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Physiological Basis of Probiotics use for Growing Gees

[1]Gulnara Tsapalova, [1]Ayrat Khabirov, [1]Ruzil Avzalov, [2]Zuleykha Ilyasova, [1]Liliia Sataeva and [1]Fatyma Gafarova

[1]*Department of Physiology, Biochemistry and Feeding of Animals, Federal State Budgetary Educational Establishment of Higher Education "Bashkir State Agrarian University", Russia*
[2]*Department of Infectious Diseases, Zoohygiene and Veterinary Sanitary Expertise, Federal State Budgetary Educational Establishment of Higher Education "Bashkir State Agrarian University", Russia*

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Corresponding Author:
Gulnara Tsapalova
Department of Physiology, Biochemistry and Feeding of Animals, Federal State Budgetary Educational Establishment of Higher Education "Bashkir State Agrarian University", Russia
Email: gultsapalova11@rambler.ru

Abstract: The article presents the results of the growing broiler goslings of the Kuban breed when the probiotics Vita fort and Lactobifadol are included in the feeding diet. The periodic feeding probiotics for seven days/seven days' break was found to provide, at the age of 62 days, an increase in body weight by 10.1% ($p<0.01$) when feeding Vita fort and by 3.7% when feeding Lactobifadol. While using probiotics, protein metabolism increased in the body of broiler goslings, = and also in the digestibility of nutrients increased. Similarly, nitrogen, phosphorus, and calcium balance showed better performance in the goslings fed with Vita fort. The use of probiotics enhanced protein metabolism and improved the process of splitting and assimilation of nutrients in the current study.

Keywords: Biochemistry, Broiler Goslings, Hematology, Probiotics, Lactobifadol

Introduction

Probiotic supplements have found application in animal husbandry, due to their effectiveness on the body and growth acceleration. The universality of probiotic additives is determined by their ability to include not one, but several strains of bacteria at once. The effectiveness of their introduction into the diet of animals and poultry is ensured by their ability to be produced in different states, both in the form of a suspension and in the form of granules, and even in the form of a paste. They do not represent the normalized components of the diet, according to the main nutrients, but are additives to the main diet of animals and poultry. The activity of bacteria that form the basis of a probiotic feed additive can significantly increase the use of feed, including the breakdown and absorption of nutrients by the animal's body (Bajagai *et al*., 2016; Fuller, 1999; Lei *et al*., 2015; Zhang and Kim, 2014).

It should be assumed that the inclusion of probiotic additives in the diet may ultimately have a positive effect on the quantitative and qualitative indicators of products obtained from animals (Ventsova and Safonov, 2021). One of their important advantages is the absence of clinical side effects (Chiofalo *et al*., 2004; Dalloul and Lillehoj, 2005; Rezende *et al*., 2012; Musa *et al*., 2009; Torres-Rodriguez *et al*., 2007; Samli *et al*., 2007).

Mountzouris *et al*. (2007) studied the effectiveness of a probiotic supplement containing two strains of the genus *Lactobacillus* and one strain of *Bifidobacterium*, *Enterococcus*, *Pediococcus*, compared with a biologically active agent containing Avilamycin. The data obtained by the authors on a significant poultry population (400 broiler goslings) are objectively confirmed by higher indicators of daily poultry growth using an agent containing strains of the genus Lactobacillus, Bifidobacterium, Enterococcus, and Pediococcus.

In the year 1996 Haddadin and his co-workers conducted studies in broiler goslings fed with *Lactobacillus acidophilus* agent for 48 weeks. The results showed that the level of egg production and feed conversion was higher than in the group fed without the use of supplements. The analysis of the chemical composition of the egg showed a low level of cholesterol in the yolk of eggs that received a probiotic supplement with food. The authors suggested that this circumstance may be a consequence of a lower cholesterol level in the blood serum of the studied bird (Haddadin *et al*., 1996; Kurtoglu *et al*., 2004; Van Immerseel *et al*., 2006).

It is well known about the restrictions imposed in different countries on the use of antibiotics in the rearing of young animals. The biotechnological industry of Russia has made a great contribution to the development of innovative feed additives based on bacteria. New probiotic additives have been developed and successfully tested in animal husbandry and poultry farming at biotechnological enterprises in Russia. Thus, the new generation probiotic Vita fort contains live spores and *Bacillus subtilis* cells, while having an antibacterial and immunosuppressive effect.

