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The effect of functional feeding of young broiler chickens of meat crosses on the quality and safety of meat

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Abstract. Food security, providing the population of the country with high-quality food is essential. aspects of the economic situation of Ukraine. Therefore, the poultry industry is one of the priority suppliers of high-quality animal protein, it is considered the most capable of modernizing production processes and attracting innovative solutions developed by scientists. The purpose of the article is to find out the effect of functional poultry feeding on the chemical and morphological composition of broiler chicken carcasses and their parts, meat quality indicators. In order to achieve the specified goal, a comprehensive evaluation of the meat of broiler chickens, grown using functional feeding, without the additional use of hormonal drugs and antibiotic substances contained in traditional compound feed for chickens, was carried out. Data on the functional and technological properties of meat, chemical composition, microbiological well-being of raw materials and morphological features of cartridge carcasses are provided. The conducted studies showed compliance of the quality of the meat with the requirements of the standard and confirmed its safety for consumption. It was found that the proposed tool for influencing the functional and technological properties of poultry meat, i.e., the use of phosphate when feeding poultry, is not only effective for poultry health, but also has a positive effect on its preservation. This fact was confirmed with the help of microbiological studies. The results of physico-chemical and sensory studies showed that the metabolic processes in the body of birds are able to utilize phosphates and transform the quality with a significant improvement of indicators. The practical significance of the work lies in the fact that the aspect of biomodification of meat raw materials and its purpose will continue to be relevant for implementation both for producers of meat products and for producers of animal products

Keywords: functional poultry feeding, quality of poultry meat, functional and technological properties, quality and safety of poultry meat

INTRODUCTION

A key aspect that affects the general economic situation of Ukraine is the quality of life of its citizens, including the resolution of issues of ensuring food security and providing the population with high-quality and safe food [1]. In this context, poultry farming in Ukraine is an important supplier of high-quality animal protein, which is able to solve the problem of protein hunger and provide not only Ukrainians, but also residents of

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other countries who suffer from a lack of protein in the diet. Poultry farming, as one of the branches of agricultural production, being science-intensive, material-intensive and energy-intensive, like all branches of agriculture, but, unlike others, is the most easily amenable to the modernization of production processes and the introduction of innovative developments by scientists. The poultry processing industry is a complex system that depends on a well-organized traceability system that ensures the quality of the final product at all stages of production, starting with rearing. The final products of this industry are meat, slaughter and processing products, down and feathers, as well as hatching and edible eggs. During 2000-2019, drastic changes took place in the meat market. If in 2000 the basis of production was beef and veal, which occupied a stable share of 45.4%, then in 2019 it decreased by almost three times. The share of pork production in vertically integrated companies also decreased.

Resource-saving technologies of the poultry processing industry provide for comprehensive processing of poultry and maximum full use of all its products. The preservation and rational involvement of poultry meat in food technologies due to the introduction of methods of deep industrial processing in order to obtain a wide range of products for various purposes is an urgent nationwide problem. One of the types of raw materials for the meat processing industry, which is quite widely used due to high manufacturability, a significant amount of protein, and low cost, is mechanically deboned poultry meat. Another promising direction of the use of raw materials of the poultry processing industry is the creation of protein and protein-collagen additives for use in the nutrition of athletes and military personnel, which are subject to preliminary processing and allow long-term storage with low humidity. [2-4].

The problem of the development of the poultry industry occupies a leading place in the works of domestic scientists. The following authors paid attention to the mentioned problem: M.V. Zubets, S.V. Merzlov, P.T. Sabluk, I.I. Vinichenko and many others. In their works, they studied the trends in the development and functioning of poultry farming in Ukraine and the possibilities of increasing the productivity of the specified industry. However, despite the significant number of publications and taking into account the rapid development of poultry farming in a changing market environment, it is necessary to continue researching the specifics and features of the functioning of enterprises in this industry in order to identify reserves and find ways to increase its efficiency [9; 10].

