ISSN 2518-1629 (Online),
ISSN 2224-5308 (Print)

ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫНЫҢ
С. Ж. Асфендияров атындағы Қазақ ұлттық медицина университеті

Х А Б А Р Л А Р Ы

ИЗВЕСТИЯ

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН
Казахский национальный медицинский университет им. С. Д. Асфендиярова

N E W S

OF THE NATIONAL ACADEMY OF SCIENCES
OF THE REPUBLIC OF KAZAKHSTAN
**Asfendiyarov
Kazakh National Medical University**

SERIES
OF BIOLOGICAL AND MEDICAL

1 (343)

JANUARY – FEBUARY 2021

PUBLISHED SINCE JANUARY 1963

PUBLISHED 6 TIMES A YEAR

ALMATY, NAS RK

«ҚР ҰҒА Хабарлары. Биология және медициналық сериясы».
ISSN 2518-1629 (Online), ISSN 2224-5308 (Print)
Меншіктеуші: «Қазақстан Республикасының Ұлттық ғылым академиясы» РҚБ (Алматы қ.).
Қазақстан Республикасының Мәдениет пен ақпарат министрлігінің Ақпарат және мұрағат комитетінде 01.06.2006 ж. берілген **№5546-Ж** мерзімдік басылым тіркеуіне қойылу туралы куәлік.

Мерзімділігі: жылына 6 **рет.**
Тиражы: 300 дана.

Редакцияның мекенжайы: 050010, Алматы қ., Шевченко көш., 28; 219, 220 бөл.; тел.: 272-13-19
http://biological-medical.kz/index.php/en/

Типографияның мекенжайы: «Аруна» ЖК, Алматы қ., Мұратбаев көш., 75.

«Известия НАН РК. Серия биологическая и медицинская».
ISSN 2518-1629 (Online), ISSN 2224-5308 (Print)
Собственник: РОО «Национальная академия наук Республики Казахстан» (г. Алматы).
Свидетельство о постановке на учет периодического печатного издания в Комитете информации и архивов Министерства культуры и информации Республики Казахстан **№5546-Ж,** выданное 01.06.2006 г.

Периодичность: 6 раз в год.
Тираж: 300 экземпляров.

Адрес редакции: 050010, г. Алматы, ул. Шевченко, 28; ком. 219, 220; тел. 272-13-19
www:nauka-nanrk.kz / biological-medical.kz

Адрес типографии: ИП «Аруна», г. Алматы, ул. Муратбаева, 75.

News of the National Academy of Sciences of the Republic of Kazakhstan. Series of biology and medicine.
ISSN 2518-1629 (Online), ISSN 2224-5308 (Print)
Owner: RPA "National Academy of Sciences of the Republic of Kazakhstan" (Almaty).
The certificate of registration of a periodic printed publication in the Committee of information and archives of the Ministry of culture and information of the Republic of Kazakhstan **N 5546-Ж**, is sued 01.06.2006.

Periodicity: 6 times a year.
Circulation: 300 copies.

Editorial address: 28, Shevchenko str. of. 219, 220, Almaty, 050010; tel. 272-13-19
http://nauka-nanrk.kz / biological-medical.kz

Address of printing house: «Aruna» ST, 75, Muratbayev str, Almaty.

N E W S
OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN
SERIES OF BIOLOGICAL AND MEDICAL
ISSN 2224-5308
Volume 1, Number 343 (2021), 22 – 29 **https://doi.org/10.32014/2021.2519-1629.56**

UDC 636.52:591.1:612.34:636.087.7

A. Grozina

Federal Scientific Center "All-Russian Research and Technological Poultry Institute" RAS, Sergiev Posad, Russia.
E-mail: alena_fisinina@mail.ru

INFLUENCE OF VARIOUS FEED ADDITIVES ON THE ACTIVITY OF CHYME AND BLOOD PLASMA ENZYMES OF YOUNG MEAT CHICKEN OF ORIGINAL LINE

Abstract. The research aimed to determine the effect of a mixture of low molecular weight organic acids and complex phytobiotics when replacing a feed antibiotic with them on the activity of digestive enzymes in the duodenal chyme and the activity of pancreatic enzymes in the blood plasma of young stock B5 and B9 meat chicken lines.

The experiments were carried out on the original lines of meat poultry lines B5 (Cornish) and B9 (Plymouth rock). There was an operation to insert a cannula into the duodenum at the age of 6 weeks. The enzymatic activity of the duodenum chyme and the content of pancreatic enzymes in the blood plasma in the groups of chickens receiving antibiotics, low molecular weight organic acids, and phytobiotics with the diet.

