EFFICIENCY OF USING A PROBIOTIC FEED ADDITIVE IN FEEDING KURCHAT BROILERS

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DOI: https://doi.org/10.30525/978-9934-26-221-0-11

Abstract. The research is based on the tasks of applied research on the topic: «Development of a complex of energy-efficient and resource-saving equipment and promising technologies for feeding farm animals of the AIC of Ukraine», state registration number 0121U108589. The authors' research is aimed at solving current problems of technological renewal and development of the agro-industrial complex of Ukraine.

The mechanism of action of probiotics is that they interfere with the development of pathogenic microflora, and can also synthesize biologically active substances (BAS – vitamins, amino acids, enzymes), while increasing digestibility and nutrient utilization. Probiotic microorganisms create a physical barrier between the cells of the intestinal epithelium and its contents. In addition, probiotic bacteria produce short-chain fatty acids, which leads to lower pH levels.

In the conditions of the scientific farm of the Faculty of Technology of Production and Processing of Livestock and Veterinary Products of Vinnytsia National Agar University, research was conducted on the use of probiotic feed additives of natural origin in feeding broiler chickens. Rational use of biologically active substances in animal feed makes it possible to significantly increase the rate of absorption of feed nutrients, productivity and conservation of poultry. The article presents the results of research on the use of feed additives of natural origin in the feeding of broiler chickens. Broiler chickens, compound feed, meat, and blood were used as the object of the study.

It has been established that the probiotic in the compound feed has a positive effect on the intensity of growth by increasing the digestibility of

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the main nutrients of the feed. It was found that the additive under study improves the quality of poultry meat due to the higher content of essential amino acids. New data have been obtained on the effect of feed additives on the availability of amino acids and the retention of mineral elements. For the first time, the dependence of physicochemical parameters, amino acid, fatty acid and mineral composition of the pectoral and femoral muscles on the ratio of different doses of the probiotic was found. An increase in the slaughter rates of broiler chickens under the action of a probiotic supplement has been established. The influence of the studied additive on the morphological, biochemical parameters of poultry blood was studied. Studies have shown a positive effect on the productivity, growth and quality of broiler meat.

1. Introduction

The main goal of poultry farming in Ukraine at the present stage is the production of complete food products using modern breeds and crosses, environmentally friendly feed additives, waste-free technologies and equipment [13; 23].

Providing the population with quality food is one of the most pressing problems of our time. A special place among food products is occupied by poultry meat as a source of complete protein and quality fat [7; 19].

One of the important indicators of product quality, in particular food, is its safety for human health and the environment. Today in Europe, there is a significant consumer interest in aspects related to animal health, not only for aesthetic reasons, but also because of the possible impact on the quality and safety of animal products. The problem of safe products in world practice is solved by assessing its responsibility or certification, which in recent decades has grown into a norm of trade relations at any level [4; 16].

This is also relevant for Ukraine. Its desire to integrate into European and global economic structures requires mastering the new rules of the game dictated by a market economy where the organization with the latest technology, the highest product quality, the lowest prices and the highest standards for the most demanding consumers survive. The issues of veterinary and sanitary control over the quality of poultry products are becoming especially relevant. Only due to the quality of products the poultry industry can take a worthy place not only in the domestic market but also in foreign markets. Consumers demand animal products produced in "natural" or biologically pure conditions, without residues of antibiotics, hormones or other drugs. As a result, the use of antibiotic growth stimulants is strictly controlled in many countries, and in the near future restrictions on the use of such drugs will cover more and more countries [3; 18; 23].

Biologically active substances with stimulating, prophylactic and healing properties are now an integral part of various feed mixtures (compound feeds, premixes, protein-vitamin-mineral supplements, whole milk substitutes, etc.), which are produced by microbiological and compound feed industries [20; 24].

Thanks to the use of feed additives, it is possible to scientifically balance compound feeds and diets not only for nutrients but also for physiologically active substances and thus increase the productivity of animals by reducing feed costs. For the treatment and prevention of gastrointestinal diseases and a number of other diseases, along with traditional veterinary drugs, probiotics – drugs based on live microbial cultures – have become widely used. Unlike the treatment and prevention of infectious diseases with antibiotics, the use of probiotics increases the nonspecific immunity of animals, restores the normal microflora, and livestock products remain environmentally safe [1; 4; 7].

Probiotics – drugs of microbial origin, which show their properties through the regulation of intestinal microflora. According to many modern researchers, probiotics are drugs from living microorganisms or growth stimulants of microbial, animal, plant origin, which have a beneficial effect on the normal flora of the body [4; 16].

Consumption of probiotics promotes the formation of non-pathogenic intestinal microflora, characterized by a high level of lactic acid-forming bacteria. The beneficial effect of probiotics is due to the following factors: competition against pathogenic bacteria for nutrients and areas for attachment; the formation of such counteracting substances as lactoferrin, lysozyme, hydrogen peroxide, lactic acid or other organic acids; modulation of the immune system by activating cytokines or stimulating macrophage cells and antibodies [11; 14].

2. Analysis of recent research and publications

Increasing consumption of poultry meat stimulates the growth of its industrial production. However, for the successful development of the industry it is necessary to combine raw materials, production and trade units into a single organizational and technological process. Broilers and poultry breeds play an important role in the production of poultry meat, which is a significant part of the human diet. With increasing competition in the domestic market, poultry farms have to look for new ways to increase the economic efficiency of production and improve the quality of final products [3; 18; 20].

Ukraine's priority task at the present stage is the production of high-quality food products using high waste-free technologies and equipment.

The supplying of people with qualitative foodstuffs is one of the most actual problems nowadays. Prohibition of antibiotics use as growth stimulators on the territory of EU countries concerning livestock was accepted as an answer for appearing of antibiotic-resistant microorganisms both to animals and people who consumed different animal products. So, fitobiotics, enzymes, probiotics and prebiotics, and other dietary supplements replaced antibiotics [3; 11; 15].

Nowadays the efforts of many scientists and practices are concentrated on the usage of such additives that are not accumulated in the tissues and livestock products and they are safe as people`s food [2; 12; 20].

It is known that probiotics form the intestine microbiocenosis, manufacture biologically active matters and creates unfavorable conditions for the development of pathogenic microflora, positively influence on forage nutrients digestibility, nitrogen balance and increases metabolism and decreases the forage consumption [4; 11; 17].

The scientific research and gained practical experience proved the efficiency of probiotics usage in poultry production. The percentage of digestive system diseases decreases, the survival and growth rates of poultry live weight increase if poultry is fed probiotics preparations. The ecological aspects of probiotics usage are also very important, because the products are free from antimicrobial agents. The poultry meat contains a lot of nutrients, bioactive and minerals; their ratio is constant, that's why poultry meat has high nutritional value. Nutritive muscles value is evaluated by its quality, protein content and its full value. The proteins of muscle tissues are of full value, because they contain all essential amino acids [5; 14].

Numerous feed additives such as probiotics, prebiotics, phytobiotics, enzymes, vitamins, et al., have been used in animal diets in recent years. However, they do not always have a positive effect on product quality. This issue is important because of advanced technologies for new feed application, the application of chemical and microbiologically synthesised products in animal nutrition.

