The effect of a synbiotic feed additive on the body of young pigs

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Abstract. The publication presents the results of the effect on the body of young pigs reared with a synbiotic feed additive. The synbiotic product consists of two components: lyophilized probiotic cultures isolated from the digestive system of pigs, and a vegetable prebiotic filler. These ingredients are combined into a dry mixture to form a synbiotic with pro- and prebiotic properties. The effect of the additive on the viability of livestock, live weight and its growth, indicators of feed consumption were studied, and the results of general and biochemical blood analysis of experimental animals were analyzed. The study showed that the inclusion of synbiotics in the diet of young pigs does not cause negative effects and is well tolerated by animals. In pigs receiving the supplement, an improvement in a number of indicators was noted: an increase in body weight gain, an increase in survival rate, as well as a decrease in feed consumption per unit of production. A blood test revealed a positive effect on hematopoiesis, in particular, on the formation of red blood cells and general hematopoiesis. In addition, an intensification of protein metabolism was observed. These results indicate a beneficial effect of synbiotic on the general condition and productivity of young pigs.

1 Introduction

The introduction of probiotics into animal infection prevention programs with opportunistic microorganisms is a promising approach [1]. The reason for this lies in their prolonged action in maintaining a favorable consortium of microorganisms in the lumen and mucous membrane of the animal gastrointestinal tract. Probiotics are considered as a promising alternative to antibiotics in animal husbandry. They help strengthen the immune system of animals and reduce the risk of intestinal diseases [2]. The active components of probiotic preparations have the ability to counteract or minimize the negative effects of opportunistic microorganisms. This is especially important, given the high probability of such microorganisms entering the animal body through feed [3]. In addition, we must not forget the actual ability of probionts to influence the colonization of bacteria in certain parts of the mucous membrane of the gastrointestinal tract, as well as the secretion of organic acids,

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digestive enzymes, and bioactive peptides [4]. Current trends in screening potential probiont strains are mainly focused on the question of whether strains have an antibacterial function, and subsequently the question arises about their effect on the conversion rates of the animal body. Therefore, it is very important to look for various biological activities of lactic acid bacteria that have different probiotic potential [5].

In this regard, the search for new promising autochthonous probiont strains with high probiotic potential that could be part of new domestic feed additives is a promising and relevant direction.

The purpose of the work is to study the effect of a synbiotic feed additive on the body of piglets during the rearing period.

2 Materials and Methods

Experiments on pigs were conducted in a pig farm, and laboratory blood tests were conducted on the basis of a scientific testing center, which are structural divisions of the FSBEI HE Kuban SAU.

The object of research is the feed additive LactoPig, which is a dry mixture of beneficial microflora (*Lactobacillus amylovorus* BKM B-3750D and *Limosilactobacillus mucosae* BKM B-3751D) isolated from the blind intestinal processes of production pigs, in combination with a filler of plant origin.

The experiments were carried out on young pigs of the LYD breed (3-breed hybrid). Piglets of the rearing group participated in the experiment. All manipulations carried out with animals were carried out in accordance with international regulatory standards.

At the first stage of the introduction of the LactoPig additive into the production cycle of a pig commercial farm, the task was to select the optimal dose of synbiotic with feed to study its tolerability by target animal species. Four groups of animals with 50 heads each were selected to complete the task. The groups were formed according to the principle of analogues and were in the same conditions throughout the entire growing period. The control group animals (group 1) received the standard ration of the enterprise (SR). Piglets from the 2nd, 3rd, and 4th experimental groups received SR with the addition of the feed additive "LactoPig" at a dosage of 0.5%, 0.7%, and 1.0% of the feed weight, respectively. The studied additive was introduced into the feed through the mixer of the feed preparation section conveyor. During the experiment, all pigs had unlimited access to drinking water from nipple waterers.

Individual weighing of animals was carried out weekly before morning feeding to track the dynamics of the intensity of body weight gain. Feed consumption was assessed daily by considering the weight of a given feed and its residues in each group. At the end of the stage of rearing young pigs, an analysis of the effectiveness of feeding was carried out. In particular, the amount of compound feed needed to produce a unit of production was determined. This indicator allows to assess the economic efficiency of the growing process and the efficiency of animal feed assimilation. The animal viability index was monitored daily.

At the end of the rearing period, blood samples from large auricular veins were sterically taken from piglets of the studied groups by applying a tourniquet at the base of the ear and sampling by vacuum blood collection systems with preliminary aseptic puncture sites with an antiseptic solution.

