

Effect of Antioxidants and Probiotics on the Indicators of Natural Resistance and Peroxidation of Lipids in Poultry

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Abstract.

With the introduction of antioxidants and probiotics in the compound feed for poultry, digestion processes are activated in the body, while lipid peroxidation processes are optimized.

The purpose of the research is to study the effects of the probiotic preparation of Bifidum SHG and the Santochinum antioxidant on the natural resistance and lipid peroxidation in replacement chickens and laying hens.

Research methodology. The objects of the research were replacement chickens and laying hens of the Smena-7 meat cross. The experimental material was processed statistically on a personal computer using the SNEDECOR software package.

Results of research. During the two stages of research and economic experiment on replacement chickens and laying hens, it was found that joint incorporation of probiotics of Bifidum SHG and Santochinum antioxidant into complete compound feed based on grain of corn, barley and soybeans with a tolerant level of aflatoxin B₁, indicators of natural resistance and lipid peroxidation were optimized. Joined addition of tested biologically active preparations allowed us to optimize the protective qualities of the body of the experimental birds due to a reliable (P > 0.95) increase of lysozyme activity by 3.4 and 4.3% and bactericidal activity - by 5.6 and 5.5% in the blood of replacement chickens and laying hens of the 3rd experimental group versus the control group. In the serum of the replacement and adult chickens from the experimental group 3, there was a significant (P > 0.95) increase in the activity of glutathione peroxidase enzymes by 43.2 and 43.0% and glutathione reductase - by 24.0 and 31.6%, accompanied by an energy reserve increase in the body.

Key words: chickens, hens, aflatoxicosis, probiotic, antioxidant, natural resistance, lipid peroxidation.

INTRODUCTION

In the last decade, from a wide range of biologically active supplements, great interest has been shown in the use of antioxidants in the feeding practice, which regulate the activity of the manifestation of the immune response of the organism of poultry to various external adverse factors, and also participate in the processes of differentiation and restoration of biological membranes. In addition, these preparations play a decisive role in the manifestation of the activity of a number of enzymes in the biochemical reactions of anabolism and catabolism [1, 2].

With the introduction of antioxidants into the compound feed of poultry, oxidation and reduction reactions in the body are activated, which reduces the risk of muscular dystrophy, and also the processes of lipid peroxidation (LPO) in the liver are optimized [3, 4, 5]. These compounds contribute to the improvement of the absorption of a number of fat- and water-soluble vitamins, macro- and microelements into the blood, taking into account the pH of the environment of the chyme of the small intestine, depending on the composition of the microflora of the digestive tract of the poultry. In case of disturbance of normobiocenosis in the intestines of poultry, as a rule, the number of the bifidobacteria, protecting the mucous membrane of all intestinal sections from penetration of representatives of undesirable microflora into the blood, decreases. To eliminate this negative fact, representatives of beneficial microflora, which are part of the food probiotic preparations, are engrafted in the gastrointestinal tract [6, 7, 8, 9].

The purpose of the research is to study the effects of the probiotic preparation of Bifidum SHG and the antioxidant Santochinum on the indices of natural resistance and lipid peroxidation of replacement chickens and laying hens.

MATERIAL AND METHODS.

The experimental part of the research was carried out on the poultry farm of Iraf-Agro LLC of RNO-Alania. The objects of the research were replacement chickens and laying hens of the Smena-7 meat cross. Scientific and economic experiment consisted of two stages. During the first scientific and economic experiment on the replacement chickens, using the method of analogue groups of standard day-old chicks of one batch of hatch, 4 groups were formed of 200 birds each. The duration of the rearing period of replacement chickens was 22-23 weeks, after which the experimental chickens were transferred to the laying hen department. During the second stage of scientific and economic experiment, the same birds were used as during the first stage of the experiment; however, taking into account the survival rate of the chickens, the number of laying hens in the groups was reduced to 180 heads.

Feeding the experimental birds in the course of the experiment was carried out in accordance with the scheme presented in table 1.

Nonspecific resistance of the organism in the experimental poultry was assessed by lysozyme activity, (determined photocolometrically using a Mikrococcus lisodeicticus test culture) and bactericidal activity (photocolometric method with the use of a test microbe of a daily broth culture of E. coli). Analysis of the activity of the impact of these additives on the processes of lipid peroxidation in the body was determined according to generally accepted methods.

The experimental material was processed statistically on a personal computer using the software package SNEDECOR.

