

Meat chicken productivity when vitamin-selenium-containing preparations in combination with enzymes use in diets

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Abstract. The article presents the research results on the vitamin-selenium-containing preparation (1.0 l / t) using effectiveness in the broiler chickens diet in combination with enzyme preparations "CelloLux-F" (100 g/t, experimental group I), "Protosubtilin G3x" (60 g/t, experimental group II) and "Amylosubtilin G3x" (200 g/t, experimental group III). It was found that the broilers of the experimental groups exceeded the average live weight by 2.74-4.95%; dry matter digestibility - by 0.89-1.58%, protein - by 1.41-2.71%, fat - by 1.16-2.03%, fiber - by 0.82-1.69 and nitrogen-free extractive substances - 0.74-1.43%, nitrogen use - by 1.35-2.99%; drawn bird weight - by 2.93-5.89%, edible carcass parts - by 3.33-6.47%, pectoral muscles - by 3.53-7.83%. In the experimental groups broiler chickens, the meat quality indicators are improved: dry matter content in the pectoral muscles - by 0.30; 0.12 and 0.07%, protein - by 0.41 (P <0.001); 0.16 (P <0.01) and 0.13% (P <0.05). The experimental broilers groups slightly exceeded the control group in terms of the biological value and the pectoral muscles meat culinary and technological properties. Redox and metabolic processes were more intensive in young animals of the experimental groups than in the control one. Among the experimental groups, the meat productivity and quality highest indicators were noted in broiler chickens of the I-st experimental group, they received the preparation "Carcesel" in combination with the enzyme preparation "CelloLux-F".

1 Introduction

The problem of the agricultural animals and poultry products production intensifying is currently one of the most urgent in Russia, as in many countries of the world, since it is directly related to the use of innovations and science-intensive technologies that play a key role in providing the population with high-quality, environmentally friendly, competitive products [9].

Carotenoids perform more than 20 biological functions - from photoreception to protecting the body from lipid peroxidation, including the prevention of cardiovascular, oncological and other diseases. At the same time, they, in combination with other fat-soluble vitamins (A and E), protect the embryo forming organs and tissues from active oxidative

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metabolites. The amount of carotenoids and vitamins in the yolk largely determines not only the hatchability of eggs, but also the survival of the young in the first days of life. [7].

In this regard, it is necessary to change qualitatively the feed base nature through the creation and use of effective biologically active additives and preparations of a new generation, which have not only nutritional value, but also protective effects on the poultry organism [8].

The preparation "Carcesel" contains beta-carotene - 0.18%, vitamin E (alpha-tocopherol acetate), vitamin C (ascorbinnalminate) - 0.5% and selenium (diacetophenonyl-selenide) - 0.225%, in unrefined vegetable oil.

At present the issue of providing poultry with beta-carotene and vitamin A is especially relevant in the industrial poultry farming. It is known that grass meal during the storage loses its nutritional properties, unlike carotene-containing feed additives of industrial production. Therefore, as an alternative to natural sources of carotenes, the modern industry produces beta-carotene-containing preparations with high stability, bioavailability and antioxidant properties against mycotoxins entering the body [1, 2, 4, 11].

In recent years, the genetic potential of poultry productivity has significantly increased. However, the poultry productivity genetic potential realization is impossible without proper and high-quality feeding. An integral part of modern diets are enzymatic preparations that allow to increase the level of feed assimilation, optimally balance the feed and at the same time optimize the cost of rations through the use of more accessible, but difficult to digest components [10,6,3].

Based on the mentioned above, the purpose of this work was to study the vitamin-selenium-containing preparation "Carcesel" in combination with enzyme preparations influence on the broiler chickens meat productivity and physiological parameters.

2 Material and research methods

To carry out a scientific and economic experiment by using the method of analogs, 4 groups of the "Ross-308" meat cross broiler chickens (a control group and 3 experimental ones) at the age of one day were formed, 50 heads each. The groups were formed by selecting healthy, certified chickens, equalized by live weight and development at the age one of day, without division by sex. Each chick was assigned an individual number on the winglets. Housing conditions, stocking density, feeding and drinking area, microclimate parameters in all groups were the same. The experiment was carried out in the conditions of the Krasnodonskaya Poultry Farm JSC in the Ilovinsky district of the Volgograd region.