The data showed that the influence of feed additives on the physiological status of poultry was different. The use of low molecular weight organic acids of the B5 and B9 chicken lines had a significant effect on the production of digestive enzymes due to an increase in the activity of chyme lipase (by 98.3%) and blood plasma lipase (by 26.6%) in B9 chickens and an increase in chyme proteases (by 30.9%) in B5 chickens compared with the control group, where the antibiotic was used. The introduction of complex phytobiotics into the diet had a negative effect on chickens of the B5 line (Cornish), reducing the activity of amylase and lipase of the duodenal chyme (by 29.2 and 26.9%) compared with the control group. In B9 (Plymouth rock) chickens, only the chyme amylase activity increased by 30.8% that indicates an improvement in the availability of feed carbohydrates. These data confirm the need to take into account the different effects of feed additives on the digestion processes in different poultry crosses.

Key words: meat chickens, pancreatic enzymes, duodenal chyme, blood, phytobiotics, low molecular weight organic acids.

Introduction. Russian poultry farming is the most stable and dynamically developing branch of the agro-industrial complex, capable of increasing the volume of poultry products in a short time and providing the population with high-quality dietary products - eggs and meat [1,2]. Improving animal feeding should be based on knowledge of the functional characteristics of their digestive system [3]. The pancreas is one of the central organs of the digestive system that maintains homeostasis of the body. [4]. First of all, it is an organ of external secretion that produces pancreatic juice, which is involved in the hydrolysis of the main components of the feed. The hydrolysis products are easily absorbed in the intestine and enter the blood and lymph [5]. It is known that pancreatic enzymes circulate through the blood and return to the pancreas, participating in the secretion of a new portion of pancreatic juice [6]. In recent years, there has

been an increasing interest in the study of issues related to the circulation of pancreatic enzymes in humans and animals, since they are involved not only in digestion but also provide regulatory functions [7].

In connection with the expansion of the list of countries where there is a ban on the use of feed antibiotics in animal husbandry, an active search for alternative drugs is underway [8, 9]. However, the ban on the use of feed antibiotics in the EU countries has led to an increase in the incidence rate of necrotizing enteritis and salmonellosis in poultry. This resulted in a reduction in the safety of stock and productivity [10]. Therefore, currently, popular directions are probiotics, prebiotics and symbiotics, acidifiers, phytobiotics, and enzyme agents [11, 12].

Our research aimed to determine the influence of a mixture of low molecular weight organic acids and complex phytobiotics on the activity of digestive enzymes in the duodenal chyme and pancreatic enzymes in the blood plasma of young stock of the B5 and B9 meat chickens lines.

Materials and methods of the research. The experiments were performed under the conditions of the physiology laboratory of the ARSRTIP RAS on the original lines of meat poultry cross: B5 - a paternal line of the paternal parental form of the Cornish breed, fast-growing; B9 is the maternal line of the maternal parental form of the Plymouth Rock breed [13]. Experimental and control groups were equipped with analogs in live weight. Each group consisted of 5 chickens. For feeding the birds of the experimental and control groups, we used full-diet compound feed in the form of a placer with a nutritional value according to the recommendations for working with the cross [14]. Light, temperature, and humidity conditions, feeding, and drinking fronts corresponded to zootechnic requirements [15].

Surgical operations on meat poultry were performed at the age of 6 weeks, provided that animals were treated humanely following the requirements of the European Convention for the protection of vertebrate animals used for experimental and other scientific purposes (ETS No.123) [16]. To obtain duodenal chyme, a T-shaped cannula was inserted into the ascending limb of the duodenum. After the operation, the bird was placed in individual cages. The research was started 3-5 days after the operation.

For research, one control and two experimental groups of 5 chickens in each were formed. The 1st control group received a basic vegetable-type diet supplemented with the feed antibiotic Bacitracin at a dose of 100 g/t of forage throughout the entire growing period. The 2nd experimental group received a mixture of low molecular weight organic acids instead of the feed antibiotic at a dose of 1000 g/t. The 3rd experimental group received complex phytobiotics instead of the feed antibiotic at a dose of 500 g/t.

Physiological experiments began in the morning in a fasting state of a bird after a 14-hour fast. The first portion of the food was 30 g, and one hour after feeding, 5 ml of duodenal chyme was collected. Then the chyme samples were centrifuged at 5000 rpm for 5 min and the supernatant was diluted in a ratio of 1:10 with chilled Ringer's solution and the activity of digestive enzymes was determined.