When ingested with water or food, bacteria multiply and are exuded into the digestive tract with the help of enzymes (proteases, amylases, etc.). It is necessary to stimulate growth, improve digestion, restore intestinal microflora, and is an antagonist of pathogenic and opportunistic microorganisms (*staphylococci, streptococci, salmonella, yeast fungi, proteus*) due to the production of antibiotics and the ability to acidify the environment; the production of enzymes that remove food putrefactive decomposition of tissues; synthesis of several amino acids, vitamins and trace elements (Simon *et al*., 2005; Stern *et al*., 2001).

The probiotic drug Lactobifadol (*L. Acidophilus, B. Adolescentis*) is also characterized by pronounced antibacterial properties. The use of Lactobifadol in poultry feeding helps to increase productivity and improve the assimilation of feed due to the formation of vitamins, enzymes, and organic acids in the intestines of poultry by lactobacilli and bifidobacteria, while they are resistant to antibiotics.

Based on the above facts, the use of the latest probiotic additives is of great importance, since the possibility of obtaining high-quality, environmentally friendly products increases, the risk of infection of poultry with infectious diseases decreases, feed costs decrease, and live weight gain increases.

The Aim of the Research

The research aimed to study the effect of probiotic supplements Vita fort and Lactobifadol, in the diet, on hematological, biochemical, and microbiological parameters. In addition, on the digestibility of feed and the balance of nutrients, as well as on the dynamics of live weight gain of Kuban breed broiler goslings, to determine the effectiveness of using these probiotic supplements.

Materials and Methods

Experimental Design

A complex of studies was carried out on broiler goslings of the Kuban breed. The research site was the young stock rearing in the conditions of industrial rearing of the scientific center for poultry breeding LLC "Bashkirskaya ptitsa" of the Republic of Bashkortostan, Russia. At one day of age, three groups were formed by the analog pairing method: A control group and two experimental groups, 30 goslings-broilers in each. The studies were carried out over a 9-week rearing cycle for broiler goslings.

Goslings-broilers of the control group were given the basic feeding diet. Goose broilers of the 1st experimental group, along with the main diet, were injected with the probiotic Vita fort at a dose of 0.05 mg per 10 kg of live weight for 7 days and then a 7-day break throughout the study. Goose broilers of the II experimental group along with the main diet were given the probiotic Lactobifadol at a dose of 0.2 g per 1 kg of live weight according to a similar scheme with the I experimental group.

Vita fort probiotic was developed by LLC SPA Biofort and includes spore-forming bacteria Bacillus subtilis strain 11B. Probiotic Lactobifadol (LLC Biotech company "Component") contains live lactobacilli *L. acidophilus* (at least 1 million/g) and *bifidobacteria B. adolescentis* (at least 80 million/g).

Feeding Goslings Broilers

Feeding goslings broilers up to 14 days of age was carried out with complete feed, with the following quality indicators per 100 g of feed: Metabolizable energy -282 kcal, raw protein -21.0%, raw fiber -5%, lysine -1.22%, methionine - 0.55%, methionine + cystine -0.91%, threonine -0.73%, tryptophan -0.26%, calcium -1.22%, phosphorus -0.8%. Further feeding from 14 days to 63 days of age was carried out with a complete feed, with the following quality indicators: Metabolic energy -306 kcal, raw protein -19.50%, raw fiber -4.5%, lysine -1.17%, methionine -0.57%, methionine + cystine -0.9%, threonine -0.8%, tryptophan - 0.24%, calcium -0.8%, assimilable phosphorus -0.4%.

Animal Housing and Management

The keeping of broiler goslings was made on a dry and clean bed of straw with a depth of 9 cm. At the same time, the density of placement of young stock was observed at the rate of 8 goslings per 1 square meter. The temperature regime was 28-30°C for the first two days of growing, in the next five days it was 26-28°C, in the second week of growing - 22-26°C, in the third week of growing - 18-22°C, then to the end of growing within the range of 16-18°C. The light regime was provided with an average intensity throughout the entire day in the first week of growing and further decreased by 4°C weekly, reaching 14 h from the 5th to the 9th week of growing.

Experimental Procedures

The growth of broiler goslings was monitored by weighing them every 10 days on a CAS SW-02 electronic scale.

The balance of nutrients and the digestibility of feed were determined by carrying out balance experiments according to the method of O.I. and following the Methodological Guidelines for conducting scientific research on feeding poultry.

At 62 days of age, 5 groups of broiler goslings were used. Broiler goslings were kept in individual cages with a metal bottom to collect poultry manure. The droppings for research were collected in the morning and the evening weighed and preserved with a 0.1 N solution of oxalic acid (2 mL per 50 g of droppings) to bind ammonia. The droppings, chemical composition, and nutritional value of the feed were determined by the method of zootechnical analysis. The total moisture was determined by drying at 65°C, dry matter, drying at 105°C, raw protein by wet ashing, raw fiber by the method of Henneberg and Stoman, raw ash by the method of combustion, calcium was determined by the complexometric method, phosphorus was determined by the vanadomolybdate method.

