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Influence of new lactulose-containing fodder additives on basic morpho-biochemical indicators of blood and resistance of broiler chicken

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Abstract. In modern industrial broiler poultry farming, the issue of combating the uncontrolled use of antibiotics in the process of growing poultry is being actively addressed. Currently, scientists are looking for an alternative solution to the issue of eliminating the use of antibiotics for prophylactic purposes. In this connection, researchers are intensively working on the development of innovative feed additives that can solve the problem with the immunostatus of the organism of poultry grown in conditions of great crowding. The article discloses the data of experimental experience on the use of new innovative lactulose-containing additives of domestic origin "Kumelakt-1" and "Laktuvet-1". Their positive effect on the morpho-biochemical parameters of the blood and the resistance of the poultry organism has been established. This information allows to predict in vivo the indicators of the safety of the poultry population and are indicators of the quality of the products obtained. New lactulose-containing innovative additives as a regulator of intestinal microflora improved the morpho-biochemical blood index and increased the resistance of the poultry organism. Namely: increased on average in I and II experimental groups in comparison with the control group, the hemoglobin index by 9.7%, erythrocytes by 10.8%, hematocrit by 5.6%. An increase in the level of urea in the blood serum was established by 10.4 and 9.7% ($P < 0.01$), glucose - by 6.5 and 4.8 6.1 and 9.0% ($P < 0.05$), phosphorus - by 8.2 and 6.6% ($P < 0.01$), magnesium - by 9.9 and 9.1% ($P < 0.05$), potassium - by 1.3 and 1.6% ($P < 0.05$), iron - by 1.4 and 1.6% ($P < 0.05$), respectively. The indicators of phagocytic activity in the experimental groups were determined, it was found that, on average, this indicator increased by 5.2% ($P < 0.05$).

1. Introduction

The dynamic development of the domestic poultry industry through the intensification of production activities made it possible to achieve a positive result in a short period of time in meeting the country's demand for poultry meat. In the production process, poultry farmers actively use various types of growth and development stimulants [1-3]. As known, industrial broiler poultry farming is especially dependent on feed antibiotics and coccidiostats. The use of antibiotic-containing additives in the process of poultry meat production remains particularly relevant today. On the one hand, this is a negative impact on the formation of persistent tolerance of pathogenic microorganisms to antibiotics, and on the other hand, it is impossible to categorically reject the prophylactic use of antibiotics in industrial poultry farming [4-6]. Given the significant overcrowding of poultry at the enterprises, antibiotic prophylaxis



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remains relevant. According to some scientists and manufacturers, complete withdrawal from antibiotic prophylaxis in conditions of industrial poultry keeping is possible only with an exceptionally favorable epizootic background of the farm. At the same time, epizootic well-being should be maintained at all stages of production, from the stage of obtaining the hatching egg to the moment of preparing the output of the livestock for slaughter. In connection with the particular importance of this issue, scientists and manufacturers of feed additives are actively working to find alternative mechanisms for antibiotic prophylaxis to influence pathogenic microflora. Recently, researchers have paid special attention to the use of Lactulose in livestock industries, as the main natural regulator of microbiocenosis in the intestines of animals and poultry. The recognized prebiotic in the world today has begun to be used as a basis for obtaining allo-lactulose, fructosyl-galactooligosaccharides, lactulose sucrose and its other derivatives [7-11].

It has been established that the main advantage of the use of lactulose-containing feed additives lies in their influence on the formation of both obligate and optional intestinal microflora, having a direct positive effect on the metabolic process in the bird's body.

Biologically active additives and preparations of various kinds, used by manufacturers in the process of growing poultry, affect the metabolism in a living organism. These changes can be recorded by using accurate research methods and analysis of blood composition. Blood, as an indicator of poultry health, is a vital indicator of the emerging final indicator of the safety of the poultry population and the quality of the industry's products [12-14]. Thus, the study of the effect of new lactulose-containing additives "Kumelakt-1" and "Laktuvet-1", developed by the Federal State Budgetary Scientific Institution "Volga Research Institute for the Production and Processing of Meat and Dairy Products" and the engineering center "Institute of Living Systems" of the North Caucasus Federal University (IZhS SKFU), refers to a number of topical and insufficiently studied issues. In this connection, the research group set up an experiment on the broiler chickens in order to study the effect of new lactulose-containing additives on natural resistance and morpho-biochemical blood index of chickens.

2. Materials and methods

The experimental part of the work on broiler chickens was carried out in the vivarium of the State Scientific Institution NIIMMP, Volgograd. During the research, classical and modern methods were used: zootechnical, biochemical, etc.

The object of the study was broiler chickens brought from the Zavolzhskaya poultry farm from the Saratov region. For the experiment, 3 groups of chickens of the Cobb 500 cross were formed (I and II experimental groups and a control group). All groups were formed from day old analogue chickens, 100 heads in each group. The vivarium is equipped in accordance with zoological requirements. Veterinary preventive measures were carried out according to the plan of antiepidemic measures.