Throughout the experiment, the chickens received a complete feed (CF), produced at the Kachalin feed mill, according to the phases of CF-0 rearing (from 1 to 4 days) with an exchange energy (EE) content of 1.18 MJ/kg and crude protein (CP) - 24.57 g; CF-2 (from 5 to 14 days) - 1.19 MJ/kg and 24.19 g; CF-5 (from 15 to 28 days) - 1.21 MJ/kg and 22.95 g; CF-6 (from 29 to 34 days) - 1.33 MJ/kg and 21.86 g; CF-7 (from 35 to 40 days) - 1.34 MJ/kg and 21.07 g.

The control group of broiler chickens received complete feed (CF), the experimental group I received CF + 1 liter of preparation "Carcesel" + 100 g of enzyme preparation "CelloLux-F", the experimental group II - CF + 1 liter of "Carcesel" + 60 g of enzyme preparation "Protosubtilin G3x", the experimental group III - CF + 1 liter of the preparation "Carcesel" + 200 g of the enzyme preparation "Amylosubtilin G3x" per 1 ton of fodder. The duration of the scientific and economic experience was 40 days.

During the research, the following indicators were studied and taken into account:

- safety of livestock, dynamics of live weight;
- digestibility and assimilation of nutrients in the diet;
- morphobiochemical composition of blood;

- meat productivity, chemical composition, meat energy and biological value, as well as organoleptic assessment of the meat quality.

The research results were processed by the method of variation statistics.

3 Research results and discussion

One of the main economically useful signs of poultry meat productivity, showing the dependence of growth and development on age, nature of feeding, maintenance technology and other factors is live weight.

In the course of the study, it was found that this trait in broiler chickens at one day old was actually the same and amounted to 42.18-42.69 g. At the age of 7 days, the experimental broiler chickens exceeded the young from the control group, in turn, by 2.78 (1.73%; $P < 0.05$); 2.36 (1.47%) and 2.05 g (1.28%). At the age of 28 days, the experimental groups broiler chickens live weight also exceeded the control group, correspondingly, by 52.54 (4.03%; $P < 0.001$); 43.20 (3.32%; $P < 0.01$) and 32.68 (2.51%; $P < 0.01$). The live weight in the broilers control group at the age of 40 days was lower than the experimental groups broilers live weight, respectively, by 120.98 (4.88%; $P < 0.001$); 83.25 (3.36%; $P < 0.01$) and 66.82 (2.70%; $P < 0.01$).

During the entire period of growing, the absolute increase in the experimental groups broiler chickens live weight exceeded the control, respectively, by 120.47 (4.95%; $P < 0.001$); 82.99 (3.41%; $P < 0.01$) and 66.68 g (2.74%; $P < 0.01$), the average daily increase was, respectively, by 3.01 (4.94%; $P < 0.001$); 2.07 (3.40%; $P < 0.01$) and 1.67 g (2.74%; $P < 0.01$).

Broiler chickens of all compared groups had well pigmented beak and legs, dense plumage and good appetite. Over the entire period of growing, the safety in the control group was 96%, in the I-st experimental group it was 100%, in the II-nd experimental one - 100% and in the III-rd experimental group - 98.0%.

The nutrients digestibility study, the nitrogen and mineral elements use are an important point for assessing the nutritional value of the tested compound feed.

While the study, it was determined that the digestibility coefficients in the experimental groups chickens meat had a sufficiently high level, in comparison with the control group chickens meat. So, the feed dry matter digestibility coefficient was, in turn, significantly higher, in comparison with the control group broiler chickens by 1.58 ($P < 0.01$); 1.11 ($P < 0.05$) and 0.89% ($P < 0.05$), crude protein - by 2.71 ($P < 0.001$); 2.42 ($P < 0.001$) and 1.41% ($P < 0.05$), crude fat - by 2.03 ($P < 0.01$), 1.52 ($P < 0.01$) and 1.16 % ($P < 0.05$), crude fiber - by 1.69 ($P < 0.01$); 0.82 and 1.08% ($P < 0.05$) and nitrogen-free extractive substances - by 1.43 ($P < 0.05$); 0.74 and 0.98% ($P < 0.05$).