Blood Sampling and Laboratory Analyses

Blood samples were taken from the axillary vein every 10 days. The analysis of biochemical parameters of blood serum (total protein, albumin, calcium, phosphorus, glucose).

Heparin was used as an anticoagulant. Plasma samples were obtained by centrifugation at 2000 rpm for 10 min. The samples were transported to a laboratory in a thermal insulation bag (24–26°C) within 2–2.5 h after taking and examining them on the same day. The transforming solution was composed of K3 Fe (CN)6, 200 mg; KSN, 50 mg; and KH2 PO4; 140 mg. Plasma samples were analyzed using analytical kits (STAT FAX® 3300, USA), according to the manufacturer's instructions (Vital Diagnostics; Vital Development Corporation, Russia). The total protein and albumin content of the blood serum was evaluated according to the manufacturer's instructions (Vital Diagnostics). The glucose concentration was determined using the enzymatic colorimetric method with a Glucose-VITAL diagnostic kit (Vital Diagnostics) and a biochemical analyzer (STAT FAX® 3300). When β-D-glucose is oxidized by atmospheric oxygen under the action of glucose oxidase, an equimolar amount of hydrogen peroxide is formed. Hydrogen peroxide oxidizes chromogenic substrates to form a colored product.

Unified colorimetric method. The Ca concentration in the blood serum was determined using the unified colorimetric method with a Calcium-VITAL diagnostic kit (Vital Development Corporation) and a biochemical analyzer (STAT FAX® 3300). Ca forms a colored complex with an o-cresol-phthalein complex in an alkaline medium.

Molybdate method. The inorganic P concentration in the blood serum was determined using the molybdenum method (ammonium molybdate is a reagent) using a Phosphorus-VITAL diagnostic kit (Vital Development Corporation) and a biochemical analyzer (STAT FAX® 3300). In this method, inorganic P interacts with ammonium and forms a phosphomolybdate complex in a sulfuric acid solution.

Analysis of Blood Morphological Parameters

The hemoglobin concentration was determined using a unified hemoglobin cyanide method. Approximately 20 mL of blood was added to 5 mL of the transforming solution, thoroughly mixed, and left for 10 min. The optical density of the experimental sample was measured using an analyzer (STAT FAX® 3300). The total number of leukocytes and erythrocytes was calculated by hemocytometry using Natt and Herrick blood cell dilution fluid. Leukocytes from thin smears were counted using the Leishman staining technique in a Goryaev chamber.

Statistical Analysis

Statistical analysis was performed using Statistic a 10 (Stat soft Inc., USA). Quantitative data were presented as the arithmetic mean and standard error (M ± m). Differences between groups were determined using the student’s t-test and were considered statistically significant at $p<0.05$.

Results and Discussion

Studies show that the inclusion of the studied probiotics in the diet of gosling broilers had a positive effect on the dynamics of live weight gain (Table 1).

The analysis of the young geese's growth in the experimental groups shows no significant differences in their weight, compared with an intact bird, until the 30-day age of the bird. Each decade of weighing indicated an excess in weight of the experimental bird that received the Vita fort probiotic with the main diet: At the age of 10 days by 9.1%, at the age of 20 days by 7.1%. Broiler goslings fed with the probiotic Lactobifadol outweighed the control bird by 5.8% at the age of 10 days and by 1.5% at the age of 20 days.

The situation underwent significant changes at the 30-day age of the bird when broiler goslings of the experimental groups significantly exceeded the weight of the control bird by 9.9% ($p<0.05$) when introducing Vitafort into the diet and by 8.7% ($p<0.05$) when using Lactobifadol. This trend continued and intensified at the age of 40 days. The difference in weight was also significant, with excess in weight in the experimental I group by 11.2% ($p<0.01$) and by 8.6% ($p<0.05$) in the II experimental group. At the age of 50 days, the nature of the excess weight of the experimental bird was preserved compared with the control one. Broiler goslings of the I experimental group had a mass of 12.0% ($p<0.01$) more and the II experimental group had 9.0% ($p<0.05$) more than in the intact group of goslings. At the age of 62 days, only broiler goslings of the II experimental group receiving the probiotic Vitafort significantly exceeded the control bird by 10.1% ($p<0.01$) in weight. In this case, the growth-stimulating effect of the Vitafort probiotic use is shown after the 20-day age of the bird and until the end of growing. The situation is similar for the use of Lactobifadol, but when it is used up to the 50-day age of broiler goslings.