Research results indicate that many factors affect the quality and safety of chicken meat, taste properties and its chemical composition:

- hereditary (species, breed, line, cross), gender and age;
- proper sanitary and hygienic condition of poultry houses, equipment, inventory;
- zoohygienic parameters of the microclimate (ventilation, lighting, temperature and humidity regimes, etc.);
- compliance of building materials, compliance with requirements for design, location and construction of the poultry house;
- availability of walking platforms, insolation and exercise of birds;
- action of stress factors,
- effectiveness of disinfection, disinsection, deratization;
- quality and quantity of litter;
- balanced diet, frequency of feeding and watering, quality of fodder;
- use of prophylactic or therapeutic drugs, etc. [2].

As researches of recent years have shown, of the large number of factors affecting the yield and quality of raw meat from broiler chicken carcasses, the influence of feeding factors on meat yield, morphological structure, and energy value is of particular interest, which in turn depend on the technological schemes of processing and rolling of carcasses and on the principles of sorting individual parts during their processing [6]. Modern economic conditions dictate new approaches to the improvement of the technology of deep processing of poultry, especially regarding the development of scientifically based output standards and the determination of objective characteristics of the meat merits of cartridge carcasses and their anatomical parts, which ensures rational use and effective price policy of production.

All over the world, great attention is paid to the principles of processing and deboning of broiler chicken carcasses, while, along with the differences caused by national characteristics of meat consumption and the range of products, in each country there are general rules that provide for the selection of the best meat from carcasses and their parts from the energy value and development of muscle, fat and connective tissues for sale in natural form. The rest of the raw materials with lower nutritional characteristics are used for further industrial processing and production of various semi-finished products, sausage and culinary products and canned food. A more detailed study of the composition and properties of the meat of broiler chickens, as well as the establishment of output standards for the processing and deboning of carcasses and their anatomical parts, with the justification of objective quality criteria, will allow rational use of meat resources in the production of poultry products and scientific arguments for differentiated pricing enterprise strategy [11-13].

By its composition, the meat of broiler chickens is a high-quality, protein-rich product with a lower energy value, compared to pork and beef. For many years, experts have been studying the chemical and morphological composition of cartridge carcasses and their parts, taking into account mainly the fattening of the bird (first, second grades and industrial processing).

However, with the same fattening, the weight of cartridge carcasses (the main characteristic of the breed) can differ significantly, and, therefore, the meat qualities of the carcasses and their parts will also differ. Some authors use a qualitative protein index to characterize meat raw materials, which is determined by the ratio of the proportion of complete proteins to incomplete proteins, while others use the pure protein index, which is determined as the difference between the amount of common and connective tissue proteins.

Among the most important aspects of a healthy diet, nutritionists include reducing the amount of fat consumed by a person [14-16]. It is considered appropriate to reduce the fat content of the cartridge carcass without reducing the amount of intramuscular fat. It should be a method of calculating the "leanness" of meat, which will allow you to calculate not the value of the mass of a separate cut or part of the carcass, but the value of its lean part (or protein), as well as determine the technological advantage of using this raw material. It should be noted that until now, the quality index of meat (the "fat: protein" ratio) was used to characterize the quality of meat and meat products, taking the 1:1 ratio as a benchmark. The effectiveness of the use of meat raw materials is largely influenced not only by the meat quality of an individual cartridge carcass, but also by its parts, which have different energy value and economic significance [17].

The purpose of the article is to determine the influence of functional poultry feeding on the morphological and chemical composition of broiler chicken carcasses and their parts, meat quality indices. To achieve the goal, a pathomorphological evaluation of the carcasses of broiler chickens was carried out and the morphological and chemical composition of the carcasses and their parts, as well as the content of proteins, fat and dry matter were determined. The work was carried out in 2019 in the laboratory conditions of the Odesa National Academy of Food Technologies and at the enterprise of the industry, namely – on the basis of the agricultural production enterprise "NIKAGROSTAR".

MATERIALS AND METHODS

The research was conducted in a farm that specializes in production, including chicken. An experimental site for growing broiler chickens was created. The chickens of the research and experimental groups were planted separately, in specially equipped territories, but at the same time they were raised in close proximity to the main stock. The experiment was organized in such a way that it was possible to determine the direct influence of feeding and drinking, under the same stress factors, under the same temperature conditions, lighting conditions, and so on. As a functional component, a mixture of phosphates was used for drinking broiler chickens (hereinafter referred to as the Experimental sample). So, in the first enclosure there were control chickens that received a diet without additives and drinking was carried out without phosphates, and in the second – chickens received a diet and drinking was carried out with phosphates. Control of zootechnical

indicators was carried out every decade according to generally accepted methods [7]. The indicators of the dynamics of body weight gains and livestock conservation were studied.