The activity of the duodenal chyme amylase was determined by the hydrolysis of starch [17] using KFK-3 (Russia) at a wavelength of 670 nm. Lipolytic activity was measured using BS-3000P semi-automatic biochemical analyzer with a flow cell (China) using a set of reagents for the determination of lipase (OOO DIAKON-VET, Russia). The protease activity was specified by the cleavage of casein according to Hammerstein with colorimetric control on KFK-3 at a wavelength of 450 nm [18].

Blood for the test was taken from the axillary vein in a fasting state into test tubes with the addition of sodium citrate. Then it was centrifuged at 5000 rpm for 3 minutes. The resulting blood plasma was tested for amylase and lipase activity using automatic analyzer ChemWell 2900 (T) (USA) using Human reagent kits (Germany). The protease activity was determined on a semiautomatic biochemical analyzer BS-3000P (SINNOWA, China) [19]. All studies were carried out in 3 replicates.

Statistical processing of the results included calculating the mean (M) and standard deviation (±m). The significance of differences was assessed by Student's t-test. Differences were considered statistically significant at $p<0.05$.

Results. The obtained results (table 1) showed that the introduction of a mixture of low molecular weight organic acids into the diet of meat chickens of the B5 (Cornish) line contributed to a significant increase in the activity of the duodenal chyme enzymes compared with the control. So, the activity of chyme amylase in chickens of the 2nd experimental group was 5.5% higher compared to this indicator in chickens of the control group. The chyme lipase activity of chickens in this group was higher by 30.9%,

and the protease activity - by 36.4%, respectively, concerning these indicators in birds of the control group.

The results also showed that the introduction of complex phytobiotics into the diet of the B5 line (Cornish) meat chickens contributed to a decrease in the activity of the duodenal chyme enzymes compared to the control. So, the activity of chyme amylase in chickens of the 3rd experimental group was lower by 29.2% compared with this indicator in chickens of the control group. The chyme lipase activity in chickens of this group was lower by 26.9%, respectively, concerning the control. Protease activity remained at the same level.

The introduction of a mixture of low molecular weight organic acids into the diet of meat chickens of the B9 line (Plymouth Rock) contributed to an increase in the amylase and lipase activity in the duodenal chyme compared to the control. So, the activity of chyme amylase in chickens of the 2nd experimental group was higher by 14.6% compared with this indicator in chickens of the control group. The chyme lipase activity in chickens of this group was higher by 98.3% concerning this indicator in chickens of the control group. The chyme protease activity did not undergo significant changes.

Table 1 Enzymatic activity of the duodenal chyme of meat chickens with adding a mixture of low molecular weight acids and phytobiotics to the diet

Groups	Indicators		
	Amylase, mg/ml/min	Lipase, u/l	Proteases, mg/ml/min
The activity of chyme enzymes of the B5 line chickens			
1st control (BD)	219.0±21.1	750.0± 54.7	22.0±1.8
2nd experimental (BD+ organic acid mixture)	231.0±25.5	982.0±76.5*	30.0±1.7*
3rd experimental (BD+ Phytobiotics)	166.0 ±7.8*	632.0 ±41.7	22.0±1.7
The activity of chyme enzymes of the B9 line chickens			
1st control (BD)	266.0±31.0	301.0±37.5	36.0±0.8
2nd experimental (BD+ organic acid mixture)	305.0±41.0	597.0±50.3**	36.0±1.0
3rd experimental (BD+ Phytobiotics)	348.0±36.5	266.0±59.7	34.0±1.5

Note: significant differences with control * – $P \leq 0.05$, ** – $P \leq 0.001$.

The results also showed that the introduction of complex phytobiotics into the diet of meat chickens of the B9 (Plymouth rock) line promoted an increase in the activity of chyme amylase and a decrease in the activity of lipase and proteases in comparison with the control. So, the activity of amylase in chickens of the 3rd experimental group was higher by 30.8% compared with this indicator in chickens of the control group. The activity of chyme lipase in birds of this group was lower by 11.6%, and the activity of proteases - by 5.5%, respectively, with these indicators of the control group birds.

The results (table 2) showed that the introduction of a mixture of low molecular weight organic acids into the diet of meat chickens of the B5 (Cornish) line contributed to a decrease in the content of amylase, lipase, and proteases in the blood plasma compared with the control. Thus, the content of amylase in the blood plasma of chickens of the 2nd experimental group was lower by 18.5%, lipase - by 3.4%, proteases - by 2.8%, respectively, compared with these indicators in chickens of the control group.