Special attention should be paid to research on protein nutrition since this is the main factor limiting productivity. Proteins make up the structural and functional basis of any living organism. All the main displays of life are related to the function of proteins: The ability to grow, develop, multiply, actively regulate their composition and functions, adapt to the environment, digest, and excretion of the final products of metabolism. We assessed the changes in the picture of blood biochemical parameters, the data on which are presented in Table 2.

The analysis of the data presented in the table makes it possible to judge a certain effect of the introduction of the probiotic into the body of broiler goslings on the quantitative parameters of the blood serum protein of experimental goslings. When probiotics were introduced into the blood serum of broiler goslings treated with Vita fort at the age of 20 days, the total protein content tended to increase by 26.8%, while in the II experimental group it was 27.9%. At the age of 30 days, broiler goslings of the I experimental group outclassed their herd mates of the control group by 19.3% in terms of total protein (p 0.05), broiler goslings of the II experimental group-by 17.1%. This trend continued at the 40-day age of the bird, when the broiler goslings receiving Vita fort were 13.2% ($p<0.05$) superior to the control bird, while the broiler goslings of the II experimental group were characterized by a tendency to exceed by 4.2%. At the age of 50 days, the difference in the values of the control and experimental groups was almost leveled. At the age of 62 days, only broiler goslings receiving Vita fort had a difference in weight with the control bird of 15.2% ($p<0.05$) and those receiving Lactobifadol tended to exceed by 9.7%.

According to the albumin content in the blood serum, data were obtained indicating a significant increase in its amount in 30-day-old broiler goslings, by 7.1% ($p<0.001$) in the I experimental group and by 4.7% ($p<0.001$) in the II experimental group of poultry.

Age-related dynamics of glucose content in blood serum (Table 3) shows that during the first month of growing, no significant changes in its level were observed in all experimental groups of broiler goslings. However, starting from the 40-day age of the bird, a significant increase in glucose levels was found by 18.2% ($p<0.001$) in the I experimental group and by 6.0% ($p<0.01$) in the II experimental group of goslings. This trend continued at the age of 50 days when the excess glucose levels in the experimental groups were 17.0% ($p<0.001$) and 5.2% ($p<0.001$), respectively. At the age of 62 days in the I experimental group, the differences with the control were 13.2% ($p<0.001$), and in the II experimental group -1.6%. (Khabirov *et al*., 2020, 2021, 2022).

Perhaps this is because the probiotic Vita fort allows better splitting of feed, as a result of which they are better absorbed in the gastrointestinal tract, including in the form of glucose, which is used for the formation of energy necessary for the growth and maintenance of physiological processes in the body of young poultry.

The introduction of probiotic supplements with the main diet had a positive effect on the level of calcium in the blood serum of broiler goslings at the age of 20 days, when it was found to exceed it compared with the control one in the I experimental group by 55.5% ($p<0.01$) and by 51.9% ($p<0.05$) in the II experimental group. At the age of 30 days in the I experimental group, its level continued to exceed the value of the control bird by 59.8% ($p<0.001$). However, at the age of 62 days in both experimental groups of broiler goslings, its level significantly fell below the level of the control group by 50.5% ($p<0.01$) in the I experimental group and by 73.3% ($p<0.001$) in the II experimental group of broiler goslings. The phosphorus content in the blood serum had a significant difference only at the age of 40 days in broiler goslings of the I experimental group, exceeding the control value by 27.4% ($p<0.05$).

It is obvious that the probiotic supplements Vita fort and Lactobifadol fed to broiler geese of experimental groups, affect the efficiency of splitting and assimilation of feed components, the data on which are presented in Table 4 and 5.

The analysis of the obtained data gives the reason to assume the bacteria included in the probiotics, in the course of their vital activity in the conditions of the gastrointestinal tract of broiler geese, affect the breakdown and assimilation of nutrients to a certain extent.

According to the results of our research, a significant effect on the increase in the digestibility of raw protein in the group of broiler goslings of the I experimental group receiving the probiotic Vita fort was confirmed, which was 87.5%, which is 3.8% higher relative to the value of the control group ($p<0.05$), while in the II experimental group of broiler goslings, this value tended to increase by 1.1% compared to the control one.

According to the digestibility of NFES, broiler goslings of the I experimental group exceeded the control bird by 4.5% ($p<0.05$), and the II experimental group by 2.4%.

In general, according to all the studied indicators, there was a steady tendency to increase the digestibility of nutrients in groups of broiler goslings receiving probiotic supplements.

