g or 18.11%. The use of the feed probiotic "Enzimsporin" contributed to the accumulation of crude protein in muscle and a decrease in the mass fraction of fat in carcasses, this was especially clearly seen in the fleshy part of the carcasses of individuals of the 3rd group. As for the ash content, no reliably significant difference was recorded in the carcasses of all groups. Therefore, the use of "Enzimsporin" is a promising direction for increasing the productivity of rabbits in industrial rabbit breeding.

1 Introduction

Rabbit breeding is a promising branch of animal husbandry. Rabbits are characterized by high fertility and early maturity, which opens up significant prospects for obtaining meat raw materials with dietary properties in a short time. The most important moments in the reproduction cycle is maintaining the immune status of rabbits at all stages of growing,

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especially during the weaning period, when the stress load on the animal's body increases and growth energy decreases [1, 6, 10].

At the same time, there is an increasing need for the use of feed antibiotics, which, on the one hand, help reduce the development of pathogenic microflora, but on the other, lead to their accumulation in the animal's body, which reduces the safety of the obtained meat resources. As a replacement for feed antibiotics, it is possible to consider probiotic preparations that have a certain activity to suppress pathogenic microflora and regulate metabolic processes in the animal's body [2-3, 5].

The main purpose of breeding animals, including rabbits, is to create high-quality food products. Current data indicate that the consumption of meat and meat-containing products is approximately 48 kilograms per person per year, while the recommended minimum is at least 90 kilograms. The rabbit breeding industry stands out as particularly promising in the field of animal husbandry due to its ability to provide high-quality products. There is a global trend towards increasing the production of rabbit meat due to its dietary advantages over the meat of other domestic animals, including lower cholesterol content and better digestibility due to the fine fiber structure [4, 8]. One of the methods to improve the situation is to improve the feeding system, especially for young animals during their growth period, which contributes to an increase in meat productivity and product quality. Today, various feed additives, probiotics and anabolic drugs are widely used to improve the level of safety and quality of agricultural products. Inclusion of non-traditional feed additives in the diet of animals has a positive effect on metabolic processes in the body, improves feed absorption and the quality of the final product, thereby increasing productivity. These additives, although used in small quantities, significantly enhance metabolic processes, stimulate the functional reserves of the body, contribute to the formation of immunity, which, ultimately, has a positive effect on the overall level of productivity [9].

The limiting factors in the use of probiotic additives in the rabbit breeding industry are the lack of sufficiently complete information on the assessment of their effect on the body of animals and the quality of the resulting meat. In this regard, a very promising direction is the scientific and practical substantiation of the choice of probiotic preparations that contribute to the normalization of the microbiocenosis of rabbits from the standpoint of increasing their meat productivity, physiological status and meat quality.

The aim of the research is to evaluate and justify the use of the probiotic preparation "Enzimsporin" in the composition of complete granulated compound feed for young rabbits.

2 Materials and methods

Experimental studies were conducted in the conditions of Lipetsk Rabbit LLC in 2023 on the livestock of young hybrid rabbits of the enterprise, selected at the age of 30 days after weaning the rabbits, from which groups of 15 heads of clinically healthy animals were formed based on the pair-analogue method. Individuals of the control group were on a commercial diet of compound feed PZK-94 GRN. Individuals of the experimental groups received compound feed with the introduction of different amounts of the probiotic drug Enzimsporin according to the research scheme: Group 1 (control), Group 2 (PCZ + Enzimsporin 0.6 kg / t of compound feed), Group 3 (PCZ + Enzimsporin 0.8 kg / t of compound feed). Fattening was carried out until the slaughter age of 90 days. Optimization of recipes for complete compound feeds for fattening young rabbits was carried out using the KormOptima software module in the conditions of Kormoresurs LLC (Voronezh). Experimental compound feeds were produced in the conditions of EcoKorm LLC in the Voronezh Region.

3 Results and Discussion

The use of additives in the feed of farm animals has a significant impact on their physiological state, which is especially important to consider during periods of active growth and development of young animals, as well as in the context of changing nutrient needs at different stages of their lives. In modern animal husbandry, there is a prevailing trend towards the use of complex feed rations enriched with probiotics, which helps improve the microflora of the digestive tract, the efficiency of digestion and the assimilation of nutrients, which in turn stimulates growth and improves the productive performance of animals and poultry [10].