In terms of the nutrients digestibility in rations between the experimental groups, the best indicators were shown by the I-st experimental group of broiler chickens, which had an advantage over the analogs of the II-nd and III-rd experimental groups. They had a higher coefficient of dry matter digestibility, respectively, by 0.47 and 0.69%, crude protein - by 0.29 and 1.30%, crude fat - by 0.51 and 0.87% ($P < 0.05$), crude fiber - by 0.87 ($P < 0.05$) and 0.61%, and nitrogen-free extractive substances - by 0.69 and 0.45%.

Nitrogen balance is considered the main criterion for evaluating protein nutrition, as well as the main indicator when studying the feeding factors influence on poultry productivity.

During the study, it was found that the nitrogen balance in the experimental groups broiler chickens was the highest, in comparison with the control group, by 6.36 ($P < 0.01$), respectively; 3.64 ($P < 0.05$) and 2.73%. The utilization coefficient of nitrogen taken was higher in the experimental groups broiler chickens, in comparison with the control group - by 2.99 ($P < 0.01$); 1.66; 1.35%, respectively.

In the research it was found that more calcium was deposited by 0.06 (10.53%; $P < 0.05$); 0.03 (5.26%) and 0.03 g (5.26%) in the experimental groups broiler chickens body. The utilization coefficient of calcium that was taken with mixed feed by the experimental broiler chickens groups increased, respectively, by 3.25; 1.65 and 1.27%.

Phosphorus deposition in the experimental groups broiler chickens body exceeded the control group indicator, respectively, by 0.04 (12.12%); 0.03 (9.09%) and 0.02 (6.06%). The utilization coefficient of phosphorus that was taken by the experimental groups broiler chickens body with the feed increased, respectively, by 2.65; 2.39 and 1.73%, compared with the control group.

It is known that the blood composition is the indicator of the organism physiological state and is closely related to the animals productivity; it depends on many factors, among which the feeding value is important.

The studies found that the preparation "Carcesel" application into the experimental groups broiler chickens diets in combination with enzyme preparations showed the increase in erythrocytes, respectively, by 8.3 ($P < 0.01$); 6.23 ($P < 0.05$) and 5.54% ($P < 0.05$), leukocytes - by 4.01; 2.12 and 3.55% and hemoglobin - by 3.60 ($P < 0.001$); 1.34 ($P < 0.05$) and 1.15% ($P < 0.05$), in comparison with the control one. This indicates the increase in the broiler chickens blood respiratory function, and a better supply of oxygen to the body and more intense redox processes, as the result of the metabolic processes activation in chickens.

The total protein content in the experimental groups broiler chickens blood serum exceeded the analogs of the control group by 1.87 g/l or 4.40% ($P < 0.01$); 0.99 g/l or 2.33% ($P < 0.05$) and 0.63 g/l or 1.48% ($P < 0.05$), respectively.

The albumin content in the experimental groups broilers blood serum increased, respectively, by 1.22 g/l or 7.23% ($P < 0.01$); 0.73 g/l or 4.33% ($P < 0.01$) and 0.45 g/l or 2.67% ($P < 0.05$), globulin content increased by 0.65 g/l or 2, 53%; 0.26 g/l or 1.01% and 0.18 g/l or 0.70%, calcium - by 3.80 ($P < 0.05$); 2.41 and 1.72%, phosphorus - by 4.67 ($P < 0.05$); 2.59 and 1.55%, in relation to the control group.

Finally, meat productivity is assessed after the poultry slaughter and in more detail during the poultry carcasses anatomical dressing [5].

Studies showed that in the I-st, II-nd and III-rd experimental groups broiler chickens body under the influence of the vitamin-selenium-containing preparation "Carcesel" in combination with enzyme preparations, in addition to quantitative changes manifested in the increase in live weight, there were also qualitative changes. Thus, the experimental groups broiler chickens pre-slaughter live weight, in comparison with the analogs of the control group, was higher, respectively, by 121.70 (5.02%; $P < 0.01$); 83.56 (3.44; $P < 0.01$) and 67.06 g (2.76%; $P < 0.05$), the drawn bird weight was by 103.30 (5.89%; $P < 0.001$); 66.95 (3.82%; $P < 0.01$) and 51.48 g (2.93%; $P < 0.05$). The slaughter yield was higher in the experimental groups, respectively, by 0.60; 0.26 and 0.12%.

The poultry meat quality main indicators are the edible parts carcass yield and the muscle tissue yield when growing broiler chickens.