The obtained data (Table 5) give the reason to believe the best nitrogen balance indicators were established in the I experimental group of broiler goslings, in which 43.2% of the total amount of nitrogen taken together with the feed was deposited in the body. According to the control group, this indicator was 9.4% higher, while the same indicator in the second experimental group of broiler goslings was only 3.3%. A similar situation was noted in the experimental groups of broiler goslings and the calcium balance. We found that 58.4% of the calcium taken with the feed was deposited in the body of broiler goslings of the I experimental group, while in the II experimental group this indicator was 56.1%. The compared indicators of the experimental groups exceeded the value of the control bird by 9.0 and 4.7%, respectively. The phosphorus balance showed it had relatively better indicators in the experimental groups compared with the control one. They exceeded the value of the control bird by 7.4% (I experimental) and 4.3% (II experimental), respectively.

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Correlation analysis provides valuable information about the effect of probiotic supplements on the internal environment of the body. In absolutely all the studied groups, a strong positive relationship was noted between the average daily increase in the level of red blood cells (0.82-0.98) and the amount of *hemoglobin* in red blood cells (0.72–0.98). A positive relationship was established between the concentration of *hemoglobin* and albumin, gamma globulins, lactic acid *Streptococcus*, and *Clostridium*, absolutely in all the studied groups. The average positive correlation of the albumin index with the quantitative content of lactobacilli in the intact group was established, while in the I experimental and II experimental groups, the correlation between these indicators is negative (-0.47) and (-0.55), respectively. The relationship of such parameters as albumins and bifidobacteria is moderately positive in goslings of the first experimental group (Vita fort) (0.33), while in goslings of the control group this relationship is negative (-0.32), the same indicator in goslings of the second experimental group was (-0.94).

Normalization of physiological processes in the body of goslings under the influence of probiotic supplements affected their growth and development. Even though at the daily age the live weight of goslings in the experimental groups is the same, under the influence of probiotic supplements, the growth rate in the experimental groups was higher than in the control ones. (Andreeva *et al*., 2021; Chateau *et al*., 1993).

Proteins make up the structural and functional basis of any living organism. All the main displays of life are related to the function of proteins: The ability to grow, develop, multiply, actively regulate their composition and functions, adapt to the environment, digest, and excretion of the final products of metabolism. The analysis of the data presented in the table makes it possible to judge a certain effect of the introduction of the probiotic into the body of broiler goslings on the quantitative parameters of the blood serum protein of experimental goslings.

The increase in glucose levels in the second experimental group (Table 3) may be because the probiotic Vita fort allows better splitting of feed, as a result of which they are better absorbed in the gastrointestinal tract, including in the form of glucose, which is used to generate the energy necessary for growth and maintenance of physiological processes in the body of young poultry (Chiofalo *et al*., 2004; Corr *et al*., 2007; Mountzouris *et al*., 2007).

The analysis of Tables 4 and 5 gives the reason to assume the bacteria included in the probiotics, in the course of their vital activity in the conditions of the gastrointestinal tract of broiler geese, affect the breakdown and assimilation of nutrients to a certain extent (Khabirov *et al*., 2020).

Table 1: Growth rates of gosling broilers

Age, days	Group	Live weight, g	Average daily gain, g
1 day	Control	94.6±02.77	
	Experimental I	94.0±02.89	
	Experimental II	95.9±02.19	
10 days	Control	413.4±12.6	31.8
	Experimental I	450.7±22.4	35.6
	Experimental II	437.1±12.2	34.1
20 days	Control	835.2±32.7	42.2
	Experimental I	894.4±33.4	44.4
	Experimental II	847.2±29.7	43.7
30 days	Control	1526.4±55.7	69,1
	Experimental I	1677.3±46.8*	78.3
	Experimental II	1659.1±37.9*	81.2
40 days	Control	2120.5±61.4	44.3
	Experimental I	2356.4±58.7**	67.9
	Experimental II	2301.4±68.4*	64.2
50 days	Control	2415.6±81.3	29.5
	Experimental I	2703.4±62.4**	34.7
	Experimental II	2632.3±68.4*	33.1
62 days	Control	2803.2±71.3	38.8
	Experimental I	3085.4±78.8**	38.2
	Experimental II	2906.6±92.6	27.4

Here and further, the difference is valid for: * – p0.05; ** – p0.01; *** – p 0.001

