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Impact of feed additives SUBACIL-1 and SUBACIL-2 on productivity of chicken-broilers

Abstract: One of the most important problems of probiotics production is the development of non-waste technologies, in particular, usage of microbial cultures fugate. In conventional technology, it must be disposed of after the intensive heat treatment in drains. The fugate does not contain bacteria, but rather products of their metabolism and biosynthesis, which may have therapeutic, preventive and growth-stimulating effects. The above mentioned fact shows the relevance of the development of non-waste technology of feed probiotics of the genus *Bacillus* and their metabolites. In al-Farabi Kazakh National University, at Biotechnology Department of Faculty of Biology and Biotechnology were obtained experimental samples of probiotic feed additives – SUBACIL. SUBACIL-1 is lyophilized biomass of *Bacillus subtilis* P-2 containing $9x10^{12}$ spores in 1g. SUBACIL-2 is a combined feed probiotic comprising metabolites of *B.subtilis* P-2 immobilized on sunflower meal with addition of soya flour hydrolyzate. In this study was investigated the impact of feed additives SUBACIL-1 and SUBACIL-2 for growing of broiler chickens, in accordance with the following factors: changes of body weight, average daily gain and safety of the birds. The addition SUBACIL-1 of feeding for broilers increases the productivity of poultry meat by 11%, SUBACIL-2 – 9%. The use of new additives during the growing period is accompanied by the increase in average daily gain. When using of SUBACIL-1 daily gain is by 9.7% more than that of control group and 2.4% while using of SUBACIL-2. The introduction of these additives allows gaining 90% (SUBACIL-1) and 85% (SUBACIL-2) preservation of livestock. The greatest efficiency index was 214.94.
Key words: feed additive, *Bacillus subtilis* P-2, fugate, SUBACIL.

Introduction

At the moment prevention of gastrointestinal diseases of poultry is an essential event in the organization of any profitable poultry farms. The traditional usage of antibiotics and chemicals for correction and treatment of gastrointestinal diseases leads to accumulation of drug-resistant strains of intestinal infections in the poultry production [1-3].

The most appropriate alternatives to feed antibiotics are considered sporogenous probiotics with approved results and comparable economic efficiency and, moreover, which pose no danger to humans and environment. Today's trend in their development is the use of bacteria of genus *Bacillus*.

Bacteria of genus *Bacillus* have high antimicrobial activity and a high level of production of enzymes [4-6]. In this regard, it seems promising to do research aimed at the development of probiotics – enzymatic microbial feed additives that enhance the nutritional value and the digestibility of the feed and thus increase the productivity index.

Another major problem of probiotics production is the use of fugate of microbial cultures. In conventional technology, it must be disposed off [7]. The filtrate is a byproduct of production of bacterial preparations or concentrates [8-10]. The fugates as a rule do not contain the bacteria, but there are products of their metabolism and biosynthesis, which may have therapeutically and preventive and growth-stimulating effect. The above mentioned facts show the relevance of the development of non-waste technology of feed probiotics of genus *Bacillus* and their metabolites.

Materials and methods

Object of study. Culture and fugate of strain *Bacillus subtilis* P-2; probiotic feed additives SUBACIL-1 and SUBACIL-2.

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Methods of research.

In al-Farabi Kazakh National University, at Biotechnology Department of Faculty of Biology and Biotechnology were obtained experimental samples of probiotic feed additives – SUBACIL. SUBACIL-1 is lyophilized biomass of *Bacillus subtilis* P-2 containing $9x10^{12}$ spores in 1g. SUBACIL-2 is a combined feed probiotic comprising metabolites of *Bacillus subtilis* P-2 immobilized on sunflower meal with addition of soya flour hydrolyzate.

The experiments were performed on broiler chickens cross «Smena-7» (day 1 to 41; in the pilot house). The experimental groups (control and test) broiler chickens were formed at day-old, according to the scheme on the basis of the experience of peers on 20 goals each. Each chicken was assigned an individual number of labeled wing rings. The chicks of all groups were kept on the outdoor by sections. Conditions of growing, the parameters of the microclimate, the front of feeding and watering, lighting mode, and the stocking density of chickens of all groups were similar.

Test parameters:

1. Body weight of chickens. In order to control the dynamics of age changes of live weight of chickens, and the average daily gain and the relative homogeneity conducted individual weighing of all livestock on a weekly basis at the same time the day before feeding was conducted.

According to the individual values was defined the uniformity of poultry in live weight (calculated average live weight of all livestock was determined by the number of individuals as a percentage of all livestock in the group with body weight within ± 10% of the average of all livestock) (Formula 1).

$$Ko = \frac{(n_1 - n_2) \times 100}{n_1} \quad (1)$$

where, K_o – uniformity coefficient (%); n_1 – the number of observations (number of goals); n_2 – the number of cases, individual values deviate by more than ± 10% of the arithmetic mean.