Table 2 The content of pancreatic enzymes in the blood plasma of meat chickens with adding a mixture of low molecular weight acids and phytobiotics to the diet

Groups	Indicators		
	Amylase, mg/ml/min	Lipase, u/l	Proteases, mg/ml/min
The content of pancreatic enzymes in the blood plasma of the B5 chicken line			
1st control (BD)	395,0±43,5	29,0±2,2	35,0±5,4
2nd experimental (BD+ organic acid mixture)	322,0±20,5	28,0±2,1	34,0±3,5
3rd experimental (BD+ Phytobiotics)	245,0±21,5*	38,0±4,5	46,0±6,5

The content of pancreatic enzymes in the blood plasma of the B9 chicken line

1st control (BD)	290,0±25,1	15,0±0,9	29,0±0,5
2nd experimental (BD+ organic acid mixture)	263,0±6,5	19,0±0,6*	30,0±0,9
3rd experimental (BD+ Phytobiotics)	336,0±26,2	16,0±1,8	27,0±3,2

Note: significant differences with control * – $P \leq 0.05$.

The results also showed that the introduction of complex phytobiotics into the diet of meat chickens of the B5 (Cornish) line contributed to a decrease in the content of amylase and an increase in lipase and proteases of blood serum compared to the control. Thus, the content of amylase in blood plasma in chickens of the 3rd control group was 37.9% lower than that in chickens of the control group. The content of lipase in blood plasma in chickens of this group was higher by 31.0%, and proteases - by 31.4%, respectively, compared with these parameters in chickens of the control group.

The addition of a mixture of low molecular weight organic acids to the diet of meat chickens of the B9 line (Plymouth rock) contributed to a decrease in the content of amylase and an increase in lipase and proteases of blood serum compared to the control. Thus, the content of amylase in blood plasma in chickens of the 2nd experimental group was lower by 9.3% compared with this indicator in chickens of the control group. The content of lipase in blood plasma in chickens of this group was higher by 26.6%, proteases - by 3.5%, respectively, compared with these indicators in chickens of the control group.

The results also showed that the introduction of complex phytobiotics into the diet of the B9 line (Plymouth rock) birds contributed to an increase in the content of amylase and lipase and a decrease in serum proteases compared to the control group. Thus, the content of amylase in blood plasma in chickens of the 3rd experimental group was higher by 15.8%, and lipase - by 6.6% in comparison with these indicators in chickens of the control group. The protease content in the plasma of chickens of this group was lower by 6.9% compared with this indicator in the control chickens.

According to our data, the introduction of a mixture of low molecular weight organic acids into the diet of meat chickens of the lines B5 (Cornish) and B9 (Plymouth rock) contributed to enhancing the activity of amylase (by 5.5 and 14.6%), lipase (by 30.9 and 98.3%) of duodenal chyme compared with these indicators in birds of the control group. Protease activity was higher than control only in B5 chickens (by 36.4%), and remained unchanged in B9 chickens.

It was also established that the introduction of complex phytobiotics into the diet of meat chickens of the lines B5 (Cornish) and B9 (Plymouth rock) contributed to a decrease in lipase activity (by 26.9 and 11.6%) of duodenal chyme compared with these indicators in birds of the control group. The chyme amylase activity was lower (by 29.2%) than in the control in B5 chickens, and in B9 chickens it was higher by 30.8%. The protease activity did not differ significantly.

Our data showed that the introduction of a mixture of low molecular weight organic acids into the diet of meat chickens of the lines B5 (Cornish) and B9 (Plymouth rock) contributed to a decrease in the content of amylase (by 18.5 and 9.3%) in blood plasma compared with the control group. The content of lipase and proteases in meat chickens of the B5 line was lower (by 3.4 and 2.8%), and in chickens of the B9 line was higher (by 26.6 and 3.5%) compared with the control.

Besides, it was found that the introduction of complex phytobiotics into the diet of meat chickens of the B5 (Cornish) and B9 (Plymouth rock) lines promoted a rise in the lipase content (by 31.0 and 6.6%) in the blood plasma compared with the control group. The amylase content in the blood plasma of chickens of the B5 line was 37.5% lower and in the B9 line - 15.8% higher than in the control group. The protease content was higher (by 31.4%) in B5 chickens, and lower (by 6.9%) in B9 chickens compared to the control group.

The use of low molecular weight organic acids mixed with the diet of B5 and B9 meat chickens made to a slight increase in the activity of amylase of the duodenal chyme, a significant increase in the activity of lipase (by 30.9 and 98.3%), and an increase in the activity of proteases in birds by 30.8% compared to the control. Amylase content in the blood plasma of chickens was slightly reduced. At the same time, the protease content differed insignificantly, since this indicator is stable. The lipase content in chickens of the B9 line exceeded the control by 26.6%, while the B5 line birds have slightly different

indicators. From these data, it follows that low molecular weight organic acids lead to the improvement of digestion in B5 and B9 chickens, which directly affects productivity, absorption of nutrients in feed, and the safety of stock. This additive in particular had an effect on fat metabolism in B9 (Plymouth rock) chickens, which is associated with the physiological characteristics of this line, including its genetically better egg-laying capacity compared to the B5 line (Cornish).