The composition, properties and quality of experimental samples of cartridge carcasses and their parts were examined according to the following indicators: mass of individual weight categories of cartridge carcasses and their parts; morphological composition of carcasses and their parts; physico-chemical studies - mass fraction of moisture – SSTU ISO 1442:2005; mass fraction of fat – SSTU ISO 1443:2005; mass fraction of protein – SSTU 25011-81; bacteriological examination of muscle tissue and parenchymal organs was carried out according to SSTU 7702.2-74, KMAFAnM – SSTU 7702.2.1-95, and the presence of pathogenic and opportunistic microorganisms – SSTU 7702.2.3-93. Together with bacterioscopy of smears-imprints, cultures were carried out on liquid and dense nutrient media. Biometric evaluation was carried out using methods of mathematical analysis and statistical processing [8].

After slaughter, the bird was evaluated by the appearance of the carcass, the location of fat, the slaughter yield, the ratio of edible and inedible parts was determined; muscle-bone index (MBI) – the ratio of muscle mass to bone mass; meat quality index (MQI) – the ratio of the mass of muscle tissue with skin to the mass of bone; the part index (PI) is the ratio of the mass of the part to the bone mass, and the meat quality index (F/Pr) is the ratio of "fat: protein".

At the first stage of scientific research, pathomorphological studies of the internal organs of the bird were carried out: experimental and control.

RESULTS AND DISCUSSION

As a result of the evaluation of experimental birds, the following was determined. The total weight is 1488 g. The weight of the carcass without internal organs is 1226 g. The pectoral muscles are well developed, the consistency is elastic, the fossa is quickly leveled when pressed. The color of the muscles is beige with a brown tint. The thickness in the area of the middle third of the muscles is 4 cm. Liver: weight 32 g, the surface is smooth and shiny, the color is light brown, the parenchyma is light brown, fine-grained. Gallbladder is significantly full. Kidneys: dark red color, soft texture, dark red parenchyma, juicy. The total weight is 10 g. Spleen: the surface is smooth and shiny, 1.4 cm in diameter, the color is brown with a brown tint, the parenchyma is fine-grained and homogeneous. Lungs are red in color, soft consistency, fine-grained red parenchyma, total weight – 5 g. Sternum with pectoral muscles weight – 272 g. Heart – weight 10 g. The surface is smooth and shiny, the myocardium is structured, red in color, the cavities are empty. Gastrointestinal tract: the mucous membrane of the esophagus is pale pink in color. The goitre is moderately filled, the contents are mushy, light brown in color. Glandular stomach: mucous pale pink. Muscle belly: the cuticle peels off easily, the muscle layer is red, structured. Small intestine: the mucous membrane is pale pink, contains a small amount of food masses. Large intestine: contains a small amount of feces, the mucous membrane is pale pink. The total weight of the intestine is 160 g. No systemic pathology was detected.

Evaluation of the control sample of poultry gave the following results. The weight of the carcass without internal organs is 1306 g. The pectoral muscles are satisfactorily developed. In the area of the middle third of the sternum (keel), there are small point hemorrhages, the consistency is flaccid, the color is beige with a bluish tint, the thickness of the middle third is 3.4 cm. The sternum with the pectoral muscles weighs 258 g. The liver weighs 40 g. , the surface is smooth and shiny, the color is dark brown with a brown tint, the consistency is soft, the parenchyma is medium-grained, brown in color. The lungs are red in color, soft in consistency, dark red parenchyma, foamy liquid is released when pressed. The total weight is 10 g. The kidneys are dark red, the consistency is soft, the total weight is 12 g, the parenchyma is dark red, granular. Spleen: size, length 1.7 cm, surface smooth and shiny, consistency soft, parenchyma dark red juicy. Heart: weight 16 g, epicardium smooth and shiny, myocardium red, structured, empty cavities. Gastrointestinal tract: the goitre is significantly filled with mushy gray-green contents. Glandular stomach: the mucous membrane is pale, the muscular stomach is moderately filled with

food masses, the cuticle separates with some difficulty. The muscle layer is fine-grained. Small intestine: the mucous membrane is red in some areas, dark red spots in some areas. The large intestine is significantly filled with fecal masses. The total weight of the intestine is 154 g. Table 1 shows the comparative results of the weight of the internal organs of the birds of the experimental and control groups.

