

21 Matveeva A. A. Gigiena kormov i kormleniya sel'skohozyajstvennyh zhivotnyh / A. A. Matveeva, N. L. Lopaeva // Molodezh' i nauka. – 2020. – № 5. – S. 36.

22 Ispol'zovanie kormovyh dobavok otechestvennogo proizvodstva v kormlenii bychkov / G. E. Uskov A. V. Copanova N. I. Shubina A. A. Bajsakalov // Vestnik Kurganskoj GSKHA. – 2021. – № 1(37). – S. 39

23 Salnikov L. I. Vliyanie uslovij soderzhaniya na etologiyu i produktivnost' bychkov pri otkorme / L.I. Salnikov L. I. Kibkalo // Vestnik Kurskoj gosudarstvennoj sel'skohozyajstvennoj akademii. – 2018. – № 5. – S. 104

РЕЗЮМЕ

В статье говорится, что в ТОО «Шалабай» создана канадская система GrowSafe, так как ведется разведение казахской белоголовой породы мясного направления. Поэтому одним из актуальных вопросов в использовании канадской системы GrowSafe является проект помещения для животных, ее соответствие санитарным требованиям. Потому что при содержании животных в помещениях, не соответствующих зоогигиеническим стандартам, их продуктивность и выносливость снижаются, могут привести к массовым заболеваниям, поэтому проектирование, строительство и эксплуатация помещений в животноводстве должны основываться не только на технических, но и на биологических и зоогигиенических требованиях. Помещения для содержания животных должны быть удобными для размещения, кормления, полива и содержания животных. Проект конюшни в ТОО "Шалабай" построен в соответствии со всеми санитарно-гигиеническими требованиями.

Прежде всего, перед подключением к системе GrowSafe проходит 10-14 дней адаптации, после чего на 40-49 дней проводится тестовая работа с подключением этой системы. Система GrowSafe используется для определения количества не потребленных кормов (ТАМ) и значений индекса породной ценности, кроме того, что позволяет контролировать размер кормов для животных, прирост живой массы. Для исследования ТАМ собирают сходные группы животных по полу, породе, размерам, от однолетних животных. Максимальная разница в возрасте между животными должна составлять до 90 дней.

UDC 636.5.034
IRSTI 68.41.31

DOI 10.56339/2305-9397-2022-4-1-164-173

Lozowicka B., PhD, Professor, **main author**, <https://orcid.org/0000-0002-2760-3333>

Plant Protection Institute National Research Institute, Władysława Węgorka 20, Poland, bozena.lozowicka@mail.ru

Paritova A.Y., PhD, Senior Lecturer, <https://orcid.org/0000-0001-7036-1037>

S.Seifullin University, 62, Zhenis st., 010000, Nur-Sultan, Republic of Kazakhstan, paritova87@mail.ru

Kushmukhanov Zh.S., master (veterinary sanitation), <https://orcid.org/0000-0002-5132-7359>

NJSC «West Kazakhstan Agrarian Technical University named after Zhangir Khan», Republic of Kazakhstan, Uralsk, st. Zhangir Khan, 51, 090009, jenis.90@mail.ru

Nakhatova N.K., master of Veterinary Sciences, <https://orcid.org/0000-0001-5249-555X>

S.Seifullin University, 62, Zhenis st., 010000, Nur-Sultan, Republic of Kazakhstan, nura_n16@mail.ru

VETERINARY AND SANITARY EVALUATION OF CHICKEN MEAT WHEN USING FEED MINERAL CONCENTRATE "NATURAL ZEOLITE" IN THE DIET

ANNOTATION

This article studied quality indicators of chicken meat when using feed mineral concentrate «Natural Zeolite» in their diet. The purpose of study is to give a veterinary and sanitary assessment of chicken meat when adding «Natural Zeolite» to diet. The research work was conducted on 120 one-day-old female Ross 90 chickens owned by the Chicken Ryaba poultry meat factory in 2021-2022

years. The zeolite used in this experiment contains at least 81% clinoptilolite. It also contains 62% SiO₂, 16% Al₂O₃, 5.45% Fe₂O₃ and 5.12% CaO, 2.30% MgO, 2.62% K₂O and 2.03% NaO (Table 2). Organoleptic examination revealed that carcasses of 10, 20 and 30-day-old chickens raised with feed additive had no foreign smell, the appearance of the carcass did not change in comparison with the carcasses of the control group. The color is pale pink, slightly moist, did not leave wet spots on the filter paper. When cooking meat, the soup turned out to be transparent, fragrant, and pleasantly smelling. The pH content of chicken meat in the research group was 5.8-6.0, which corresponded to the pH of ripe, raw meat. The activity of peroxidase in the muscles of experimental and control chickens was the same. No ammonia and ammonium salts were found in the studied samples of poultry meat of the control and experimental groups. The content of amino-ammiac nitrogen in muscles of the studied chickens was 1.07 - 1.11 mg. The number of mesophilic aerobic and facultative anaerobic microorganisms (NMAFAnM) was 6.5×10^3 - 1.0×10^4 . Pathogens, including salmonella and listeria monocytogens, were not isolated in 25 g of the product. The nutritional value of meat in 100 g of the product was 132.6 kcal in 10-day chicken meat; 137.9 kcal in 20-day chicken meat; 143.1 kcal in 30-day chicken meat.