Probiotics have become widespread among feed additives of natural origin. They create an unfavourable pH environment for pathogenic and opportunistic microflora and stimulate the growth and biological activity of normal intestinal microflora, having a positive effect on the composition of the microbiocenosis, probiotic microorganisms also produce biologically active substances and amino acids [16; 25].

Abroad, probiotics are gaining popularity, consisting of several types of microorganisms belonging to different genera. The composition of such probiotics is substantiated by the authors with various positive effects on the body. The mechanism of action of the probiotic effect is interpreted differently and depends on the composition of the microflora of the probiotic. The scientific substantiation of the design of new probiotic drugs reveals new aspects of the relationship between macro- and microorganisms. They are mostly reduced to the following: the main thing is the safety of strains intended for their introduction into probiotics, the presence of antagonistic properties to competitive, including pathogenic and opportunistic microflora, resistance to antibiotics most commonly used for antibiotic therapy, the ability of probiotic microorganisms actively assimilate a wide range of nutrients that are in the digestive tract as a result of biochemical processes of digestion in humans and animals, the presence of adhesive activity against epithelial cells of the digestive tract of humans and animals for which probiotics are prescribed, higher than growth of probiotic cultures, which allows them to more quickly assimilate the nutrient substrate, and thus increase the productivity of cells of probiotic strains [14; 16; 24; 25].

The microbiological industry is actively developing the creation of new and effective feed additives, including probiotic additives based on lactic acid bacteria (*Lactobacillus* and *Enterococcus*). It is known that the hydrolysis of feed nutrients to monomers is carried out using enzymes and acids, and symbiotic microorganisms that are in the digestive tract [18; 21].

Lactobacilli are the normal intestinal microflora of humans and animals. Inhabiting various parts of the digestive tract, lactobacilli in the process of life interact with other microorganisms, as a result, inhibit the development of putrefactive and opportunistic microbes, as well as pathogenic bacteria – the causative agents of acute intestinal infections. During normal metabolism, lactic acid bacteria ferment some carbohydrates to form lactic acid, lysozyme, lactocidin, plantarricin, lactolin and hydrogen peroxide. Lactobacilli in the process of digestion break down complex organic substances and, above all, cellulose and fiber [4; 23].

Enterococci are quite common microorganisms in the gastrointestinal tract of animals. They play an important role in parietal digestion and ensuring the body's resistance [4; 18].

Some research results have shown the promise of using such probiotic supplements in the diets of farm animals. However, how the new probiotic supplements that are made according to improved recipes affect the productivity of broiler chickens has not yet been explored. Moreover, digestibility of nutrients depends on the species and the animal age, chemical composition, preparation methods for feeding, feeding level and other factors [16; 14; 24].

The aim of this study was to investigate feed nutrient digestion and slaughter indicators of broiler chickens fed a probiotic supplement based on lactic acid bacteria (Lactobacillus and Enterococcus).

3. Purpose and objectives

The aim of our research was to study the productive effect of the probiotic "Entero-active" in the feeding of poultry. The experiments were conducted in the conditions of a research farm of Vinnytsia National Agrarian University in accordance with the general scheme of research.

This goal was achieved by solving the following tasks:

– experimentally justify the optimal dose of compound probiotics in the feed;

– to study the productivity, metabolism and slaughter qualities of broiler chickens under the action of feed additives;

– to study the physical and chemical quality of poultry meat under the action of probiotics;

– determine the morphological and biochemical parameters of blood in poultry using a feed additive;

– to study the effect of probiotics on the mineral, amino acid and chemical content of broiler meat.

The study was carried out on the research farm of Vinnytsia National Agrarian University (Ukraine). The experiment lasted for 42 days, by the method of analogue groups four groups were selected (I – control group, II, III, IV – experimental groups) of one-day broiler chickens “Ross-308” with 50 birds per group, the mean body weight was 62 ± 2 g The basic period was 32 days, the comparative one was 7 days [8].

The control group consumed the basic diet (BD) in the form of complete feed. The researched groups were additionally fed by different doses of probiotics supplement (Table 1).

In order to research the probiotic supplement effect on the chemical, mineral and amino acid effect meat composition of the researched poultry the control slaughter was done at the end of the experiment; we took four chicken from each group; their pectoral and thigh muscles were researched according to the standard methods [8; 9].

The researched probiotic supplement Entero-active contains lactic acid bacteria of Lactobacillus bulgaricus – $2{,}0*10^{10}$ CCU/kg (colonies of conventional units / kg) and Enterococcus faecium – $2.0*10^{10}$ CCU/kg.

Table 1

Chart of experience

Group	Duration, days	Feeding traits		
		Age, days		
		1 – 10	11 – 28	29 – 42
Control	42	OR (complete feed)		
Experimental II	42	OP+0.062% Entero-active	OP+0.025% Entero-active	OP+0.0125 % Entero-active
Experimental III	42	OP+0.125% Entero-active	OP+0.05% Entero-active	OP+0.025% Entero-active
Experimental IV	42	OP+0.25% Entero-active	OP+0.1% Entero-active	OP+0.05% Entero-active

The mechanism of action of probiotic Entero-active is the formation of the lactic and acetic acids; they are unfavorable pH environment for pathogenic and opportunistic pathogenic microorganisms, stimulate growth and biological activity of intestinal flora, it positively influences microbiota composition, besides probiotic microorganisms produce biologically active substances, enzymes and amino acids.

The producer of preparation Entero-active is BTU-Tsentr (Biotechnology of Ukraine, Ladyzhyn, Vinnytsia region); the recommended dose of probiotic as a part of poultry complete feed is 0.125% (1-10 days), 0.05% (11-28 days), 0.025% (29-42 days). In order to find the optimal dose of probiotic Entero-active for feeding modern crosses of broiler chickens we have investigated minimum, average and maximum dose of the researched supplement.

Broilers were kept in TBB-AV cage batteries (manufactured by VO TECHNA, Kyiv, Ukraine) with a nipple watering system with a stocking density of 20 birds per m^2. The dimensions of the cage were: 1,200 × 1,604 × 408 mm. The cage consisted of risers, flooring, side mesh walls and doors. The floor of the cages was made of a galvanized metal mesh (diameter of the coated wire, 2.2 mm) with holes the size of (16x25) mm, which eliminated the possibility of manure soiling, as well as injury to the legs of the bird. Temperatures were as follows: from days 1 to 5 – 32–35 °C, from day 21 days – 20 °C. Relative humidity 60-70%. Lighting intensity 10–20 lux.

During the physiological trial, which lasted forfive days, the birds were kept in separate cages. The digestibility of feed nutrients was determined by the difference between their content in the consumed feed and the excreted manure [9]. Consumed feed and manure were analysed. Compound feed samples were taken daily for analysis. Feed samples were taken in accordance with DSTU ISO 6497: 2005. Twice a day, morning and evening, manure was collected, which was preserved with toluene and stored in a closed glass container in the refrigerator at +5 [8]. Assessment of morphological and biochemical parameters of the blood were made at the end of the experiments. Four animals were selected from each group, from which blood was taken in the morning before feeding [10]. The amino acid composition was determined with a TTT 339 automatic analyser using LG ANB cation exchange resin with SO_3 active group. Haematological parameters were determined as follows: haemoglobin content – hemoglobin cyanide method using a hemoglobinometer type "Minigem-540", erythrocytes and leukocytes – using Goryaev's camera.to study the feeding efficiency (such as slaughter qualities) of the experimental birds were carried out at the end of the experiment after slaughter – four birds from each group [8].

