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Research Article

RESEARCH OF METABOLISM PROCESSES IN THE GASTROINTESTINAL TRACT AND FOOD VALUE OF BROILER MEAT IN DETOXICATION OF AFLATOXINS

Victor H. Temiraev¹, Rita V. Kalagova², Rustem B. Temiraev³, Alexander T. Farniev⁴,
Hassan A. Ketenchiev⁵, Aslan G. Vaniev⁶, Jabrail L. Arsanukaev⁷, Anjelika F. Baeva⁸,
Lada A. Vityuk⁹, Oksana T. Ibragimova¹⁰

¹Doctor of Agricultural Sciences, Professor, Gorsky State Agrarian University, Vladikavkaz, 362040, Russian Federation., ²Doctor of Chemical Sciences, Professor, North Ossetian State Medical Academy Vladikavkaz, 362040, Russian Federation., ³Doctor of Agricultural Sciences, Professor, North-Caucasian Mining and Metallurgical Institute (State Technological University), Vladikavkaz 362021, Russian Federation., ⁴Doctor of Agricultural Sciences, Professor, Gorsky State Agrarian University, 362040, Vladikavkaz, 37 Kirov Street, Russian Federation., ⁵Doctor of Biological Sciences, Associate Professor, Kabardino-Balkarian State University H.M. Berbekov, Nalchik, 360030, Russian Federation., ⁶Doctor of Biological Sciences, Professor, Gorsky State Agrarian University, 362040, Vladikavkaz, 37 Kirov Street, Russian Federation., ⁷Doctor of Biological Sciences, Professor, Chechen State Pedagogical University, 364031, Groznyi, Russian Federation., ⁸Doctor of Agricultural Sciences, Professor, North-Caucasian Mining and Metallurgical Institute (State Technological University), Vladikavkaz, 362021, Russian Federation., ⁹Candidate of Technical Sciences, Associate professor, North-Caucasian Mining and Metallurgical Institute (State Technological University), Vladikavkaz, 362021, Russian Federation., ¹⁰Candidate of Technical Sciences, Associate professor, North-Ossetian State University named after K.L. Khetagurov, Vladikavkaz, 362025, Russian Federation.

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Abstract:

Adsorbents are characterized by synergetic effect with a wide range of different biologically active additives, including mold inhibitors that are successfully used to reduce the accumulation of mycotoxins in feed, which positively affect broilers metabolism and biological value of poultry meat. The research aims to study broilers meat productivity and enzymatic activity of enzymes in the gastrointestinal tract when preparations mold inhibitor Mold-Zap and adsorbent Ecosil are introduced into diets with a tolerant level of aflatoxin B₁. The experimental material was statistically processed by Student's t-test using software package SNEDECOR. In the course of the research it was found that in the mixture preparations Mold-Zap at a dose of 1,5 kg/t feed and Ecosil at a dose of 125 g/t feed had the highest stimulating effect on the activity of cellulases, proteinases and amylases in the content of the gizzard stomach and duodenum. The highest stimulating effect on birds' slaughter indicators had joint supplement of preparations Ecosil and Mold-Zap to mixed feed, which provided for broilers in the third test group weight gain of semi-eviscerated carcass by 14,7% and eviscerated – 13,7%, as well as slaughter yield – by 1,6%. Broilers of the third test group relative to the control contained 1,04-1,16% and 1,24-1,59% more dry matters and protein in their pectoral and femoris. The joint supplement of preparations Ecosil and Mold-Zap provided for chickens of the third test group the most significant ($p>0,95$) superiority over the control in the meat biological value by 22,2%.

Keywords: Broilers, adsorbent, mold inhibitor, enzyme activity, meat productivity, biological value of meat.

Corresponding author:**Victor H. Temiraev,***Doctor of Agricultural Sciences, Professor, Gorsky State Agrarian University, Vladikavkaz, 362040, Russian Federation.*

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INTRODUCTION:

The increase in the production of dietary poultry meat depends not only on the genetic potential of meat poultry cross, full value feeding, but also the feed quality, which is often infected with mold fungi. The harmful effect of feed, affected by fungal microflora, on the poultry body is associated with the presence of toxic substances arising when feed is affected during storage by microscopic fungi *Aspergillus*, *Penicilium*, etc. Among mycotoxins, aflatoxins produced by microscopic fungi *Aspergillus flavus* and *Aspergillus parasitikus* are provided by their toxic, carcinogenic and mutative properties [1, 2].

It is known that to detoxify various toxicants, including mycotoxins, feed adsorbents are successfully used, which bind these compounds in the digestive tract and remove them from the bird's body allowing to reduce the risk of intoxication and increase consumer properties of poultry meat [3, 4, 5, 6].