Table 1 - Scheme of scientific and economic experiment

Group	Feeding features
I stage of scientific and economic experiment on the replacement chickens	
Control	Basal diet (BD) – standard compound feed
1 test	BD + Bifidum SHG at the rate of 5 doses per 200 birds
2 test	BD + Santochinum at the rate of 125 g/t of feed
3 test	BD + Bifidum SHG probiotic at the rate of 5 doses per 200 birds + Santochinum at the rate of 125 g/t of feed
II stage of scientific and economic experiment on the laying hens	
Control	Basal diet (BD) – standard compound feed
1 test	BD+Bifidum SHG at the rate of 5 doses per 200 birds
2 test	BD + Santochinum at the rate of 125 g/t of feed
3 test	BD + Bifidum SHG probiotic at the rate of 5 doses per 200 birds + Santochinum at the rate of 125 g/t of feed

Table 2 - Changes in the body weight of the experimental chickens during the two stages of the experiment

Group	Live weight per bird (g); age (days)			Live weight gain, g	
	1	150	455	replacement chickens	laying hens
Control	40.4±0.23	2302.2±17.5	3701.3±19.4	2261.8±16.3	1399.1±20.3
1 test	40.1±0.19	2439.2±19.9*	3728.4±17.0	2439.1±15.5*	1289.2±17.9*
2 test	40.3±0.24	2448.1±18.3*	3736.6±20.2	2407.8±16.9*	1288.5±18.5*
3 test	39.9±0.21	2497.4±13.5*	3719.6±18.6	2457.5±17.5*	1222.2±17.0*

*P>0.95

Table 3 - Condition of natural resistance of experimental birds

Group	Total protein, g/l	albumins, %	Globulins, %:			Lyso-zyme activity, %	Bacteri-cidal activity, %
			α-	β-	γ-		
I stage of scientific and economic experiment							
Control	74.4±0.18 ±0,18	48.8±0.13	14.8±0.06	12.8±0.10	23.6±0.12	17.7±0.15	38.8±0.27
1 test	77.1±0.12* ±0,17	49.6±0.22*	14.0±0.16*	12.0±0.21	24.4±0.10*	20.0±0.21*	41.9±0.33*
2 test	77.5±0.20*	49.9±0.17*	13.7±0.11 *	11.7±0.19	24.7±0.16*	20.4±0.14*	42.2±0.37*
3 test	78.1±0.21*	50.8±0.20*	12.3±0.09*	11.1±0.15	25.8±0.12*	21.1±0.19*	44.4±0.30*
II stage of scientific and economic experiment							
Control	74.7±0.24	48.5±0.18	15.3±0.20	14.1±0.12	23.0±0.20	20.1±0.19	52.0±0.32
1test	78.2±0.30	49.4±0.28*	14.4±0.18*	12.1±0.15*	24.1±0.29*	22.9±0.14*	55.2±0.29*
2 test	78.6±0.31	48.8±0.22*	14.0±0.21*	12.7±0.20*	24.5±0.22*	23.2±0.30*	55.7±0.38*
3test	79.2±0.28	50.9±0.28*	13.0±0.12*	11.0±0.18*	25.1±0.31*	24.4±0.28*	57.5±0.27*

*P>0.95

Table 4 - Indicators of lipid peroxidation and antioxidant protection systems in experimental birds

n = 5

Группа Group	Conjugated dienes AU/mg lipids	Malonic dialdehyde, μmol/l	Glutathione peroxidase, μmol G SH/ l.min. 10 ³	Glutathione reductase, μmol G SS G/l.min	Catalase, μmol H ₂ O ₂ / l.min. 10 ³
I stage of scientific and economic experiment					
Control	0.328±0.02	1.70±0.03	7.20±0.10	113.1±1.5	46.0±1.3
1 test	0.246±0.01*	1.33±0.01*	9.91±0.14*	127.3±2.4*	42.6±1.0*
2 test	0.236±0.03*	1.28±0.02*	10.08±0.20*	129.6±1.7*	41.8±2.0*
3 test	0.205±0.02*	1.10±0.03*	10.31±0.19*	140.2±1.9*	40.1±1.5*
II stage of scientific and economic experiment					
Control	0.379±0.02	1.90±0.03	7.60±0.15	129.1±2.0	51.8±1.8
1 test	0.305±0.01*	1.44±0.04*	10.21±0.13*	159.8±1.4*	45.6±2.1*
2 test	0.298±0.02*	1.40±0.01*	10.34±0.22*	162.0±2.3*	45.0±2.3*
3 test	0.280±0.04*	1.28±0.04*	10.87±0.21*	169.9±2.8*	43.9±1.4*

*P>0.95

RESULTS AND DISCUSSION.

In the formula of the compound feed for experimental poultry, grain ingredients of cereal and leguminous crops were represented by: corn, barley and soybeans of domestic selection, which were cultivated in Nogir JSC of the Prigorodny District of RNO-Alania.

In the selected grain samples of barley, corn and soybean, there were no detected cases of exceeding the MAC (maximum allowable concentration) for the ochratoxin A and T-2-

toxin. At the same time, in their composition we recorded the excess of MAC of the aflatoxin B1 level: in barley grain - by 40%, corn - by 60% and soybeans - by 60%. By mixing the grain of these crops, unfavorable for the concentration of this type of aflatoxin with other ingredients that are safe for this toxin, we were able to reduce its level in the composition of the used poultry compound feed to 0.23 mg/kg, which did not exceed the tolerant amount of aflatoxin B1 for poultry - 0.25 mg/kg.