Slaughter was by cutting the sublingual vein. Slaughter qualities were investigated according to the following indicators: pre-slaughter live weight of poultry after 12 hours of fasting; mass of ungutted carcass – mass of carcass exsanguinated and without plumage; mass of half-gutted carcass – carcass exsanguinated, without plumage and intestines; the mass of the gutted carcass – the mass of the exsanguinated carcass, without plumage, head, legs, wings on the elbow joint, intestine; mass of edible and inedible parts [8]. The growth rate of birds is estimated on the basis of average daily, absolute and relative live weight gain using appropriate formulas.

The absolute increase in live weight (A) was determined by the formula:

$$A = W_t – W_o,$$

W_t – live weight at the end of the period, g; W_o – live weight at the beginning of the period, g.

The average daily gain (C) is determined by the formula:

$$C = W_t – W_o / t_2-t_1,$$

t_1 – age at the beginning of the period, days; t_2 – age at the end of the period, days.

Relative growth (B) is used to compare the growth rate of birds with different starting weights:

$$B = W_t – W_o / 0,5 (W_t + W_o) * 100\%.$$

To study the anatomical and morphological analysis of carcasses, hematological parameters at the end of the experiment conducted a control slaughter of birds. Slaughter qualities were investigated on the following indicators:

– pre-slaughter live weight of poultry after 12 hours of starvation;

– weight of unharvested carcass – weight of carcass bled and without plumage;

– weight of half-gutted carcass – weight of bled carcass, without plumage and intestines;

– the mass of the gutted carcass – the mass of the carcass exsanguinated, without plumage, head, legs, wings at the elbow, intestines.

– mass of edible and inedible parts.

Processing of experimental data and statistical analysis of the results were performed on a PC using MS Excel 2019 software (from Microsoft, USA) and Statistica 12.6 (from Dell Technologies, USA) using built-in statistical functions. The differences between the mean values were considered statistically significant at $P<0.05$ [22]. The data in the tables are given as the means and standard deviatiosn. Statistical evaluation of differences was performed using Student's criterion.

4. Results of the research

Meat productivity is associated with the growth and development of a young organism. The rate of growth and development is determined by the genotype of the bird and is realized in accordance with environmental conditions.

Growth is an integral part of the development process, which is determined by the quantitative change in live weight of birds, individual organs and sizes with age.

Digestibility of nutrients depends on the species and age of the animal, chemical composition, methods of preparation for feeding, level of feeding and other factors.

Microorganisms play an important role due to the participation in the process of breakdown of nutrients that are not hydrolyzed by digestive enzymes of animals. Therefore, our research has revealed certain patterns in the digestion of nutrients by birds, depending on the doses of probiotic drug used in their diets.

In order to characterize the effect of probiotics on the intensity of growth and development of birds, live weight, average daily, absolute and relative gains, nutrient digestibility and quality of broiler meat were determined.

It was found that the addition of probiotic supplement "Entero-active" in addition to complete feed for broiler chickens has a positive effect on their live weight (Table 2).

The results of research show that from the beginning of the 7th day of cultivation, the growth rate of chickens in the experimental groups increases. Thus, after the seventh day, broilers that consumed probiotics at a dose of 0.125% (group 3) and 0.25% (group 4) by weight of feed, had a higher live weight than the control analogues by 12.5 and 14.1% ($P<0.01$), respectively. In addition, the tendency to intensify anabolic processes continued until the end of the experiment.

Table 2

Dynamics of live weight and safety of broiler chickens, d, г (M ± m, n =50)

Age, days	Group			
	Control	Experimental II	Experimental III	Experimental IV
1	45,9 ± 1,16	45,7 ± 0,83	45,2 ± 0,86	46,3 ± 1,03
7	115,5 ± 2,22	116,4 ± 3,60	130,0 ± 2,75**	131,8 ± 2,35**
14	300,9 ± 5,51	322,7 ± 7,07*	330,0 ± 5,22**	335,9 ± 4,14**
21	526,3 ± 11,60	546,7 ± 10,80	543,9 ± 12,36	580,1 ± 8,11**
28	877,8 ± 20,17	855,7 ± 17,56	894,9± 16,23	981,8 ± 16,47**
35	1320,1 ± 35,11	1318,9 ± 29,4	1347,8 ± 34,20	1518,6±27,64**
42	2008,4 ± 18,59	2037,2 ± 19,50	2196,3 ± 23,62***	2345,2± 18,49***
Saved, %	96,0	97,0	97,5	98,0

When feeding young animals compound feed with a feed additive content of 0.025% (group 2) at the age of 14 days, the live weight of poultry increased by 7.2% (P <0.05) compared to the control. At the same time, the live weight of poultry of the 3rd group with a feed content of 0.05% probiotic was higher by 9.6% (P <0.01), and the 4th group (0.1% probiotic) by 11.6% than young animals of the 1st group.

At the age of 21, 28, 35 days the highest live weight had a bird of the 4th group compared to the 1st group by 10.2, 11.8 and 15% (P <0.01), with the 2nd group by 6, 1, 14.7 and 15.1%, and with the 3rd group by 6.6, 9.7 and 12.6%.

The predominance in live weight of broiler chickens of the 3rd and 4th experimental groups, which were fed probiotics at 42 days of age, was more significant. With the use of average (0.025%) and maximum (0.05%) doses of probiotic drug, the live weight of broilers was 9.3 and 16.7% (P <0.01), respectively, higher than analogues from the control group.

In addition, the consumption of probiotic supplements increases the safety of broiler chickens in the 2nd group by 1%, in the 3rd – by 1.5% and in the 4th – by 2.0%.

The use of probiotics in the feeding of broiler chickens increases the average daily gain (Table 3).Starting from the first week of rearing (1-7 days), in the birds of the 3rd and 4th experimental groups there is a probable advantage in gains over the control group by 22.2 (P <0.01) and 23.2% 0.001), respectively.

It was found that broilers that consumed feed additives with compound feed during the rearing period from 8 to 14 days of age had higher average daily gains in the 2nd group by 12.5% (P <0.05) and in the 4th group by 10, 2% (P <0,05) compared with the control group.

Table 3

Average daily gain of live weight of broiler chickens, g (M ± m, n = 50)

Age of chickens, days	Group			
	Control	Experimental II	Experimental III	Experimental IV
1 – 7	9,9 ± 0,40	10,2 ± 0,51	12,1 ± 0,39**	12,2 ± 0,37***
8 – 14	26,4 ± 0,89	29,7 ± 1,08*	28,5 ± 0,84	29,1 ± 0,76*
15 – 21	31,1 ± 1,95	31,9 ± 1,65	30,7 ± 1,95	34,8 ± 1,35
22 – 28	49,3 ± 2,73	44,6 ± 3,06	50,1 ± 2,61	57,3 ± 2,77*
29 – 35	63,1 ± 4,22	65,9 ± 4,83	64,6 ± 5,47	76,7 ± 3,82*
36 – 42	98,8 ± 5,60	101,2 ± 5,72	121,1 ± 5,66**	118,0 ± 4,48**
On the average	46,4 ± 13,17	47,2 ± 13,41	51,1 ± 16,17	54,6 ± 15,98

At 15–21 days of age, there was a trend towards increased gains in the test bird that consumed the probiotic supplement. So, in the 2nd and 4th groups, the average daily gains were higher than the control group by 2.5% and 11.8%, respectively. At the same time, there is a slightly smaller increase in the 3rd group compared to the control by 1.3%, although no probable difference was recorded.