The introduction of complex phytobiotics into the diet in meat chickens of lines B5 and B9 did not affect the activity of the duodenal chyme proteases. However, other indicators had significant differences. In B5 line (Cornish) chickens, the activity of amylase and lipase of the duodenal chyme decreased (by 29.2 and 26.9%) and the lipase content (by 31.0%) in the blood plasma increased as compared with the control. Also, in B5 chickens, the amylase and protease contents in blood plasma increased (by 37.5 and 31.4%). These data indirectly indicate that the complex phytobiotics in chickens of this line will not have an effective influence on the digestion processes. In meat chickens of the B9 line (Plymouth rock), the amylase activity of the duodenal chyme increased by 30.8% and the lipase activity was slightly down relative to the control group. At the same time, blood counts fluctuated insignificantly. Thus, the addition of complex phytobiotics into the diet showed only a positive effect on carbohydrate metabolism in the B9 line chickens.

Conclusion. The introduction of the low molecular weight organic acids mixture into the diet of meat chickens of the B5 and B9 lines had a positive effect on the digestion processes. The pronounced effect consisted in a significant rise in the activity of chyme lipase (by 98.3%) and blood plasma lipase (by 26.6%) in B9 chickens and the increase in chyme proteases (by 30.9%) in B5 chickens compared to the control group where the antibiotic was used. The use of the complex phytobiotics with the diet had a negative effect on the B5 line chickens (Cornish), reducing the amylase and lipase activities of the duodenal chyme (by 29.2 and 26.9%) compared with the control group. In B9 chickens (Plymouth rock breed), only the chyme amylase activity increased by 30.8%, which indicates an improvement in the availability of feed carbohydrates. However, the use of low molecular weight organic acids had a more pronounced effect on the production of digestive enzymes. Thus, when introducing additives into the diet, an alternative to feed antibiotics, it is necessary to take into consideration their different effects on the digestion processes in different poultry crosses.

Грозина А.

РҒА "Бүкілресейлік құс шаруашылығы ғылыми-зерттеу және технологиялық институты"
Федералды ғылыми орталығы, Сергиев Посад, Ресей
E-mail: alena_fisinina@mail.ru

ТҮРЛІ АЗЫҚ ҚОСПАЛАРЫНЫҢ ЕТТІ ТАУЫҚТАРДЫҢ БАСТАПҚЫ ҚАТАРДАҒЫ ЖАС ТӨЛДЕРІНІҢ ХИМУС ФЕРМЕНТТЕРІ МЕН ҚАН ПЛАЗМАСЫНЫҢ БЕЛСЕНДІЛІГІНЕ ӘСЕРІ

Аннотация. Зерттеудің мақсаты төменгі молекулалы органикалық қышқылдар мен кешенді фитобиотик қоспасының оларды азық антибиотикімен дуоденальды химиядағы ас қорыту ферменттерінің белсенділігіне және бастапқы Б5 және Б9 етті тауықтардың жас төлдерінің қан плазмасындағы панкреатиялық ферменттердің белсенділігіне алмастыру кезіндегі әсерін анықтау.

Тәжірибелер В5 (Корниш) және В9 (Плимутрок) құс етінің бастапқы желілерінде жүргізілді. Алты аптадан кейін он екі елі ішекке каннула енгізу операциясы жасалды. Он екі елі ішек химиясының ферментативті белсенділігі және дие-тамен антибиотиктер, төмен молекулалы органикалық қышқылдар және фитобиотиктер қабылдаған тауықтар тобындағы қан плазмасындағы панкреатиялық ферменттердің құрамы зерттелді.

Алынған мәліметтер жемшөп қоспаларының құстың физиологиялық жағдайына әсері әртүрлі екенін көрсетті. В5 және В9 тауықтарының төмен молекулалық органикалық қышқылдарын қолдану антибиотик қолданылған бақылау тобымен салыстырғанда В5 тауықтарында

химиопептаза (98,3%) және қан плазмасы липазасының (26,6%) белсенділігін арттыру және В9 тауықтарында химопротеидтердің (30,9%) мөлшерін арттыру арқылы ас қорыту ферменттерінің өндірісіне айтарлықтай әсер етті. Кешенді фитобиотиктерді диетаға енгізу бақылау тобымен салыстырғанда амилаза мен он екі елі ішектің липазасының белсенділігін (29,2 және 26,9%) төмендетіп, В5 (Корниш) тауықтарына теріс әсер етті. В9 тауықтарында (Плимут-рок) тек химамилаза белсенділігі 30,8%-ға артты, бұл жемдік көмірсулардың қол жетімділігінің жақсарғанын көрсетеді. Бұл мәліметтер құстардың әртүрлі кресттеріндегі ас қорыту процестеріне жемшөп қоспаларының әртүрлі әсерін ескеру қажеттілігін растайды.

