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# Effect of Chitosan and Whey Powder on the Weight of Broiler Chickens

Rahmonov F. X.,
Doctoral Student of Samarkand State University of Veterinary, Animal Husbandry and Biotechnology. Uzbekistan, Samarkand.
farxod1313jon@gmail.com

Eshimov D.
Associate Professor of Samarkand State University of Veterinary Medicine, Animal Husbandry and Biotechnology. Uzbekistan, Samarkand.
eshimovd1947@gmail.com

Islamov X. I.
Assistant, Samarkand State University of Veterinary Medicine, Animal Husbandry and Biotechnology, Uzbekistan, Samarkand.
islomovxur85@mail.ru

**Abstract:**
At the present time, great attention is being paid to the development of chicken farming in our republic. It can be solved by developing ways to reduce the cost of food ration, using secondary products of the food industry. Waste from food industry enterprises is an important source of replenishment of food reserves. Silkworm waste is included in the above components to obtain productivity-enhancing substances. These include chitosan, which is derived from chitin by deacetylation to varying degrees. One of the foods is whey powder. Whey milk protein has a set of essential amino acids for poultry. Compared to the currently used industrial and vivarium feeds, the results of this product have a high level of efficiency.

**Keywords**. Chitosan, chitin, whey powder, broiler, poultry, protein.

## Introduction

Biopolymer "Chitosan" of natural origin, as well as its use as an immunostimulator - a tool that increases the productivity of broiler chickens and improves the quality of poultry products - is of great scientific interest. The drug "Chitosan" is a natural polymer of polysaccharide nature, one of the most common organic compounds in nature. Raw materials for its production are chitin, structural polysaccharide of crustacean epidermis, insect cuticles and fungal cell wall. The most common sources of its production are shells of crustaceans (crabs, crustaceans, etc.) [1]."Chitosan" biopolymer has properties such as high sorption capacity, non-toxicity, ability to heal wounds, anticoagulant, bacteriostatic and antitumor activity. It is also a good flocculant, emulsifier, thickener and structure builder. The wide possibilities of using chemical modifications of chitin and chitosan to obtain materials with different structures and properties make these polymers one of the most interesting types of raw materials.

Recently, a low-cost product, whey, has been attracted to the growth of quantitative mass

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production. It is a by-product obtained during the production of cottage cheese, cheese, milk and other dairy products. Its production in the circular economy system encourages more and more producers to process whey, which generates additional income and creates internal sources of food resources. Whey is the richest food [2, 3].

**Purpose of work**

Study of the effect of biopolymer chitosan + dry whey on the physiological and biochemical parameters of broiler chickens.

**Research materials and methods**

Research and production experience to develop optimal doses and evaluate the effect of Chitosan + whey powder preparation on the safety and quality of broiler chicken products was carried out in the conditions of the generally accepted vivarium method. The subject of the study was Cobb broiler chickens. 100 chickens participated in the experiment. Content - cellular, 6 heads. in a cage (4 groups). Group 1 served as control, groups 2, 3 and 4 were experimental. Group 2 chickens additionally received chitosan + dry whey at a dose of 40 mg per head (chitosan 2 mg, dry whey 38 mg), group 3 - at a dose of 60 mg (chitosan 4 mg, dry whey 56 mg) and group 4 - 80 received the drug in mg dose (chitosan 6 mg, whey powder 74 mg). Broiler chickens were fed with "Super Don" feed. The supplement was added to the diet from the age of 7 days along with drinking water, after dissolving the biopolymer in a 2% solution of acetic acid. In the last decade of life, the use of premix for broiler chickens was carried out to remove toxic feed components and antibiotics from the body. In order to control the development of experimental chickens, taking into account their safety, they were weighed at the age of 28 days and at the end of the experiment (at the age of 42 days). During the experiment, the chickens of the experimental and control groups were monitored for their clinical status, safety, and weight gain. Blood samples were taken at 3, 4, 5 and 6 weeks, and physiological and biochemical parameters were determined [4, 5, 6, 7].

Determination of moisture content of meat was determined by weight loss during drying of test samples (GOST 9793-74. "Meat products. Methods of moisture determination"). The study of its chemical composition (fat, ash, protein) was conducted according to GOSTs: 23042-86, 31727-2012, 25011-81.

All obtained experimental digital materials were subjected to statistical processing on a computer using the "Microsoft Excel-2007" program.