Adsorbents are characterized by synergetic effect with a wide range of different biologically active

additives, including mold inhibitors that are successfully used to reduce the accumulation of mycotoxins in feed, which positively affects broilers metabolism and biological value of poultry meat [7,8, 9].

The research aims to study broilers meat productivity and enzymatic activity of enzymes in the gastrointestinal tract when preparations mold inhibitor Mold-Zap and adsorbent Ecosil are introduced into diets with a tolerant level of aflatoxin B₁.

MATERIAL AND RESEARCH METHODS:

The aim was achieved by conducting the experiment on the poultry farm of the agricultural production cooperative "Vesna" in Digorsky district, RNO – Alania. The object of research was broilers of cross "Smena-8", which at day old by the analogue scale were divided into 4 groups of 100 birds each. The period of growing chickens lasted 42 days.

Experimental birds feeding was carried out in accordance with the existing standards of poultry feeding by the scheme given in Table 1.

Table 1 – Scheme of the scientific and economic experiment

Group	Feeding habits
Control	Basic diet (BD)
Test 1	BD+ preparation Mold-Zap at a dose of 1,5 kg/t feed
Test 2	BD+ preparation Ecosil at a dose of 125g/t feed
Test 3	BD+ preparation Mold-Zap at a dose of 1,5 kg/t feed + preparation Ecosil at a dose of 125 g/t feed

To determine the fermentation intensity of nutrients in diets of 5 selected birds from each group, the activity of proteinases, cellulases, lipases and amylases in accordance with the standard practice was studied in the content of the gizzard stomach and duodenum after the control slaughter.

The control slaughter of broilers was carried out according to the standard practice.

Aflatoxin B₁ quantitation in feed was carried out according to the standard practice.

The experimental material was statistically processed by Student's t-test using software package SNEDECOR.

RESEARCH RESULTS AND DISCUSSION:

To reduce the cost of mixed feeds, this enterprise buys cereal and soybean grain mainly from the farms of RNO – Alania. On this basis, the content of some mycotoxins was studied: T-2-toxin, ochratoxin A and aflatoxin B₁ in grain ingredients of mixed feeds for experimental broilers (Table 2).

Table 2 – Mycotoxin content in cereal and soybean grain, mg/kg

Feed	МycotoxinsМикотоксины					
	aflatoxin B ₁		T-2 toxin		ochratoxin A	
	MPC	actual	MPC	actual	MPC	actual
Corn chop	0,05	0,08	0,1	0,08	0,05	0,07
Wheat chop	0,05	0,07	0,1	0,11	0,05	0,05
Soybean “Rannyaya-10”	0,05	0,08	0,1	0,09	0,05	0,04

During the research it was found that the content of aflatoxin B₁ exceeded the maximum permissible concentration (MPC) in soybean of “Rannyaya-10” variety by 1,60 times, in corn chop – 1,60 and wheat chop – 1,40 times.

According to the chemical analysis, it was found that the MPC excess in T-2-toxin was only in wheat chop by 1,10 times, and in the content of ochratoxin A – only in corn chop – 1,40 times.

Thanks to the technological method of mixing corn, wheat and soybean grain, unfavourable for mycotoxins, and other favourable ingredients, T-2-

toxin and ochratoxin A level in the experimental birds feed was reduced below the MPC. The content of aflatoxin B₁ was 20% higher than MPC in the formulation of mixed feed PK-5 and PK-6, but did not exceed the tolerant amount — 0,25 mg/kg [10].

The digestive processes of hydrolysis of feed organic polymers in the poultry body are directly affected by the structural features of the digestive system, i.e. the presence of goiter and two-chamber stomach, where, mainly, along with the small intestine, the protein is cleaved. On this basis, the fermentative activity of content in boilers' gizzard stomach and duodenum was studied (Table 3).

Table 3 – Fermentative activity of the experimental chickens' gizzard stomach and duodenum chyme, u/g

Digestive tract division	Group			
	Control	Test 1	Test 2	Test 3
Proteinases activity				
Gizzard stomach	0,534±0,002	0,577±0,002	0,599±0,002	0,611±0,001
Duodenum	1,611±0,001	1,751±0,001	1,814±0,001	1,848±0,002
Cellulases activity				
Gizzard stomach	2,15±0,02	2,47±0,02	2,42±0,02	2,32±0,02
Duodenum	12,17±0,02	13,99±0,02	13,72±0,02	13,19±0,02
Amylases activity				
Gizzard stomach	0,61±0,003	0,66±0,001	0,69±0,002	0,70±0,001
Duodenum	1,74±0,002	1,89±0,001	1,96±0,002	2,06±0,003

*P>0,95

The obtained during the experiment results showed that the mixture of preparations Ecosil and Mold-Zap had the most promoting effect on the activity of proteolytic enzymes in the digestive tract of boilers from the third test group, which allowed them to surpass in the proteinases activity of the gizzard stomach content by 14,4% and duodenum – 14,7% respectively.