Key words: feed additives; veterinary-sanitary evaluation; chicken meat; mineral concentrate «Natural Zeolite»; diet; microbiological research; physico-chemical research

Introduction. Improving the well-being of people is closely related to improving the food supply of the population. An important role in the growth of food production belongs to poultry farming as the most intensive branch of animal husbandry. Poultry farming in our country is characterized by increasing requirements for the quantitative growth of products, improving their quality and reducing cost [1].

Today, modern management of industrial poultry farming has reached a qualitatively new level. Both all over the world and in our country, targeted breeding work is being carried out to build capacity in the direction of meat and eggs. Poultry has the greatest effect of converting vegetable protein into an animal, which compares favorably with cattle and pigs in this indicator. Possessing unique qualities of self-sufficiency, the bird impresses with its very high intensity. When producing a kilogram of egg mass or broiler meat, the feed conversion is less than two units, from 4 to 5 kg is required for the production of one kilogram of pork, from 7 to 10 kg of feed is required for the production of beef [2-3].

Poultry meat is considered one of the most popular and widespread food products [4]. Modern, intensive production of poultry products has made it possible to obtain a phenomenal profit due to the efficient and economical production of high-quality and safe meat, eggs and biological products [5]. Poultry meat production continues to grow worldwide.

Experts expect that in less than ten years chicken will become the main source of protein for consumers. Statistics show that this also applies to our country. For 4 months of 2022, 139.9 thousand tons of cattle meat were sold on the domestic market. This is 3.2% or 4.6 thousand tons less than in the same period of 2021. Biologically active food additives are concentrates of natural or biologically active substances identical to natural ones (including essential food substances) intended for direct intake or inclusion in the composition of food products. Rational use of biologically active additives provides a unique opportunity to purposefully influence the most damaged joint of metabolic processes by correcting the metabolic connection. At the same time, the profitability of livestock production increases [2, 6].

Trace elements are introduced into the feed in the form of premixes. In most cases, seven trace elements are used-cobalt, copper, iron, iodine, manganese, zinc and selenium. Of the trace elements, calcium, phosphorus, potassium, sodium, chlorine, magnesium and sulfur are very important in animal feeding. The possibility of biological use of the organism plays a decisive role in the choice of sources of trace elements. Sources of trace elements can be organic and inorganic. The most well-known of them are products called chelated bonds of trace elements with an amino acid or protein molecule [7-8].

An important source of minerals is plant food. However, their composition varies depending on the level of agricultural technology for growing fodder crops, biochemical crops, etc. in recent years, natural minerals-limestone, clay, phosphates, flakes, kudurites, etc. have been used as fertilizers for animals. Natural clays and clay substances are divided depending on the composition, physical nature, crystal structure into bentonites, kudurites, coalites, attapulgit, ascangelites, vermiculites, diatomites, zeolites, silicates. The chemical composition of natural mineral additives depends on the type of mineral and the deposit [9-10].

Natural zeolite contains up to 40 macro- and microelements, each of which is vital for agricultural animals and poultry, they are usually lacking in feed. In nature, animals and birds themselves find and consume zeolites in the quantities they need. The recommended amount of zeolites as a mineral supplement contributes to an increase in the average daily weight gain, an increase in egg production, a reduction in feed costs per unit of production, a decrease in waste of young animals, and an extension and increase in the reproductive functions of animals and birds. All this turned out to be possible due to the sorption and cation-exchange properties, which consist in the removal of ammonia nitrogen, heavy metals, toxins from the body, and the assimilation of the necessary elements by the body. The main parameter that determines the possibility of using zeolites in the production of animal feed and premixes is the content of clinoptilolite, the main zeolite mineral, and an increased content of sodium, potassium and calcium [11-13].

The organization of full-fledged feeding of animals is possible provided that all nutrients, including minerals, are provided in the diet in an optimal amount and ratio. Minerals that affect energy, nitrogen, carbohydrate and lipid metabolism play an important and diverse role in the body of animals and birds; they are the structural material of organs and tissues; they are part of organic substances; they support the protective functions of the body processes of neutralizing toxic substances. Minerals make up about 5% of body weight, most of which provide the following mechanisms: activity of the immune system. Trace elements are important components of metal enzymes that are involved in the active functioning of cellular functions, and also provide resistance to the body. There are a lot of works about the influence of zeolites for growth and productivity of animals, birds and fish. Paritova A.Yu. and co-authors presented the results of the impact of zeolites on fish. [9-14].