Probiotics, being biologically active additives, contain live cultures of microorganisms or products of their metabolism, which play a key role in maintaining the health of the gastrointestinal tract, preventing various diseases of the digestive system, and strengthening the immune system of animals. This has an overall positive effect on their productivity.

The effectiveness of complete granulated compound feeds enriched with the probiotic complex "Enzimsporin" was assessed in 2024 in the conditions of Lipetsk Rabbit LLC in the Lipetsk Region on 30-day-old male rabbits of French selection (Figure 1). In order to justify the use of probiotic complexes in complete granulated compound feeds, three groups of rabbits were formed using the pair-analogue method, taking into account their physiological condition, live weight and age. The pre-selected population of rabbits was subjected to clinical examination and coprological examination.



Fig. 1. Rabbit of the breed "Hycole" (French selection) (LLC "Lipetsk rabbit").

Enzimsporin is a probiotic feed supplement designed to improve digestion and increase animal productivity. It contains spore-forming bacteria, represented in equal proportions by the following strains: *Bacillus subtilis* BKM B-2998 D, *Bacillus licheniformis* BKM B-2999 D and *Bacillus subtilis* BKM B-3057 D. Maltodextrin and corn flour are used as auxiliary substances. The concentration of live spore-forming *Bacillus* bacteria in one gram of this feed supplement is at least 5×10^9 colony-forming units (CFU/g). *Bacillus* bacteria, which are part of the drug "Enzimsporin", perform a protective function, preventing the colonization of the intestinal tract of animals by opportunistic microorganisms, and contribute to the formation of healthy intestinal flora. Due to the production of biologically active compounds and enzymes, this supplement helps activate digestion processes, stimulates metabolic processes and improves the assimilation of nutrients from feed.

Monitoring the live weight of rabbits during the experiment showed that intensive growth in the live weight of rabbits was recorded in the period from 30 to 90 days of fattening (Figure 2).

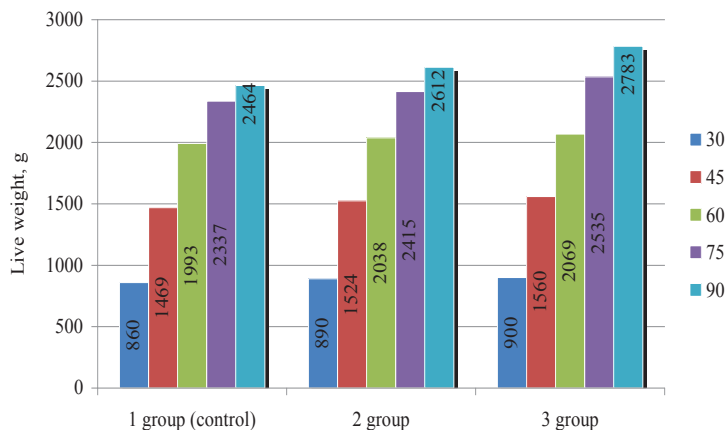


Fig. 2. Monitoring changes in live weight of rabbits: Group 1 (control), Group 2 (PZK + “Enzymsporin” 0.6 kg/t of compound feed) and Group 3 (PZK + “Enzymsporin” 0.8 kg/t of compound feed).



Fig. 3. Number of rabbits being fattened.

During the period of 60 to 75 days, a significant increase in the weight of the tested rabbits was observed in all experimental groups. Particularly superior were the animals from the third group, which were given granulated feed enriched with the Enzymsporin complex. These results confirm that the use of probiotic complexes together with agents that neutralize toxins contributes to a significant acceleration of live weight gain (Figure 3). In the context of these studies, it is worth emphasizing that by the age of 45 days, the rabbits from the control group showed a lower weight compared to the animals from the experimental groups by 55 g and 91 g, which was 3.74% and 6.19%, respectively. By the 90th day of the experiment, the rabbits of the third group exceeded their relatives from the control group by 319 g (12.94%), and also exceeded the animals of the second group by 148 g (6.00%).