An automatic URIT-5160 Vet analyzer was used to evaluate hematological parameters. Additionally, the Panchenkov method was used to measure the erythrocyte sedimentation rate (ESR), which corresponds to standard veterinary diagnostic practices. The biochemical profile of the blood was determined using an automatic DIRUI CS-600 analyzer, using

specialized veterinary reagents DiaVetTest. Such an integrated approach allowed to obtain a complete picture of the hematological and biochemical parameters of animal blood.

The analysis and interpretation of the experimental data obtained were carried out using biometric methods. Microsoft Excel 2019 software on the Windows 10 platform was used for this purpose. During the processing, the following statistical indicators were calculated: arithmetic mean (M), standard error of the mean (m), and standard deviation (σ). A comparative analysis of quantitative characteristics was carried out by comparing the average values of two samples using the Student's t-test and determining the significance level (p). The differences were considered statistically significant at $p \leq 0.05$. This approach provided a reliable basis for assessing the reliability of the results obtained.

3 Results and Discussion

3.1 The results of the synbiotic effect on economic indicators in the cultivation of young pigs

During the first 10-14 days of the rearing period, during the clinical examination of piglets, unstable feed intake was observed in all experiment groups, which was greatly influenced by the increased excitability of animals in a new location, manifested by synchronous running of groups of animals within the section and an acute reaction to sound stimuli. During the acclimatization period of piglets of the control group, signs of defecation were recorded in recreation and feeding areas, which is the reason for the change of habitat and diet, while in the experimental groups these stress phenomena were less pronounced. Body temperature, heart rate, and respiratory movements in all groups were slightly increased during the transition period, which gradually returned to normal.

The results of productivity, viability, and conversion of piglet feed during the rearing of the experimental and control groups are presented in Table 1.

Table 1. Economic indicators for the rearing of young pigs (n = 50), M±m.

Indicator	Group			
	1st control	2nd experiment	3rd experiment	4nd experiment
Growing period, day	29−84	29−84	29−84	29−84
Number at payout, heads	50	50	50	50
Number at transfer, heads	46	48	49	50
Weight of piglets when transferred from the farrowing site and the suckling period, kg	8.18±0.07	8.56±0.08*	9.13±0.08*	9.31±0.09*
Weight of piglets at the end of the rearing stage, on average, kg	28.68±0.68	29.34±0.49	31.60±0.54	33.36±0.51*
Increase per 1 head over the period of research, on average, kg	20.50	20.78	22.47	24.05
Amount of feed consumed during the experiment period by the 1st head, on average, kg	46.95	47.56	48.25	49.32
Feed conversion, kg	2.29	2.28	2.14	2.05
Fallen animals, heads	2	1	0	0
Mortality, %	4.0	2.0	0	0
Culling, heads	2	1	1	0

Culling, %	4.0	2.0	2.0	0
Total waste, %	8.0	0	0	0
Viability, %	92.0	96.0	98.0	100.0

* − difference with the control group is significant ($p \leq 0.05$)

As a result of 56 days of rearing of experimental piglets at the rearing stage, the 2nd and 3rd experimental groups of animals exceeded the weight of animals at the end of the control group stage by 2.30% and 10.18%. The 4th experimental group significantly exceeded the analyzed indicator compared with the control by 16.31% ($p \leq 0.05$). The average increase in the weight gain of one head (increase over the technological period) of the 2nd, 3rd, and 4th groups correspond to the indicators of 1.36%, 9.60%, and 17.31% relative to the control data. Feed conversion rates of reared piglets reflect a decrease in their costs per 1 kg of increase in the experimental groups by 0.43, 6.55, and 10.48%, respectively, in the 2nd, 3rd, and 4th experimental groups relative to the control.

The livestock viability in the period under review was 92% in the group of control animals with an equal ratio of death and culling of 4% (2 heads each). The yield of economically valuable livestock of the 2nd experimental group was 96% with equal proportions of waste due to death and culling - 2% each (1 head each), which exceeded the control indicator by 4%. In the 3rd experimental group, 98% of viability and 2% (1 head) of waste due to culling. The livestock waste of the 4th experimental group was consistently absent throughout the experiment, the viability was 100%.

3.2 Results of the effect of synbiotic on morpho-biochemical blood parameters in the rearing of young pigs

The results of studies of the general blood analysis of piglets during rearing at the end of the technological period are presented in Table 2.

Table 2. The results of morphological parameters of piglets' blood during rearing (n=5), M±m.

