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Conference Paper

Efficacy of Probiotic Preparation Based on Propionic Acid Bacteria in the Diets of Broiler Chickens

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Abstract

The article presents the results of testing in the diets of broiler chickens of probiotic preparation "Propionic", developed by the staff of the laboratory of Microbiology of the "Siberian research Institute for cheese- making" Department of the Federal State budgetary scientific institution "Federal Altai center of agrobiotechnology", which includes a multi-strain culture of propionic acid bacteria species Propionibacterium freudenreichii. Scientific and economic experience was carried out under the conditions of poultry farm LLC "Kuzbass broiler" of the Kemerovo region. For the research 2 groups of chickens-broilers (80 in each) was formed. The control group received the basic diet without probiotic. In the experimental groups to the main diet instead of feed antibiotic preparation "Propionic" was added. In chickens of the experimental group, receiving probiotic preparation "Propionic", there was an increase in live weight by 2.38 %, absolute and average daily growth-by 2.42 %. The safety of probiotic-treated chickens was increased by 1.25%. Morphological and biochemical parameters of blood in chickens of control and experimental groups were within physiological norm that testifies to a healthy physiological condition of a bird. The serum of chickens treated with probiotic showed a decrease in the concentration of glucose by 2.97 % and cholesterol-by 6.38 %. The use of the probiotic preparation "Propionic" allowed reducing feed costs per 1 kg of growth by 2.87 % and get an additional profit of 2.98 RUB from one head.

Keywords: poultry, broiler chickens, poultry feeding, probiotics, probiotic preparations, propionic acid bacteria.

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1. Introduction

Poultry farming is one of the leading branches of agriculture not only in Russia but all over the world. First of all, this is explained by the demand for inexpensive and high-quality food products [1, 2]. Among the poultry meat produced by poultry enterprises, the first place in terms of volume is occupied by the meat of broiler chickens, which are characterized by high growth rates and large size. For a short period of their cultivation, which is 38--42 days, their live weight from the daily age increases by 50--55 times

and reaches 1.5--2.5 kg. However, their growth is significantly ahead of development. Unformed immune and enzymatic systems make them highly sensitive to bacterial and viral agents, as well as to various stresses [3, 4].

Farmers often face problems with the safety of young poultry due to various diseases of the gastrointestinal tract. It should be noted that gastrointestinal diseases take the second place after viral and are the main cause of death of young animals [5, 6].

A balance between normal and pathogenic intestinal microflora is essential to maintain high productivity and poultry health. Any change in this equilibrium is accompanied by functional disorders that lead to a decrease in poultry productivity [7, 8].

Under the influence of probiotic preparation used in feeding broiler chickens, colonial resistance of the intestine increases and the digestibility of feed substances increases. As a result, it has a positive effect on the whole body [9--11].

When developing and evaluating the effect of new drugs, biological additives and probiotics on the poultry body, it is impossible to do without studying the morphological and biochemical parameters of blood, since blood in the body performs many functions aimed at maintaining its vital functions [12--14]. It ensures the transport of oxygen to the cells and the release of carbon dioxide from them, as well as contributes to the thermoregulation of the body and provides its nonspecific resistance. The changes in blood composition lead to disruption of metabolic processes [15].

2. Methods and Equipment

2.1. Methods

Scientific-economic experience was carried out in the production conditions of the poultry farm LLC "Kuzbass broiler" of the Kemerovo region. The object of the study were broiler chickens of the industrial herd of Hubbard f-15 cross at the age of 1--40 days.

Probiotic preparation "Propionic" was developed by the staff of the laboratory of Microbiology of milk and milk products of the "Siberian research Institute for cheese-making" Department of the Federal State budget scientific institution "Federal Altai center of agrobiotechnology". Strains of propionic acid bacteria included in the composition of the preparation, were taken from the "Siberian collection of microorganisms" of the "Siberian research Institute for cheese-making" Department. Reduced dry demineralized milk whey was used as a substrate for cultivation and biomass growth of propionic acid bacteria [16].