Based on the obtained data, it can be concluded that the control sample of poultry developed catarrhal enteritis against the background of the absence of preventive measures to ensure the health of the poultry in the diet, unlike the experimental sample.

In order to carry out further evaluation of the raw materials, the cartridge carcasses of the experimental and control batches and their parts were used. The processing of pellet carcasses of broiler chickens of different weight groups (from 600 to 1800 g, with an interval between groups of 200 g) was carried out in laboratory conditions with the selection of wings along the shoulder-scapular joints, femurs along the hip joint, and the chest along the line of the ribs. If necessary, the wing was divided by joints into three component parts, and the thigh - into two (shin and thigh). The back obtained after processing could be divided into front and back parts along the line of connection of the corresponding vertebrae. Carcasses of chickens of the parent flock of the meat breed weighing up to 3000 g were processed and collapsed according to a similar scheme.

Table 1. *Results of pathomorphological studies M±m, n=7*

Experiment		Control	
Total weight	1488 gr ±0.5	**Total weight**	1660 gr ±0.5
Carcass	122gr 82%±0.8	**Carcass**	1306 gr 78%±0.9
Sternum +m	272 gr 18%±0.8	**Sternum +m**	258 gr 15%±0.8
Pectoral muscles	4cm ±0.3	**Pectoral muscles**	3.4 cm ±0.3
Liver	32 gr ±0.5	**Liver**	40 gr ±0.5
Kidneys	10 gr ±0.5	**Kidneys**	12 gr ±0.5
Lungs	5 gr ±0.5	**Lungs**	10 gr ±0.5
Heart	10 gr ±0.5	**Heart**	16 gr ±0.5
Spleen	1.4 cm ±0.5	**Spleen**	1.7 cm ±0.5
Intestines	160 gr ±0.5	**Intestines**	154 gr ±0.5

Selected parts were manually deboned with anatomical removal of bones, the weight of muscle and bone tissue, as well as skin was determined by weighing, the morphological and chemical composition of the obtained parts and whole carcasses was studied. The results of the experiment show that with an increase in the weight condition of the bird, the yield of carcass parts is almost linear, with the exception of the yield of meat and skin in carcasses weighing from 600 to 1,200 g and the yield of bones in carcasses weighing from 1,800 to 3,000 g: in these cases, deviation from linear dependence. The data obtained in the experiment provide a generalized description of the yields of carcass parts and their morphological components, which is the basis for calculating the quality indices of cartridge carcasses and their parts after determining the chemical composition. The chemical composition (content of moisture, fat, protein and ash) of each part was determined separately for muscle tissue, skin and bone. At the same time, some tolerances were made, in particular, indicators of the chemical composition of the skin of whole dressed carcasses were determined by the arithmetic mean value. For example, in weight categories from 600 to 1,200 g, the moisture content was 60.0%, fat – 22.2%, protein – 17.3% and ash – 0.5%; for groups from 1,200 to 1600 g – 58.1, respectively;

24.7; 16.7 and 0.5%; from 1,600 to 1,800 g and above – 56.2; 28.0; 15.3 and 0.5%. As the weight of the carcass increased, the amount of fat in the skin increased. Abdominal fat was separated from the carcass separately and taken into account when determining the quality indices of the cartridge carcass.

The chemical composition of the bone was determined for each part separately and the average arithmetic values of the indicators, equal for all weight groups of the treated poultry carcasses, were found. Data on the morphological and chemical composition, the content of connective tissue in dressed carcasses and their parts, as well as on individual quality indices, show that with an increase in the weight condition of dressed carcasses, the mass fractions of individual parts increase in the following sequence: wings, then the dorsal and thoracic parts and itself a large share is made up of the thigh. However, the highest values of the meat-bone index and meat quality index for thighs were obtained only in the weight category of dressed carcasses weighing 600 g.

The intensity of the development of muscle tissue and pulp, as well as the content of pure protein, is always higher in the chest; these indicators increase until the mass of the cartridge carcass reaches 1200 g, then the rate decreases slightly due to the growth of skin and bone particles.