Table 2: Protein parameters of blood serum

	Group		
Indicator	Control	Experimental I	Experimental II
Age - 10 days			
Total protein, g/l	41.46±5.20	40.95±4.12	42.03±5.82
Albumin, %	53.10±1.24	54.50±0.96	54.30±0.57
Age - 20 days			
Total protein, g/l	46.40±5.51	58.80±4.46	59.33±5.60
Albumin, %	57.78±1.25	58.33±0.96	57.95±0.43
Age - 30 days			
Total protein, g/l	47.22±1.84	56.32±2.65*	55.28±2.22*
Albumin, %	61.44±0.54	65.80±0.53***	64.30±0.45***
Age - 40 days			
Total protein, g/l	39.08±1.31	44.24±1.85*	40.70±1.17
Albumin, %	50.86±0.78	53.42±0.62*	51.60±1.37
Age - 50 days			
Total protein, g/l	44.06±1.51	45.98±1.23	44.76±1.80
Albumin, %	59.90±1.64	61.24±1.03	59.54±1.42
Age-62 days			
Total protein, g/l	39.95±0.95	46.01±2.10*	43.82±2.60
Albumin, %	58.42±0.62	58.66±0.71	59.46±0.90

Table 3: Biochemical parameters of blood serum

	Group		
Indicator	Control	Experimental I	Experimental II
Age - 10 days			
Calcium, mmol/l	1.58±0.68	2.10±0.28	1.94±0.54
Phosphorus, mmol/l	1.45±0.15	1.58±0.13	1.48±0.11
Glucose, mmol/l	6.42±0.12	6.48±0.09	6.35±0.06
Age - 20 days			
Calcium, mmol/l	1.93±0.35	3.00±0.44**	2.93±0.69*
Phosphorus, mmol/l	1.53±0.21	1.88±0.19	1.58±0.14
Glucose, mmol/l	6.95±0.32	6.87±0.10	6.72±0.05
Age - 30 days			
Calcium, mmol/l	4.92±0.49	7.86±0.33***	4.80±0.48
Phosphorus, mmol/l	4.18±0.29	4.40±0.58	4.12±0.17
Glucose, mmol/l	5.54±0.67	6.91±0.84	6.22±0.56
Age - 40 days			
Calcium, mmol/l	3.46±0.41	3.52±0.75	2.74±0.45
Phosphorus, mmol/l	2.34±0.21	2.98±0.15*	2.10±0.14
Glucose, mmol/l	6.05±0.07	7.15±0.10***	6.41±0.08**
Age - 50 days			
Calcium, mmol/l	4.62±0.36	4.84±0.41	4.50±0.23
Phosphorus, mmol/l	3.44±1.20	3.68±0.45	2.50±0.24
Glucose, mmol/l	6.18±0.06	7.23±0.09***	6.50±0.04***
Age-62 days			
Calcium, mmol/l	6.86±0.49	4.56±0.58**	3.96±0.32***
Phosphorus, mmol/l	4.82±0.33	4.58±0.55	3.48±0.56
Glucose, mmol/l	6.60±0.06	7.47±0.14***	6.70±0.11

Table 4: Coefficients of digestibility of nutrients, % (M ± m, n = 5)

	Group		
Indicator	Control	Experimental I	Experimental II
Dry matter	72.4±1.22	74.4±1.30	73.0±1.13
Organic matter	75.2±1.16	78.6±1.24	77.8±1.10
Raw protein	84.3±0.86	87.5±0.90*	85.2±0.77
Raw fat	83.8±0.74	86.0±0.93	85.4±0.81
Raw fiber	21.0±1.65	27.3±2.60	25.7±2.05
Nitrogen-free extractive substances	72.4±0.85	75.6±0.94*	74.1±0.68

Table 5: Nitrogen, calcium, and phosphorus balance

	Group		
Indicator	Control	Experimental I	Experimental II
Nitrogen			
Taken with food, g	8.19±0.76	8.79±0.61	8.42±0.42
Excreted with droppings, g	4.95±0.12	4.99±0.17	4.98±0.15
Deposited in the body, g	3.24±0.31	3.80±0.18	3.44±0.20
% of taken	39.50	43.20	40.80
Calcium			
Taken with food, g	3.65±0.34	3.92±0.27	3.75±0.19
Excreted with droppings, g	1.69±0.17	1.63±0.14	1.64±0.16
Deposited in the body, g	1.96±0.21	2.29±0.11	2.11±0.19
% of taken	53.60	58.40	56.10
Phosphorus			
Taken with food, g	1.83±0.17	1.96±0.14	1.88±0.09
Excreted with droppings, g	0.93±0.08	0.92±0.06	0.91±0.06
Deposited in the body, g	0.90±0.09	1.04±0.09	0.97±0.08
% of taken	49.20	52.80	51.30

Conclusion

During the research work, it was revealed that the introduction of probiotics into the main diet of broiler goslings has a positive effect on their growth intensity, there is an increase in the amount of total protein in the experimental groups, which indicates a better digestibility of feed protein. The glucose content was found to increase in all experimental groups, this is due to a better breakdown of fiber in the digestive tract. Taking into account the above mentioned, the use of probiotics Vita fort and Lactobifadol in the growing of goslings is advisable from 20 to 62 days of age. The use of probiotics enhanced protein metabolism in the body and improved the process of splitting and assimilation of nutrients. Thus, the study indicated that the use of probiotics Vita fort and Lactobifadol is beneficial in the growing goslings between 20 to 62 days of age.