The studies found that the experimental groups exceeded the control group in the edible parts carcass yield by 94.84 (6.47%; $P < 0.001$); 62.40 (4.26%; $P < 0.01$) and 48.83 (3.33%; $P < 0.01$), respectively. The average mass of the experimental groups broiler chickens muscle tissue was higher, compared with young animals in the control group, respectively, by 75.87 (6.75%; $P < 0.001$); 48.93 (4.35%; $P < 0.01$) and 37.34 g (3.32%; $P < 0.05$), pectoral muscle mass was, respectively, by 38.27 (7.83%; $P < 0.001$); 23.27 (4.76%; $P < 0.01$) and 17.28 g (3.53%; $P < 0.05$).

Muscles are an important component of poultry meat, which chemical composition and energy supply largely determines its quality.

The I-st, II-nd and III-rd experimental groups broiler chickens pectoral muscles chemical composition result showed that the dry matter content exceeded the control group, respectively, by 0.30; 0.12 and 0.07%, organic matter was by 0.33 ($P < 0.05$); 0.14 and 0.09%.

The increase in dry matter content in the of the I-st, II-nd and III-rd experimental groups broiler chickens pectoral muscles was achieved due to the increase in protein, the content of which exceeded the control group by 0.41 ($P < 0.001$); 0.16 ($P < 0.01$) and 0.13% ($P < 0.05$), respectively. The fat content in the the I-st, II-nd and III-rd experimental groups broiler chickens pectoral muscles decreased by 0.08; 0.02 and 0.04%, compared with the control one. The ash content in the experimental broiler chickens pectoral muscles was practically the same. No significant differences were found in the experimental broiler chickens pectoral muscles energy nutrition.

The meat nutritional value is determined by the combination of various characteristics, such as biological, technological, energy values and organoleptic indicators, which provide the physiological human need for energy and basic nutrients [10].

As the research result, it was found that the essential amino acid tryptophan was contained more in the experimental groups broiler chickens pectoral muscles. So, in the average sample of the experimental groups broiler chickens pectoral muscles, tryptophan was contained more than in the control group, by 6.71 mg% or 3.30% ($P < 0.01$); 10.66 mg% or 5.24% ($P < 0.001$) and 8.73 mg% or 4.29% ($P < 0.001$), and oxyproline was less, respectively, by 0.29 mg% or 0, 76%; 0.96 mg% or 2.52% ($P < 0.05$) and 0.11 mg% or 0.29%. The higher the tryptophan to hydro-xyproline ratio value, the higher the poultry meat biological value, i.e. protein-quality indicator.

The protein quality indicator was higher in the experimental groups broiler chickens, respectively, by 3.92 ($P < 0.05$); 7.84 ($P < 0.001$) and 4.48% ($P < 0.001$), compared with the control one.

When assessing the meat consumer properties, along with chemical and biological properties, its technological and culinary qualities are taken into account.

During the research, it was found that the meat water-holding capacity indicator was higher in the experimental groups' broiler chickens consuming the preparation "Carcesel" in combination with the enzyme preparations. The experimental groups broiler chickens surpassed their counterparts from the control group in this indicator, respectively, by 0.34; 0.79 ($P < 0.01$) and 0.50 ($P < 0.05$). At the same time, the experimental groups' broiler chickens meat had lower digestibility indicators.

The difference, in comparison with the control group, respectively, in the experimental groups was 0.53 ($P < 0.01$); 0.88 ($P < 0.01$) and 0.65% ($P < 0.01$).

The meat culinary-technological index (CTI) was higher in the experimental groups broiler chickens, in comparison with analogs from the control group by 1.81; 3.61 ($P < 0.01$) and 2.41% ($P < 0.05$), respectively.

The organoleptic evaluation of broth, boiled and fried meat showed that the studied feed preparations and additives application in the experimental groups broiler chickens diet contributed to the increase in their organoleptic characteristics.

4 Conclusion

The results obtained by us in the scientific, economic and physiological experience indicate that the use of the beta-carotene-containing preparation "Carcesel" in the experimental groups broiler chickens diets in the combination with the enzyme preparations "Cello-Lux-F", "Protosubtilin G3x", "Amilosubtilin G3x" contributes to the increase in live weight, the livestock safety, the metabolic processes intensity, meat productivity and meat quality. At the same time, the best indicators were obtained in broiler chickens of the 1-st experimental

group, the preparation "Carcesel" in combination with the enzyme preparation "CelloLux-F" was applied into their diet.

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