Indicator	Group			
	1st control	2nd experiment	3rd experiment	4nd experiment
Red blood cells, 10^{12}/l	7.03±0.11	7.24±0.13	7.56±0.11	7.82±0.10*
Hemoglobin, g/l	126.30±0.78	127.20±1.05	129.10±1.04	130.70±0.59*
Hematocrit, %	43.45±1.94	43.92±1.66	45.84±1.83	46.25±1.98
ESR, mm/hour	4.90±0.19	4.20±0.17	4.40±0.11	4.80±0.13
Leukocytes, 10^{9}/l	16.13±0.80	15.67±0.72	15.59±0.74	15.81±0.78

* − difference with the control group is significant ($p \leq 0.05$)

The study of hematological parameters of piglets revealed significant positive changes when using the synbiotic supplement "LactoPig". In particular, the most pronounced effect was observed in the 4th experimental group. In these animals, there was a statistically significant increase in the number of red blood cells by 11.24% and the hemoglobin level by 3.48% compared with the control group ($p \leq 0.05$). The difference in these indicators in the 2nd and 3rd experimental groups was: erythrocytes – 2.99% and 0.71%, hemoglobin – 7.54% and 2.22%, respectively. In terms of hemoglobin, the experimental groups outperformed the control values by 1.08%, 5.50%, and 6.44% in the 2nd, 3rd, and 4th experimental groups, respectively.

There was a decrease in leukocytes by 2.85% (2nd experimental group), 3.35% (3rd experimental group), and 1.98% (4th experimental group) without statistical reliability. When

considering the detailed composition of leukocytes, there were no significant differences with the control indicators and deviations from the normal values of this animal species.

The results of the biochemical blood analysis of piglets during rearing at the end of the technological period are presented in Table 3.

Table 3. The results of biochemical parameters of piglets' blood during rearing (n=5), M±m

Indicator	Group			
	1st control	2nd experiment	3rd experiment	4nd experiment
AST, u/l	52.94±2.45	50.12±2.48	53.24±2.53	50.52±2.51
ALT, u/l	39.98±1.93	37.60±1.87	38.86±1.90	38.56±1.85
Alkaline phosphatase, u/l	169.90±7.78	172.82±7.71	173.35±7.89	175.22±8.13
Cholesterol, mmol/l	1.80±0.07	1.83±0.08	1.86±0.06	1.91±0.09
Triglycerides, mmol/l	0.42±0.03	0.42±0.02	0.39±0.03	0.40±0.02
Total bilirubin, mmol/l	2.53±0.11	2.54±0.12	2.53±0.11	2.52±0.12
Direct bilirubin, mmol/l	1.89±0.07	1.86±0.02	1.84±0.05	1.88±0.08
Urea, mmol/l	2.36±0.09	2.36±0.10	2.43±0.08	2.52±0.09
Creatinine, umol/l	161.60±7.98	164.30±5.82	161.00±7.06	164.60±6.96
Total protein, g/l	71.38±0.78	72.18±0.47	74.22±0.78	75.80±0.44*
Albumin, g/l	29.99±1.43	30.17±1.34	32.26±1.35	32.16±1.31
Glucose, mmol/l	5.26±0.21	5.44±0.23	5.37±0.24	5.45±0.27
LDH, u/l	327.65±16.23	332.74±14.24	328.86±13.12	321.47±15.80
Calcium, mmol/l	2.59±0.10	2.69±0.12	2.67±0.10	2.72±0.13
Phosphorus, mmol/l	1.52±0.07	1.55±0.05	1.57±0.08	1.60±0.06

* − difference with the control group is significant ($p \leq 0.05$)

In the indicators of biochemical analysis of blood serum in experimental piglets of all groups, no deviations from the specific norms were found. Statistically significant differences in the total protein index were found in the 4th experimental group of animals, the difference with the control, in which was 6.19% ($p \leq 0.05$), in the 2nd and 3rd experimental groups, the positive differences of this indicator against the control were 1.12% and 3.98%. In addition, an increase in the mineral components of blood serum calcium in the 2nd experimental group was established by 3.86%, 3.09% in the 3rd experimental group, and 5.02% in the 4th experimental group. The percentage of phosphorus content positively exceeded the control by 1.97%, 3.29%, and 5.26%, respectively, for the 2nd, 3rd, and 4th experimental groups. But in both cases, the changes are not statistically significant.

4 Conclusions

Thus, the use of the synbiotic feed additive "LactoPig" in the diet of pigs during rearing contributed to an increase in economic indicators. The best results were recorded in the group where 1.0% of the feed additive was used by weight (4th experimental group). It was also found that the use of synbiotics not only does not have a negative effect on the body of the target objects, but even on the contrary stimulates erythropoiesis and hematopoiesis, as well as significantly enhances protein metabolism in the body of experimental animals.

Acknowledgements

The work was carried out using funds from the University Development Program within the framework of the Strategic Academic Leadership Program “Priority-2030”.

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