Zbigniew Grundzki studied the effect of various levels of Transcarpathian zeolite (clinoptilolite) on individual parameters of the immune response in chickens by assessing the concentrations of acute phase proteins haptoglobin, C-reactive protein (CRP), serum amyloid A, transferrin and alpha-1-acid glycoprotein, as well as cytokines tumor necrosis factor- α (TNF- α), interferon- γ (IFN- γ), IL-2 and IL-10 in blood serum and liver tissues of chickens. The study was conducted on 450 one-day-old male Ross 308 chickens. The results of immunological tests suggest that for long-term maintenance of homeostasis in chickens, the addition of 2% zeolite as a feed additive is most beneficial. The results indicate that 3% clinoptilolite induce production of Th1 pro-inflammatory cytokines, increasing the synthesis of IL-2, IFN- γ , and TNF- α . A high concentration of IL-10 after zeolite application in combination with a high concentration of IL-2, TNF- α and IFN- γ indicates a decrease in the intensity of inflammatory processes, an increase in the humoral immune response and a simultaneous inhibition of the production of Th1-type cytokines. The increase of CRP concentration in conjunction with high concentrations of pro- and anti-inflammatory cytokines in the birds from the group receiving 3% clinoptilolite demonstrates indicates that it can influence the development of local inflammatory processes and enhance immune regulation in birds. The research has shown that clinoptilolite influences on an increase in birds' resistance to infection, as confirmed by clinical observations and anatomopathological examination and by the increase in the synthesis of acute phase proteins with immunoregulatory properties [15].

The Institute of Experimental Veterinary Medicine of Siberia and the Far East conducted experiments on adult birds of the egg direction, including 5% and 10% of zeolite Bundles of various deposits in the general diet. Studies have shown that the hematological parameters in experimental and control animals were within the physiological norm. No pathological abnormalities were found [16].

The purpose of the work is to give a veterinary and sanitary assessment of chicken meat when zeolite feed additives are added to the diet.

Materials and methods. The research work was conducted on 120 one-day-old female Ross 90 chickens owned by the Kurochka Ryaba poultry meat factory (Figure 1) in 2021-2022 years. The experimental chickens were kept indoors on the floor with controlled temperature and humidity. 90 chickens at the age of 1 day were taken as material for the study. Approximately 2% of the feed mineral concentrate “Natural Zeolite” of the total volume of the feed was added to the poultry feed. As a mineral additive, a mixture was obtained, consisting of Ca, Mg and other minerals.



Figure 1 – Kurochka Ryaba poultry meat factory's feed mill

In the process of poultry rearing, a mineral supplement of about 2% of the total amount of feed supplied was added to the feed ration of chickens. A total of 31 research samples were taken for the study.

Chickens were weighed and randomly divided into groups of 30 chickens in each group. All groups were equipped with teat drinkers and feeders, the height of which was constantly adjusted according to the age of the chicks. All groups of chickens were in the same room with electric lighting 24 hours a day until the 10th day of the experiment and 16 hours a day from the 10th to the 30th day of the experiment, according to the lighting scheme for chickens raised on a farm at the Ryaba chicken farm.

As research materials, poultry meat was obtained from the slaughterhouse of the Chicken Ryaba poultry meat factory at Capital Projects LTD LLP.

Sampling of selected samples. Sampling methods and preparation for microbiological studies were carried out in accordance with ST 7702.2.0-95-poultry meat, offal and semi-finished products from poultry meat. The experiment was completed when the chicks reached 30 days of age. Every 10 day we measure the chickens and pay attention to the veterinary-sanitary parameters of slaughtered chicken carcasses.

The chemical composition of the feed additive «Natural zeolite» was determined in the laboratory of the Ambar feed plant in Haifa region (Israel). To determine the content of impurity elements, the method of X-ray spectral fluorescence analysis was used. The content of calcium, mapsha, iron, zinc, potassium ions. sodium, ammonium was carried out by the methods of polarography, photometry, atomic absorption. The technological characteristics of the zeolite were determined according to the methods accepted in the industry.

Research results. Before we started experiments on feeding chickens with zeolites, we studied the chemical composition of the main feed and the zeolite feed additive, which was added to the diet of chickens. Table 1 below shows the percentages of nutrients of feed mixtures.

As you can see in figure 2 zeolites generally have complicated relief microsurface formed at microcrystals and units represented in the majority of cases the finemass. Aggregates of microcrystals are concentrated in micro geods and microcracks located in the breed are relatively evenly distributed [16].

At the end of the breeding period, a 30-day slaughter of poultry used in the experiment at the Chicken Ryaba poultry meat factory at Capital Projects LTD LLP.

Table 1 - Composition of feed mixtures (%) and content of main nutrients (g/kg)

Nutrients	%
Protein	21
Fat	5
Energy (Kcal/kg)	3100
Crude cellulose	5
P	0,7
Ca	1
Ash	6

The feed additive that was used in this experiment contains at least 81% clinoptilolite as the active substance at a moisture level of no more than 6%. It also contains 62% SiO₂, 16% Al₂O₃, 5.45% Fe₂O₃ and 5.12% CaO, 2.30% MgO, 2.62% K₂O and 2.03% NaO (Table 2). The particle size ranges from 0.2-0.5 mm.

