Optimizing broiler diets using protein supplement

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Abstract. The results of the studies showed that the inclusion of compound feed protein supplement "Biobardin" in the amount of 3-5% had a positive effect on the main indicators of productivity (preservation and increase in live weight) of broiler chickens. The feed obtained using Biobardin was characterized by a higher content of protein, organic acids, bacteriocins, and also contained the biomass of lactic acid and propionic acid bacteria. It was established that the broiler chickens absorbed enriched mixed feed more efficiently than the chickens, which consumed similar mixed feed without the studied additives. The broiler chickens from the experimental groups were significantly superior to their peers from the control group: the chickens not only grow better, use feed more economically, but also effectively transform the nutrients of the diet into body weight gain. On the basis of the results of experimental feedings, near-complete preservation of young birds, rapid development and weight gain, good physical condition, absence of diseases, good food intake were noted. The introduction of 5% protein feed additive “Biobardin” into the broilers’ diet can be a real competitor to the traditional source - fish flour or alternatively be used in industrial poultry farming along with it.

1. Introduction

The modern strategy for the development of poultry farming in Russia involves a significant increase in the volume of domestic feed production, improving their quality, balancingness and protein content [1-3].

Currently used methods of bird feeding do not always allow fully balancing diets according to the most important indicators of energy, protein, minerals and vitamins, so the genetically established potential of bird productivity is used only by 50-60% [4]. In addition, the artisan production of complete feed in order to reduce their cost leads to poor quality, imbalance, and lack of protein, significant cost overruns and high production costs.

Based on the conducted fundamental research in RSRIFB, a modern technology for the production of protein feed additives "Biobardin" based on post-alcohol distillery waste have been developed and implemented on an industrial scale [5]. The feed additive is characterized by a high content of protein (40-45%), amino acids, vitamins, trace elements, contains a complex of enzymes, bacteriocins, as well as a consortium of lactic and propionic acid bacteria, providing probiotic and protective and preventive properties of the feed product. The results of the previous trials of “Biobardin” showed high efficiency in feeding animals (cattle, pigs) [5]. The composition of “Biobardin” allows its use in poultry farming for the production of the most important products - poultry meat and eggs. However, despite such a high potential of protein supplements, studies on the use of "Biobardin" in poultry have not been conducted.

The purpose of the article is to study the possibility of using protein feed additive “Biobardin” in compound feeds for broiler chickens with the aim of balancing the protein feeding diets of the bird and for partial replacement of soy oil and sunflower meal in them.
2. Research materials and methods
In the vivarium, a scientific and production experiment on broiler chickens of “Cobb-500” cross was conducted; 5 groups (control group and 4 experimental groups) of 30 birds each were formed from these broiler chickens on the basis of analogues.

Poultry was fed ad libitum dry with balanced feed with nutritional parameters corresponding to the recommended feeding standards of VNITIP. Up to the age of 5 days, chickens of all groups received a "zero" diet, chickens of 6 days plus received experienced feed mixtures.

As additives protein feed additive “Biobardin” (protein content 45%), fish meal (protein content 65-67%) was used. Poultry conditions were in accordance with accepted zoohygienic parameters. The duration of the experiment is 35 days. The experimental design is shown in table 1.

| Table 1. Experimental design. |
|-------------------------------|
| Groups | Feeding habits |
| No. 1 - Control | Basic diet [BD] |
| No. 2 - experimental | BD + 3.0 % “Biobardin” |
| No. 3 - experimental | BD + 4.0 % “Biobardin” |
| No. 4 - experimental | BD + 5.0 % “Biobardin” |
| No. 5 - experimental | BD + 5.0 % fish meal |

Indicators which were taken into account:
- livestock safety (daily count of dead birds);
- live weight (individual weighing of the entire livestock);
- daily average growth at the end of the growing period;
- average daily feed intake (by groups);
- the cost of feed per 1 head and 1 kg of increase in live weight of chickens (at the end of the growing period).

At the end of the growing period, to study the digestibility and use of nutrients in the diet, balance experiments were conducted.

The biometric processing of the digital material obtained in the experiments was carried out by the method of variation statistics (Student t-criteria) using Microsoft Excel 9.0 program.

3. Results and discussion
An analysis of the data on the cultivation of poultry up to the age of 5 weeks showed that the best results were obtained when “Biobardin” and fish meal were added to the diet in an amount of 5% (table 2).

| Table 2. Zootechnical indicators of broiler chickens’ raising under different variants of feeding rations (calculated data). |
|---------------------------------------------------------------|
| Indicators | 1 | 2 | 3 | 4 | 5 |
| Preservation for the raising period, % | 96.7±3.3 | 83.3±6.0 | 86.7±6.2 | 90.0±5.5 | 86.7±6.2 |
| Live weight of 3-week-old chickens, g | 787.5±22.4 | 686.6±22.6 | 692.7±28.7 | 713.5±21.4 | 728.922.4 |
| The average live weight of a bird (50 %♀+50 %♂), g | 1940.2±35.0 | 1779.5±49.3 | 1805.3±36.5 | 1841.8±37.8 | 1871.4±36.3 |
The average daily gain, g/day
54.2  49.6  50.4  51.4  52.3

Gross increase in live weight in
the group, kg
55.01  43.23  45.68  48.47  47.40

Feed consumption by broiler
chickens during the raising
period, g/head*
3.282  3.317  3.344  3.385  3.267
- including compound feed*
3282  3220  3216  3223  3112

Feed costs per 1 kg of growth
(conversion), kg/kg*
1.76  2.11  2.05  1.99  1.93
- including compound feed
under the action of the additive,
kg/kg
- - -  2.05  1.97  1.90  1.85

Efficiency of using additionally
introduced protein to
compensate for the gain in live
weight, kg/kg*
- - -  0.29  0.24  0.23  0.37

Note: hereinafter, superscripts (a-i) indicate confidence thresholds for \( P \leq 0.10 \) … \( P \leq 0.001 \) compared to the control group (group 1); indicators taken with the consideration of live weight and bird safety by the end of the production period of its raising are defined with an asterisk (*).