2. The rate of growth of chickens (average daily gain). The rate is determined by the absolute weight gain of chickens, calculated according to the Formula 2:

$$U = U_1 - U_2 \quad (2)$$

where, U_1 – mass at the beginning of the growing period, g; U_2 – mass at the end of cultivation, g.

The average daily weight gain of chickens was calculated by Formula 3:

$$U/t = U_1/t_1 - U_2/t_2 \quad (3)$$

where, U/t – the average absolute increase, $g \times d^{-1}$; t_1 – the age at the beginning of the growing period, days; t_2 – the age at the end of the growing period, days.

3. Preservation of broilers,%. It was calculated on the base on the daily account of the number of dead chickens. Preservation of livestock carried out on a daily basis, taking into account the causes of mortality. The cost of feed for the rearing period by taking into account a given feed and balances for the period.

4. Consumption of feed, kg per 1 kg of growth.

5. Performance Index of broiler growing by Formula 4:

$$PIBG = (Body\ weight \times Preservation) / (Period\ of\ growing \times Consumption\ of\ feed) \div 10 \quad (4)$$

Experimental data was processed using the application «Statistics for Windows, v 5.0» and «BIOSTAT», «Microsoft Excel for Windows 2007», spreadsheet Excel 7.0. Calculates an average value, the meridian, standard deviation, standard error of the mean and others.

Results and their discussion

Probiotic feed additives SUBACIL – 1 and SUBACIL – 2 have a positive impact on microbiocenosis, stimulating the growth of lactobacilli and cellulose-fermenting bacteria in the intestines of broiler chickens on the background of the elimination of opportunistic and pathogenic enterobacteria. Application of SUBACIL -1 in experimental *Salmonella* infection increases the level of intestinal colonization resistance, as evidenced by the 85% of reduction of cases of isolation of pathogen from the material enrolled for study of.

During the study the impact of feed additives SUBACIL-1 and SUBACIL-2 for growing broiler chickens was examined, on the following factors: changes in body weight, average daily gain and the preservation of the Poultry.

The work was carried out on broiler chickens of 'Smena-7' cross. Technological parameters of feeding and keeping chickens corresponded to generally accepted recommendations in this area. Experimental and control groups included 20 broiler chickens.

Table 1 – Scheme the search experience

Group	Number of chickens	Dose	Subjects factors
Control	20	-	The basic diet; Probiotics have not been used
Experiment 1	20	1 g to 30 L per water	Basic diet; SUBACIL-1
Experiment 2	20	1 g to 1 kg per dry food	Basic diet; SUBACIL -2
Experiment 3	20	1 g to 1 kg per dry food	Basic diet; Probiotic drug «Biosporin»
Experiment 4	20	5 ml to 10 L per water during five days	Basic diet; Antibiotic «Enroksil 10%»

Each experiment lasted for technological growth cycle (41 days).

The main indicator of the meat efficiency of poultry is dynamics of live weight during technological period of growing. Live weight is the main index according of which the amount of meat of poultry of any age is determined [11]. Live weight is established by weighting. Broiler chickens were weighed in the morning, prior to feeding. The control determination of mass was performed weekly. As a result of the conducted investigations, the positive effect of feedings on intensity of chickens growth was established (Table 2).

Table 2 – Changes of live weight of broiler chickens during the growth process

Age of broilers, days	Live weight, g				
	Control group	SUBACIL-1	SUBACIL-2	Biosporin	Enroksil 10%
1	36.0±0.2	36.0±0.3	36.0±0.3	36.0±0.4	36.0±0.3
7	125.5±4.0	128.7±32.8	131.4±19.6	128.5±23.7	121.5±22.8
14	288.9±6.5	289.5±21.4	302.7±29.5	288.9±7.5	278.5±23.3
21	589.8±43.0	603.3±11.4	627.6±20.8	597.6±22.3	591.3±14.5
28	901.8±41.7	923.0±16.0	941.2±34.0	899.5±11.5	901.4±14.4
35	1270.3±53.6	1342.7±21.2	1356.0±41.2	1268.0±44.2	1281.7±23.8
41	1705.3±7.2	1880.6±87.9	1850.8±89.9	1799.7±86.1	1712.6±76.4

The received data showed that chickens of the experimental group with introduction of feeding SUBACIL-1 were distinguished by high rate of growth compared to chickens of control group.

For the period from the 1st to the 7th day of the experiment the increase of the average live weight of chickens in the experimental group compared to the control group were more by 2.4%. From the 7th to the 14th day of the experiment the average weight of chickens in the experimental group increased by 0.3%. The third week of the experiment allowed the increase all the average weight of broilers by 2.3%. Further, from the 21st to the 28th day of 2.4%. In the next period (28 – 35 days) – 5.7%. In the final period (35-41 days) – 10.7%.