Table 2 – Chemical composition of feed mineral concentrate “Natural Zeolite”

Components	Natural zeolite wt. %
SiO ₂	62
Al ₂ O ₃	16
TiO ₂	0.17
Fe ₂ O ₃	5.45
FeO	0.59
CaO	5.12
MgO	2.30
MnO	0.15
Na ₂ O	2.03
K ₂ O	2.62
P ₂ O ₅	0.12

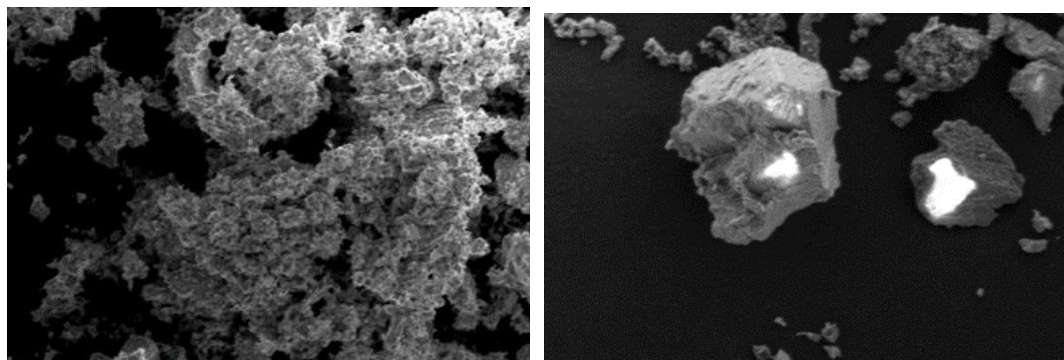


Figure 2 – Electronic photo of clinoptilolite crystals. Magnification × 250

Pre-slaughter and post-slaughter veterinary and sanitary control did not reveal any visible pathological changes in the carcasses and internal organs of the bird, the degree of bleeding was good. Veterinary and sanitary assessment of internal organs showed that all internal organs of the studied birds are normal and without visible pathological changes.

Carcasses of 10,20 and 30-day-old chickens raised with a mineral feed additive had no foreign smell, the appearance of the carcass, adipose tissue, serous membranes of the thoracic-abdominal cavity did not change in comparison with the carcasses of the control group. The color is pale pink, slightly moist, did not leave wet spots on the filter paper. When cooking meat, the soup turned out to be transparent, fragrant, and pleasantly smelling. Oil accumulates on the face in the form of large drops. The results are presented in table 3.

Table 3 – Organoleptic parameters of the studied chicken meat

The name of the indicator	10-day-old bird	20-day-old bird	30-day-old bird
Meat color	Pale yellow with a pink tinge, yellowish-gray with a pink tinge on low-fat carcasses;	Pale yellow with a pink tinge, yellowish-gray with a pink tinge on low-fat carcasses;	Pale yellow with a pink tinge, yellowish-gray with a pink tinge on low-fat carcasses;
Consistency	The muscles are dense, elastic, when pressed with a finger, they quickly fell into place	The muscles are dense, elastic, when pressed with a finger, they quickly fell into place	The muscles are dense, elastic, when pressed with a finger, they quickly fell into place
Transparency and smell of broth	Transparent and has a pleasant smell	Transparent and has a pleasant smell	Transparent and has a pleasant smell
Smell	It is typical for fresh poultry meat	It is typical for fresh poultry meat	It is typical for fresh poultry meat

An important indicator of meat quality is the pH of the meat extract, since the concentration of hydrogen ions in meat depends on the glycogen content in the muscles at the time of slaughter and, therefore, is a derivative of the physiological state of the bird before slaughter. The pH content of chicken meat in the research group was 5.8-6.0, which corresponded to the pH of ripe raw meat.

The activity of peroxidase in the muscles of experimental and control chickens was the same.

The accumulation of amino acids and ammonia in muscle tissue is a constant and characteristic sign of a decrease in the quality of meat

No ammonia and ammonium salts were found in the studied samples of poultry meat of the control and experimental groups. The content of aminammiac nitrogen in the muscles of the studied chickens was 1.07 - 1.11 mg.

The results were obtained within the hygienic standard for determining the number of mesophilic aerobic and facultative anaerobic microorganisms (NMAFAnM) by sowing in agar medium ($6,5 \times 10^3$ - $1,0 \times 10^4$), this showed the high sanitary quality of the meat of the studied birds (Figure 3).