During the rearing of young animals at the age of 22-28 days, the highest average daily gain was noted in the 4th group – by 16.2% (P<0.05) for the bird of the 1st group. At the same time, a smaller average daily gain for the control group was recorded in the 2nd group by 9.6%, but no probable difference was found.

In the period from 29 to 35 days of age, the highest average daily gain was observed in broilers of the 4th group, which consumed the probiotic at a dose of 0.05% by weight of the feed. Thus, the increase in group 4 was dominated by analogues in the control by 21.5% (P<0.05).

The average daily gains of broiler chickens of the 3rd and 4th groups at the age of 36 to 42 days were higher by 22.3 g and 19.2 g or by 22.5% and 19.4%, respectively (P<0.01) compared to the control group.

On average, the average daily gain in live weight of broilers in the control group was 46.4 g, in the experimental groups this figure was slightly higher and ranged from 47.2 to 54.6 g, which is 1.7 and 17.6% more than in control.

To study the performance of broiler chickens, the absolute increase was also determined (Figure 1).

It is noted that the use of probiotic additives in the diet of broiler chickens allows to increase the absolute increase over the entire period of the experiment in the 2nd experimental group by 29.0 g, or 1.4%, in the 3rd group by 188.6 g, or by 9.6% and in the 4th by 336.4 g, or by 17.1% compared to control counterparts.

According to the research results, the highest digestibility of protein and nitrogen-free extractives (NFE) was observed when the average dose of the additive were additionally fed; they were higher by 3.4% and 4.0% (P <0.001) than the control one. The broilers of the II and IV groups had increased the digestibility of protein, although a probable difference with the control was not found (Table 4).

It is advisable to pay attention to the dry matter and fiber digestibility by broiler chicken dependence on different doses of Entero-active probiotic supplement comparing them with the control poultry group.

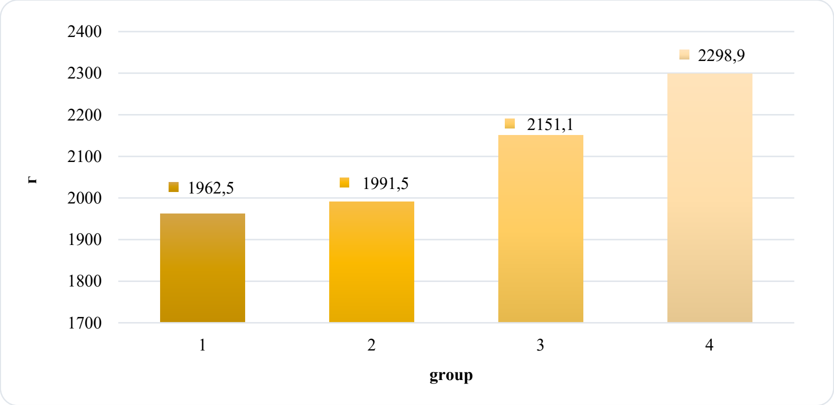

Figure 1. Absolute increase in live weight of broilers during the experiment, g

Table 4

Coefficients of feed nutrients digestibility, % ($\overline{X} \pm Sx$, n=4)

Indicator	Group			
	Control I	Experimental II	Experimental III	Experimental IV
Dry matter	77.9 ± 0.39	79.7 ± 1.01	80.3 ± 0.24**	80.2 ± 0.45**
Protein	84.1 ± 0.32	85.6 ± 0.70	87.5 ± 0.11***	84.8 ± 0.95
Fat	94.8 ± 0.08	94.6 ± 0.30	95.0 ± 0.10	93.5 ± 0.22**
Fiber	6.1 ± 2.05	26.3 ± 3.43**	22.1 ± 1.14***	37.2 ± 2.26***
NFE	86.6 ± 0.24	88.1 ± 0.57*	90.6 ± 0.16***	87.9 ± 0.17**

According to the research results, feeding the probiotic maximum dose increased the dry matter digestibility by 2.3% (P <0.01), the average dose increased the dry matter digestibility by 2.4% (P <0.01).

The maximum dose of the additive caused the highest digestibility of fiber by broilers (31.1% (P <0.001)) relative to the control group. However, in groups II and III the digestibility of fiber was higher than in the control by 20.2% (P <0.01) and 16.0 % (P <0.001), respectively.

Group II consumed the minimum dose of probiotic drug; they outperformed by NFE digestibility the control group by 1.5% (P <0.05).

The consumption of probiotics by group IV increased the NFE digestibility by 1.3% (P <0.01). However, it caused decrease of fat digestibility by 1.3% (P<0.01).

According to research data, the probiotics application for broiler chicken feeding has a positive effect on the amino acids’ digestibility (Table 5).

According to the research results, the broiler chickens fed by the average dose of the supplement have the highest digestibility of amino acids. Thus, the digestibility of such essential amino acids as lysine, histidine, arginine, valine, methionine, isoleucine and leucine in group III significantly exceeds the control analogues, respectively, by 4.8%, 3.8%, 4.9%, 4.1%, 2.6%, 7.6% and 4.1% (P <0.001). In group II the absorption of phenylalanine was by 31.9% (P <0.001) less than the control sample.

It should be noted that feeding by the minimum dose of probiotics causes a decrease in the coefficients of digestion of amino acids compared to control values. The highest digestibility of aspartic and glutamic acids was found in the group III, it was higher by 5.3% and 9.7% (P <0.001 and P <0.001), respectively, compared with the control.

Table 5

Digestibility of amino acids by broiler chickens, % (M ± m, n=4)

Amino acids	Control I	Experimental II	Experimental III	Experimental IV
Lysine	87.0 ± 0.24	84.3 ± 0.74*	91.8 ± 0.15***	88.5 ± 0.21**
Histidine	90.5 ± 0.22	87.7 ± 0.49**	94.3 ± 0.09***	91.8 ± 0.45*
Arginine	88.1 ± 0.09	82.7 ± 0.90**	93.0 ± 0.21***	91.4 ± 0.24***
Aspartic acid	83.4 ± 1.52	79.0 ± 1.52*	88.7 ± 0.14***	86.0 ± 0.30**
Threonine	81.9 ± 0.29	76.1 ± 0.93**	89.4 ± 0.29***	85.5 ± 0.28***
Serine	82.8 ± 0.49	72.9 ± 1.25***	88.8 ± 0.19***	85.8 ± 0.40**
Glutamic acid	83.9 ± 0.34	86.2 ± 0.65*	93.6 ± 0.12***	90.9 ± 0.21***
Proline	85.9 ± 0.334	79.5 ± 0.53***	90.2 ± 0.10***	88.2 ± 0.21**
Glycine	76.9 ± 0.44	61.1 ± 1.88***	83.2 ± 0.45***	78.1 ± 0.42
Alanine	76.1 ± 0.75	58.4 ± 2.29***	82.7 ± 0.48***	74.5 ± 0.43
Cystine	89.8 ± 0.10	85.2 ± 1.16**	92.2 ± 0.19***	88.3 ± 0.55
Valine	84.5 ± 0.35	71.4 ± 1.49***	88.6 ± 0.36***	86.2 ± 0.43*
Methionine	93.9 ± 0.07	92.9 ± 0.43	96.5 ± 0.40***	92.9 ± 0.28*
Isoleucine	78.4 ± 0.29	75.0 ± 0.95*	86.0 ± 0.30***	82.1 ± 0.35***
Leucine	85.8 ± 0.26	75.7 ± 0.81***	89.9 ± 0.11***	87.9 ± 0.23***
Tyrosine	86.6 ± 0.49	75.2 ± 0.85***	88.7 ± 0.51*	91.2 ± 0.60**
Phenylalanine	88.9 ± 0.45	57.0 ± 1.30***	89.5 ± 0.23	88.0 ± 0.28