Түйін сөздер: етті тауықтары, панкреатиялық ферменттер, он екі елі ішек жентегі, қан, фитобиотик, төмен молеку-лалы органикалық қышқылдар.

Грозина А.

Федеральный Научный Центр «Всероссийский научно-исследовательский
и технологический институт птицеводства» РАН, Сергиев Посад, Россия
E-mail: alena_fisinina@mail.ru

ВЛИЯНИЕ РАЗЛИЧНЫХ КОРМОВЫХ ДОБАВОК НА АКТИВНОСТЬ ФЕРМЕНТОВ ХИМУСА И ПЛАЗМЫ КРОВИ МОЛОДНЯКА ИСХОДНЫХ ЛИНИЙ МЯСНЫХ КУР

Аннотация. Цель исследований – определение влияния смеси низкомолекулярных органических кислот и комп-лексного фитобиотика при замене ими кормового антибиотика на активность пищеварительных ферментов в дуоденальном химусе и активность панкреатических ферментов в плазме крови молодняка исходных линий Б5 и Б9 мясных кур.

Эксперименты проводились на оригинальных линиях мясной птицы линий В5 (Корниш) и В9 (Плимутрок). В возрасте 6 недель была проведена операция по введению канюли в двенадцатиперстную кишку. Изучена ферментативная активность химуса двенадцатиперстной кишки и содержание панкреатических ферментов в плазме крови в группах цыплят, получавших с рационом антибиотики, низкомолекулярные органические кислоты и фитобиотики.

Полученные данные показали, что влияние кормовых добавок на физиологическое состояние птицы было различным. Применение низкомолекулярных органических кислот линий цыплят В5 и В9 оказало значительное влияние на выработку пищеварительных ферментов за счет повышения активности химиопептазы (на 98,3%) и липазы плазмы крови (на 26,6%) у цыплят В9 и увеличения содержания химопротеаз (на 30,9%) у цыплят В5 по сравнению с контрольной группой, где применялся антибиотик. Введение в рацион комплексных фитобиотиков оказало негативное влияние на цыплят линии В5 (Корниш), снизив активность амилазы и липазы двенадцатиперстной кишки (на 29,2 и 26,9%) по сравнению с контрольной группой. У цыплят В9 (Плимутрок) только активность химамилазы увеличилась на 30,8%, что свидетельствует об улучшении доступности кормовых углеводов. Эти данные подтверждают необходимость учета различного влияния кормовых добавок на процессы пищеварения у разных кроссов птицы.

Ключевые слова: мясные куры, панкреатические ферменты, дуоденальный химус, кровь, фитобиотик, низкомолекулярные органические кислоты.

Information about author:

Grozina Alena Andreyevna, PhD (Bio), Senior Research Associate, Department of Physiology and Biochemistry of Federal Scientific Center “All-Russian Research and Technological Poultry Institute” at RAS, Sergiev Posad, Russia; alena_fisinina@mail.ru; https://orcid.org/0000-0002-3088-0454

REFERENCES

[1] Fisinin V., Suray P. (2013) Intestinal immunity in birds: facts and reflections [Kishechnyy immunitet u ptits: fakty i razmyshleniya] // Agricultural biology. No. 4. P. 3-19 (in Russ.).

[2] Fisinin V., Suray P. (2011) Effective protection against stress in poultry farming: from vitamins to vitagens [Effektiv-naya zashchita ot stressov v ptitsevodstve: ot vitaminov k vitagenam] // Poultry and poultry products. No. 5. P. 23-24 (in Russ.).

[3] Egorov I.A., Lenkova T.N., Manukyan V.A., Nikonov I.N., Vertiprakhov V.G., Egorova T.A., Grozina A.A., Laptev G.Yu., Novikova N I., Ilyina L.A., Yildirim E.A. (2019) Physiological and microbiological features of digestion of meat chickens in the embryonic and postembryonic periods for the creation of new feeding technologies ensuring the fullest realization of the genetic potential of the bird [Fiziologicheskiye i mikrobiologicheskiye osobennosti pishchevareniya kur myasnykh porod v embrional'nyy i postembrional'nyy periody dlya sozdaniya novykh tekhnologiy kormleniya, obespechivayushchikh maksimal'no polnuyu realizatsiyu geneticheskogo potentsiala ptitsy]. All-Russian Research and Technological Poultry Institute, BIOTROF+, Sergiev Posad. 196 p. (in Russ.).