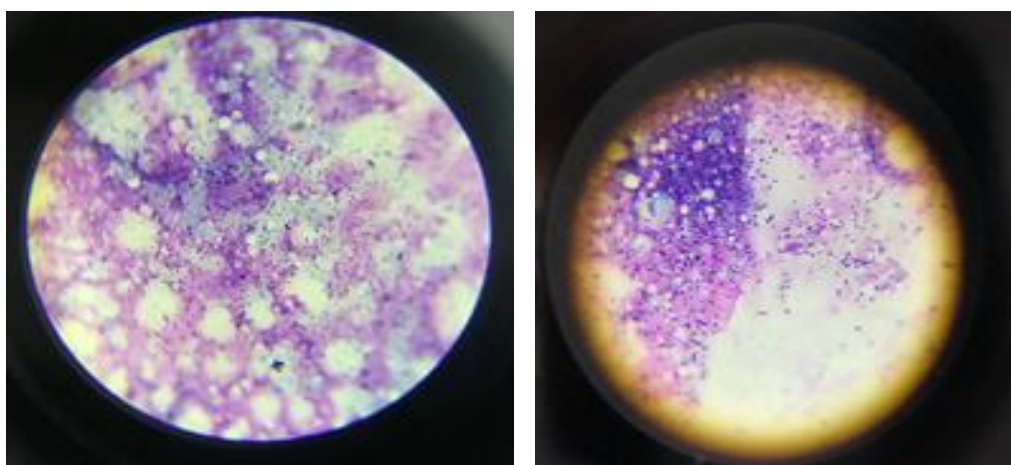


Figure 3 – Bacterioscopy of smears of chicken meat

Salmonella can infect poultry in various ways, from the farm to the market. Salmonella can be present in bird feathers from the gastrointestinal tract of a bird. In addition, during various technological operations (such as cutting, cutting, grinding and mixing), organisms can contaminate the surface of meat [9].

Pathogens, including salmonella and listeria monocytogens, were not isolated in 25 g of the product, which corresponded to the sanitary and hygienic requirements of food products.

When calculating the amount of 100 g of volatile fatty acids according to the formula $X = ((Y - Y_0) K * 5.61 * 100) / M$ in the studied chicken meat, the average was 3.676 ± 0.01 (Table 4).

Studies have shown that meat obtained from the carcass of birds receiving mineral feed additives together with feed, the chemical composition is similar to the control products.

Table 4 – Physico-chemical parameters of chicken meat

Indicators	Study group		
	10-day-old bird	20-day-old bird	30-day-old bird
pH	5,75	5,86	5,88
Peroxidase enzyme	Active	Active	Active
Amino-ammonia nitrogen	1,07±0,1	1,09±0,04	1,1±0,06
The content of ammonia and ammonium salts	-	-	-
Volatile fatty acids	3,57±0,01	3,55± 0,01	3,90 ±0,01

The protein content in poultry muscles exceeded the control values by 1.4%; in 20-day chicken meat - by 0.2%, respectively; in 30-day chicken - by 0.5%.

The mass fraction of fat was 1.9% less than in 10-day chicken meat, respectively; 1.3% less than in 20-day chicken; 1.1% less than in 30-day chicken meat.

The nutritional value of meat in 100 g of the product was 132.6 kcal in 10-day chicken meat; 137.9 kcal in 20-day chicken meat; 143.1 kcal in 30-day chicken meat. In the control group, these indicators were 130.4 kcal; 136.7 kcal and 143.0 kcal, respectively. The results are relatively shown in figure 4.

Discussion. There is interest in using natural minerals with adsorption properties as a feed additive for animals and chickens and having a universal pharmacological effect (Semenenko et al., 2020). Among the most popular examples of these minerals are zeolites used as feed additives to stimulate the growth of birds (Tang et al., 2018).

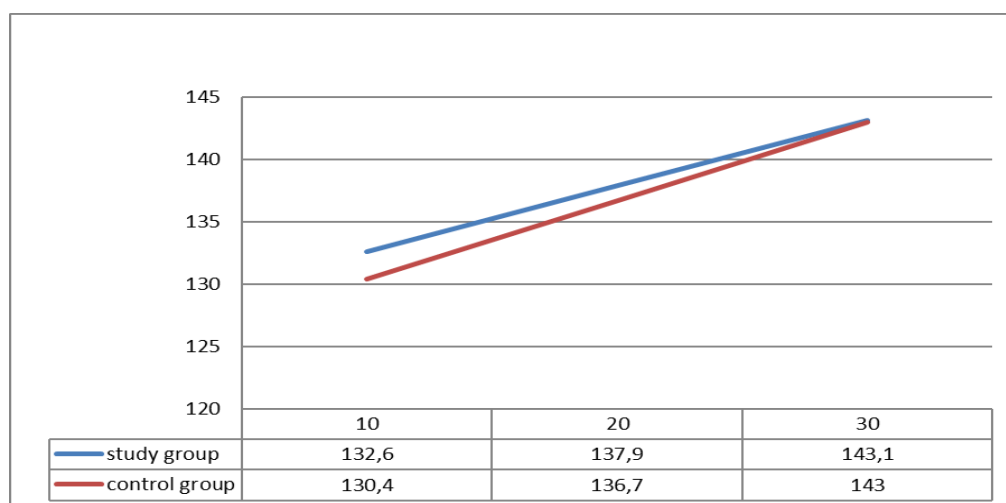


Figure 4 – Relative nutritional value of the studied chicken meat

Many works describe the effect of zeolite on growth rates, the immune system, but there is little information on the effect of aluminosilicates on the quality of poultry meat. In an initial study on minerals, Banashak et al. (2020) found that the use of zeolite was associated with good meat quality. They suggested the need for further research to determine the appropriate doses of natural additives in feed. Zhou et al. (2014) demonstrated that 2% zeolite and attapulgit (1:1) feed intake improved body weight gain and feed intake, which was also found in our study or in experiments with 2% zeolite inclusion. Miroslav Banashak et al. proved that the addition of zeolite to the feed has a positive effect on growth rates, carcass characteristics and meat quality. The addition of halloysite and zeolite (25:75) at 0.5-2% to broiler chicken feed could improve feed digestibility as evidenced by higher body weight

