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The Efficiency of Using Functional Feed Additives in Combined Feeds for Broiler Chickens

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Abstract*: The research was aimed at studying the efficiency of using functional feed additives based on fermented brewer's grains with vegetative filler and an adsorbent in combined feeds for broiler chickens. The use of the developed biological product resulted in increasing the live weight in the second group of chickens by 8.0 %, the average daily live weight gain – by 8.2 %, while reducing the feed used per unit of the product by 8.0 %. The results of analyzing the contents of the microflora of the caeca in the intestine showed a reduction of the common microbial number in the experimental group of chickens from 2x109 to 3x107 and an increase in the number of lactobacilli from 1x106 to 6x107. Therefore, the efficiency of the composite biological product in feeding broiler chickens has been proven.

***Keywords*: broiler chickens, biological product, live weight, weight gain, feed used, intestine microflora.**

I. INTRODUCTION

In the early 20th century, probiotics were used to improve the "intestinal microbiota". Subsequent studies revealed the effect of probiotics not only on the intestinal microflora, but on the health in general, on strengthening the immune system, and on preventing infectious diseases of various etiologies. It is currently believed that probiotics are live microorganisms that can bring benefit to health when taken in adequate amounts [1-4].

In recent decades, there has been a gradual increase in the number of studies devoted to the use of probiotics for agricultural animals and poultry. It has been established that bacteria of the probiotics produce antimicrobial substances that have a direct inhibitory effect on the pathogens. The substances produced by some bacteria of the probiotics include vitamins, amino acids, organic acids (e.g., lactic acid and acetic acid), hydrogen peroxide (H2O2), bacteriocins and uncharacterized low-molecular substances with antifungal properties [5, 6].

The prebiotics are defined as nondigestible food ingredients that have a beneficial effect on the host organism by selectively stimulating the growth or activity of a single bacterium or a limited number of bacteria in the intestines, thus improving the health of the host. For instance, dietary fibers are considered prebiotics for intestinal lactic acid bacteria [7]. It is known that a significant part of the territory of the Russian Federation is exposed to anthropogenic emissions and natural disturbances, and contains high concentrations of heavy metals entering the feeds and, consequently, the food products of animal origin [8]. This results in diseases in animals and humans, deteriorates immunity, and shortens the lifespan. Adsorbents are highly efficient for preventing the ingress of heavy metals from the feed into the end products of livestock breeding, and reduce heavy metals accumulation in the muscle tissues of animals up to 50 times. Reduction of the toxic load is accompanied by normalization of the metabolic processes and the increased productivity, levels of calcium, phosphorus, and iron in the blood, as well as the reduced level of cholesterol [1, 9]. In recent years, the efficiency of synbiotics, i.e., feed additives that combine both probiotic and prebiotic functions has been proven. The positive factors also include adsorbents [1, 2, 3, 5, 7]. An important consideration for synbiotic therapy of the intestine is the choice of the synbiotic for the used prebiotic. The adsorbent is used as a filler that also plays a detoxifying role. Therefore, significant activation of the immune response of the host may be expected in the intestine. Probiotic bacteria are activated to produce several cytokines that stimulate the functions of T-cells and B-cells. Thus, it can be expected that synbiotics in the intestinal tract activate both the innate and the acquired cellular and humoral immunity [1, 2, 3, 5, 7].

The research was aimed at studying the efficiency of using functional feed additives based on fermented brewer's grains with vegetative filler and an adsorbent in combined feeds for broiler chickens.

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II. METHODS

A. General description

To achieve the goal, the following tasks were set:

1. Studying the effect of using a functional biological product on the live weight gain of broiler chickens.

2. Determining the effect of the studied feed additive on meat productivity and the development of internal organs of chickens.

The functionality of the biological product is determined by the content of prebiotic vegetative substrate and the introduction of the fermentation starter – biopreservative that consists of lactic acid bacteria and propionibacteria.

B. Algorithm

To solve the set tasks, a scientific and economical experiment was performed in the conditions of the Kavkaz poultry farm in the Dinsky district of the Krasnodar region.

The broiler chickens of the Cobb-500 cross were kept in KBU-3 battery cages. The keeping and feeding conditions were in line with the zootechnic norms.

Three groups of chickens were formed by the method of analog pairs from the same hatching, 36 chickens in each group. The scheme of the scientific and economic experiment is shown in Table 1.

Table 1. The scheme of the scientific and economic experiment

Group	Feeding characteristic
1 – reference	Main diet (MD)
2 – experimental	MD + 1.5 % by the weight of the feed Premix

The chickens were weighed individually in the one-day age, and then by periods of growing: on days 14, 28, and 42 from the date of the experiment start.

The total microbial count in the contents of the caeca in the intestines of the broiler chickens was studied upon check slaughtering of the chickens at the age of 42 days. For this purpose, general samples of the contents of the caeca in the intestine were taken from six chickens from each group.

The total microbial count (TMC) and lactobacteria count, CFU (the count of colony-forming units) were determined by the method of serial dilutions in MPA (meat-peptone agar) and Lactobacillus agar. The contents of the caeca in the intestines of the broiler chickens in the amount of 1 ml were diluted in 9 ml of sodium chloride solution, after which further tenfold dilutions were made from the obtained ten-fold dilutions. From the last seven Petri dishes, 0.1 ml of the suspension were seeded using the pour-plate method on MPA and Lactobacillus agar. After 24 h of incubation at 37.5 °C, colonies grown on MPA were counted; and after 48 h of incubation at the same temperature, colonies grown on lactobacilli were counted.

