Method of growing broiler chickens using new feed additives

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Abstract. In this article discusses the possibility of using non-traditional feed additives from microalgae of the genus Chlorella, lactulose-containing preparation for broiler chickens. Balanced diets can greatly reduce morbidity, increase weight gain and improve the efficiency of poultry farming. The results obtained in the course of the experiment allow us to conclude that the complex use of the additives under study makes it possible to solve the indicated problems. It was found that when chlorella and a lactulose-containing preparation were used together, the bird surpassed its peers in terms of growth and development intensity. The advantage of indicators of live weight of broiler chickens of the III experimental group in comparison with the indicators of I and II of the experimental group was established and amounted to 2.29 and 2.66% (p <0.01). The results of the control slaughter indicate that the meat raw materials obtained from broiler chickens of the experimental groups.

1. Introduction

Scientists' studies have established that the use of highly productive crosses in poultry farms and complexes of young animals, which have a high genetic growth potential and an intensive level of metabolism, is very often accompanied by a low level of immunological reactivity and natural resistance of the body, which leads to gastrointestinal intestinal diseases and death of young poultry [1, 2].

An effective means of correcting dysbacteriosis, normalizing microbiological processes in the digestive tract, increasing the growth rate and productivity of young poultry by improving the digestibility and use of nutrients in the diet, reducing feed costs per unit of growth is the use of safe and new natural feed additives [3, 4].

As known, the use of chlorella in the diet of chickens contributed to an increase in growth rates, an improvement in the modulated immune response [5]. Chlorella vulgaris contains in its composition polyunsaturated fatty acids, carotenoids, which contribute to the development and increase the resistance of young animals and poultry [6, 7].

The aim of our work is to study the effect of chlorella suspension (strain Chlorella vulgaris IGF No. C-111) separately, as well as in combination with a lactulose-containing preparation as a feed additive on the growth and development of broiler chickens.
2. Materials and research methods

2.1 Setting up the experiment

The experiment was carried out in the vivarium of the VRIMMP, equipped in accordance with SP 2.2.1.3218-14. The object of research was broiler chickens of the Cobb-500 cross, imported from the Zavolzhskaya poultry farm, Krasnokutsk district, Saratov region. Were formed 4 groups of broiler chickens of day-old age, 50 heads each. The experiment lasted 38 days. The scheme of the experiment is presented in table 1. During this time, the experimental bird received a balanced diet in accordance with the feeding norms developed by the Federal Research Center VNITIP RAS, taking into account the actual nutritional value of the incoming feed ingredients.

Table 1. Scheme of the experiment.

| Group        | Number of heads | Feeding characteristics                                   |
|--------------|-----------------|----------------------------------------------------------|
| Control      | 50              | General diet (GD)                                         |
| I experimental | 50          | GD + chlorella 5 ml/kg feed                               |
| II experimental | 50          | GD + drug №1 0.4 g/kg live weight                         |
| III experimental | 50          | GD + chlorella 5 ml/kg feed + drug №1 (0.4 g/kg live weight) |

2.2 Experimental technique

We have developed a technology for the preparation of a complete granulated compound feed with a chlorella suspension:

1. Grain components are extruded (feed extruder EK-40) where temperature treatment of the feed means under pressure with simultaneous mechanochemical deformation and "explosion" in the shock front at the exit of the product from the extruder die takes place. As a result of such processing, the taste of feed improves, since various aromatic substances are formed, digestibility increases significantly due to the breakdown of complex components into simpler ones, and some toxins are neutralized and their producers die.

2. Components of compound feed that require grinding are ground on a hammer mill (ADM-0.3) to a particle size of no more than 1-1.5 mm.

3. All components are uniformly mixed in a vertical mixing bunker (BSH-0.5) and then fed into a horizontal mixer with the possibility of introducing liquid components (SGU-0.61), where the chlorella suspension is introduced into the mixture prepared for granulation at the rate of 0.5 l / 10 kg.

4. The mass is brought to high homogeneity and fed by the dispenser into the receiving hopper of the granulator (GM-100).

