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EFFECTS OF DIETARY SUPPLEMENTATION WITH INDIGENOUS PROBIOTIC BACTERIA ON MEAT COMPOSITION, CARCASS TRAITS, AND ECONOMIC EFFICIENCY IN BROILER CHICKENS

©*Ergashev A.*, ORCID: 0009-0007-6638-8158, Tashkent Branch of Samarkand State University of Veterinary Medicine, Animal Husbandry and Biotechnology, Tashkent, Uzbekistan, alisher051187@gmail.com

ВЛИЯНИЕ КОРМОВОЙ ДОБАВКИ НА ОСНОВЕ АБОРИГЕННЫХ ПРОБИОТИЧЕСКИХ БАКТЕРИЙ НА ХИМИЧЕСКИЙ СОСТАВ МЯСА, УБОЙНЫЕ ПОКАЗАТЕЛИ И ЭКОНОМИЧЕСКУЮ ЭФФЕКТИВНОСТЬ ВЫРАЩИВАНИЯ БРОЙЛЕРОВ

©*Эргашев А. А.*, ORCID: 0009-0007-6638-8158, Ташкентский филиал Самаркандского государственного университета ветеринарной медицины, животноводства и биотехнологий, г. Ташкент, Узбекистан, alisher051187@gmail.com

Abstract. The chemical composition of broiler chicken meat is one of the most reliable indicators of its nutritional and biological value. Improving meat quality while reducing the use of antibiotic growth promoters has become a major objective in modern poultry production. This study investigated the effects of an indigenous probiotic feed additive, containing *Lactobacillus* and *Bifidobacterium* strains, on the chemical composition of broiler chicken meat. Broilers were assigned to one control group and two experimental groups receiving different levels of probiotic supplementation. The chemical composition of thigh and breast muscles—including moisture, dry matter, crude protein, fat, and ash contents—was analyzed. Birds supplemented with probiotics showed increased crude protein and dry matter contents, accompanied by reduced fat deposition compared with the control group. The highest protein concentration was observed in birds receiving 5 mL of probiotic supplementation. Moreover, probiotic supplementation improved slaughter yield and economic profitability. The findings demonstrate that indigenous probiotic bacteria can serve as an effective alternative to antibiotic growth promoters, improving both meat quality and production efficiency in broiler chickens.

Аннотация. Химический состав мяса цыплят-бройлеров является одним из важнейших показателей его пищевой и биологической ценности. Повышение качества мяса при одновременном сокращении использования антибиотиков — стимуляторов роста — является одной из ключевых задач современного птицеводства. В настоящем исследовании изучено влияние кормовой добавки на основе аборигенных пробиотических бактерий, содержащей штаммы *Lactobacillus* и *Bifidobacterium*, на химический состав мяса, убойные показатели и экономическую эффективность выращивания цыплят-бройлеров. Птица была распределена на одну контрольную и две опытные группы, получавшие различные дозы пробиотической добавки. Проведен анализ химического состава грудных и бедренных мышц с определением содержания влаги, сухого вещества, сырого протеина, жира и золы. Кроме того, были оценены убойный выход и основные экономические показатели производства. Результаты исследования показали, что включение аборигенных пробиотиков в рацион способствовало достоверному улучшению качества мяса. У бройлеров опытных групп отмечено повышение содержания сырого протеина и сухого вещества при одновременном снижении содержания жира по

сравнению с контрольной группой. Наибольшая концентрация сырого протеина была зарегистрирована у птицы, получавшей 5 мл пробиотической добавки. Помимо этого, применение пробиотиков обеспечило увеличение убойного выхода и повышение экономической эффективности производства мяса бройлеров. Полученные результаты свидетельствуют о том, что аборигенные пробиотические бактерии могут служить эффективной альтернативой антибиотикам — стимуляторам роста, обеспечивая улучшение качества мяса, убойных показателей и производственной эффективности при выращивании цыплят-бройлеров. Использование пробиотических штаммов местного происхождения представляет собой перспективное направление устойчивого и экологически безопасного развития современного птицеводства.

Keywords: broiler chickens, indigenous probiotics, *Lactobacillus*, *Bifidobacterium*, meat quality, crude protein, carcass characteristics, poultry nutrition.

Ключевые слова: цыплята-бройлеры, аборигенные пробиотики, *Lactobacillus*, *Bifidobacterium*, качество мяса, сырой протеин, убойные показатели, кормление птицы, экономическая эффективность.