Thus, the maximum gain of live mass of chickens, receiving feed additive SUBACIL-1 relatively to the control ones was in the final weeks of cultivation (10.7%).

For probiotic additive SUBACIL-2 the maximum live weight gain is 8.5% for Biosporin – 5.5% and antibiotic «Enroksil 10%» – 0.4%.

According to the obtained results it can be concluded that the probiotic preparations have a positive effect on live weight gain. The most effective preparation is SUBACIL-1. «Enroksil 10%» almost has no effect on live weight gain, as evidenced by the results (0.4%).

It is important indicator of the effectiveness of feed additives is the average daily gain of broiler chickens. Table 3 shows the calculation data of growth speed of chickens in experimental control groups.

Table 3 – Dynamics of average daily gain of broiler chickens

Age of broilers, days	Average daily gain, g				
	Control group	SUBACIL-1	SUBACIL-2	Biosporin	Enroksil 10%
1-7	17.5±0.5	15.2±0.4	14.2±0.5	13.6±0.6	13.8±0.4
7-14	28.9±0.5	28.6±0.5	23.6±0.6	22.5±0.2	21.5±0.3
14-21	49.9±0.4	49.8±0.4	44.9±0.3	46.8±0.1	45.1±0.4
21-28	51.2±0.6	47.8±0.3	47.4±0.8	48.1±0.8	44.5±0.5
28-35	57.0±2.03	60.1±2.2	54.4±2.2	57.2±2.0	54.3±2.1
35-41	76.5±1.4	88.2±1.7	81.3±1.4	84.6±1.4	72.7±1.8
1-41	41.5±1.6	45.0±1.4	42.1±1.9	41.1±1.4	41.0±1.1

According to the table the dynamics of growth speed of chickens was corresponded to the increase of their mass. Over the whole period of the experiment (from the 1st to the 41st day) the growth speed of broiler chickens received SUBACIL-1 by 9.7% exceeded the indicators of the control group, SUBACIL-2 – 2.4%, Biosporin – 1.8%.

Preservation was determined by everyday counting of dead chickens. Data on the preservation of broiler chickens for the experimental period are shown in Table 4.

Chickens preservation receiving only food and water is 70%. Analyzing the obtained results, in general we can say that, within the technological cycle, the preservation of broilers after applying the test preparations was 90% (SUBACIL-1) and 85% (SUBACIL-2). In comparison groups using Biosporin and «Enroksil 10%» resulted in increased preservation till 80% and 75% respectively.

According to the obtained data an index of efficiency of growing of broiler chickens was calculated.

Table 4 – Preservation of broiler chickens per experimental period

Index		Control group		SUBACIL-1		SUBACIL-2		Biosporin		Enroksil 10%	
		Heads	%	Heads	%	Heads	%	Heads	%	Heads	%
Safety in weeks	1	19	95	19	95	20	100	20	100	20	100
	2	19	95	19	95	19	95	20	100	19	95
	3	18	90	19	95	19	95	19	95	19	95
	4	17	90	19	95	19	95	18	90	18	90
	5	17	85	18	90	18	90	17	85	17	85
	6	16	85	18	90	18	90	16	80	16	80
	7	14	70	18	90	17	85	16	80	15	75

Table 5 – An index of efficiency of growing of broilers

Options	Live weight, g	Safety, %	Term cultivation, days	Consumption of feed on 1 kg of growth, kg	Performance Index
Control	1705.3±87.2	70	41	1.96	159.13
SUBACIL-1	1880.6±87.9	90	41	1.92	214.94
SUBACIL-2	1850.8±89.9	85	41	1.88	204.00
Biosporin	1799.7±86.1	80	41	1.95	180.01
Enroksil 10%	1712.6±76.4	75	41	1.98	168.71

The highest index of efficiency in the group, receiving the feed additive SUBACIL-1, is 214.94.

Thus, the addition of SUBACIL-1in feed for broilers increases the meat productivity of poultry by 11%, SUBACIL-2 by 9%. Using the new additives during the whole growing period is accompanied by the increase of average daily gain. When using SUBACIL-1, an average daily gain by 9.7% or more than in the control group and by 2.4% when using SUBACIL-2. The introduction of these additives allows achieving 90% (SUBACIL-1) and 85% (SUBACIL-2) of preservation of livestock.

Conclusions

The addition of SUBACIL-1 increases productivity of poultry meat by 11%, SUBACIL-2 by 9%. The use of new additives during the whole growing period is accompanied by the increase of average daily gains. When using SUBACIL-1 average daily gain by 9.7% more than in the control group and by 2.4% when using SUBACIL-2. The introduction of these additives allows achieving 90% (SUBACIL -1) and 85% (SUBACIL-2) of preservation of livestock. The greatest efficiency index was 214.94.

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