Limitations

For the study, goslings were used from the age of one day to 62 days because the technological period of cultivation ends, and the period of molting begins in the bird.

Live weight indicators and biochemical blood parameters were examined, strictly after ten days, up to 62 days of age.

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Author’s Contributions

Gulnara Tsapalova: Conceived and designed the analysis; collected the data; performed the analysis; wrote the paper.

Ayrat Khabirov: Conceived and designed the analysis; contributed data or analysis tools; wrote the paper.

Ruzil Avzalov: Collected the data; contributed data in analysis; performed the analysis.

Zuleykha Ilyasova: Conceived and designed the analysis; performed the analysis; wrote the paper.

Liliia Sataeva: Contributed in data analysis; performed the analysis; wrote the paper.

Fatyma Gafarova: Contributed and designed the analysis; collected the data; contributed data in analysis.

Ethics

The authors declare that the work is written with due consideration of ethical standards. The study was conducted per the ethical principles approved by the Ethics Committee of Federal State Budgetary Educational Establishment of Higher Education "Bashkir State Agrarian University".

References

Andreeva, A. V., Khakimova, A. Z., Ivanov, A. I., Nikolaeva, O. N., & Altynbekov, O. M. (2021). Immunomodulatory effect of the combined use of Vetosporin Zh probiotic and Gumi-malysh biologically active additive. *Veterinary World*, *14*(7), 1915. https://doi.org/10.14202/vetworld.2021.1915-1921

Bajagai, Y. S., Klieve, A. V., Dart, P. J., & Bryden, W. L. (2016). *Probiotics in animal nutrition: Production, impact, and regulation*. FAO. https://agris.fao.org/agris-search/search.do?recordID=XF2017001765

Chateau, N., Castellanos, I., & Deschamps, A. M. (1993). Distribution of pathogen inhibition in the Lactobacillus isolates of a commercial probiotic consortium. *Journal of Applied Bacteriology*, *74*(1), 36-40. https://doi.org/10.1111/j.1365-2672.1993.tb02993.x

Chiofalo, V., Liotta, L., & Chiofalo, B. (2004). Effects of the administration of Lactobacilli on body growth and the metabolic profile in growing Maltese goat kids. *Reproduction Nutrition Development, 44*(5), 449-457. https://doi.org/10.1051/rnd:2004051

Corr, S. C., Li, Y., Riedel, C. U., O'Toole, P. W., Hill, C., & Gahan, C. G. (2007). Bacteriocin production as a mechanism for the antiinfective activity of Lactobacillus salivarius UCC118. *Proceedings of the National Academy of Sciences*, *104*(18), 7617-7621. https://doi.org/10.1073/pnas.0700440104

Dalloul, R. A., & Lillehoj, H. S. (2005). Recent advances in immunomodulation and vaccination strategies against coccidiosis. *Avian diseases*, *49*(1), 1-8. https://doi.org/10.1637/7306-11150R

Fuller, R. (1999). Probiotics for farm animals. *Probiotics: A critical review.*, 15-22. https://www.cabdirect.org/cabdirect/abstract/19991401381

Haddadin, M. S. Y., Abdulrahim, S. M., Hashlamoun, E. A. R., & Robinson, R. K. (1996). The effect of Lactobacillus acidophilus on the production and chemical composition of hen's eggs. *Poultry Science*, *75*(4), 491-494. https://doi.org/10.1051/rnd:2004051

Khabirov, A. F., Samorodova, I. M., Kuznetsov, A. I., Lykasova, I. A., Fedoseeva, N. A., Derkho, M. A., ... & Rebezov, Y. M. (2020). Effect of Feeding Diet Containing Probiotics on Growth Rate and Hematological Changes in the Blood of Turkeys. *International Journal of Pharmaceutical Research*, *12*(1), 1454-1458. https://elibrary.ru/item.asp?id=43097775