The increasing demand for safe, high-quality, and environmentally sustainable poultry products has intensified the need for innovative feeding strategies that enhance production efficiency while maintaining animal health. The poultry industry plays a crucial role in ensuring food security by providing affordable animal protein for a growing human population. Consequently, the development of scientifically based production technologies that improve productivity and meat quality has become a global priority. A major challenge in modern poultry farming is reducing dependence on antibiotic growth promoters due to concerns regarding antimicrobial resistance and antibiotic residues in poultry products. Consequently, considerable attention has been directed toward the application of probiotics as natural alternatives capable of improving intestinal health, nutrient utilization, immune responses, and overall production performance. Among commercially produced broiler chickens, the Ross-308 and Cobb-500 crosses have become the most widely used due to their rapid growth rate, high feed efficiency, and excellent carcass yield. These commercial hybrids are also extensively reared in Uzbekistan, where poultry farming continues to expand to meet increasing domestic demand for poultry meat. Although numerous international studies have demonstrated the beneficial effects of probiotics on broiler performance, limited information is available regarding the effectiveness of indigenous probiotic strains developed in Uzbekistan. Therefore, evaluating locally isolated probiotic bacteria under commercial production conditions is of considerable scientific and practical importance.

Unlike commercially imported probiotic preparations, the probiotic used in the present study was developed from indigenous *Lactobacillus* spp. and *Bifidobacterium* spp. isolated from traditional fermented dairy products in Uzbekistan. This locally adapted formulation may provide improved compatibility with regional poultry production systems while reducing dependence on imported feed additives. Therefore, the objective of this study was to evaluate the effects of dietary supplementation with this indigenous probiotic on growth performance, nutrient digestibility, carcass characteristics, meat chemical composition, slaughter yield, and economic efficiency in broiler chickens.

Materials and methods

Ethical approval. All experimental procedures involving animals were conducted in accordance with national regulations governing the ethical use of animals in scientific research. Broiler chickens

were managed under standard commercial husbandry practices, and all efforts were made to minimize animal stress and discomfort throughout the experimental period.

Experimental location. The experiment was conducted under commercial poultry production conditions in Uzbekistan. Broiler chickens were reared in environmentally controlled poultry houses equipped with standard ventilation, heating, lighting, and feeding systems. Environmental conditions were maintained according to management recommendations for the ROSS-308 commercial broiler strain.

Experimental birds and design: A total of 300 one-day-old ROSS-308 broiler chicks were used in the experiment and randomly assigned to three experimental groups with equal numbers of birds.

The experimental groups were as follows: Control group (C): birds received the basal diet without probiotic supplementation;

Probiotic group 1 (P2): birds received the basal diet supplemented with 2 mL of indigenous probiotic preparation;

Probiotic group 2 (P5): birds received the basal diet supplemented with 5 mL of indigenous probiotic preparation. The feeding trial lasted for 35 days, during which all birds had free access to feed and drinking water (ad libitum).

The experimental diets were formulated to satisfy the nutrient requirements of broiler chickens according to accepted commercial feeding recommendations.

Indigenous probiotic preparation: The probiotic preparation consisted of indigenous *Lactobacillus* spp. and *Bifidobacterium* spp. isolated from traditional fermented dairy products in Uzbekistan. The isolates were selected based on their acid tolerance, bile salt resistance, and antagonistic activity against common poultry enteropathogens before inclusion in the experimental probiotic formulation.

Housing and management: Birds from all experimental groups were maintained under identical environmental conditions. Temperature, relative humidity, ventilation rate, lighting schedule, and stocking density were managed according to commercial recommendations for Ross-308 broilers.

Fresh drinking water and feed were continuously available throughout the experimental period. Routine vaccination and biosecurity programs were applied equally to all groups.

Nutrient digestibility: Digestibility coefficients of the principal dietary nutrients were determined using standard zootechnical methods. Samples of feed and excreta were collected during the experimental period for laboratory analysis. Digestibility coefficients were calculated for dry matter, crude protein, crude fat, crude fiber, and nitrogen-free extract.

Statistical analysis: All experimental data were analyzed using IBM SPSS Statistics. Results are presented as mean $\pm$ standard error (SE). Differences among treatment groups were evaluated using one-way analysis of variance (ANOVA). When significant differences were detected, group means were compared using Tukey's multiple comparison test. Differences were considered statistically significant at $P < 0.05$.