5. The resulting granules are cooled and sieved (AM-4). In the course of the experimental work, the effect on the productivity of poultry of feed additives, which is a suspension of chlorella of the Chlorella Vulgaris strain IGF No. C-11, lactulose-containing preparation No. 1 and their composition, was investigated. Preparation No. 1 contains lactulose 22.3% (in terms of dry matter), and its mineral part contains salts of calcium, phosphorus, magnesium, iron, trace elements - zinc, selenium, necessary for the growth and development of farm animals and poultry, and their bioavailability increases in the presence of lactulose. During the experiment, a suspension of planktonic strains (cell density from 50 to 500 million / ml), as well as a lactulose-containing preparation, were dosed directly into the granulator receiver, which contributed to the uniform moistening of grain raw materials up to 20%. The composition control and distribution was carried out in manual mode. The control slaughter was carried out on the 38th day of detention. In the course of the experiment, the live weight of the experimental birds was determined by individual weighing on an electronic scale VK-3000 with an accuracy of ± 0.1 g weekly from day old to slaughter.

The digestibility and use of nutrients in the diets were established according to the results of the experiment in accordance with the methodological recommendations of VNITIP. The cultivation efficiency index (CEI) was determined by the formula:
\[ CEI = \frac{C \times m}{t \times K} \times 100, \]

where \( C \) is safety, \%; \( m \) - live pre-slaughter weight, kg; \( t \) - the growing period; \( K \) - feed conversion, kg.

The chemical composition of the pectoral muscles was investigated in accordance with GOST 9793-74; 25011-81 and 23042-86.

3. Research results and discussion

Research on the use of a new feed additive was carried out with the aim of solving the issue of creating a new way of growing poultry, increasing the level of productivity without the use of chemotherapeutic drugs, including feed antibiotics.

As shown by modern studies, lactulose-containing drugs have an effect on health as a prebiotic agent and an amplifier of the immune system [8, 9]. At the same time, the effect of chlorella on improving growth and, as a consequence, on the qualitative characteristics of poultry products has been scientifically confirmed [10, 11].

In our studies, in the course of determining the live weight of broiler chickens, it was found that in the process of feeding by the end of the first week, the use of feed additives contributed to a more intensive growth of broiler chickens, and by the end of the second week there was a significant difference in live weight between chickens of the experimental and control groups (table 2).

**Table 2. Dynamics of live weight of broiler chickens, g (n=50).**

| Age, days | Group | Control       | I experimental | II experimental | III experimental |
|-----------|-------|---------------|----------------|-----------------|-----------------|
| 1         | 41.4±0.72 | 41.2±0.71     | 41.3±0.71      | 41.3±0.70       |
| 7         | 181.6±7.11 | 19.6±7.49    | 195.8±7.53*    | 196.3±7.92      |
| 14        | 488.6±12.43 | 527.1±12.51* | 528.0±12.65*   | 529.4±13.92*    |
| 21        | 928.0±14.12 | 965.2±14.69* | 968.3±14.50*   | 971.1±14.58*    |
| 28        | 1472.6±16.75 | 1526.9±16.58*| 1532.8±16.43*  | 1595.2±16.46*   |
| 35        | 2127.6±16.08 | 2210.3±16.24 | 2241.9±16.12** | 2289.4±16.10*   |
| 38        | 2218.1±22.40 | 2311.0±23.10**| 2318.8±23.10** | 2368.9±22.86**  |

* \( p <0.05; ** p <0.01; *** p <0.001.\)

It can be seen from experience that at 14 days of age the live weight of broiler chickens of the I and II experimental groups significantly exceeded the control peers by 38.5 g (7.88\%; \( p <0.05 \)) 39 g (7.98\%; \( p <0.05 \)) and 40.8 g (8.35\%; \( p <0.05 \)), respectively. Throughout the experiment, the live weight of the birds of the experimental groups exceeded the control ones and amounted, respectively, to 92.9 g (4.19\%; \( p <0.01 \)) 100.8 g (4.54\%; \( p <0.01 \)) and 150.8 g (6.79\%; \( p <0.01 \)), respectively.