The physiological state of animals kept in agriculture is influenced by many factors, one of which is the quality of feeding. Physiological status is determined by both the composition of the diet and the efficiency of metabolic processes [7]. Biochemical analysis of the blood of rabbits receiving the probiotic complex "Enzymsporin" as part of the

compound feed are presented in Table 1. A reliable increase in the level of total protein and albumin was found, which may indicate an intensification of protein metabolism.

Table 1. Biochemical parameters of rabbit blood.

Indicator	Group		
	1st group (control)	2nd group (experimental 1)	3rd group (experimental 2)
At the beginning of the experiment (30 days)			
Protein composition of blood serum, g/l			
Total protein, g/l	66.88±0.13	68.32±0.74	68.81±0.83
Globulins, g/l:	35.67±0.25	36.03±0.61	35.63±0.34
Albumins, g/l	42.32±1.10	40.60±1.18	40.73±1.21
At the end of the experiment (90 days)			
Protein composition of blood serum, g/l			
Total protein, g/l	75.00±0.17	75.18±1.43*	79.77±1.88*
Globulins, g/l:	34.99±0.18	37.05±0.53	37.14±0.70
Albumins, g/l	39.34±1.04	41.10±1.89*	42.63±2.45**

*P<0.95**P<0.99

To assess the meat productivity of fattened young rabbits, an analysis of the post-mortem evaluation of the carcasses of rabbits of the first and third groups was carried out.

Analysis of the results of the post-mortem evaluation of the weight of rabbit carcasses revealed that the inclusion of the probiotic preparation "Enzimsporin" in the diet of the compound feed led to an increase in slaughter weight and pre-slaughter weight (according to Figure 4). In comparison, rabbits from the first (control) group showed a lower slaughter weight value - 1458 g compared to the carcasses of rabbits of the third group - 1722. Thus, the slaughter weight of carcasses of rabbits of the third group consuming compound feed with the introduction of 0.8 kg per 1 ton of compound feed of the probiotic preparation "Enzimsporin" exceeded this indicator relative to the control group by 264 g or 18.11%. Carcasses of rabbits of groups 1 and 3 are shown in Figure 5.

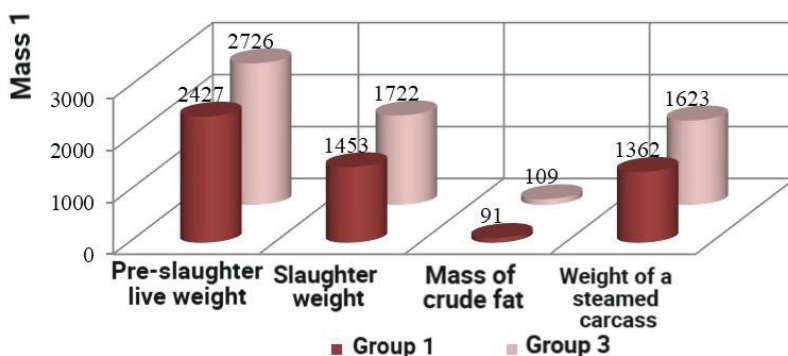


Fig. 4. Results of control slaughter of rabbits.

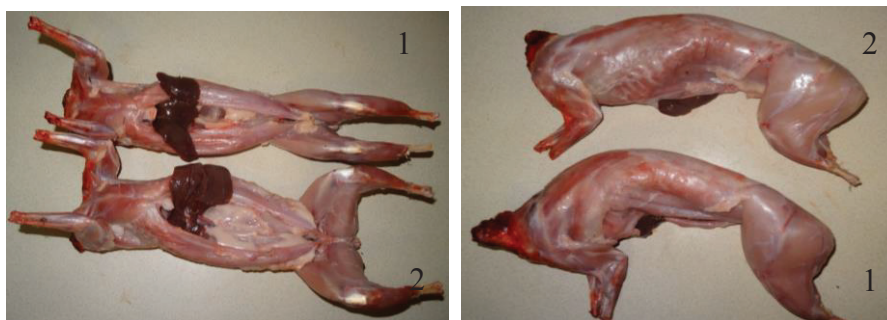


Fig. 5. Rabbit carcasses: 1 – control group (CG), 2 – third group (“Enzimsporin” at a dosage of 0.8 kg/t of compound feed).