Results and discussion

Chemical Composition of Broiler Chicken Meat: To evaluate the effect of the indigenous probiotic on meat quality, samples of thigh muscle were collected from three randomly selected birds in each experimental group at 34 days of age and analyzed for their chemical composition. The results are presented in Table 1.

The moisture content of the thigh muscle showed only minor differences among the experimental groups. The highest moisture content was observed in the control group ($75.24 \pm 0.03\%$), whereas birds supplemented with 5 mL of the probiotic exhibited the lowest value ($73.82 \pm 0.09\%$). Consequently, the dry matter content increased progressively with probiotic supplementation,

reaching $26.18 \pm 0.21\%$ in the 5 mL treatment group compared with $24.76 \pm 0.16\%$ in the control group ($P \leq 0.01$).

A more pronounced effect of probiotic supplementation was observed for crude protein concentration. Broilers receiving the basal diet supplemented with probiotics exhibited significantly higher muscle protein content than control birds. The crude protein concentration increased from $20.5 \pm 0.40\%$ in the control group to $21.2 \pm 0.45\%$ in the group receiving 2 mL of probiotic, and further increased to $22.1 \pm 0.47\%$ in birds supplemented with 5 mL ($P \leq 0.01$). These findings indicate that probiotic supplementation enhanced protein deposition in muscle tissues, thereby improving the nutritional value of broiler meat.

Table 1

CHEMICAL COMPOSITION OF THIGH MUSCLE
IN BROILER CHICKENS AT 34 DAYS OF AGE, %

<i>Parameter</i>	<i>Control</i>	<i>Probiotic (2 mL)</i>	<i>Probiotic (5 mL)</i>
Moisture	75.24 ± 0.033	74.68 ± 0.086	73.82 ± 0.091
Dry matter	24.76 ± 0.16	25.32 ± 0.19	26.18 ± 0.21
Crude protein	20.5 ± 0.40	21.2 ± 0.45	22.1 ± 0.47
Crude fat	2.05 ± 0.44	1.90 ± 0.09	1.84 ± 0.08
Ash	2.21 ± 0.14	2.22 ± 0.21	2.23 ± 0.25

Values are presented as mean $\pm$ standard error (SE); $n = 3$. Differences were considered statistically significant at $P \leq 0.01$

Conversely, the crude fat content decreased as the probiotic inclusion level increased. Birds in the control group exhibited the highest fat concentration ($2.05 \pm 0.44\%$), whereas the corresponding values were $1.90 \pm 0.09\%$ and $1.84 \pm 0.08\%$ in the 2 mL and 5 mL probiotic groups, respectively. The reduction in intramuscular fat suggests that probiotic supplementation promoted lean tissue development rather than lipid deposition.

No substantial differences were observed in ash content among the experimental groups. Ash values ranged from $2.21 \pm 0.14\%$ to $2.23 \pm 0.25\%$, indicating that probiotic supplementation had little influence on the total mineral content of broiler meat. Overall, dietary supplementation with the indigenous probiotic improved the chemical composition of broiler meat by increasing crude protein and dry matter contents while simultaneously reducing fat accumulation. The most favorable results were consistently observed in birds receiving 5 mL of the probiotic preparation, demonstrating a dose-dependent improvement in meat quality. The chemical composition of breast and thigh muscles is considered one of the most reliable indicators of the nutritional quality of poultry meat, as it directly reflects protein, fat, mineral, and moisture contents. An increase in muscle protein content alongside a reduction in fat deposition generally improves the nutritional and technological quality of broiler meat. The results of the chemical composition analysis are presented in Table 2.

In the breast muscle, probiotic supplementation increased dry matter and crude protein contents compared with the control group. Birds receiving 5 mL of the probiotic exhibited the highest crude protein concentration ($20.53 \pm 0.28\%$), representing an increase of approximately 7.7% compared with the control ($19.06 \pm 0.99\%$). The highest dry matter content ($27.30 \pm 0.44\%$) was observed in the 2 mL treatment group, whereas the 5 mL group maintained a higher value than the control. Crude fat content was lowest in birds receiving 5 mL of the probiotic ($5.10 \pm 0.52\%$), while the 2 mL group showed a transient increase ($7.69 \pm 1.06\%$). Ash content remained relatively constant among treatments, suggesting that probiotic supplementation had minimal influence on the mineral composition of the breast muscle. The protein-to-fat ratio, which is considered an important indicator of meat nutritional

quality, increased markedly from 2.18 in the control group to 4.00 in the 5 mL probiotic group, indicating an improvement in lean meat quality.