To conduct the experiment, 2 experimental groups of with 80 heads in each were formed. The age of chickens at statement on experience made 1 day. The groups were kept in cages in the experimental poultry house. The temperature in the room, the ventilation and lighting system, the feeding and watering front fully met the requirements for the maintenance of the cross. Conditions of feeding and keeping of experimental chickens were identical. Chickens of the control group received the main diet of the farm, which included a feed antibiotic. In the experimental group, a probiotic preparation "Propionic" was added to the main diet of the farm instead of a feed antibiotic. The daily dose of probiotic was changed according to the age of chickens starting from 0.65 ml/head. and gradually increasing the size of the daily giving to 3.90 ml/head (table 1).

Table 1: Scheme of scientific-economic experience.

Ageofchickens, days	Probiotic dose, ml/head per day	
	Controlgroup	Experimentalgroup
1--4	Basicdiet (BD)	BD
5	BD	BD + 0,65
6--10	BD	BD + 0,9
11--20	BD	BD + 1,6
21--30	BD	BD + 2,6
31--39	BD	BD + 3,9

During the experiment the safety of livestock, live weight, absolute, average daily gain, as well as morphological and biochemical parameters of blood were determined.

Zootechnical parameters were taken into account by the following methods: feed intake by daily records of feed consumption in the group with subsequent recalculation on 1 kg of live weight gain; retention of broiler chickens were estimated by the number of dead birds on the day of slaughter; growth dynamics of body weight by individual the weigh-in before the morning feeding at the 45 goals of the group and then calculate the absolute and average daily gain.

Morphological parameters of blood were determined by counting erythrocytes and leukocytes in the Goryaev chamber, hemoglobin -- hemoglobin cyanide method. Biochemical parameters in blood serum were determined using ready-made reagent kits and automatic analyzer BioChem SA.

Statistical data processing was carried out using a personal computer and Microsoft Excel analysis package. The integrity and homogeneity of the sample were estimated by calculating the arithmetic mean error. The reliability of the results was determined by calculating the Student coefficient. The results were considered reliable at $P>0.95$.

3. Results

At the time of the experiment, the average live weight of broiler chickens of the control and experimental groups was almost the same (table 2). However, starting from the age of two weeks, the chickens of the experimental group were 2.33% higher in live weight than the chickens of the control group. To the end of the experiment the live weight in both groups was within 2332.80--2388.27 that is in compliance with this cross standards. However, the highest average live weight was characterized by the chickens of the experimental group -- 2388.27 it exceeded the control group by 2.38 %.

Table 2: Live weight of broilers in dynamics.

Age of chickens, days	Liveweight, g	
	Control group	Experimentalgroup
1	42,06±0,61	42,03±0,59
7	182,30±1,50	181,70±1,48
14	471,50±2,90	482,50±3,01*
21	935,30±5,54	852,10±5,54*
28	1471,80±7,41	1496,50±7,55*
35	1955,10±9,36	1982,10±9,28*
40	2332,80±14,29	2388,27±13,66**
Difference with control, %		

*P>0,95; **P>0,99

Absolute and average daily live weight gain of broiler chickens in the experimental group was higher than in the control group by 2.42 %. The absolute increase amounted to 2346.24 g, average -- to 60.16 g.

At the end of the experiment, the safety of livestock was in the range of 97.50--98.75 %, which is the norm for this cross. At the same time, the best safety of livestock was noted in the experimental group and amounted to 98.75 %, which is 1.25 % higher than the control.

In the study of blood morphological parameters any deviations from the norm were not revealed. However, in the experimental group, where broilers received a probiotic preparation "Propionic" instead of a feed antibiotic, there was a tendency to increase the content of red blood cells and hemoglobin relative to the control group, but also within the normal range. The data obtained during the calculation of leukocytes in the blood of experimental chickens showed that the poultry of the experimental group had a slight age-related decrease in the concentration of leukocytes in contrast to the chickens

Table 3: Morphological and biochemical parameters of blood of broiler chickens.