and weight gain as well as overall muscle mass, best results were obtained in the group of birds, where 0.475 kg/m² of halloysite and zeolite were added to the wheat litter.

Conclusion

Based on the above results, it can be seen that chicken meat grown with mineral feed additives as part of the diet, in accordance with the "Rules for the veterinary examination of slaughter animals and the veterinary and sanitary examination of meat and meat products" chicken meat for 10, 20 and 30 days recognized as suitable for further use in food.

Funding information (if available) and/or acknowledgment

We express our gratitude to the Bolashak International Scholarship for financial assistance in conducting part of the research in the laboratory of Ramat Negev Institute (Israel) and head of LLP "Capital Project Ltd" that include the Kurochka Ryaba poultry farm.

REFERENCES

- 1 Buyarov V.S., Buyarov A.V., Klejmenov I.S., Shalimova O.A. Sostoyanie i perspektivy razvitiya myasnogo pticevodstva // Vestnik Orel GAU. – 2012. - №1 (12) – S. 49-60.
- 2 Mallek Z., Fendri I., Khannous L., Ben Hassena A., Traore A.I., Ayadi M.A., Gdoura R. Effect of zeolite (clinoptilolite) as feed additive in Tunisian broilers on the total flora, meat texture and the production of omega 3 polyunsaturated fatty acid // Lipids Health Dis. – 2012. -№6 (11):35. – P. 1-7. doi: 10.1186/1476-511X-11-35. PMID: 22394592; PMCID: PMC3364149.
- 3 Buyarov V.S., Krajs V.V., Buyarov A.V., Mironov D.S., Belenhin V.A. Effektivnost' sovremennyh tekhnologij proizvodstva myasa brojlerov i praktika ih vnedreniya // Vestnik Orel GAU. - 2010. - №2(23). - P.42-49.
- 4 Chernogradskaya N.M., Sharvadze R.L., Grigoriev M.F., Grigorieva A.I. Influence of zeolite honguruu on growth and development, digestibility and metabolism of geese // Agrarian Bulletin of the Urals. - 2020. №5 (196). - P. 80-85.
- 5 RFCA Ratings /RatingAgency 2011. Analysis of the livestock industry in Kazakhstan.
- 6 Mastinu A., Kumar A., Maccarinelli G., Bonini S.A., Premoli M., Aria F., Gianoncelli A., Memo M. Zeolite Clinoptilolite: Therapeutic Virtues of an Ancient Mineral // Molecules. – 2019. - №24. – P. 1517. <https://doi.org/10.3390/molecules24081517>
- 7 Hcini E., Ben Slima A., Kallel I. et al. Does supplemental zeolite (clinoptilolite) affect growth performance, meat texture, oxidative stress and production of polyunsaturated fatty acid of Turkey poult?// Lipids Health Dis. – 2018. - №17 (177) – P. <https://doi.org/10.1186/s12944-018-0820-7>
- 8 A.P. Kalashnikova. Normy i raciony kormleniya sel'skohozyajstvennyh zhivotnyh : sprav. posobie . – 3-e izd., pererab. i dop. - M. : KolosS, 2003. - 456 s.
- 9 N.V. Muhina. Korma i biologicheski aktivnye kormovye dobavki dlya zhivotnyh /– M. : Kolos S, 2008. – 271 s.
- 10 Rouger O. Tresse M. Zagorec Bacterial contaminants of poultry meat: sources, species, and dynamics Microorganisms. – 2017. - № 5 (3) - p. 50
11. Amad A.A. Addition of natural Zeolite to broiler chickens diet and its effect on performance, carcass traits and protein and calcium in blood// Journal of Veterinary Research. – 2018. -№74. - P.261-271.
- 12 Schneider A.F., De Almeida D.S., Yuri F.M., Zimmermann O.F., Gerber M.W., Gewehr C.E. Natural Zeolites in diet or litter of broilers//British Poultry Science. – 2016. - №57 (2). - P. 257-263.
- 13 Rawia S.H., Abaza M.A., Elghalid O.A., Abd El-Hady A.M. Effect of incorporating natural zeolite with or without phytase enzyme into broilers diets on blood constituents and carcass traits// Egypt. Poult. Sci. Vol. – 2020. - №40. - P. 225-242.
- 14 Paritova A., Sarsembayeva N., Łozowicka B., Maulanov A., Kuzembekova G., Abzhaliyeva A., Kaczyński P. The Influence of Chankanay Zeolites as Feed Additives on the Chemical, Biochemical and Histological Profile of the Rainbow Trout (*Oncorhynchus mykiss*) // J Aquac Res Development. - 2013. - № 5 (1). - P.1112-1118. <http://dx.doi.org/10.4172/2155-9546.1000205>
- 15 Grądzki Z., Jarosz L., Stępień-Pyśniak D., Marek A. The effect of feed supplementation with Transcarpathian zeolite (clinoptilolite) on the concentrations of acute phase proteins and