New domestic lactulose-containing feed additives were approved for testing:

- Feed additive "Kumelakt-1" is obtained from sprouted pumpkin seeds and dry lactulose, contains 100 g (not less): lactulose - 10.0 g. The composition also includes monose, polyphenol, flavonoids, tocopherols (vitamin E), organic acids, macro- and microelements: calcium - 1.8-2.4 g, phosphorus - 0.7-1.2 g, potassium - 0.6-1.5 g, magnesium - 0.4-0.8 g.
- The feed additive "Laktuvet-1" contains 97.5% of dry substances, including the content of lactulose - 14.3%, lactose - at least 25.2%, monose (galactose, glucose) - at least 12.5% , calcium - 3.4-4.4%, phosphorus - 1.4-1.7%, potassium - 0.7-1.7%, magnesium - 0.5-0.7%, and other macro- and trace elements.

The first experimental group received a general economic ration with the inclusion of the feed additive "Kumelakt-1" at the rate of 0.45 g / kg of live weight, the second - to the diet received "Laktuvet-1" at the rate of 0.40 g / kg of live weight, the control group of birds received exclusively the general economic ration.

A blood test was carried out in the integrated laboratory of the GNU NIIMMP every 10 days of detention. During the experiment, the morphological parameters of the blood, the biochemical composition of the blood, the trace element composition of the blood, as well as the indices of the resistance of the organism of broiler chickens were taken into account. The morphological composition of the poultry blood was determined on an automatic hematological analyzer URIT - 3020 Vet Plus (China), the biochemical composition - on a semi-automatic biochemical analyzer URIT - 800 Vet (China) in 5 heads from each group, the bactericidal activity of blood serum - according to the O.V. Smirnova's method (1966), phagocytic activity and index - according to the V.E. Chumachenko's method (1990).

3. Results and discussion

It's well known, by analyzing the composition of blood, it is possible to trace changes in the metabolism in the body of a bird, including those under the influence of the applied feed additives.

In the course of the work carried out, it was found that the morphological parameters of blood were at the level of physiological values in all experimental groups of chickens. However, at the same time, a significant difference was recorded between the indices of the experimental groups and the control in terms of the content of hemoglobin, erythrocytes and hematocrit in the blood. In the course of the research, an increase in hemoglobin in the blood of chickens of the experimental groups was revealed in comparison with the same indicator of the control group of birds by 12.2 and 8.7 g / l ($P < 0.01$), erythrocytes - by 0.39 and 0.37 10^{12} / l ($P < 0.01$), hematocrit - by 1.71 and 1.74% ($P < 0.05$), respectively. At the same time, there is a slight decrease in leukocytes and platelets in the blood of chickens from the experimental groups.

It is known that the intensity of redox processes in the body of a bird is characterized by the level of immunoglobulin in the blood. This study revealed an increase in the concentration of immunoglobulins in the blood of poultry in the experimental groups by an average of 12% ($P < 0.01$) in comparison with the same indicator in poultry from the control group.

As shown by the research results, feed additives with lactulose also had a significant effect on protein metabolism in broiler chickens.

In the experimental groups, the content of total protein in the blood serum of broilers exceeded that of the control group by an average of 5.8%, and albumin increased on average their presence in the blood of broiler chickens by 2.6%.

The absolute content of globulin fractions recorded insignificant fluctuations, their relative content was higher in relation to the control indicators by 8.41 and 8.68% ($P < 0.05$), which indicates a higher level of immunity in the body of experimental chickens.

Table 1. Biochemical composition of blood (35 days of age) (n=5) ($M \pm m$).

Groups	Indicators				
	Total protein, g / l	Albumin g / l	%	Globulin g / l	%
Control	40.52±0.57	18.41±0.13	45.43±0.32	22.11±0.41	54.57±0.26
I experiment	42.92±0.71*	18.95±0.11*	44.15±0.31*	23.97±0.26*	55.85±0.13**
II experiment	42.86±0.69*	18.83±0.15	43.93±0.43*	24.03±0.23**	56.07±0.17**
	AST, E / l	ALT, E / L	Urea, mmol / l	Trypsin, u / l	Glucose, mmol / l
Control	284.0±8.37	6.54±0.14	2.98±0.062	82.1±0.12	5.96±0.17
I experiment	266.0±8.60	5.93±0.11*	3.29±0.068*	81.2±0.24**	6.34±0.20
II experiment	261.2±2.78*	5.84±0.12**	3.27±0.071*	80.1±0.86*	6.37±0.11

The indicator of urea in the blood serum indicates the development of protein metabolism in the chickens of the experimental groups. The level of urea in the blood of the chickens of the experimental groups was increased on average in the experimental groups by 9.8% in comparison with the data of the

control group. At the same time, the activity of trypsin is reduced by 1.1% ($P < 0.05$) in the first experimental group and by 2.4% ($P < 0.05$) in the second experimental group in comparison with the data of the control group, which confirms the increased activity of assimilation protein feed.