The maximum addition of “Biobardin” turned out to be more preferable in comparison with the analogous inclusion of fish meal in mixed feed, although it was characterized by lower indicators of live weight in the surviving individuals. This was reflected not only in the complex of zootechnical indicators, but was also confirmed by a visual assessment: the chickens were distinguished by their mobility, good appetite and clean feather cover.

In general, it is worth noting that a significant and certain increase in live weight of the bird by 4.1-10.2% \( (P \leq 0.10-0.01) \), as well as a significant decrease in the mortality rate of the livestock compared to the control group, undoubtedly served vivid confirmation of the ability of all levels of “Biocardin” to improve livestock performance in broiler chickens. In our studies, the maximum zootechnical effect was obtained when 5% of fish meal was included in the feed mixture, however, according to the set of taken into account indicators, the 5% input level of “Biobardin” was practically inferior to it in terms of protective effect, being a much cheaper feed additive of domestic production, which is significant factor for industrial poultry farming.

A daily feed consumption survey showed that the broiler chickens from the experimental groups significantly exceeded the broiler chickens from the control group in this indicator. In the experimental groups, the cost of feed per 1 kg of increase in live weight of the bird had a pronounced tendency to decrease, which, in turn, is possible only with a general normalization of metabolic processes in broiler chickens that consumed the studied levels of “Biobardin”. It was noted that an increase in the dosage of “Biobardin” contributes to an increase in the efficiency of feed mixtures and their conversion by 5.5; 9.2 and 12.4%, respectively (tables 2, 3).

However, it is interesting to note that when using 5% fish meal in the diet, the activity of feed transformation, as well as the live weight of the experimental birds, were slightly higher. The explanation is given by the calculated data on the absolute amount of protein consumed by one head, which was additionally introduced to the main diet in excess of the recommended norms. At the same time, protein of “Biobardin” is transformed much more efficiently, being a priori a biologically more complete substance of microbiological origin. Also, it is impossible not to take into account the ability of probiotic bacteria contained in “Biobardin” in an amount of up to \( 1 \times 10^3 \) CFU/g of product to indirectly participate in the processes of cavity digestion and general metabolism.

The results of the balance experiments (table 3) generally confirmed and partially detailed the nature of the changes detected by previous studies [6–8].
Table 3. Digestibility and use of nutrients by broiler chickens under the influence of test additives.

| Indicators                             | C         | 2         | 3         | 4         | 5         |
|----------------------------------------|-----------|-----------|-----------|-----------|-----------|
| Digestibility of dry matter, %         | 74.1±1.8  | 68.6±0.7b | 70.5±0.8  | 71.7±0.7  | 72.4±1.0  |
| Digestibility of crude protein, %      | 85.3±0.9  | 74.6±0.7s | 75.1±0.5s | 77.0±0.2s | 77.9±1.0d |
| Digestibility of crude fat, %          | 74.6±0.6  | 72.3±0.2c | 72.2±0.3c | 73.5±1.1  | 73.8±0.7  |
| Digestibility of crude fiber, %        | 14.4±0.4  | 13.0±0.3b | 13.3±0.8  | 13.4±0.8  | 12.8±1.2  |
| Digestion of nitrogen-free extractive | 73.3±2.2  | 69.0±2.4  | 72.0±1.9  | 73.0±1.6  | 73.8±0.9  |
| Nitrogen utilization, %                | 45.3±0.4  | 35.0±0.4i | 36.9±1.2i | 38.1±0.7i | 38.8±0.6i |
| Use of gross energy, %                 | 69.1±1.0  | 64.4±0.84 | 65.9±0.9j | 67.1±0.9  | 67.7±0.9  |

Analyzing the data obtained, it can be confidently said that all tested levels (3-5%) of the studied additive worked in a positive direction. When used in the experimental groups, the digestibility of the dry matter of the feed was increased by an average of 2.1-5.2% (P ≤ 0.05-0.001); the use of gross energy of the diet was increased by 1.9-4.6% ((P ≤ 0.10-0.02); energy-intensive components such as raw fat was increased by 1.5-2.7% (P ≤ 0.10-0.05) and the carbohydrate part of the diet (nitrogen-free extractive substances) was increased by 2.9-6.9% (P ≤ 0.10-0.01), which, in turn, is possible only with the normalization of metabolic processes.

In order to discuss the results, we noted a disproportion between the increasing levels of “Biobardin” in the diet and the physiological response of the body, expressed in increased digestibility of the feed. Apparently, these differences can be explained by the high content of crude fiber in “Biobardin” (up to 13.8%), which is able to bind and carry out part of the nutrients from the body with fecal masses.

4. Conclusion
The inclusion in the feed, the feed additive “Biobardin” (3-5%) balanced in nutrients had a positive effect on the main indicators of productivity (safety and live weight) of broiler chickens. Broiler chickens absorbed nutrients from an optimized diet much better than chickens which consumed similar compound feeds without additives, which increased the efficiency of feed use by broiler chickens during the productive period of their raising.

According to the results of experimental feedings, almost complete safety of young birds, rapid development and weight gain, good physical condition, absence of diseases, good feed eatability were noted, which makes it possible to use feed protein additive “Biobardin” as an alternative to fish meal for balancing broiler chickens’ diets.

References
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