The morphological and chemical composition of the carcass and its parts on the example of broiler chickens weighing 1200 g, presented in Tables 2 and 3, allows you to objectively characterize the yield of poultry meat and the possible profit of the enterprise. This approach was used to determine the ratios of dressed carcasses of chickens, chickens and broiler chickens of different weight groups weighing from 600 to 1,800 g (with an interval between groups of 200 g), chickens of the parent flock of meat breed weighing up to 3,000 g and other types of poultry .

Table 2. *Morphological and chemical composition of the cartridge carcass and its parts, M±m, n=7*

Parts of the carcass	Morphological composition	Moisture, %	Fat,%	Protein%	Ash, %	Connective tissue, %	Pure protein, %
Lump							
Muscles	20.0	76.0	4.5	19.6	0.9	1.9	90.3
Muscles and skin	23.0	73.0	7.0	19.2	0.9	2.3	88.2
Muscles and bones	26.1	71.9	7.4	18.5	2.2	3.0	82.9
Chicken breast							
Muscles	20.7	71.0	11.1	16.9	1.0	3.5	79.4
Muscles and skin	23.1	69.1	13.1	16.9	0.9	3.7	77.9
Lump (Muscles and bones)	33.0	67.2	13.4	16.2	3.2	4.9	69.8
Wing							
Muscles	5.1	68.3	13.2	17.0	1.5	3.1	81.8
Muscles and skin	8.3	64.3	17.7	16.8	0.5	3.8	77.3
Wing (Muscles and bones)	12.1	64.3	14.8	16.1	4.8	5.6	65.5
Back							
Muscles	11.0	68.0	19.9	10.6	1.5	3.4	67.9
Muscles (Muscles and bones)	18.1	63.5	22.1	13.4	1.0	4.1	69.2
Back (Muscles and bones)	25.0	62.4	20.8	13.1	3.7	5.2	60.5

Parts of the carcass	Morphological composition	Moisture, %	Fat,%	Protein%	Ash, %	Connective tissue, %	Pure protein, %
Carcass							
Muscles	57.0	71.6	10.6	16.8	1.0	2.6	84.6
Flesh (muscles and skin) of the carcass without abdominal fat	74.0	68.3	14.0	16.8	0.9	3.2	80.6
Abdominal fat	5.0	8.4	90.0	1.5	0.1	–	–
Flesh (muscles and skin) of the carcass with abdominal fat	80.1	64.7	18.6	15.9	0.8	3.0	80.6
Carcass without skin	79.0	65.7	16.1	15.1	3.7	4.0	73.2
Carcass	98.0	64.0	17.6	15.4	3.0	4.1	70.7

Table 3. *Indices of the meat quality of the patra carcass and its parts M±m, n=7*

Part of the carcass	MBI	IMB	IP	A/C
Chicken breast				
Muscles	7.90			0.23
Muscles and skin		9.05		0.37
Muscles and bones			10.05	0.40
Lump				
Muscles	3.68			0.65
Muscles and skin		4.32		0.78
Lump (Muscles and bones)			5.33	0.82
Wing				
Muscles	1.14			0.78
Muscles and skin		1.90		1.06
Wing (Muscles and bones)			2.90	0.92
Back				
Muscles	2.00			1.88
Muscles (Muscles and bones)		3.68		1.65
Back (Muscles and bones)			4.68	1.59
Carcass				
Muscles	3.20			0.63
Flesh (muscles and skin) of the carcass without abdominal fat		4.51		0.55
Abdominal fat				0.78
Flesh (muscles and skin) of the carcass with abdominal fat	4.45			1.06
Carcass without skin			5.51	0.80

In the production of poultry meat, there is a problem of obtaining raw materials with high humidity and low functional and technological properties, which can cause the production of low-quality products with the use of a large number of additives, which will affect its safety [18; 19]. Thus, at the first stage, the mass fraction of moisture, protein and dry matter in the control and experimental samples was determined. The results of the research are shown in Fig. 1.

According to the results of the conducted research and comparison of the control and experimental samples, it was determined that a greater amount of moisture was obtained in the meat of chickens from the control group, which is an undesirable factor, because such meat has a shorter shelf life and corresponds to the indicators of "immature" meat.

