Development of the Probiotic Feed Supplement Based on Lactobacillus Plantarum to Increase the Broiler Productivity

Tatyana Lenkova, Ilya Nikonov, Yuri Kuznetsov, Larisa Karpenko, Anna Balykina

***Abstract*: This article reflects the results of the development of a method for testing a promising feed supplement based on the Lactobacillus plantarum strain, with a high antagonistic activity to campylobacter. To determine the digestibility and use of food nutrients by broilers, a physiological (balance experiment) was conducted on three males from each group at the age of 28 days.**

By the end of the growing period, there was a clear tendency to increase the live weight of 36-day-old chickens compared with the control group in experimental group 2, which received a feed supplement, including bacteria Lactobacillus plantarum. She was 4.0% higher.

As a result of scientific work, it was shown that feeding broiler chickens with a probiotic feed additive based on Lactobacillus plantarum helps to increase their productivity during the entire growing cycle.

***Keywords*: probiotics, lactobacilli, Lactobacillus Plantarum, broilers, Campylobacter jejuni.**

I. INTRODUCTION

The creation and introduction of a new highly productive poultry cross with an intensive metabolism into the industrial poultry industry led to a change in the microbiota. In turn, this factor often leads to disruption of immune homeostasis and the development of diseases such as uric acid diathesis, biting, growth disorders, fatty degeneration of the liver, causing decreased productivity, poor consumer properties of poultry products, and sometimes even death of the bird.

In industrial cultivation, an intensive accumulation of opportunistic enterobacteria occurs both indoors and in the immediate environment.

Eating feed, the bird in enclosed spaces is completely devoid of contact with natural donors of normal microorganisms available in nature (soil, insects, plants, animals), which leads to faster colonization of the intestines of chickens by conditionally pathogenic microorganisms, commensals - for example, Campylobacter spp and a slowdown of processes colonization of the intestine with normal microflora, including lactobacilli, bifidobacteria and enterococci, forming a parietal biofilm.

Currently, 6 types of diet components (feed additives) are used in practice to modulate the composition of poultry intestinal microflora: antibiotics, exogenous enzymes, prebiotics, probiotics, synbiotics, probiotics (Yang, Y. et al., 2009). The ban in several countries on the use of feed antibiotics (in the EU since 2006), which were previously the main microflora modulating supplement (Castanon, JIR, 2007), has caused increased interest in other types of these supplements, which are intensively studied all over the world. The interest is also spurred by the growing concern of the world community about the problem of resistance of pathogens to antibiotics (Nhung, N.T. et al., 2017).

The most studied to date are probiotic drugs. Probiotics now refer to live microbial feed additives that improve the health and productivity of farm animals (Saleh, A. and Hayashi, K., 2011). Currently, species of the genus Lactobacillus (bulgaricus, plantarum, acidophilus, salivarius, lactis, helveticus, casei), Bacillus subtilis, Enterococcus faecium and faecalis, Streptococcus thermophilus, species of the genus Bifidobacterium, some strains of E. coli are used as probiotic additives R., 1989; O'Dea, EE et al., 2006; Choudhari, A. et al., 2008), some species of the genera Bacillus and Lactococcus (Yang, Y. et al., 2009). A number of fungal species are also used: Aspergillus oryzae, Saccharomyces cerevisiae, and acidophilus (Huang, M.K. et al., 2004; Hassanein, S.M. and Soliman, N.K., 2010).

The positive effect of probiotic cultures is associated with their development of SCFA, which reduce the pH of the chyme and, consequently, the growth of pathogenic microorganisms that poorly tolerate the relatively high acidity of the environment (clostridia, Salmonella, pathogenic strains of E. coli) (Chichlowski, M. et al., 2007); competing with pathogens for adhesion sites to the intestinal wall with stimulation of a number of aspects of the host's own immunity (Ohashi, Y. and Ushida, U. 2009).

Numerous probiotic preparations and biologically active feed additives currently used are not fully able to solve this problem. Chickens raised in industrial poultry have no intestinal colonization resistance to Campylobacter spp and Salmonella spp.

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II. MATERIALS AND METHODS

This study aimed to test a promising feed supplement based on the Lactobacillus Plantarum strain, with high antagonistic activity to campylobacter.

The studies were performed in the nutrition department of the Federal Scientific Center "VNITIP" RAS and the vivarium of the Zagorsk EPH Scientific Production Center in 2018-2019.

The scientific and industrial experience was carried out on broilers of the Cobb 500 cross country from daily to 36 days of age. The chickens were kept in AviMax cell batteries, 35 goals in each group, in compliance with all technological parameters.

Poultry was fed in two phases (6–21 days and from 22 days until the end of rearing). In the first 5 days, chickens of all groups received the same starter feed. The additive was introduced into the feed by the method of stepwise mixing. The scheme of scientific and industrial experience is presented in Table I.