It was found that the digestibility of threonine was by 7.5% (P <0.001), serine was by 6.0% (P <0.001), proline was by 4.3% (P <0.001), glycine was by 6, 3% (P <0.001), alanine was by 6.6% (P <0.001) and cystine was be 3.1% (P <0.001) more in group III than in the control one. The highest content of tyrosine is observed in group IV, it was higher by 4.6% (P <0.01).

The mineral elements play a vital role in metabolism, because the organic matter of feed is better used by animals in the presence of sufficient amounts of both macro-and micronutrients. Diets imbalance in terms of mineral content leads to metabolic disorders in animals, as well as a decrease in natural immunity.

Therefore, an important aspect of our research was to study the retention of mineral elements in the feed of broiler chickens (Table 6).

It was found that poultry additionally fed by feed additive had an increased retention of Ca and Mn, respectively, in group II by 22.0% and 24.6% (P <0.001 and P <0.01), in group III by 22.2% and 18.8%

Table 6

Retention of mineral feed elements, % ($\overline{X} \pm Sx$, n=4)

Group	Ca	P	Mg	Mn
Control I	17.9 ± 1.53	60.8 ± 1.42	31.8 ± 1.14	7.2 ± 2.45
Experimental II	39.9 ± 2.82***	67.7 ± 1.95*	32.7 ± 3.95	31.8 ± 3.29**
Experimental III	40.1 ± 0.91***	66.8 ± 1.02*	40.8 ± 0.68***	26.0 ± 1.13***
Experimental IV	41.4 ± 1.49***	66.4 ± 2.18	44.0 ± 1.69**	40.3 ± 1.36***

(P <0.001 and P <0.001) and in group IV by 23.5 % and 33.1% (P <0.001 and P <0.001) compared with the control group.

The animal growth phosphorus need is the sum of the absorbed phosphorus accumulated in soft tissues and phosphorus deposited in the bones. A significant difference in the phosphorus absorption increase was observed in experimental groups II and III by 6.9% and 6.0% (P <0.05), respectively.

The probiotic has a positive effect on Mg content, it was by 9.0% (P<0.001) and by 12.2% (P<0.01) more in group III and IV than in the control. Lack of this mineral element in the poultry diet leads to increased excitability of the nervous system, ataxia and seizures.

It was found that group II consumed 189.4 kg of feed, it is by 1.5% less than the control group. However, feed consumption per 1 kg of growth decreased by 3.1% in group II, by 7.7% in group III and by 12.9% in group IV (Table 7).

It should be noted that poultry additionally fed by Entero-active probiotic drug have increased both feed conversion feed payment. However, feed costs per 1 kg of growth were lower than in the control group.

According to the research results, the probiotic additive had a positive effect on the slaughter indicators of broiler chickens (Table 8).

Poultry from groups III and IV had a significant advantage by 9.3% (P<0.001) and 16.7% (P<0.01) considering the pre-slaughter live weight.

When broilers consumed the probiotic drug, the weight of ungutted and gutted carcasses increased by 8.7% (P <0.001) and 9.5% (P<0.01) in the group III, and by 15.0% (P<0.01) and 17.3% (P<0.05) in group IV respectively, compared with chickens in the control group.

The weight of semi-gutted carcass was higher by 8.6 % and 16.2 % in groups III and IV, respectively, than in the control group. However, no significant difference was found.

Table 7

Feed costs and returns of broilers, kg

Group	Feed consumption, kg						Feed returns	
	for experiment		per head		per 1 kg of gain			
	total	± control	total	± control	total	± control	total	± control
Control I	192.2	-	3.84	-	1.95	-	0.51	-
Experimental II	189.4	- 2.8	3.78	-0.06	1.89	- 0.06	0.52	+ 0.01
Experimental III	193.8	+ 1.6	3.88	+ 0.04	1.80	- 0.15	0.55	+ 0.04
Experimental IV	195.0	+ 2.8	3.90	+ 0.06	1.70	- 0.25	0.58	+ 0.07

Table 8

Slaughter rates of broiler chickens, g (M ± m, n = 4)

Indicator	Group			
	Control I	Experimental II	Experimental III	Experimental IV
Pre-slaughter weight	2,064.5 ± 15.3	2,104.0±14.8	2,258.0±26.7***	2,410.7±95.6**
Ungutted carcass weight	1,867.2 ± 8.3	1,923.0±55.9	2,031.0±24.8***	2,148.0±93.1**
Semi gutted carcass weight	1,650.5 ± 53.0	1,652.5±73.0	1,793.2 ± 30.0	1,918.0±101.6
Gutted carcass weight	1,406.0 ± 18.2	1,412.5±89.5	1,540.5±29.5**	1,650.0±82.14*

Blood, together with the nervous system, provides the functional unity of the whole organism. The close connection of blood with tissues and organs makes it possible to diagnose pathological changes in the body, monitor the course of the pathological process, and evaluate the effectiveness of therapeutic agents. It should be noted that the productivity, metabolism and resistance of the animal organism depend on hematological parameters.

The blood system is involved in metabolic processes as a holistic mechanism but there are violations of the quantitative composition and functions of certain groups of blood cells.

Thus, the morphological analysis of the blood can characterize the effect of the factor on the animals' body (Table 9).

Additional introduction of a feed additive causes leukocytes level increase. Thus, the largest number of leukocytes relative to the control indicator was recorded in group IV, it was higher by 16.0% but no significant difference was found.

Table 9

Morphological parameters of broiler blood (M ± m, n = 4)

Group	Leukocytes (G/l)	Erythrocytes (T/l)	Hemoglobin (g/l)	ESR (mm/hour)
Control I	18.1 ± 0.96	3.0 ± 0.17	106.5 ± 5.28	1.7 ± 0.55
Experimental II	20.8 ± 0.92	2.9 ± 0.08	122.0 ± 4.97	1.5 ± 0.33
Experimental III	20.1 ± 0.80	2.8 ± 0.07	121.5 ± 2.60*	1.7 ± 0.55
Experimental IV	21.0 ± 1.88	2.8 ± 0.04	116.0 ± 2.49	1.5 ± 0.33

The erythrocyte level of experimental poultry does not differ significantly from analogues.

Hemoglobin is known to bind oxygen and carbon dioxide, and to perform respiratory function. The highest content of hemoglobin was observed in groups II and III. It was more by 14.5% and by 14.0% ($P < 0.05$) respectively compared with control analogues.

