Body weight dynamics of broiler chickens by feeding probiotic preparation

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Abstract. Under industrial conditions, broiler chickens are constantly exposed to stressful factors that can increase their susceptibility to intestinal diseases, leading to reduced productivity, immune suppression, and increased mortality. Antibiotics are widely used to maintain and improve productivity in such conditions. However, in recent years, there has been a tightening of the rules on the use of antibiotics in animal husbandry in order to stop them from entering food for people, as well as in connection with the emergence of strains of pathogenic bacteria that have developed resistance to a wide range of antibiotics, which pose a danger to human health and life. In this regard, manufacturers are searching for alternatives to antibiotics. One of the most promising groups is probiotics. In the course of the study, it was found that low-protein diets (with a low protein content, but balanced by the amino acid profile) can unlock the potential of probiotic cultures of the Bacillus amyloliquefaciens strain and, as a result, increase the safety of broiler chickens by 4.6 %, body weight by 10.1 %.

1. Introduction
Currently, poultry farming is an effectively developing industry in our country. The constantly increasing production of poultry meat plays an important role in import substitution [1-3]. At the same time, properly organized feeding of poultry serves as one of the factors of providing the population with safe and high-quality products [4].

Recently, the question of the need to abandon the use of antibiotics as growth promoters and replace them with other drugs has become more and more frequent [5-7]. In this connection, the majority of poultry meat production enterprises resort to the use of various feed products that have a positive impact on the productive indicators in the cultivation of poultry and the quality of the resulting meat. These supplements include probiotics [8-10].

The inclusion of probiotics in the technology of growing broiler chickens is one of the most effective ways to prevent stomach diseases, based on environmentally safe mechanisms for maintaining a high level of colonization resistance of the intestine, stimulating the fattening of poultry. Probiotics are often used as additives to compound feeds with an increased level of fiber, which the bird, especially young, is not able to digest well. Introduced into the gastrointestinal tract of animals with food, they destroy the shell of plant cells and make available for assimilation the nutrients contained in them [11-13].

The main factor determining the effectiveness of the probiotic is the strain. The microorganisms that are part of probiotics affect the body at the systemic level, activating nonspecific resistance and
increasing the resistance of young animals to infectious diseases [14-16]. Probiotics, in most cases, are considered as therapeutic and preventive drugs, and there are almost no studies on the effect of probiotics on the growth and development of modern broiler chicken crosses and improving the quality of the resulting products [17-19]. However, there is evidence that their use improves the absorption of nutrients in the intestine, reduces the amount of ammonium and toxic biogenic amines formed during the decay of proteins [20-24].

Thus, for researchers in the field of poultry production technology, there is a large front for scientific research and the implementation of their results in the real sector of the agro-industrial complex in view of the search for probiotics that can have a complex effect on the poultry body, and the development of effective schemes for their use [25-27].

Currently, cases of viral diseases of poultry have become more frequent, and accordingly, there is a need for the use of drugs that increase the resistance of the body, such drugs include Bacillus amyloliquefaciens.

2. Materials and methods
Scientific and economic experience on the effect of probiotic cultures of strain Bacillus amyloliquefaciens on the safety of broiler chickens was carried out on chickens cross Cobb-500 in terms of training and research of poultry ESIC "Agrotechnopark" Belgorodskiy GAU.

To conduct the study, 4 groups were formed - a control group and 3 experimental groups. For this purpose, 36 sections of 65 heads each were formed from a batch of 2340 day-old broiler chickens, 9 sections (replication) for each experimental group. The broilers were randomly distributed into 36 cells. The planting density was 17.3 heads/ m². In total, 4 different diets were studied. The experience lasted 40 days.

The parameters of the microclimate, planting density, feeding and watering front, were similar for all groups of poultry and corresponded to the standard indicators.

The bird received rations of the Starter, Grower, Finisher, Starter Feed the bird received from the moment of setting up for the experiment, the 0th (1st) day. The transition from the Starter to the Grower brand feed was made at the age of 10 days by gradually replacing one feed with another (in % of the standard - 70/30, 50/50, 30/70). Next, the bird received food Grower up to 22 days of age. From the age of 23 days, the bird was smoothly transferred to the Finisher feed (in a similar proportion as when switching from the Starter to the Grower) and fed this type of feed until the end of the experiment.

The features of feeding broiler chickens were as follows:

1. Control group (Standard diet);
2. Experimental group (Low-protein diet);
3. Experimental group (Standard diet + probiotic Bacillus amyloliquefaciens);
4. Experimental group (Low-protein diet + probiotic Bacillus amyloliquefaciens).

In experimental groups 2 and 4 (Low-protein diet), the rations GROWER and FINISHER additionally provide for the introduction of such synthetic amino acids as L-Valine, L-Isoleucine and L-arginine. The reduction in the crude feed protein index in groups 2 and 4 will be about 1.5-2% for each phase. The decrease in the crude protein index in these groups is limited by balancing the so-called "glycine equivalent" (the sum of glycine + serine x 0.7143), where the calculated value of this indicator is at least 118% of the total lysine.