[4] Vertiprakhov V.G. (2004) Features of the secretory function of the pancreas of broiler chickens and the possibility of correcting animal digestion with zeolite-based enzyme preparations [Osobennosti sekretornoy funktsii podzheludochnoy zhelezy tsyplyat-broylerov i vozmozhnosti korrektsii pishchevareniya zhivotnykh fermentnymi preparatami na tseolitovoy osnove]: Abstract of thesis for the degree of Doctor of Biological Sciences. Novosibirsk. 37 p. (in Russ.).

[5] Egorov I.A., Vertiprakhov V.G., Lenkova T.N., Manukyan V.A., Grozina A.A., Egorova T.A. (2017) Age-related changes in pancreatic enzymes in the body of broiler chickens [Vozrastnyye izmeneniya pankreaticheskikh fermentov v organizme tsyplyat-broylerov] // Poultry farming. No. 2. P. 23-29 (in Russ.). doi: 10.15389/agrobiology.2017.2.374rus

[6] Korotko G.F. (2013) Formation of the enzyme component of the secretions of the digestive glands (review) [Formiro-vaniye fermentnogo komponenta sekretov pishchevaritel'nykh zhelez (obzor)] // Physical culture, sports - science and practice. No. 1. P. 51-57 (in Russ.).

[7] Vertiprakhov V.G., Grozina A.A., Dolgorukova A.M. (2016) Activity of pancreatic enzymes in broiler chickens at different stages of digestion [Aktivnost' fermentov podzheludochnoy zhelezy u tsyplyat-broylerov na raznykh etapakh pishchevareniya] // Agricultural biology. No. 4. P. 509-515 (in Russ.). doi: 10.15389/agrobiology.2016.4.509rus

[8] Dibner J.J., Richards J.R. (2005) Antibiotic growth promoters in agriculture: History and mode of action // Poultry Science. Vol. 84. P. 634-643. DOI: 10.1093/ps/84.4.634

[9] Semenov V.G., Kuzmina N.N., Petrov O.Yu., Baimukanov A., Dzhanabekova G.K., Sarimbekova S.N., Nesipbayeva A.K., Zhylkyshybayeva M.M. (2019). Comparative assessment of the impact of natural antioxidants on the qualitative indicators of semi-finished products from broiler-chicken meat and oxidative processes in their storage // Bulletin of the National academy of sciences of the Republic of Kazakhstan. 2019. Vol. 6, No. 382. P. 54-63. https://doi.org/10.32014/2019.2518-1467.145 ISSN 2518-1467 (Online), ISSN 1991-3494 (Print).

[10] Mahmood K., Rahman S.U., Hussain I., Abbas R.Z., Khalig T., Arif J., Mahmood F. (2014) Non-antibiotic strategies for the control of necrotic enteritis in poultry // World's Poultry Science Journal. Vol. 70. P. 865-879. https://doi.org/10.1017/S0043933914000919

[11] Bedford M. (2000) Removal of antibiotic growth promoters from poultry diets: implications and strategies to minimize subsequent problems // World's Poultry Science Journal. Vol. 56. P. 347-365.

[12 Konstantinov V. (2010) Organic acids - an excellent result [Organicheskiye kisloty – otlichnyy rezul'tat] // Compound feed. No. 9. P. 115-116 (in Russ.).

[13] Egorova A.V., Tuchemskiy L.I., Emanuylova Zh.V., Efimov D.N. (2015) Productivity of parental forms of meat chickens breeding at the Smena selection and genetic center [Produktivnost' roditel'skikh form myasnykh kur selektsii selektsionno-geneticheskogo tsentra Smena] // Animal science. No. 6. P. 2-4 (in Russ.).

[14] Egorov I.A., Manukyan V.A., Okolelova T.M., Lenkova T.N., Andrianova E.N., Shevyakov A.N., Egorova T.V., Egorova T.A., Baikovskaya E Yu., Gogina N.N., Krivoruchko L.I., Sysoeva I.G., Menshenin I.A., Grigorieva E.N., Panin I.G., Grechishnikov V.V., Panin A.I., Kustova S.V., Afanasyev V.A., Ponomarenko Yu.A. (2018) Guidelines to feeding poultry. Federal Scientific Center All-Russian Research and Technological Poultry Institute of RAS. 226 p. (in Russ.).