On the one hand, this is explained by the fact that the growing period was 42…45 days, this particular period is used for industrial growing in contrast to the home or organic growing method, which ensures economic efficiency and profitability of production with the minimum possible growing period at the enterprise, and is explained by the use phosphates, which are able to retain moisture, but in this case it should be investigated in which form the moisture is, in a chemical form or in a physical form. For this purpose, studies were conducted on the definition of VZZ and VUZ.

In previous studies, the amount of protein in different parts of the carcass was determined, in this experiment, the average value of protein and dry matter of the carcass of the control and experimental samples was calculated and determined. The amount of protein practically did not differ and is 0.72%. Based on the above, it is expedient to evaluate individual parts and determine directions of use, taking into account such characteristics.

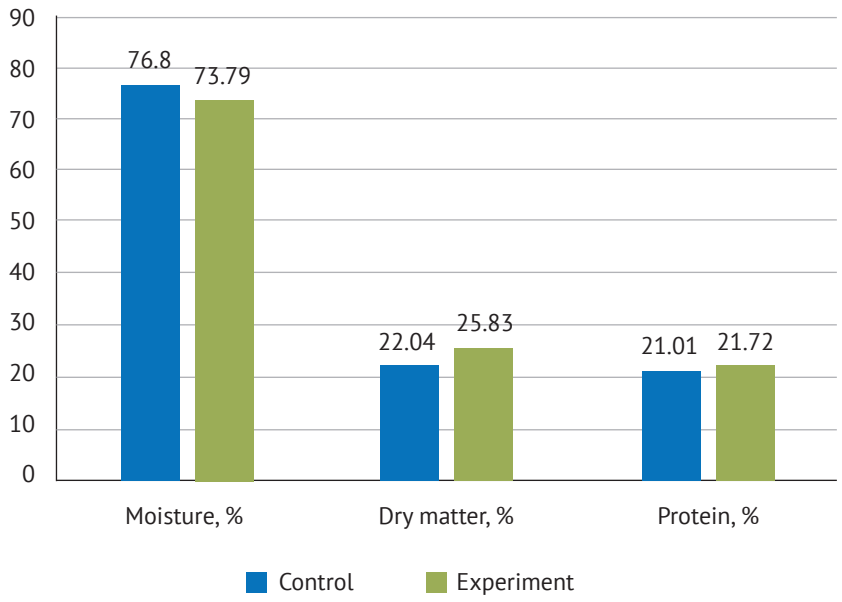

Figure 1. *Chemical composition of muscle tissue of experimental chickens*

Determination of the mass fraction of fat showed the result presented in fig. 2 and is 2.01% in the experimental group, and 1.04% in the control group. Based on the fact that the duration of cultivation is 42-45 days, the amount of fat depends on the stage of physiological development and during this period it was incomplete. On the one hand, a small increase in the amount of fat leads to improved taste characteristics during heat treatment, on the other hand, such an increase will not lead to a deterioration in quality characteristics.

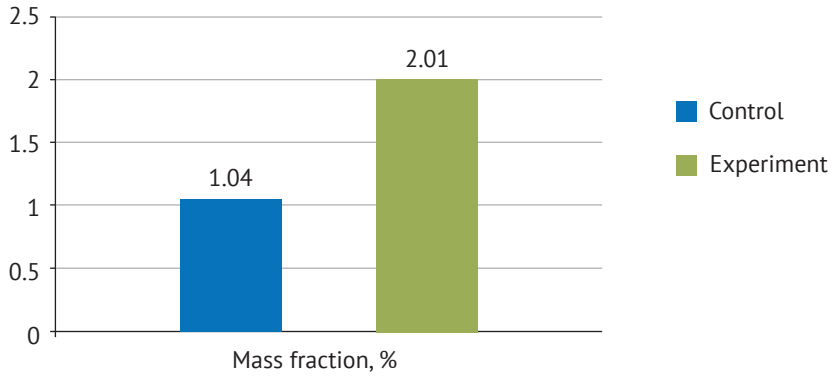

Figure 2. *Determination of the mass fraction of fat in the muscles of experimental chickens*

In the production of poultry meat, special attention is paid to microbiological indicators, on the basis of which it is possible to predict the behavior during further processing and storage [20; 21]. The results are shown in Table 4.