During the first stage of the experiment, the survival rate of the replacement chickens of the control group of the test cross was 92%. According to this indicator, the birds of 1, 2, and 3 experimental groups outstripped control by 2.0; 2.0 and 4.0%, respectively. According to the data of the second stage of research, the survival rate of the chickens was the lowest in the control group - 95%. According to the analyzed indicator, the birds of 1, 2 and 3 experimental groups surpassed the control group of the same age by 2.0; 1.0 and 3.0%, respectively. This fact indicates a better effect of joint additions to the compound feed of antioxidant of Santochinum and probiotic of Bifidum SHG on the survival rate of experimental chickens and laying hens.

During the experiment, the effect of tested preparations on changes in the body weight of the experimental chickens was studied (Table 2).

During the first stage of scientific and economic experiment, replacement chickens of the 3 experimental group had a higher growth rate, reliably ($P > 0.95$) being 8.65% ahead the control analogues by the absolute weight gain. Moreover, according to this indicator, 1 and 2 experimental groups occupied an intermediate position between the birds of the control and 3 experimental groups.

During the first stage of the experiment, the feed conversion rate per 1 kg of body weight gain of the experimental birds was calculated and it was found that the feed was most efficiently used by the chickens of the 3 experimental group, which spent 8.71% less feed versus the control group.

According to the data of the second stage of scientific and economic experiment, it is clear that, against the analogues of the control group (3701.3 g), the birds of none of the experimental groups (3728.4-3719.6g) had a significant ($P < 0.95$) superiority in growth rate by the end of the research. That is, the live weight of the experimental laying hens of all groups was without significant differences. We consider it a consequence of the fact that the growth-promoting effect of a combined feeding a probiotic and antioxidant while transferring replacement chicks to the parent department, was leveled under the influence of the compensatory reaction of the organism. So, after 150-160 days of age in adult birds, a significant part of the nutrients is transformed into egg mass. Therefore, by the end of the laying egg period, layers of the 1, 2 and 3 experimental groups increased live weight gain by 7.90-12.64% ($P > 0.95$) less as compared to the control.

During the experiment, we studied the state of natural resistance of the experimental birds (Table 2).

The introduction of an antioxidant in combination with the probiotic in the compound feed for experimental chickens and hens provided a significant ($P < 0.95$) increase in their blood of total protein by 3.7 and 4.5 g/l; albumin - by 2.0% and 2.4%, γ -globulins - by 2.2 and 2.1%, in comparison with the control analogues; at the same time, there was a downward trend in α and β -globulins. In addition, it was found that with joint supplements of tested biologically active preparations, it was possible to optimize the resistance qualities of the organism thanks to a reliable ($P > 0.95$) increase in the blood of replacement chickens and laying hens of the 3 experimental group (in comparison with the control group) of lysozyme activity level - by 3, 4 and 4.3% and bactericidal activity - by 5.6 and 5.5%, respectively.

During both stages of the experiment, we studied the indicators of antioxidant protection (AOP) and lipid peroxidation (POL) in the poultry of the compared groups under the influence of the tested feed additives (Table 4).

It was established that a higher stimulating effect on the mechanism of antioxidant protection of the birds in the 3 experimental group was promoted by the joint introduction of probiotic and the preparation of Santochinum into the rations.

Moreover, in the serum of the replacement chickens and adult hens of the 3 experimental group, a significant ($P > 0.95$) increase in the activity of glutathione peroxidase enzymes by 43.2 and 43.0% and glutathione reductase - by 24.0 and 31.6% in comparison with the control group. This fact testifies to the stimulation of the formation of ATP in mitochondria, accompanied by an increase in the energy reserve in the body. Along with this, the activity of the enzymes of glutathione peroxidase and glutathione reductase was characterized by an inversely proportional relationship with the presence in the blood of birds of conjugated dienes and malonic dialdehyde. This indicates the strengthening of the mechanism of antioxidant protection of the body in experimental chickens and adult hens of the 3 experimental group.

Joint supplements of the antioxidant Santochinum and probiotic Bifidum SHG to the diets contributed to enhancing the mechanism of inhibition of free-radical oxidation in the body, which ensured a significant ($P > 0.95$) decrease in catalase enzyme activity by 12.8 and 15.2% in chickens and laying hens of the 3 group.

CONCLUSION.

Combined supplements of probiotic of Bifidum SHG at the rate of 5 doses per 200 birds and antioxidant Santochinum at a dose of 125 g/t of feed in complete compound feed contributed to optimization of the indices of natural resistance and lipid peroxidation while reducing the risk of aflatoxicosis in replacement chickens and laying hens.

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