cytokines in the serum and hepatic tissue of chickens// Poultry Science. - 2020. -№99 (5). - P. 2424-2437. <https://doi.org/10.1016/j.psj.2020.01.003>.

16 Paritova A.Y. Assessment of fish quality while using non-traditional feed additive Tseofish. Monograph. Yedinyy tsentr 75, 2022. – 209 p.

17 Tang Z., Wen C., Li P., Wang T., Zhou Y. Effect of zinc-bearing zeolite clinoptilolite on growth performance, nutrient retention, digestive enzyme activities, and intestinal function of broiler chickens//Biological Trace Element Research. – 2014. - №158. – P.51-57.

18 Banaszak M., Biesek J., Bogucka J., Dankowiakowska A., Olszewski D., Bigorowski B., Grabowicz M., Adamski M. Impact of aluminosilicates on productivity, carcass traits, meat quality, and jejunum morphology of broiler chickens //Poultry Science. – 2020. -№ 99. – P. 7169-7177.

19 Zhou P., Tan Y.Q., Zhang L., Zhou Y.M., Gao F., Zhou G.H. Effects of dietary supplementation with the combination of zeolite and attapulgit on growth performance, nutrient digestibility, secretion of digestive enzymes and intestinal health in broiler chickens// Asian-Australasian Journal of Animal Sciences. – 2014. - №27. – P. 1311-1318.

20 Banaszak M., Biesek J., Adamski M. Wheat litter and feed with aluminosilicates for improved growth and meat quality in broiler chickens // Peer. J. – 2021. - №4 (9).– P.11918. doi: 10.7717/peerj.11918. PMID: 34430084; PMCID: PMC8349159.

ТҮЙІН

Бұл мақалада «Табиғи цеолит» азықтық минералды концентратын тауық рационында пайдалану кезінде тауық етінің сапалық көрсеткіштері зерттелді. Зерттеудің мақсаты – рационға «табиғи цеолитті» қосу кезінде тауық етіне ветеринариялық-санитариялық баға беру. Зерттеу жұмысы 2021-2022 жылдары Chicken Ryaba құс еті фабрикасына қарасты 120 бір күндік Росс 90 тұқымды тауықтарда жүргізілді. Осы тәжірибеде қолданылған цеолитте кем дегенде 81% клиноптилолит бар. Сондай-ақ оның құрамында 62% SiO₂, 16% Al₂O₃, 5,45% Fe₂O₃ және 5,12% CaO, 2,30% MgO, 2,62 K₂O және 2,03% NaO бар. Органолептикалық сараптама жемдік қоспамен өсірілген 10, 20 және 30 күндік тауықтардың ұшаларының бөтен иісі болмағанымен, бақылау тобының ұшаларымен салыстырғанда ұшаның сыртқы түрі өзгермегені анықталды. Еттің түсі бозғылт қызғылт, аздап ылғалды, сүзгі қағазында дымқыл дақтар қалдырмаған. Етті пісіргенде сорпа мөлдір, хош иісті, иісі жағымды болып шықты. Зерттеу тобында тауық етінің рН мөлшері 5,8-6,0 болды, бұл піскен, шикі еттің рН-ға сәйкес болды. Эксперименттік және бақылау тауықтарының бұлшықеттеріндегі пероксидазаның белсенділігі бірдей болды. Бақылау және тәжірибе топтарының құс етінің зерттелген үлгілерінен аммиак және аммоний тұздары табылмады. Зерттелген тауықтардың бұлшықеттеріндегі аминаммиакты азоттың мөлшері 1,07 - 1,11 мг болды. Мезофильді аэробты және факультативті анаэробты микроорганизмдердің (МАФанМС) саны 6,5×10³-1,0×10⁴ құрады. Қоздырғыштар, соның ішінде сальмонеллалар мен листерия моноцитогендері 25 г өнімде оқшауланбаған. 100 г өнімдегі еттің тағамдық құндылығы 10 күндік тауық етінде 132,6 ккал болды; 20 күндік тауық етінде 137,9 ккал; 30 күндік тауық етінде 143,1 ккал.