Table 4. *Microbiological parameters of experimental samples*

Indicator / Research groups	Pathogenic microorganisms, salmonella, CFU	KMAFAnM, lg CFU/g
Control	Not identified	3,54 ± 0,04
Experiment	Not identified	3,03 ± 0,02
Limit value	25	Not more 5

Based on the results of the sensory assessment, it was established that the test and control samples have a light color – for the fillet part, and a pale pink color – for the thighs and other parts with a higher myoglobin content. The surface of both samples is evenly covered with a thin layer of adipose tissue, which indicates that the chicken can be classified as 1 fattening category. From the side of the abdominal cavity – the color is pale pink, the blood vessels are not enlarged, there are no hemorrhages. The smell is characteristic of this type of meat and category. The results are shown in Figure 3.

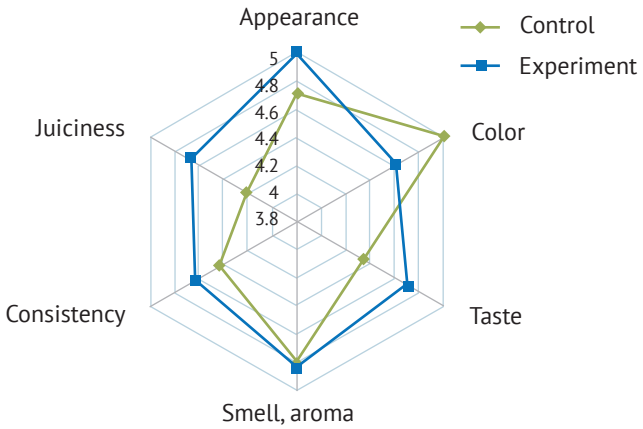

Figure 3. *Profilogram of meat samples of broiler chickens depending on the form of feeding*

A study on determining the taste and aroma profile of different parts of chicken was conducted by a group of experts and it was determined that the chickens of the experimental group had a more pronounced taste and aroma, namely: for pectoral muscles – 4.8 versus 4.4 in the control sample; for the femoral part – 4.6 versus 4.3 for the control group. The results are correlated with the fact that the experimental sample had a higher amount of moisture, which in turn was a consequence of the higher juiciness of the sample compared to the control one. The results of the cooking test established that the broth met the parameters of the State Food and Drug Administration, namely, it was transparent, aromatic and without sediment in the form of flakes, without extraneous aroma.

Therefore, the addition of phosphates to the ration of drinking water contributes to obtaining a high-quality product with functional and technological properties.

CONCLUSIONS

The issue of intra-life modification of meat raw materials and its directed use was and will be relevant both among producers of livestock products and for producers of sausage and meat products. This is explained by the fact that currently the quality of meat raw materials according to autolysis indicators has certain defects, for example, low moisture-binding capacity or a high amount of moisture that does not meet the requirements of DSTU. As a result of the conducted research, it was established that the proposed method of influencing the functional and technological properties of poultry meat, namely the use of phosphates in the process of watering poultry, is effective not only in relation to the health of the bird, but is able to positively affect its preservation, which is confirmed by microbiological data of research The results of physico-chemical and organoleptic studies indicate that metabolic processes in the bird's body allow phosphates to be utilized and quality to be modified with a significant improvement in performance.

As can be seen from research, a healthy bird gives high productivity, and drinking in the specified way ensures high taste qualities of meat. At the same time, all of the above contributes to increasing the nutritional value of broiler meat.

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Вплив функціональної годівлі молодняка курчат бролерів м'ясних кросів на якість і безпечність м'яса

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Одеська національна академія харчових технологій

Анотація. Стаття присвячена комплексній оцінці м'яса курчат-бройлерів, вирощених з використанням функціонального годування, без додаткового використання гормональних препаратів та антибіотичних речовин, що містяться в традиційних комбікормах для курчат. Наведено дані про функціонально-технологічні властивості м'яса, хімічний склад, мікробіологічний добробут сировини та морфологічні особливості патраних тушок. Проведені дослідження показали відповідність якості м'яса вимогам стандарту та підтвердили його безпеку для вживання

Ключові слова: функціональна годівля птиці, якість м'яса птиці, функціональнотехнологічні властивості, якість та безпечність м'яса птиці