The maximum slaughter yield (62.43%) was recorded in the third group (dosage 0.8 kg / t of compound feed) and exceeded the control group by 4.57%.

The largest mass of separated pulp (1285 g) was characteristic of carcasses of the 3rd group of rabbits, which exceeded the mass of separated pulp of individuals in the 1st (control group) by 250.0 g or 24.15%.

The study found that the introduction of the "Enzimsporin" additive into the rabbit diet in the amount of 0.8 kg per ton of feed leads to a significant increase in the meat index, which reached 7.50 units. This result confirms the effectiveness of using this additive in feed rations to improve the quality of rabbit meat, contributing to an increase in slaughter yield and improvement of the muscularity of carcasses. In comparison, rabbits from the control group showed a meat index of 6.16 units, which is significantly lower.

Additionally, the study revealed a positive effect of the probiotic preparation "Enzimsporin" on the development of the internal organs of rabbits. Rabbits from the third group, which received this preparation, demonstrated a significant advantage in the weight of internal organs compared to the control group (Figure 6).



Fig. 6. Rabbit carcasses: 1 – control group (CG), 2 – third group (“Enzimsporin” at a dosage of 0.8 kg/t of compound feed).

The quality of meat, as noted in the works, directly correlates with its chemical composition and energy value. In this context, Table 2 presents data on the chemical composition of rabbit meat, demonstrating the effect of various additives on its indicators.

Table 2. Chemical composition and energy value of an average sample of rabbit meat (n=3).

Indicator	Group I	Group III
Mass fraction of moisture, %	73.75±0.57	72.25±0.64
Mass fraction of protein, %	19.77±0.63	21.82±0.35*
Mass fraction of fat, %	5.36±0.06	4.76±0.39**
Ash content, %	1.12±0.02	1.17±0.02

*p<0.95 **p<0.99

The use of the feed probiotic "Enzimsporin" contributed to the accumulation of crude protein in muscle tissue and a decrease in the mass fraction of fat in carcasses, this was especially clearly seen in the fleshy part of carcasses of individuals of the 3rd group (Figure 7).

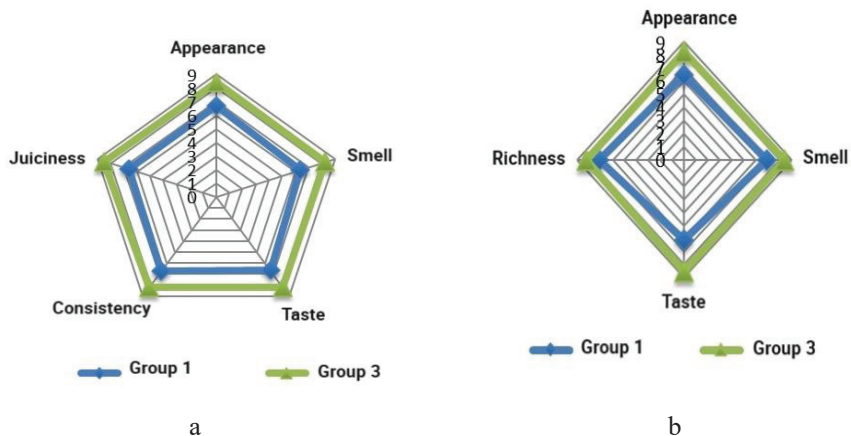


Fig. 7. Organoleptic evaluation of rabbit meat and broth: a – evaluation of rabbit meat; b – evaluation of rabbit broth.

The results of the conducted studies prove the feasibility of using probiotic complexes that contribute to increasing the resistance and physiological status of experimental rabbits in feed rations and, as a consequence, to increasing productive qualities.

4 Conclusion

The results of the conducted studies indicate that the addition of a probiotic agent with high substrate specificity "Enzimsporin" to complete granulated feed for rabbits contributed to an increase in meat productivity of fattened young animals. The use of the feed probiotic "Enzimsporin" contributed to the accumulation of crude protein in muscle tissue and a decrease in the mass fraction of fat in carcasses. Therefore, the use of "Enzimsporin" is a promising direction for increasing the productivity of rabbits in industrial rabbit breeding.

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