РЕЗЮМЕ

В данной статье изучены качественные показатели мяса кур при использовании в их рационе кормового минерального концентрата «Цеолит натуральный». Цель исследования - дать ветеринарно-санитарную оценку куриного мяса при добавлении в рацион «Цеолит натуральный». Исследования проводились на 120 суточных цыплятах Росс 90, принадлежащих птицефабрике «Курица Ряба» в 2021-2022 гг. Цеолит, использованный в этом эксперименте, содержит не менее 81% клиноптилолита. Он также содержит 62 % SiO₂, 16 % Al₂O₃, 5,45 % Fe₂O₃ и 5,12 % CaO, 2,30 % MgO, 2,62 % K₂O и 2,03 % NaO (табл. 2). Органолептическое исследование показало, что тушки 10, 20 и 30-дневных цыплят, выращенных с кормовой добавкой, не имели постороннего запаха, внешний вид тушки не изменился по сравнению с тушами контрольной группы. Цвет бледно-розовый, слегка влажный, на фильтровальной бумаге мокрых пятен не оставил. При варке мяса суп получился прозрачным, ароматным, приятно пахнущим. Содержание рН куриного мяса в опытной группе составляло 5,8-6,0, что соответствовало рН созревшего, сырого мяса. Активность пероксидазы в мышцах опытных и контрольных цыплят была одинаковой. В исследованных образцах мяса птицы контрольной и

опытных групп аммиак и соли аммония не обнаружены. Содержание аминамиакального азота в мышцах исследованных цыплят составило 1,07-1,11 мг. Численность мезофильных аэробных и факультативных микроорганизмов (КМАФАнМ) составила $6,5 \times 10^3$ - $1,0 \times 10^4$. Возбудители, в том числе сальмонеллы и листерии моноцитогены, не были выделены в 25 г продукта. Пищевая ценность мяса в 100 г продукта составила 132,6 ккал в мясе 10-дневной курицы; мясо 20-дневной курицы 137,9 ккал; 143,1 ккал в мясе 30-дневной курицы.

УДК 579.851
МРНТИ 34.15.23

DOI 10.56339/2305-9397-2022-4-1-173-181

Daugaliyeva A.T., candidate of veterinary sciences, **main author**, <https://orcid.org/0000-0002-7703-7798>

LLP «Kazakh Research Institute for Livestock and Fodder Production», st. Zhandosova 51, Almaty, Republic of Kazakhstan, aida1979@bk.ru

Daugaliyeva C.T., candidate of veterinary sciences, <https://orcid.org/0000-0002-8826-3942>

LLP «Scientific Production Center of Microbiology and Virology», Bogenbai Batyr str., 105, Almaty, Republic of Kazakhstan, saule.daugaliyeva@mail.ru

Kanatbayev C.G., doctor of biological sciences, Professor, <https://orcid.org/0000-0003-0640-4316>

«West Kazakhstan Scientific Veterinary Station» branch of «Kazakh Scientific Research Veterinary Institute» LLP, 52/1, Gagarina str., Uralsk, Republic of Kazakhstan, serik_kg@mail.ru

Baitlessov E.U., doctor of veterinary sciences, Professor, <https://orcid.org/0000-0002-5764-0514>

West-Kazakhstan innovative-technological university, 44, Ihsanova, Uralsk, Republic of Kazakhstan, beu64@mail.ru

METHANE EMISSION FROM CATTLE IN THE REPUBLIC OF KAZAKHSTAN

ANNOTATION

Methane emissions from animals are one of the factors behind the increase in greenhouse gases that have led to climate change on Earth in recent years. Our study is devoted to an actual problem – a comparison of methane emissions (greenhouse gases) from cattle, depending on the types of feeding, regions of Kazakhstan and breeds. The study examines the microbiota of feces from 47 heads of cattle and the microbiota of rumen contents from 6 heads of bulls. The samples were analyzed using 16S metabarcoding. Particular attention in our studies was paid to the presence and ratio in the microbial community of methanogenic archaea, which are sources of methane production. As a result of the research, it was found that the minimum methane emission was found in the domestic Kazakh white-headed breed. The western region of Kazakhstan differs from other regions in beta diversity. Therefore, grazing animals affects their microbiota, resulting in reduced methane emissions. A significant difference in alpha diversity between the variability of the microbiota of cows from Northern and Southern Kazakhstan and between Northern and Western Kazakhstan indicates that samples of the Northern region have a more diverse microbiota than other regions. With regard to breed differences, the Simmental and Holstein breeds have the largest amount of the *Methanobrevibacter* genus, and the smallest amount in the Kazakh white-headed breed. Each breed of cattle contains a different rumen microbiota due to genetic influence.

Key words: *cattle, methane, microbiota, 16S metabarcoding, Kazakhstan*

Introduction. More than half of the methane in the atmosphere is the result of the extensive development of agriculture, primarily animal husbandry. Methane leads to a strong greenhouse effect compared to carbon dioxide: it is able to retain more heat than carbon dioxide. Stomach gas as a result of improper nutrition and digestion is becoming a serious problem in countries with powerful agriculture. The main negative effect of the meat production industry is the emission of greenhouse gases, and as a result, global climate change. By 2030, an increase in temperatures of 1.5 to 2°C is expected. Kazakhstan is a country with developed animal husbandry, in which the number of cattle is