[15] Saleeva I.P., Lysenko V.P., Shol V.G., Alekseev F.F., Gusev V.A., Belyakova L.S., Titov V.Yu., Novotorov E.N., Kosenko O V., Koroleva N.A., Ivanov A.V., Ofitserov V.A., Ovseichik E.A., Starkova E.S., Burynina N.S., Okuneva T.S. (2015) Research methodology on the technology of production of eggs and poultry meat [Metodika provedeniya issledovaniy po tekhnologii proizvodstva yaits i myasa ptitsy]. Federal Scientific Center All-Russian Research and Technological Poultry Institute of RAS. 103 p. (in Russ.).

[16] The European convention for the protection of vertebrate animals used for experimental and other scientific purposes (ETS No.123). Strasbourg. 1986. https://www.coe.int/en/web/conventions/

[17] Merina-Gluzkina V.M. (1965) Comparative evaluation of saccharifying and dextrinizing methods in determining the activity of amylase in the blood of healthy and patients with acute pancreatitis [Sravnitel'naya otsenka sakharifitsiruyushchego i dekstriniziruyushchego metodov pri opredelenii aktivnosti amilazy krovi zdorovykh i bol'nykh ostrym pankreatitom] // Laboratory work. No. 3. P. 142-146 (in Russ.).

[18] Batoev Ts.Zh. (1971) Photometric determination of the activity of proteolytic enzymes in the pancreas, juice to reduce the concentration of casein [Fotometricheskoye opredeleniye aktivnosti proteoliticheskikh fermentov v podzheludochnoy zheleze, soke po umen'sheniyu kontsentratsii kazeina] // Collection of scientific works of the Buryat Agricultural Institute (Ulan-Ude). No. 25. P. 122-126.

[19] Mikhailova A.G., Khairullin R.F., Demidyuk I.V., Kostrov S.V., Grinberg V.Y., Rumsh L.D. (2014) Cloning, sequen-cing, expression, and characterization of thermostability of oligopeptidase B from Serratia proteamaculans, a novel psychrophilic protease // Protein Expression and Purification. Vol. 93. P. 63-76. https://doi.org/10.1016/j.pep.2013.10.011

МАЗМҰНЫ – СОДЕРЖАНИЕ – CONTENTS

Publication Ethics and Publication Malpractice in the journals of the National Academy of Sciences of the Republic of Kazakhstan

For information on Ethics in publishing and Ethical guidelines for journal publication see **http://www.elsevier.com/publishingethics** and **http://www.elsevier.com/journal-authors/ethics**.

Submission of an article to the National Academy of Sciences of the Republic of Kazakhstan implies that the described work has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis or as an electronic preprint, see **http://www.elsevier.com/postingpolicy**), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. In particular, translations into English of papers already published in another language are not accepted.

No other forms of scientific misconduct are allowed, such as plagiarism, falsification, fraudulent data, incorrect interpretation of other works, incorrect citations, etc. The National Academy of Sciences of the Republic of Kazakhstan follows the Code of Conduct of the Committee on Publication Ethics (COPE), and follows the COPE Flowcharts for Resolving Cases of Suspected Misconduct (**http://publicationethics.org/files/u2/New_Code.pdf**). To verify originality, your article may be checked by the Cross Check originality detection service **http://www.elsevier.com/editors/plagdetect**.

The authors are obliged to participate in peer review process and be ready to provide corrections, clarifications, retractions and apologies when needed. All authors of a paper should have significantly contributed to the research.

The reviewers should provide objective judgments and should point out relevant published works which are not yet cited. Reviewed articles should be treated confidentially. The reviewers will be chosen in such a way that there is no conflict of interests with respect to the research, the authors and/or the research funders.

The editors have complete responsibility and authority to reject or accept a paper, and they will only accept a paper when reasonably certain. They will preserve anonymity of reviewers and promote publication of corrections, clarifications, retractions and apologies when needed. The acceptance of a paper automatically implies the copyright transfer to the National Academy of Sciences of the Republic of Kazakhstan.

The Editorial Board of the National Academy of Sciences of the Republic of Kazakhstan will monitor and safeguard publishing ethics.

Правила оформления статьи для публикации в журнале смотреть на сайтах:

www:nauka-nanrk.kz

ISSN 2518-1629 (Online), ISSN 2224-5308 (Print)

http://biological-medical.kz/index.php/en/

Редакторы: *М.С. Ахметова, Д. С. Аленов, А. Ботанқызы*
Верстка на компьютере *Зикирбаева В.С.*

Подписано в печать 15.02.2021.
Формат 60x881/8. Бумага офсетная. Печать – ризограф.
4,6 п.л. Тираж 300. Заказ 1.

Национальная академия наук РК
050010, Алматы, ул. Шевченко, 28, т. 272-13-19