Age of chickens, days	Control group	Experimental group
	Hemoglobin, g/l	
28	75,20±1,07	79,80±1,11*
40	78,80±1,16	82,80±1,02*
	Erythrocytes, 10^{12}/l	
28	2,20±0,02	2,29±0,02*
40	2,28±0,03	2,40±0,02*
	Leukocytes, 10^{9}/l	
28	24,26±0,52	24,38±0,62
40	24,90±0,59	24,22±0,66
	Total protein, g/l	
28	43,20±0,55	43,78±0,56
40	53,18±0,69	54,12±0,52
	Albumins, g/l	
28	18,32±0,30	18,72±0,29
40	20,82±0,26	21,40±0,25
	Globulins, g/l	
28	24,88±0,51	25,06±0,33
40	32,47±0,71	32,71±0,35
	Ca, mmol/l	
28	2,50±0,03	2,70±0,03**
40	3,77±0,03	3,89±0,03*
	P, mmol/l	
28	2,03±0,02	2,14±0,03*
40	2,77±0,03	2,83±0,02
	Glucose, mmol/l	
28	9,91±0,05	9,43±0,04**
40	10,43±0,04	10,12±0,03**
	Cholesterin, mmol/l	
28	1,91±0,02	1,80±0,02*
40	1,88±0,02	1,76±0,02*

*P>0,95; **P>0,99

of the control group, which indicates an increase in the resistance of the organism of broiler chickens in the experimental group (table 3).

The biochemical parameters of blood of chickens were also within physiological norm. It should be noted that in chickens of the experimental group the protein content in blood serum was slightly higher. At the end of the experience of the birds treated with probiotic preparation "Propionic" in the serum there was an increase in amounts of total protein 1.66 %, albumin -- 2.40, globulin by 1.19 % compared to the control group.

In the experimental group, the blood glucose concentration decreased by 2.9 % and cholesterol by 6.38 %. The phosphorus content was 2.77 mmol/l in chickens of the experimental group and 2.83 mmol/l in poultry of the control group. The concentration of calcium in the blood of broiler chickens of the experimental group was 3.89 mmol/l, which is 3.1 % lower compared to the control group.

To assess the effectiveness of feeding experimental broiler chickens, feed costs per 1 kg of live weight gain were taken into account. In the control group this figure was 1.74 kg, which is of 2.87 % higher than in the experimental group where the cost of feed per 1 kg gain was 1.69 kg. The economic efficiency of application of probiotic preparation "Propionic" in the experimental group amounted to 2.98 rubles from one head.

4. Discussion

Based on the data obtained as a result of the study, it is clear that the use of the probiotic preparation "Propionic" in the experimental group had a positive effect on a number of zootechnical and physiological parameters. With respect to control, the chickens of the experimental group at the time of slaughter were characterized by an increase in live weight by 2.38 %, preservation of livestock -- by 1.25 %, and a decrease in feed costs per 1 kg of live weight gain by 2.87 %. The results of the blood test show that the studied morphological and biochemical parameters are within the physiological norm. This means that the birds of the control and experimental groups were clinically healthy, no inflammatory and pathological processes in the body were detected. However, it should be noted that in the experimental group of broiler chickens there was a tendency to improve a number of indicators within the physiological norm: increase in hemoglobin, erythrocytes, total protein, calcium and phosphorus, decrease in leukocytes. In addition, reliable results were obtained to reduce the concentration of cholesterol in the blood by 6.38 % and glucose by 2.97 %.

5. Conclusion

The addition of the probiotic preparation "Propionic" to the diet of broiler chickens in a daily dose of 0.65--3.90 ml/head had a positive effect on the physiological state of birds, improved productivity and reduced the economic costs of production.

The use of the preparation "Propionic", starting from the fifth day of life of chickens and to slaughter of poultry at the age of 40 days allowed receiving additional profit production by 2.98 rubles from one head.

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Conflict of Interest

The authors have no conflict of interest to declare.

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