**Research Results and Discussion**

Feeding the premix to chickens had a positive effect on the growth and development of broiler chickens, which is evidenced by the positive dynamics of hematological and biochemical indicators. Before the start of the experiment, the number of erythrocytes in the blood of one-day-old chickens was 3.21±0.31×1012/l. In the later periods of the study, this indicator increased in all groups, and on the 42nd day of the experiment, it was the highest in experimental group 2, where the number of erythrocytes was 3.68 ± 0.26 × 1012 / l (Table 1).



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In the 6th week of the experiment, in the 4th group, this indicator increased by 2.3% from the control indicator, in the 2nd - by 6%, in the 3rd - by 0.7% and amounted to 140.7 ± 19.27 g / l.

Before the start of the experiment, the total protein content in the blood of chickens was 34.40±3.07 g/l, of which albumins - 16.28±1.39 g/l and globulins - 18.12±2.29 g/l. At the end of the experiment, this indicator was higher than the background values only in group 4, which was 36.6±3.06 g/l, and the amount of albumins and globulins was 15.38±1.31 g/l and 21.18±2.19 g. formed /l, respectively.

During the experiment in the control and experimental groups, all studied biochemical parameters of blood (uric acid, glucose, bilirubin, cholesterol content) were within physiological limits.

As mentioned above, feeding premix to chickens had a positive effect on their growth, development and safety.

**Table 1. Blood parameters of control and experimental group birds when using the used premix (M±m, n=25)**

| Indicators | Sampling age, weeks. | Control group | Experienced groups | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Erythrocytes 1012/l | 3 | 3.21 ± 0.31 | 3.21 ± 0.31 | 3.21 ± 0.31 | 3.21 ± 0.31 |
| | 4 | 3.86±0.52 | 3.86±0.52 | 3.86±0.52 | 3.86±0.52 |
| | 5 | 3.64±0.36 | 3.65±0.27 | 3.68 ± 0.26 | 3.66±0.32 |
| Hemoglobin, g/l | 3 | 118 ± 6.89 | 118 ± 6.89 | 118 ± 6.89 | 118 ± 6.89 |
| | 4 | 125.2 ± 8.15 | 125.2 ± 8.15 | 125.2 ± 8.15 | 125.2 ± 8.15 |
| | 5 | 137.46 ± 14.6 | 132.68 ± 21.8 | 139.62 ± 17.1 | 140.7 ± 19.27 |
| Total protein, g/l | 3 | 30.22 ± 1.68 | 30.22 ± 1.68 | 30.22 ± 1.68 | 30.22 ± 1.68 |
| | 4 | 34.4 ± 3.07 | 34.4 ± 3.07 | 34.4 ± 3.07 | 34.4 ± 3.07 |
| | 5 | 31.34 ± 2.67 | 34 ± 1.75 | 36.6 ± 3.06 | 35.8 ± 2.81* |
| Albumins, g/l | 3 | 14.42 ± 1.24 | 14.42 ± 1.24 | 14.42 ± 1.24 | 14.42 ± 1.24 |
| | 4 | 16.28 ± 1.39 | 16.28 ± 1.39 | 16.28 ± 1.39 | 16.28 ± 1.39 |
| | 5 | 15.52 ± 1.38 | 14.38±0.45 | 15.38 ± 1.31 | 15.2 ± 1.69 |
| Globulins, g/l | 3 | 15.8±0.67 | 15.8±0.67 | 15.8±0.67 | 15.8±0.67 |
| | 4 | 18.12 ± 2.29 | 18.12 ± 2.29 | 18.12 ± 2.29 | 18.12 ± 2.29 |
| | 5 | 15.82 ± 1.35 | 19.6 ± 1.68 | 21.18 ± 2.19 | 20.58± 1.26** |
| Total calcium, mmol/l | 3 | 2.75±0.15 | 2.75±0.15 | 2.75±0.15 | 2.75±0.15 |
| | 4 | 2.66 ± 0.19 | 2.66 ± 0.19 | 2.66 ± 0.19 | 2.66 ± 0.19 |
| | 5 | 2.36±0.15 | 2.42 ± 0.11 | 2.44 ± 0.11 | 2.42 ± 0.09 |
| Uric acid µmol/l | 3 | 278.4 ± 33.5 | 278.4 ± 33.5 | 278.4 ± 33.5 | 278.4 ± 33.5 |
| | 4 | 287.4 ± 27.45 | 287.4 ± 27.45 | 287.4 ± 27.45 | 287.4 ± 27.45 |
| | 5 | 300.6 ± 28.01 | 294.18±17.97 | 287.88±15.65 | 288.48 ± 17.07 |
| Cholesterol, mol/l | 3 | 2.51±0.34 | 2.51±0.34 | 2.51±0.34 | 2.51±0.34 |
| | 4 | 2.07 ± 0.15 | 2.07 ± 0.15 | 2.07 ± 0.15 | 2.07 ± 0.15 |
| | 5 | 2.61±0.25 | 2.29±0.36 | 2.1 ± 0.19 | 2.19±0.4 |
| Glucose, mol/l | 3 | 9.12 ± 1.78 | 9.12 ± 1.78 | 9.12 ± 1.78 | 9.12 ± 1.78 |
| | 4 | 8.8±0.73 | 8.8±0.73 | 8.8±0.73 | 8.8±0.73 |
| | 5 | 8.52 ± 1.71 | 8.46±0.85 | 8.28 ± 1.34 | 8.4 ± 1.52 |
| Bilirubin, µmol/l | 3 | 12.78±0.61 | 12.78±0.61 | 12.78±0.61 | 12.78±0.61 |
| | 4 | 11.05±2.8 | 11.05±2.8 | 11.05±2.8 | 11.05±2.8 |
| | 5 | 10.72 ± 3.46 | 9.27 ± 3.93 | 8.23 ± 3.41 | 9.74 ± 2.47 |