The absolute increase in live weight during the feeding period (1-38 days) in the experimental groups was 2269.8; 2277.6 and 2327.6 g versus 2176.7 g in the control, which is 4.27; 4.64 and 6.93\% (\( p <0.01 \)) more, respectively. Poultry preservation by the end of the experiment in the experimental groups was 100%, in the control - 96%.

Studies have shown that the inclusion of a new feed additive in the diet of birds slightly improved the digestive processes and the digestibility of the feed due to the activation of lactic acid bacteria. As a result, an increase was reliably established in animals of the III experimental group in comparison with the experimental groups:

- coefficient of digestibility of dry matter by 1.42; 0.72 and 0.61\% (\( p <0.05 \));
- crude protein - by 1.93; 0.84 and 0.71\% (\( p <0.05 \));
- crude fat - by 1.56; 0.73 and 0.62\% (\( p <0.05 \));
- nitrogen-free extractives - by 1.73; 0.69 and 0.64\% (\( p <0.05 \)), respectively.
At the end of the experiment, control slaughter and anatomical cutting of broiler chickens were carried out (Table 3).

As shown by the control slaughter data, the use of feed additives in poultry rations had a positive effect on the increase in the weight of the gutted carcass in comparison with the indicators of the control group: by 73.1 g (4.6%), 82.8 g (5.2%), respectively, while the advantage was noted in the III experimental group by 137.5 g (8.7%). In terms of the slaughter yield, the carcasses from the III experimental group also exceeded.

Table 3. Results of control slaughter of broiler chickens, n=10.

| Indicator                        | Control        | I experimental | II experimental | III experimental |
|----------------------------------|----------------|----------------|-----------------|------------------|
| Pre-slaughter weight, g          | 2184.52±16.10  | 2286.40±16.50  | 2236.40±17.21   | 2345.60±          |
| Gutted carcass weight, g         | 1581.62±15.01  | 1662.21±15.14  | 1662.20±15.32   | 1714.63±          |
| Dressing percentage, %           | 72.4           | 72.7           | 72.7            | 73.1             |

According to the available data indicating the direct effect of lactulose-containing supplements on the diet of poultry [11-13], our studies also indicate that chlorella in combination with a lactulose-containing drug affects the digestibility and is able to determine a positive effect on the digestibility of poultry feed. So, in the III experimental group of the CES by 67.3; 39.1 and 38.4 units more than in the I experimental group and in the control.

To determine the nutritional value of the meat of the experimental broiler chickens, the chemical composition of the pectoral muscles was investigated (Table 4).

Table 4. The chemical composition of the pectoral muscles of broilers.

| Indicator, % | Control       | I experimental | II experimental | III experimental |
|--------------|---------------|----------------|-----------------|------------------|
| Moisture     | 74.28±0.19    | 73.61±0.25     | 73.84±0.24      | 73.01±0.19       |
| Protein      | 21.63±0.18    | 22.23±0.20***  | 22.12±0.19***   | 23.20±0.15***    |
| Fat          | 2.87±0.08     | 2.52±0.09***   | 2.57±0.09       | 2.32±0.09***     |
| Ash          | 1.03±0.07     | 1.05±0.06      | 1.04±0.6        | 1.05±0.07        |

The use of feed additives in feeding broiler chickens contributed to a decrease in moisture and an increase in protein in the experimental groups by 0.49; 0.60 and 1.57% (p <0.001), respectively, against the background of a decrease in the mass fraction of fat by 0.30; 0.35 and 0.55% (p <0.001), respectively, while the ash content in the pectoral muscle samples did not differ significantly.

In the study of organoleptic, physicochemical, microbiological and safety indicators of meat of broiler chickens of experimental groups, it corresponded to the Technical Regulations of the Customs Union TR CU 034/2013 "On the safety of meat and meat products.

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4. Conclusion
As a result of the studies carried out, it was found that the use of new feed additives based on chlorella and a lactose-containing preparation, especially when used together, when growing broiler chickens, helped to increase the digestibility of nutrients, normalize metabolic processes in the body of chickens, which in turn, strengthens their health and productivity, allowing to minimize the use of chemical therapeutic drugs, including antibiotics, in the process of growing.
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