It is known that cellulases are not produced in the gastrointestinal tract of poultry. However, a part of the feed cellulose undergoes hydrolysis due to cellulolytic enzymes extracted with the gut microflora. In the course of studies it was found that the mixture of preparations Ecosil and Mold-Zap had the greatest promoting effect on the cellulases activity in the digestive tract of boilers from the third test group, which allowed them to surpass in

cellulases activity of the gizzard stomach content by 7,9% and duodenum – by 8,3%, respectively.

The mixture of preparations Ecosil and Mold-Zap had the greatest promoting effect on the activity of amylolytic enzymes in the digestive tract of boilers from the third test group, which allowed them to surpass in amylases activity of the gizzard stomach

content by 14,7% as well as duodenum – by 18,4%, respectively.

Meat productivity of boilers depends on the activity of hydrolysis in the gastrointestinal tract and nutrients fixation. On this basis, the control slaughter using five selected birds from each group was carried out (Table 4).

Table 4 – Results of the experimental birds' slaughter

Indicator	Group			
	Control	Test 1	Test 2	Test 3
Pre-slaughter weight of 1 bird, g	2054,9 ± 7,1	2232,9 ± 6,5	2225,8 ± 6,6	2280,8 ± 6,1
Weight of semi-eviscerated carcass, g	1676,7 ± 5,9	1842,1 ± 5,7	1843 ± 5,9	1922,7 ± 5,5
In % to live weight	81,6	82,5	82,8	84,3
Weight of eviscerated carcass, g	1321,2 ± 4,5	1458 ± 3,7	1460,2 ± 4,3	1502,9 ± 3,6
Slaughter yield, %	64,3	65,3	65,6	65,9

It is found that the highest promoting effect on slaughter indicators of the experimental birds had joint supplement of preparations Ecosil and Mold-Zap to the mixed feed, which provided for broilers in the third test group relative to the control significant ($P>0,95$) increase in the weight of semi-eviscerated carcass by 14,7% and eviscerated – by 13,7% as well as slaughter yield – 1,6%, respectively.

Feeding conditions have an impact on the nutritional value of poultry meat. In view of the high growth rate of modern meat poultry crosses, the chemical composition of meat should be also considered (Table 5).

Table 5 – Chemical composition of pectoral and femoris, %

Indicator	Group			
	Control	Test 1	Test 2	Test 3
Pectoral				
Dry matter, %	25,17 ± 0,18	25,79 ± 0,22	26,00 ± 0,14	26,21 ± 0,12
Protein, %	21,76 ± 0,14	22,65 ± 0,17	22,88 ± 0,13	23,00 ± 0,13
Fat, %	2,22 ± 0,03	2,14 ± 0,05	2,19 ± 0,03	2,02 ± 0,03
Femoris				
Dry matter, %	23,69 ± 0,20	24,39 ± 0,17	24,52 ± 0,11	24,85 ± 0,14
Protein, %	18,84 ± 0,12	19,72 ± 0,14	20,00 ± 0,15	20,43 ± 0,19
Fat, %	3,30 ± 0,04	3,14 ± 0,03	2,80 ± 0,03	2,54 ± 0,05

The most favourable effect on consumer properties of boilers meat had joint supplement of preparations mold inhibitor and absorbent. Due to this, broilers in the third test group relative to the control contained significantly 1,04-1,16% and 1,24-1,59% ($P>0,95$) more dry matter and protein in pectoral and femoris

and fat, on the contrary, 0,20 and 0,74% ($P>0,95$) less.

Biological full value of the experimental birds meat (Table 6) was determined by meat protein quality index (PQI) (estimated in ratio of tryptophan to oxyproline in pectoral).

Table 6 – Biological full value of chickens meat (pectoral)

Indicator	Group			
	Control	Test 1	Test 2	Test 3
Tryptophan, %	1,63 ± 0,14	1,73 ± 0,14	1,76 ± 0,14	1,79 ± 0,14
Oxyproline, %	0,43 ± 0,01	0,415 ± 0,01	0,4 ± 0,02	0,39 ± 0,012
PQI	3,773 ± 0,22	4,149 ± 0,23	4,434 ± 0,44	4,612 ± 0,47

The results obtained during the experiment showed that joint supplement of preparations Ecosil and Mold-Zap provided for chickens in the third test group the most significant ($P>0,95$) superiority over the control in the biological meat value by 22,2%.

CONCLUSION:

On the basis of the data obtained the mixture of preparations Mold-Zap at a dose of 1,5 kg/t feed and Ecosil at a dose of 125 g/t feed is recommended to introduce into broilers diets with increased content of aflatoxin B₁ to activate enzymes in the gastrointestinal tract and improve consumer qualities of poultry meat.

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