The erythrocyte sedimentation rate (ESR) does not change significantly in the experimental groups.

According to research data, feed additive Entero-active has a positive effect on the digestibility of feed nutrients, increases the absorption of amino acids and minerals in the body and enhances metabolic processes in broiler chickens.

The research has proved that the usage of different doses of probiotic supplements “Entero-active” has positively effects on amino acid content and mineral contents of the broiler chickens muscles.

The quality of poultry products depends on several factors, but for the most part it is determined by the quality of the grown poultry supplied for processing: its live weight, slaughter yield, fatness, the ratio of muscle and bone tissue, and also valuable parts of the carcass, organoleptic indicators, etc.

The main role in improving the quality of products is played by the optimal feeding of poultry, providing it with the necessary nutrients and biologically active substances. Balanced and complete feeding allows not only to increase the commercial qualities of poultry carcasses, but also to improve their biological properties. The feeding by probiotics also influenced the nutrient contents in pectoral and thigh muscles of broiler chickens (Table 10).

Table 10

The chemical composition of broiler chickens meat, %
(M ± m, n = 4) (in air-dry matter)

Indicator	Group			
	Control	Experimental II	Experimental III	Experimental IV
White meat				
Dry matter	92.4 ± 0,03	92.6 ± 0,02**	91.7 ± 0,10**	92.3 ± 0,01*
Protein	73.1 ± 0,87	73.5 ± 0,07	73.6 ± 0,21	73.3 ± 0,10
Fat	5.5 ± 0,04	6.7 ± 0,04***	5.8 ± 0,01***	5.6 ± 0,02
Ash	4.12±0,031	4.21±0,082	4.43±0,032***	4.87±0,009***
Red meat				
Dry matter	92.6 ± 0,01	92.6 ± 0,06	92.5 ± 0,02**	92.7 ± 0,02**
Protein	60.8 ± 0,30	55.4±0,19***	58.8 ± 0,18**	58.9 ± 0,16**
Fat	22.1 ± 0,05	25.0±0,05***	26.0 ± 0,05***	24.9 ± 0,07***
Ash	3.6 ± 0,02	4.0 ± 0,04***	3.4 ± 0,02***	3.6 ± 0,01

Broiler chickens dry matter contents of the second poultry group white meat increases by 0.2% (P<0.01); the broiler chickens dry matter contents of the fourth poultry group red meat increases by 0.1% (P<0.05) under the action of probiotics than in control group. However, the poultry of the third group has the lower level of dry matter in pectoral muscles by 0.7 % and in thigh muscles by 0.1% (P<0.01). Protein contents in pectoral muscles don’t change considerably, but this thigh muscles indicator is lower for poultry of the second group by 5.4% (P<0.001), the third group by 2.0% and the fourth group by 1.9% than in control group.

The consumption of probiotic Entero-active facilitates the fat percentage in white and red poultry meat; it is 1.2 and 2.9% (P<0.001) for the second group, 0.3 and 3.9% (P<0.01) for the third group; the forth group has the increasing of fat percentage only in pectoral muscles by 2.8% (P<0.001) than in control group. The white meat of the forth group has the highest ash level, it is higher by 0.75% ($P<0.001$) than in control group; the red meat of the second group has the highest ash level; it is higher by 0.4% ($P<0.001$) than in control group; it is observed under the action of probiotic.

Minerals research in meat of researched poultry was conducted in order to investigate the influence of probiotic supplement on the broilers meat (Table 11).

Table 11

Mineral contents of broiler chicken pectoral muscles (M ± m, n=4) (in absolutely dry matter)

Element	Group			
	Control	Experimental II	Experimental III	Experimental IV
P, g/kg	12.6 ± 0.08	12.4 ± 0.08	12.9 ± 0.04*	13.2±0.04***
Ca, g/kg	0.41 ± 0.003	0.33±0.006***	0.36±0.001***	0.39±0.003**
Mg, g/kg	0.427±0.0002	0.444±0.0020***	0.426±0.0016	0.431±0.0009**
Fe, mg/kg	379.1 ± 1.68	230.1±1.74***	555.4±6.90***	291.5±3.56***
Zn, mg/kg	29.3 ± 0.11	25.5±0.09***	28.5±0.06***	27.9 ±0.20**
Mn, mg/kg	6.7 ± 0.86	4.5 ± 0.77	7.6 ± 0.31	4.3 ± 0.32*
Cu, mg/kg	1.1 ± 0.05	0.3 ± 0.02***	0.6 ± 0.07**	1.2 ± 0.02

Additional usage of probiotics as a component of mixed fodder for broiler chickens facilitated the increasing of phosphorus contents by 2.3% ($P<0.05$) for the third group and by 4.7% ($P<0.001$) for the fourth group than in control group. The decreasing of calcium contents was observed; it was lower by 19.6 ($P<0.001$), 12.2 ($P<0.001$) and 4.9% ($P<0.01$) in the second, third and fourth group.

The contents of magnesium in the pectoral muscles of broiler chickens fed by feed additive significantly increased in the second group by 3.9% ($P<0.001$) and fourth group by 0.9% ($P<0.01$) than in control group.

It is interesting to note that usage of probiotic supplement average dose increases the iron contents in the white meat by 46.5% ($P<0.001$), this rate decreases by 39.4% ($P <0.001$) and 23.2% ($P <0.001$) respectively under minimal and maximum dose than the control sample.

The highest manganese contents has the white meat of the third group; it is higher by 13.4%, although significant difference with the control group wasn't observed. The fourth group has the lower contents of this trace element by 35.9% ($P<0.05$) than the control group has.

The usage of probiotic supplement has positive influence on the mineral contents of white meat, but it causes the decreasing of copper contents in the second and third groups by 72.8 and 45.5% ($P<0.001$ and $P<0.001$) than in the control group.

It should be mentioned that poultry fed by probiotics has the lower zinc contents in pectoral muscles; it was lower by 13.0% ($P<0.001$) in the second group, by 2.8% ($P<0.001$) in the third group and by 4.8% ($P<0.01$) in the fourth group than in control group.

The research of mineral contents of red meat of researched poultry has given an opportunity to prove that the level of macro- and microelements was different under the action of probiotic (Table 12).

According to the results of research the largest quantity of phosphorus was in the fourth group, it was larger by 4.7% ($P<0.01$); the smallest quantity was in the second and third groups, it was smaller respectively by 14.3% ($P<0.01$) and 11.5% ($P<0.001$) than in control group.

It should be mentioned that the calcium contents of broiler chicken thigh muscles increase under the action of probiotic; it is increased 4.1 times ($P<0.001$) in the second group, by 21.3% ($P<0.001$) in the third group, and by 71.7% ($P<0.001$) in the forth group in comparison with the control group.

It was proved that probiotic supplements causes reducing red meat magnesium in the second, third and fourth groups, respectively by 3.4 ($P<0.001$), 10.8 ($P<0.001$) and 0.9% ($P<0.05$) in comparison with the first group.

The iron content of the thigh muscle was higher than benchmark in all experimental groups fed by probiotic; it was higher by 13.8% ($P<0.001$) in the second group, by 70.5% ($P<0.001$) in the third group and by 67.9% ($P<0.001$) in the fourth group.