Khabirov, A., Avzalov, R., Tsapalova, G. andreeva, A., & Basharov, A. (2022). Effect of a probiotic containing lactobacilli and bifidobacteria on the metabolic processes, litter microbiocenosis and production indicators of broiler Pekin ducklings. *Veterinary World*, *15*(4). https://doi.org/10.14202/vetworld.2022.998-1005

Khabirov, A., Khaziakhmetov, F., Kuznetsov, V., Tagirov, H., Rebezov, M. andreyeva, A., ... & Ayaz, M. (2021). Effect of normosil probiotic supplementation on the growth performance and blood parameters of broiler chickens. *Indian J of Pharmaceutical Education and Research*, *55*(1). https://doi.org/10.5530/ijper.54.4.199

Kurtoglu, V., Kurtoglu, F., Seker, E., Coskun, B., Balevi, T., & Polat, E. S. (2004). Effect of probiotic supplementation on laying hen diets on yield performance and serum and egg yolk cholesterol. *Food Additives and Contaminants*, *21*(9), 817-823. https://doi.org/10.1080/02652030310001639530

Lei, X., Piao, X., Ru, Y., Zhang, H., Péron, A., & Zhang, H. (2015). Effect of Bacillus amyloliquefaciens-based direct-fed microbial on performance, nutrient utilization, intestinal morphology and cecal microflora in broiler chickens. *Asian-Australasian Journal of Animal Sciences*, *28*(2), 239. https://doi.org/10.5713/ajas.14.0330

Mountzouris, K. C., Tsirtsikos, P., Kalamara, E., Nitsch, S., Schatzmayr, G., & Fegeros, K. (2007). Evaluation of the efficacy of a probiotic containing Lactobacillus, Bifidobacterium, Enterococcus, and Pediococcus strains in promoting broiler performance and modulating cecal microflora composition and metabolic activities. *Poultry Science*, *86*(2), 309-317. https://doi.org/10.1093/ps/86.2.309

Musa, H. H., Wu, S. L., Zhu, C. H., Seri, H. I., & Zhu, G. Q. (2009). The potential benefits of probiotics in animal production and health. *J. anim. vet. adv*, *8*(2), 313-321.

Rezende, A. S. C. D., Trigo, P., Lana, Â. M. Q., Santiago, J. M., Silva, V. P., & Montijano, F. C. (2012). Yeast as a feed additive for training horses. *Ciência e Agrotecnologia*, *36*, 354-362. https://www.scielo.br/j/cagro/a/tPBx6znVdtCMr6Z44VNfcDd/abstract/?lang=en

Samli, H. E., Senkoylu, N., Koc, F., Kanter, M., & Agma, A. (2007). Effects of Enterococcus faecium and dried whey on broiler performance, gut histomorphology and intestinal microbiota. *Archives of Animal Nutrition*, *61*(1), 42-49. https://doi.org/10.1080/17450390601106655

Simon, O., Vahjen, W., & Scharek, L. (2005). Micro-organisms as feed additives-probiotics. *Advances in pork Production*, *16*(2), 161.

Stern, N. J., Cox, N. A., Bailey, J. S., Berrang, M. E., & Musgrove, M. T. (2001). Comparison of mucosal competitive exclusion and competitive exclusion treatment to reduce Salmonella and Campylobacter spp. colonization in broiler chickens. *Poultry Science*, *80*(2), 156-160. https://doi.org/10.1093/ps/80.2.156

Torres-Rodriguez, A., Donoghue, A. M., Donoghue, D. J., Barton, J. T., Tellez, G., & Hargis, B. M. (2007). Performance and condemnation rate analysis of commercial turkey flocks treated with a Lactobacillus spp.-based probiotic. *Poultry Science*, *86*(3), 444-446. https://doi.org/10.1093/ps/86.3.444

Van Immerseel, F., Russell, J. B., Flythe, M. D., Gantois, I., Timbermont, L., Pasmans, F., ... & Ducatelle, R. (2006). The use of organic acids to combat Salmonella in poultry: A mechanistic explanation of the efficacy. *Avian Pathology*, *35*(3), 182-188. https://doi.org/10.1080/03079450600711045

Ventsova, I., & Safonov, V. (2021). The role of oxidative stress during pregnancy on obstetric pathology development in high-yielding dairy cows American *Journal of Animal and Veterinary Sciences*, 2021, 16(1), 7–14, https://doi.org/10.3844/ajavsp.2021.7.14

Zhang, Z. F., & Kim, I. H. (2014). Effects of multistrain probiotics on growth performance, apparent ileal nutrient digestibility, blood characteristics, cecal microbial shedding, and excreta odor contents in broilers. *Poultry Science*, *93*(2), 364-370. https://doi.org/10.3382/ps.2013-03314