The obtained material was treated using the biometric method of variational statistics according to N. P. Plokhinsky (1970). The differences were considered statistically significant at: * – $P \leq 0.05$; ** – $P \leq 0.01$; *** – $P \leq 0.001$.

Unlike the traditional scheme, the scheme of feeding the chickens at the poultry farm included the period of 0 – 7 days (pre-start) when the combined feeds contained the maximum number of maize and soybean meal. In the period of 8 – 14 days, the share of the meal increased by reducing the specific weight of maize, soybean meal, wheat, and adding sunflower cake (Table 2).

Table 2. The composition of the complete combined feed for the broiler chickens by periods of growing

Components	Age, days			
	0 – 7	8 – 14	15 – 28	28 – 42
Maize	39.2	32.9	33.3	35.0
Wheat	15.0	20.0	25.7	29.7
Barley without husk	-	-	2.7	-
Soybean meal	27.0	-	-	10.9
Soybean cake	11.8	35.1	24.1	-
Sunflower cake	-	4.4	6.4	14.0
Sunflower oil	2.0	2.6	3.2	4.0
Meat and bone meal	-	-	-	2.2
Defluorinated phosphate	1.6	1.3	1.6	1.2
Fodder lime	1.0	1.1	1.0	1.0
Monocalcium phosphate	0.4	0.6	-	-
Premix P5	2.0	2.0	-	-
Premix P6-1	-	-	2.0	2.0
The combined feed contains, %				
Metabolizable energy, kcal/100 g	301.0	305.0	311.0	314.2
Crude protein, %	22.93	21.46	18.88	19.09
Crude fat, %	7.2	7.1	7.0	8.12
Crude fiber, %	4.0	4.7	4.5	4.99
Linoleic acid, %	2.8	3.8	3.6	4.4
Lysine, %	1.45	1.21	1.09	1.00
Calcium, %	1.02	1.01	0.90	0.80
Phosphorus, %	0.78	0.77	0.75	0.59

The data from Table 2 show that the combined feeds for the broiler chickens are balanced per the detailed feeding norms.

III. RESULTS

The live weight gain of the broiler chickens in the scientific and economical experiment is shown in Table 2.

As a result of using the biological product, the live weight veraciously increased in the second group of chickens by 8.0 %.

The average daily weight gain in the first 14 days increased in the second group by 2.7 %. In the fattening period of 15 – 28 days, this value was higher in the experimental group by 10.6 %. In the final period of growing of 29 – 42 days, the live weight gain was higher by 7.7 % in the second experimental group than that in the reference group. In general, this value was higher in the experimental group by 8.2 %.

Table 3. The growth rate of the broiler chickens in the experiment

Indicators	Group	
	1 (reference)	4 (experimental)
Live weight (g) by periods (days):		
1	44.2 ± 0.39	44.3 ± 0.4
in % to the reference	100	100.2
14	452.8 ± 10.6	465.1 ± 6.5
in % to the reference	100	102.7
28	1,466.6 ± 30.8	1,586.5 ± 35.1**
in % to the reference	100	108.2
42	2,408.6 ± 44.8	2,601.9 ± 39.6***
in % to the reference	100	108.0
The gross live weight gain over the period, g:		
1 – 14 days, g	408.56	420.84
in % to the reference	100	103.0
15 – 28 days, g	1,013.87	1,121.33
in % to the reference	100	110.6
29 – 42 days, g	942.02	1,015.43
in % to the reference	100	107.8
1 – 42 days, g	2,364.45	2,557.60
in % to the reference	100	108.2
The average daily live weight gain over the period, g:		
1 – 14 days	29.2	30.0
in % to the reference	100	102.7
15 – 28 days	72.4	80.1
in % to the reference	100	110.6
29 – 42 days	67.3	72.5
in % to the reference	100	107.7
1 – 42 days	56.3	60.9
in % to the reference	100	108.2

Note: * – P < 0.05, ** – P < 0.01

It was also found that the feed used per 1 kg of the live weight gain was lower in the experimental group by 8.0 %, with virtually the same consumption of the feed mixture.

The results of analyzing the changes in the contents of the microflora of the caeca in the intestine showed a reduction of the common microbial number in the experimental group of chickens from 2x109 to 3x107 and am increase in the number of lactobacilli from 1x106 to 6x107.

In general, over the entire experiment, the value of the average daily gain was the highest in the experimental group – 8.2 % above the value in the reference group. This implies that the dosage of 1.5 % of the biological product from the weight of the feed is very efficient. With that, the authors noted a reduction in the total microbial count in the contents of the caeca in the intestines of the chickens and an increase in number of lactobacilli, which proves increasing the live weight gain due to changes in the microbial composition of chickens' intestines toward increasing the number of lactic acid bacteria.

Taking the results of the study into account, one can assume that the innovative combination of prebiotics (vegetative component), probiotics, and adsorbents plays an important role in the development of efficient combined biological products.

IV. CONCLUSION

The authors believe that it is expedient to feed to broiler chickens the biological product with the functional properties based on fermented brewer's grains with a vegetable filler and an adsorbent in the amount of 1.5 % by the weight of the feed.

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