The researched additive also had a notable positive effect on the zinc level in the red meat. The third and the forth group had the largest portion of this trace element; it was higher by 5.4 % ($P<0.001$) in the third group and by 4.5 % ($P<0.001$) in the fourth group than the control sample.

The highest amount of manganese was found in the third group at 31.5%, but significant difference from the control group was not found.

It should be mentioned that the copper level increases in thigh muscles of broilers of the second group in 4.2 times ($P<0.001$), the third group by

Table 12

The mineral content of broiler chicken thigh muscles (M ± m, n=4)

Element	Group			
	Control	Experimental II	Experimental III	Experimental IV
P, g/kg	10.5 ± 0.07	9.0 ± 0.28**	9.3 ± 0.08***	11.0 ± 0.10**
Ca, g/kg	0.244±0.0027	1.011±0.0050***	0.296±0.0005***	0.419±0.0032***
Mg, g/kg	0.363±0.0011	0.351±0.0015***	0.324±0.0004***	0.360 ± 0.001*
Fe, mg/kg	492.0 ± 4.15	560.3 ± 4.73***	839.1 ± 8.39***	826.3 ± 6.36***
Zn, mg/kg	66.4 ± 0.41	65.6 ± 0.27	70.0 ± 0.06***	69.4 ± 0.08***
Mn, mg/kg	7.3 ± 1.34	6.1 ± 0.25	9.6 ± 0.54	8.6 ± 0.50
Cu, mg/kg	0.73 ± 0.01	3,1 ± 0.39***	0.94 ± 0.04**	2.1 ± 0.03***

28.7% (P<0.01) and the fourth group in 2.8 times (P<0.001) than in control group. The increase of this microelement is within physiological norms.

It was proved that poultry fed by researched additive had the higher lysine contents in the white meat that the control sample has; the second group had by 0.8 % (P<0.001), the third one had by 0.19% (P<0.01) and the fourth had by 1.66% (P<0.001) than the control group has (Table. 13).

The histidine decreases in the pectoral muscles of broilers if they are fed by average or maximum dose of probiotic; it decreases by 0.33% (P<0.001) and 0.1% (P<0.05) than in control group. However, the second group has a slight increase of this indicator by 0.03%; but significant differences weren’t found.

The highest arginine contents were found in the meat of broilers from the second group; it was by 0.38% (P<0,001) higher than in control one; the fourth group has the lowest its level; it was lower by 2.71% (P<0.001) than in control group.

The additional consumption of feed additive by broilers facilitates the increasing of valine and methionine in the white meat; it was higher by 0.15 % (P<0.01) it the second group, by 0.11% (P<0.05) in the third one, and by 0.33% (P<0.001) in the fourth one than on control group.

The isoleucine contents of poultry pectoral muscle were lower in the second, third and fourth groups than in control one by 0.21% (P<0.001), 0.29% (P<0.001) and 0.7% (P<0.001) respectively.

In addition, the decrease of leucine proportion was observed in the fourth group under the action of probiotic, it was by 0.36% (P<0.05) lower

Table 13

Amino acid composition of the pectoral muscles of broiler chickens

Amino acid	Group			
	Control	Experimental II	Experimental III	Experimental IV
Lysine	7.62 ± 0.038	8.42 ± 0.036***	7.81 ± 0.030**	9.28 ± 0.067***
Histidine	3.83 ± 0.014	3.86 ± 0.020	3.50 ± 0.019***	3.73 ± 0.082*
Arginine	7.53 ± 0.027	7.91 ± 0.035***	7.60 ± 0.066	4.82 ± 0.106***
Threonine	5.11 ± 0.012	5.13 ± 0.023	5.16 ± 0.031	5.18 ± 0.079
Valine	5.50 ± 0.22	5.65 ± 0.30**	5.66 ± 0.026**	5.52 ± 0.072
Methionine	3.15 ± 0.022	3.26 ± 0.023*	3.48 ± 0.016***	3.32 ± 0.083
Isoleucine	5.53 ± 0.015	5.32 ± 0.014***	5.24 ± 0.022***	4.83 ± 0.048***
Leucine	9.40 ± 0.065	9.39 ± 0.030	9.50 ± 0.061	9.04 ± 0.132*
Phenylalanine	4.52 ± 0.023	4.68 ± 0.023**	4.69 ± 0.035**	4.63 ± 0.045

than in control one. Meanwhile, its highest level was in the third group (by 0.1%), but significant differences with control group weren't found.

There are also quantitative amino acid changes in the thigh muscle of broiler chickens under the influence of probiotic (Table 14).

The level of essential amino acids such as lysine and histidine has increased in the broilers red meat under the action of researched preparation; it has increased in the fourth group by 0.05 and 0.08% ($P<0.05$ and $P<0.01$) respectively. However, the meat of the second group poultry has lower indicator of amino acids mentioned above, it is lower by 0.29 and 0.12% ($P<0.001$) respectively.

The arginine amount in the red meat decreases by 0.41% ($P<0.001$) in the second group, however the fourth group has this indicator at the control level.

It should be mentioned that threonine amount decreases in the red meat by 0.48% ($P<0.001$) in the second group and by 0.29% ($P<0.001$) in the third group, however the fourth group has this indicator at the control level.

The usage of researched additive as a part of broilers diet influences on the decreasing of valine and methionine level in the thigh muscles by 0.13 and 0.19% ($P<0.001$) in the second group, by 0.18 and 0.11% ($P<0.001$) in the third group, by 0.1 and 0.03% ($P<0.001$ and $P<0.01$) in the fourth group than in control one.

The contents of isoleucine and leucine in the thigh muscles of the poultry from the second group is by 0.09 and 0.21% ($P < 0.001$) lower; from the

Table 14

Amino acid composition in thigh muscle of broiler chickens

Amino acid	Group			
	Control	Experimental II	Experimental III	Experimental IV
Lysine	8.82 ± 0.007	8.53 ± 0.017***	8.78 ± 0.004**	8.87 ± 0.019*
Histidine	2.95 ± 0.008	2.83 ± 0.017***	2.85 ± 0.015**	3.03 ± 0.019**
Arginine	7.06 ± 0.010	6.65 ± 0.029***	7.04 ± 0.011	7.06 ± 0.026
Valine	5.23 ± 0.009	5.10 ± 0.019***	5.05 ± 0.017***	5.13 ± 0.012***
Methionine	3.00 ± 0.003	2.81 ± 0.020***	2.89 ± 0.005***	2.97 ± 0.005**
Isoleucine	4.83 ± 0.011	4.74 ± 0.008***	4.74 ± 0.002***	4.81 ± 0.008
Leucine	8.49 ± 0.017	8.28 ± 0.028***	8.29 ± 0.005***	8.48 ± 0.008
Phenylalanine	4.41 ± 0.004	4.40 ± 0.120	4.34 ± 0.008***	4.39 ± 0.005*

third group is by 0.09 and 0.2% ($P < 0.001$) lower than in similar samples of the first group. It should be mentioned that amino acids amount does not differ considerably from the meat of the fourth group.

Together with fat, valuable biological substances such as polyunsaturated fatty acids, phosphatides, fat-soluble vitamins, and stearins enter the body. For the body to assimilate fat-soluble vitamins from other sources, the presence of fat in the intestines is an essential condition.