Table- I: Experiment scheme on broilers of the cross "Cobb-500"

Group	Features of broiler feeding
1 control	Complete feed with nutrition corresponding to the recommendations for cross-country (PC)
2 experienced	PC + feed supplement at a dose of 1 kg g / t feed containing 10^7 CFU / g Lactobacillus plantarum

To study the digestibility and use of food nutrients by broilers, a physiological (balance experiment) was conducted on three males from each group at the age of 28 days.

Taken into account indicators:

- the safety of the livestock (%) by accounting for the dead bird;
- live weight of chickens at the beginning of the experiment at the age of 24, at 7-, 21- and 36-day olds;
- feed consumption by daily accounting for a given amount of feed;
- feed costs per 1 kg of increase in live weight, kg;
- slaughter yield of meat, %;
- mass of internal organs, g;
- total nitrogen content in feed, litter, muscles (Kjeldahl method);
- the amino acid content in the feed, litter, muscle (by ion-exchange chromatography on an AAA-T 339 automatic analyzer);
- the content of crude fat in feed, litter, muscle (in the Soxhlet apparatus);
- the content of crude fiber in feed, litter (acid-base treatment described by P.T. Lebedev and others);
- calcium content in the feed, manure (on an atomic absorption spectrometer);
- phosphorus content in the feed, litter (photometric method);
- the content of crude ash in feed, litter, muscle (by dry ashing of the sample);
- the content of vitamins A, E, B2 in the liver (by high-performance liquid chromatography on a Milichrome-1 apparatus);
- digestibility of dry matter of feed, protein, fiber, fat, the use of nitrogen, amino acids, calcium, phosphorus - in the balanced experiment;
- the chemical composition of the foot and pectoral muscles.

III. RESULT AND DISCUSSION

The results of scientific and industrial experience are presented in Table II.

Table- II: The results of the experiment on broiler chickens

Indicators	Group	
	1	2
The safety of the livestock, %	100,0	100,0
The live weight of broilers (g) in ages: daily	43,0 ±0,22	43,1 ±0,21
% to control	100,0	100,2
7 day	198,6 ±3,53	196,6 ±2,57
% to control	100,0	99,0
21 - day	933,4 ±16,56	953,4 ±11,88
% to control	100,0	102,1
Average at 36 days of age	2057,5 ±33,16	2139,9 ±36,44
% to control	100,0	104,0
including hens	1921,2 ±33,21	2045,7 ±22,33
% to control	100,0	106,5
including cockerels	2193,8 ±35,14	2234,0 ±42,22
% to control	100,0	101,8
The average daily gain in live weight, g	56,0	58,2
% to control	100,0	103,9
Feed intake per 1 goal. for the growing period, kg	3,29	3,27
% to control	100,0	100,6
The cost of feed per 1 kg of increase in live weight, kg	1,63	1,56
% to control	100,0	95,7

From the data presented in the table, it follows that the safety of the livestock in the groups was 100%. The live weight of broilers at 7 days of age was practically the same between the groups. At 21 days of age in experimental group 2, it was 2.1% higher. By the end of the growing period, there was a clear tendency to increase the live weight of 36-day-old chickens compared with the control group in experimental group 2, which received a feed supplement, including bacteria Lactobacillus plantarum. She was 4.0% higher.

The live weight of males in the experimental groups did not undergo significant changes compared to the control, the difference was unreliable. At the same time, the tested feed additive had a more significant effect on this indicator in hens. So, in experimental group 2, it was 6.5% ($p \leq 0.01$) higher than in control group 1.

There were no significant differences between the groups in terms of feed intake by birds. However, feed conversion in the experimental group was better. So, when using a feed additive based on Lactobacillus plantarum (group 2), the feed cost per 1 kg of live weight gain was 4.3% lower than in group 1.

The difference in productivity in the experimental group compared to the control was obtained due to the improvement of digestibility and the use of feed nutrients by broilers under the influence of the test additive

(Table III).

Table- II: Digestibility and use of feed nutrients by broilers, %

Indicators	Group	
	1	2
Digestibility: dry matter feed	72,3	75,4
protein	90,5	93,1
fat	87,7	90,9
fiber	7,5	12,0
Using: nitrogen	57,4	61,8
calcium	38,2	39,3
phosphorus	35,7	36,4
lysine	84,4	88,3
methionine	83,7	87,0

From the data given in the table, it follows that the use of lactic acid bacteria Lactobacillus Plantarum in compound feeds improved digestibility (%): dry matter feed by 3.1, protein by 2.6, fat by 3.2, fiber by 4.5. The use of feed nitrogen in this group was better than in the control by 4.4%, lysine - by 3.9%, methionine - by 3.3%.

IV. CONCLUSION

Thus, as a result of the studies, it was shown that feeding broiler chickens with a probiotic feed additive based on Lactobacillus plantarum helps to increase their productivity during the entire growing cycle.

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