*P<0.05; **P<0.01. Significantly compared to the control group

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The experiment shows that the survival rate of broiler chickens of group 4, which received premix at a dose of 80 mg per 5 weeks of age, was 0.6% and 0.1-0.3% higher than the control. Compared to groups 2-3.

2.1% in group 4, 2.7% in control.

Studies have shown that broiler chickens in the 3rd experimental group were characterized by high growth intensity during the experiment. The average daily growth in it was 51 g (in the control - 45.1 g). The largest live weight of birds in the group was in experimental group 3. It was 0.8 and 4.6% higher than other experimental groups and was 2182 g (Table 2).

**Table 2. Dynamics of live weight and average daily growth of broiler chickens, when premix is included in the diet.**

| Groups | Weight at the age of 2 weeks, g | Average daily gain at 3 weeks of age, g | Weight at the age of 5 weeks, g | Average daily gain at the age of 5 weeks, g |
|---|---|---|---|---|
| Management | 910±67.6 | 31 | 1934±64.9 | 45.1 |
| 1- experienced | 1078±62.5* | 37.1 | 2085 ±70.6* | 48.7 |
| 2- experienced | 1089±58.2* | 37.5 | 2165 ±81.1* | 50.6 |
| 3- experienced | 1051 ±48.7* | 36.1 | 2182 ±61.3* | 51.0 |

*P<0.01.

The next stage of the research was to study meat quality parameters after feeding broiler chickens with premix.

**Table 3 Toxicological assessment of poultry meat**

| Indicators | Experiment 1 | Experiment 2 | Management |
|---|---|---|---|
| Relative bio. value, % | 100.4±1.2 | 100.2±1.2 | 100 |
| Toxicity, % pathologist. cell shapes | 0.1±0.09 | 0.1±0.09 | 0.1±0.10 |

The organoleptic examination of carcasses of all studied groups revealed the following indicators. In all samples, the surface of the carcass is dry, white-yellow with a pink tint; the mucous membrane of the oral cavity is shiny, light pink, slightly moistened; the beak is shiny; the eyeball is convex, the cornea is shiny; light yellow subcutaneous and visceral fat; the serous membrane of the abdominal cavity is moist, shiny; cut muscles are slightly moist, light pink in color, have an elastic structure; the smell is characteristic of fresh meat. A cooking test in meat inspection revealed that the broth in all experimental samples was clear and fragrant. No foreign odor was detected.

The table shows that the introduction of premix into the diet leads to an increase in the biological value of broiler chicken meat. Thus, the biological value increases in the groups receiving the nutritional supplement by 7–16.5% compared to the control.

**Summary**

1. Blood parameters of premix broiler chickens received at a dose of 80 mg/head were within physiological limits. Also, pathological changes in the liver and kidneys were not detected when using the drug according to this scheme.

2. Premix as a sorbent for mycotoxins, heavy metals and metabolic products of bacteria and



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as a means of coating the mucous membrane of the gastrointestinal tract, reducing their entry into the chicken body. This leads to an increase in the productivity of broilers and an increase in the biological value of meat.

3. The data obtained on the study of the safety and productivity of broiler chickens under the influence of the premix and its effect on the quality of meat show that its optimal dose is drinking a solution of 80 mg/dose per day, head, from 5 weeks of age.

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