During the experiment, the following indicators were determined:

- Microclimate data in the poultry house (daily) (temperature, humidity, ventilation parameters in m³ / h per head, illumination);
- Accounting for the distribution of feed (daily);
- Accounting for diseases/waste/death (daily);
Body weight by weighing at age-0 (1) day, 10th day, 23rd day, 40th day; per phase.

Table 1. Scheme of experience with the distribution of groups in the experimental building.

| Rations/groups |
|----------------|
| T1  | T2  | T3  | T4  |
| 11  | 21  | 31  | 41  |
| 12  | 22  | 32  | 42  |
| 13  | 23  | 33  | 43  |
| 14  | 24  | 34  | 44  |
| 15  | 25  | 35  | 45  |
| 16  | 26  | 36  | 46  |
| 17  | 27  | 37  | 47  |
| 18  | 28  | 38  | 48  |
| 19  | 29  | 39  | 49  |

The conditions of keeping chickens in all groups were the same and met the recommended standards for this cross.

Numerous studies have found that the conditions of keeping poultry often serve as stress factors for it, which reduce the efficiency of agricultural production.

3. Results and Discussion

The body reacts to the influence of environmental factors depending on its adaptive capabilities. At the same time, the specificity of adaptive reactions depends on the initial functional state, the period of adaptation, etc.

During the experimental period (from the daily age to the 40-day age), the physiological state of the bird was monitored daily. In order to determine the effect of the use of probiotic cultures of the Bacillus amyloliquefaciens strain on the resistance of the poultry body, we evaluated its safety for individual growing periods and in general for the entire period of the experiment.

The probiotic Bacillus amyloliquefaciens contributed to the normalization of the microflora of the gastrointestinal tract and increased the immunological reactivity of poultry (table 2).

Table 2. Safety of broiler chickens, %

| Diet | Safety by group | Average |
|------|-----------------|---------|
| T1   | Group 11  
      | Safety 95.4  | 90.3    |
|      | Group 12  
      | Safety 100  |         |
|      | Group 13  
      | Safety 89.2  |         |
|      | Group 14  
      | Safety 89.2  |         |
|      | Group 15  
      | Safety 84.6  |         |
|      | Group 16  
      | Safety 86.2  |         |
|      | Group 17  
      | Safety 89.2  |         |
|      | Group 18  
      | Safety 87.7  |         |
|      | Group 19  
      | Safety 90.8  |         |
| T2   | Group 21  
      | Safety 90.8  | 89.9    |
|      | Group 22  
      | Safety 89.2  |         |
|      | Group 23  
      | Safety 87.7  |         |
|      | Group 24  
      | Safety 92.3  |         |
|      | Group 25  
      | Safety 93.8  |         |
|      | Group 26  
      | Safety 87.7  |         |
|      | Group 27  
      | Safety 95.4  |         |
|      | Group 28  
      | Safety 89.2  |         |
|      | Group 29  
      | Safety 83.1  |         |
| T3   | Group 31  
      | Safety 92.3  | 94.0    |
|      | Group 32  
      | Safety 93.8  |         |
|      | Group 33  
      | Safety 90.8  |         |
|      | Group 34  
      | Safety 93.8  |         |
|      | Group 35  
      | Safety 96.9  |         |
|      | Group 36  
      | Safety 96.9  |         |
|      | Group 37  
      | Safety 95.4  |         |
|      | Group 38  
      | Safety 95.4  |         |
|      | Group 39  
      | Safety 90.8  |         |
| T4   | Group 41  
      | Safety 92.3  | 94.5    |
|      | Group 42  
      | Safety 90.8  |         |
|      | Group 43  
      | Safety 96.9  |         |
|      | Group 44  
      | Safety 96.9  |         |
|      | Group 45  
      | Safety 98.5  |         |
|      | Group 46  
      | Safety 92.3  |         |
|      | Group 47  
      | Safety 95.4  |         |
|      | Group 48  
      | Safety 95.4  |         |
|      | Group 49  
      | Safety 92.3  |         |

The analysis of the safety indicators of chickens showed that the lowest indicators were recorded in groups 1 and 2, where the chickens did not consume probiotics with the diet, here the safety was recorded at the level of 89.9-90.3%.

In the course of the study, it was found that the safety of livestock increases based on the use of probiotics. The maximum safety index of 94.5% was observed in the 4th group, who received a low-protein diet with the use of probiotic cultures of the Bacillus amyloliquefaciens strain, which is 4.6% higher than the indicators of the control group 1.
Broiler chickens of the "Cobb-500" cross have a potential (genetically inherent in the body) ability to accelerate the intensity of body weight gain from 60 to 130 g per day and, as a result, are characterized by high live weight indicators.