During the research, it was found that the content of transferases in the experimental groups in comparison with the indicators of the control group decreased: AST - by 6.30 and 8.73% ($P < 0.01$), ALT - by 10.22 and 11.9% ($P < 0.05$), respectively. This decrease confirms the stabilization of metabolic processes in the body of the experimental bird. The activity of transaminases, including aspartate aminotransferase (AST) and alanine aminotransferase (ALT), in blood serum is used for diagnostic purposes to determine the presence of liver diseases. The level of cholesterol in the blood serum of the chickens of the experimental groups determined in the course of the research was lower than the level of cholesterol in the control group by 10.8 and 10.2% ($P < 0.05$). The level of triacylglycerols in the experimental groups was also lower than the data of the control group by 10.80 and 9.50% ($P < 0.05$), respectively.

Innovative feed additives contributed to an increase in the blood glucose concentration of chickens in the experimental groups by 6.38 and 3.88% ($P < 0.01$), respectively, in comparison with the blood data of peers from the control group.

The new lactulose-containing additives used in the experiment also activated the mineral metabolism in the bird's body (table 2).

Under the influence of additives based on lactulose, it was experimentally confirmed that the content of microelements in the blood of poultry of the experimental groups increased, namely: Ga - by 6.1 and 9.0%; P - by 8.2 and 6.6%, Mg - by 9.9 and 9.1%, K - by 1.3 and 1.6%, Fe - by 1.4 and 1.6%, respectively. The Na index in the blood of chickens from the experimental groups showed a slight increase.

Table 2. Micro- and macroelement composition of blood (n=5).

Indicators	Control	I experiment	II experiment
calcium (Ga), mmol / l	5.19±0.18	5.51±0.26	5.66±0.24
phosphorus (P), mmol / l	2.55±0.07	2.76±0.05*	2.72±0.08*
magnesium (Mg), mmol / l	1.31± 0.02	1.44±0.04*	1.43±0.05*
sodium (Na), mmol / l	124.08±0.08	124.39±0.07*	124.21±0.06*
potassium (K), mmol / l	23.12±0.07	23.42±0.08*	23.48±0.11*
iron (Fe), mmol / l	25.27±0.11	25.63±0.09*	25.68±0.08*

The immune status of an organism is an important indicator affecting the safety of a bird, its growth, development, as well as its productive qualities. New lactulose-containing additives had a positive effect on the main indicators of the body resistance of the chickens of the experimental groups. Thus, in the chickens of the experimental groups, a significant increase in bactericidal activity indicators exceeded the same indicator in the control group by 1.6 and 1.3% ($P < 0.05$), respectively. The concentration of lysozyme is higher than in the control group by 5.5 and 4.6%. The activity of β -lysine increased slightly, but the difference was insignificant.

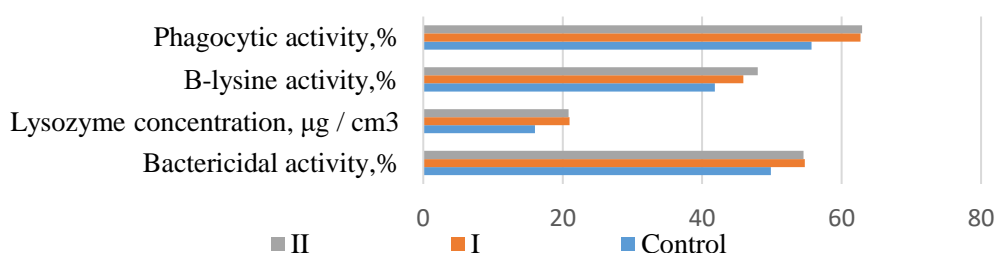


Figure 1. Indicators of resistance of the organism of the experimental bird (n = 5).

It is known that phagocytosis of micro- and macrophages is one of the indicators of the body's cellular defense. Our studies revealed that the phagocytic activity in chickens from the experimental groups exceeded the same indicator in the control group by 5.0 and 5.4% ($P < 0.05$), respectively. Positive dynamics is also observed in terms of the phagocytic index, which in the birds of the experimental groups increased in comparison with similar data in the control group by 1.97 and 1.25 ($P < 0.05$), respectively. Based on the analysis of the research data, it can be argued that the practical use of new additives with lactulose "Kumelakt-1" and "Laktuvet-1" positively affects the formation of bactericidal, lysozyme and phagocytic activity in broiler chickens, indicating a higher level of their natural resistance.

4. Conclusion

As a result of the conducted studies, it was found that the use of new lactulose-containing feed additives "Kumelakt-1" (at a dosage of 0.45 g / kg of live weight) and "Laktuvet-1" (at a dosage of 0.40 g / kg of live weight) has a beneficial effect on the morpho-biochemical composition of blood, metabolic processes, micro- and macroelement status and the formation of the level of natural resistance of the bird's body. At the same time, there were no significant differences in efficiency between the studied feed additives.

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