Dietary fats are broken down by lipases in the small intestine to fatty acids, monoacylglycerols and glycerol, and in this form are absorbed by intestinal epithelial cells. Unsaturated fatty acids with more than one double bond cannot be synthesized in the body and are therefore called essential fatty acids.

Thus, the studies were aimed at studying the effect of the probiotic on the content of fatty acids in the pectoral muscles of broilers (Table 15).

The use of a probiotic additive in the feed of broiler chickens contributes to an increase in white meat of the fourth group of myristic fatty acid – by 0.02%, pentadecylenic – by 0.05%, palmitoline – by 1.38%, oleic by 1.91%. γ-linolenic – by 0.02%, α-linolenic – by 0.09%, gondoin – by 0.05% and dihomolinoleic – by 0.03% compared with the control sample.

The use of a probiotic in the diet of broilers allows you to get a higher content in white meat than in control, in the 2nd group – palmitic – by 0.63% and in the 3rd stearin group – by 0.57%, linoleic – by 0.39 % and arachidonic fatty acid – by 0.71%.

Table 15

Fatty acid content of the pectoral muscles of broiler chickens, %

Fatty acid	Group			
	Control	Experimental II	Experimental III	Experimental IV
Laurinova	0,01	0,01	0,01	0,01
Miristinova	0,34	0,35	0,35	0,36
Pentadecylene	0,07	0,09	0,10	0,12
Pentadecyleic	0,03	0,03	0,03	0,03
palmitic	16,50	17,13	16,50	16,67
Palmitoleic	5,40	6,12	5,19	6,78
margarine	0,24	0,19	0,21	0,19
Margarine oleic	0,05	0,04	0,05	0,05
Stearic	6,36	6,25	6,93	5,41
Oleic	33,62	33,52	32,29	35,53
Linoleva	33,19	31,70	33,58	30,57
γ-linolenic	0,11	0,12	0,13	0,13
α-linolenic	2,30	2,18	2,19	2,39
Arakhinov	0,15	0,09	0,10	0,08
Gondoinova	0,12	0,10	0,11	0,17
Digomolinoleic	0,03	0,03	0,03	0,05
Arakhidonova	1,48	2,04	2,19	1,45

At the same time, in the experimental groups, which were fed the feed additive in addition to the main diet, there was a tendency to decrease in poultry white meat.

The effect of the probiotic on the content of fatty acids in the femoral muscles of broilers (Table 16).

It has been established that the additional coordination of the feed additive for broilers contributes to an increase in the amount of fatty acids in red meat. Thus, the content of myristic – by 0.02% and linoleic – by 2.73% in the 2nd group is higher than in the control.

In the third group, according to the action of the probiotic, the level of stearic and gondoic fatty acids increased by 0.69 and 0.07%, respectively, compared with the control.

The highest proportion of fatty acids in the femoral muscles was found in the 4th group of pentadecylene – by 0.02%, palmitoleic – by 0.47%, oleic – by 0.87%, α-linolenic – by 0.07% and arachidonic – by 0.34%.

Table 16

The content of fatty acids in the thigh muscles of broiler chickens, %

Fatty acid	Group			
	Control	Experimental II	Experimental III	Experimental IV
Laurinova	0,02	0,02	0,01	0,01
Miristinova	0,43	0,45	0,39	0,37
Pentadecylene	0,08	0,09	0,06	0,10
Pentadecyleic	0,03	0,03	0,03	0,03
Palmitic	18,06	16,38	16,44	17,65
Palmitoleic	6,11	5,89	4,99	6,58
Margarine	0,22	0,18	0,18	0,18
Margarine oleic	0,07	0,04	0,04	0,07
Stearic	5,01	5,04	5,70	4,74
Oleic	36,87	35,79	36,17	37,70
Linoleva	30,32	33,05	32,97	29,67
γ-linolenic	0,12	0,07	0,08	0,11
α-linolenic	2,06	2,11	1,95	2,13
Arakhinov	0,14	0,14	0,13	0,08
Gondoinova	0,08	0,13	0,15	0,09
Digomolinoleic	0,05	0,03	0,03	0,03
Arakhidonova	0,34	0,57	0,68	0,47

Consequently, the use of a probiotic supplement in various doses in the feed of broiler chickens affected the content of essential amino acids and unsaturated fatty acids in muscles not synthesized by the body.

5. Conclusion

1. The broiler chickens fed by additive Entero-active have increased the digestibility of dry matter by 2.4% ($P < 0.01$), protein by 3,4% ($P < 0.001$), fiber by 31.1% ($P < 0.001$) and NFE by 4.0% ($P < 0.001$) comparing with the control group.

2. The application of probiotic supplement Entero-active for the broilers' feeding increases the availability of essential amino acids, i.e. lysine by 4.8% ($P<0.001$), histidine by 3.8% ($P<0.001$), arginine by 4.9% ($P<0.001$), threonine by 7.5% ($P<0.001$), valine by 4.1% ($P<0.001$), methionine by 2.6% ($P < 0.001$), isoleucine by 7.6% ($P < 0.001$) compared with the control indicator.

3. It was found the absorption of Ca, P, Mg, Mn, increases respectively, by 23.5% ($P<0.001$), 6.9% ($P <0.05$), 12.2% ($P <0.01$), and by 33.1% ($P <0.001$) under the action of probiotics.

4. The Entero-active probiotic application in the diet of broiler chickens increases the pre-slaughter live weight by 16.7% ($P <0.01$), the weight of ungutted carcasses by 15.0% ($P <0.01$) and gutted carcasses by 17.3% ($P <0,05$), feed costs per 1 kg increase by 12.9%, relative to control. It was investigated that the probiotic Entero-active increases the hemoglobin content by 14.0% broiler chickens compared with the control group.

5. The studies proved that the additional use of the studied probiotic supplements with food of broiler chickens allowed increasing phosphorus contents by 4.7%, magnesium by 3.9% and iron by 46.5% in the pectoral muscles compared with the control group. The use of probiotic for broilers feeding has increased phosphorus by 4.7%, calcium by 4.1 times, iron by 70.5%, zinc by 5.4%, magnesium by 31.5% and copper in 4.2 times in thigh muscles of poultry.

6. It was proved that probiotic increases the synthesis of such essential amino acids in the pectoral muscles as lysine by 1.66%, histidine by 0.03%, arginine by 0.38%, threonine by 0.07%, valine by 0.16%, methionine by 0.33%, leucine by 0.1% and phenylalanine by 0.17%. The increasing of level of lysine and histidine respectively by 0.05 and 0.08% is observed in the thigh muscles of broilers under the influence of probiotic.

7. It was found that under the action of the additive in the pectoral muscles of broilers, the content of unsaturated fatty acids increases: oleic – by 1.91%, palmitoline – by 1.38%, γ-linolenic – by 0.02%, α-linolenic – by 0 09%, gondoic – by 0.05%, linoleic – by 0.39% and arachidonic – by 0.71%. In the thigh muscles of chickens, the probiotic “Entero-active” increases the level of unsaturated fatty acids: palmitolic – by 0.47%, oleic – by 0.83%, linoleic – by 2.73%, α-linolenic – by 0.07%, gondoic – by 0.07% and arachidonic – by 0.34% compared with the control.

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