It is necessary to create favorable conditions for the manifestation of the genetic potential to the full extent and to achieve high productivity indicators, in particular live weight, by building muscle mass.

At the age of 0 (1) day, 10th days, 23rd days, 40th days; during the phase, we conducted control weighing to determine the dynamics of body weight (Table 3).

Analysis of the dynamics of chicken growth revealed changes in the growth of chickens in different age periods. With almost equal body weight on the first day and on the 10th day, on the 23rd day, the chickens of the second and fourth experimental groups had higher body weight indicators.

Table 3. Live weight of broiler chickens of the "Cobb-500" cross when using a probiotic strain of Bacillus amyloliquefaciens, g

| Diet | Days age | Body weight by group | Average |
|------|----------|----------------------|---------|
|      | Days age | 11  12  13  14  15  16  17  18  19 |         |
| 1    | 1        | 49.9  50.3  50.2  50.5  50.4  49.8  50.6  50.4  50.2  50.2 |
| 10   | 262.4    | 268.1  270.5  254.8  260.1  257.8  270.7  263.0  265.3  263.6 |
| T1   | 23       | 997.4  1008.8  1052.1  1027.5  963.4  979.6  949.5  1020.3  950.5  994.3 |
| 40 (%) | 2465.0   | 2464.0  2467.0  2498.0  2388.0  2469.0  2445.0  2476.0  2450.0  2458.0 |
| 40 (%) | 2292.0   | 2257.0  2359.0  2305.0  2316.0  2290.0  2300.0  2333.0  2355.0  2319.1 |
| 40 (aver.) | 2380   | 2364  2408  2393  2356  2378  2366  2415  2396  2383.9 |
| 1    | 50.1    | 50.7  50.4  50.0  50.5  50.1  50.6  50.0  50.3  50.3 |
| 10   | 284.1   | 275.6  262.5  258.2  260.3  267.6  267.1  264.1  272.8  268.0 |
| T2   | 23       | 978.1  989.0  997.3  972.6  1042.4  1053.5  984.7  946.2  1007.0  996.8 |
| 40 (%) | 2510.0   | 2608.0  2613.0  2543.0  2623.0  2651.0  2607.0  2594.0  2667.0  2601.8 |
| 40 (%) | 2451.0   | 2451.0  2491.0  2526.0  2439.0  2536.0  2482.0  2403.0  2512.0  2476.8 |
| 40 (aver.) | 2483   | 2539  2554  2534  2528  2589  2548  2486  2500  2540.2 |
| 1    | 50.4    | 50.4  50.2  50.1  50.0  49.6  50.2  50.6  49.6  50.1 |
| 10   | 267.4   | 272.0  272.1  258.4  258.9  267.3  267.2  270.3  258.6  265.8 |
| T3   | 23       | 1033.1  1053.7  1011.9  1029.5  1007.0  1046.8  945.2  987.3  1020.1  1015.0 |
| 40 (%) | 2572.0   | 2481.0  2461.0  2520.0  2453.0  2539.0  2513.0  2449.0  2553.0  2500.3 |
| 40 (%) | 2352.0   | 2364.0  2351.0  2341.0  2343.0  2410.0  2373.0  2308.0  2355.0  2355.2 |
| 40 (aver.) | 2456   | 2422  2402  2433  2395  2475  2437  2375  2442  2426.3 |
| 1    | 49.8    | 50.3  50.5  50.4  50.3  50.2  50.6  50.4  50.2  50.3 |
| 10   | 282.2   | 261.3  251.8  269.7  273.8  276.3  265.8  262.3  270.5  268.2 |
| T4   | 23       | 1006.3  1030.2  1073.2  1039.7  1048.9  1075.3  1034.1  1060.2  1077.2  1049.5 |
| 40 (%) | 2647.0   | 2623.0  2723.0  2684.0  2710.0  2728.0  2717.0  2699.0  2713.0  2693.8 |
| 40 (%) | 2536.0   | 2547.0  2586.0  2529.0  2531.0  2586.0  2605.0  2559.0  2579.0  2562.0 |
| 40 (aver.) | 2590   | 2589  2647  2609  2616  2661  2658  2613  2640  2624.7 |

At the age of 40 days, the best results were recorded in the 4th experimental group, whose diet was low in protein, and also included a probiotic.

4. Conclusion
The use of probiotics for balancing diets allows not only to optimize the diet to reduce its cost without compromising production results, but also to improve intestinal health, and therefore reduce the use of antibiotics for the treatment/prevention of intestinal diseases.

As a result of the conducted studies, it can be argued that low-protein diets (with a low protein content, but balanced by the amino acid profile) can unlock the potential of probiotic cultures of the Bacillus amyloliquefaciens strain and, as a result, increase the safety of broiler chickens by 4.6%, body weight by 10, 1 %.

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