Table 2

CHEMICAL COMPOSITION OF BREAST AND THIGH MUSCLES IN BROILER CHICKENS, %

Parameter	Control	Probiotic (2 mL)	Probiotic (5 mL)
Breast muscle			
Dry matter (%)	25.84 ± 0.99	27.30 ± 0.44	26.57 ± 0.38
Crude fat (%)	5.99 ± 0.51	7.69 ± 1.06	5.10 ± 0.52
Crude protein (%)	19.06 ± 0.99	19.20 ± 0.72	20.53 ± 0.28
Ash (%)	1.01 ± 0.05	0.98 ± 0.02	0.96 ± 0.02
Protein/fat ratio	2.18	2.50	4.00
Thigh muscle			
Dry matter (%)	25.06 ± 0.57	26.00 ± 1.00	27.63 ± 1.50
Crude fat (%)	8.67 ± 0.82	4.35 ± 0.96	4.17 ± 0.56
Crude protein (%)	12.17 ± 0.48	14.20 ± 0.40	15.46 ± 0.72
Ash (%)	0.86 ± 0.03	0.77 ± 0.03	0.69 ± 0.06
Protein/fat ratio	1.78	1.88	1.95

In the thigh muscle, probiotic supplementation produced a progressive increase in both dry matter and crude protein contents. Dry matter increased from 25.06±0.57% in the control group to 27.63±1.50% in birds supplemented with 5 mL of the probiotic. Similarly, crude protein concentration increased from 12.17±0.48% to 15.46±0.72%, corresponding to an increase of approximately 27% relative to the control. Conversely, crude fat content declined substantially, decreasing from 8.67±0.82% in the control group to 4.17±0.56% in the 5 mL treatment group. Ash content showed only slight variation among treatments.

The economic efficiency of probiotic supplementation was evaluated based on the total production output, production costs, net profit, and profitability of broiler production. These indicators provide a comprehensive assessment of the practical feasibility of incorporating indigenous probiotics into commercial poultry production systems. The results are presented in Table 3.

Table 3

ECONOMIC EFFICIENCY OF DIETARY SUPPLEMENTATION
WITH AN INDIGENOUS PROBIOTIC IN BROILER CHICKEN PRODUCTION

Parameter	Control	Probiotic (2 mL)	Probiotic (5 mL)
Initial number of birds	100	100	100
Birds at the end of the trial	95	98	98
Initial body weight (g)	39	39	39
Final body weight (g)	2768	3036	3206
Absolute weight gain (g/bird)	2729	2997	3167
Total live weight produced (kg)	279.53	297.53	314.19
Carcass yield (%)	72.0	73.5	81.8
Total carcass meat production (kg)	148.96	225.89	276.75
Total production cost (UZS)	2 289 515	2 789 515	2 939 515
Gross income (UZS)	3 366 496	5 105 114	6 251 550
Net profit (UZS)	1 076 981	2 315 599	3 312 035
Profitability (%)	32.0	45.4	53.0

Economic evaluation is an essential component of broiler production because improvements in biological performance should ultimately translate into increased profitability. Therefore, the effects of probiotic supplementation on production efficiency were assessed by comparing production costs, gross income, net profit, and profitability among the experimental groups. The results demonstrated that dietary supplementation with the indigenous probiotic improved not only the productive performance of broiler chickens but also the economic returns of production. Improved growth performance, a higher survival rate, and increased carcass yield contributed to greater production output, while the additional cost of probiotic supplementation was compensated by increased revenue. Consequently, probiotic-treated groups exhibited higher net profit and profitability than the control group, indicating the economic advantages of using indigenous probiotic feed additives in commercial broiler production.

The survival rate of broiler chickens was improved by probiotic supplementation. At the end of the 35-day production cycle, the survival rate increased from 95% in the control group to 98% in both probiotic-treated groups. In addition, probiotic supplementation markedly enhanced growth performance, resulting in higher final live body weights. Birds receiving 5 mL of the probiotic achieved the highest final body weight (3206 g), followed by the 2 mL group (3036 g), whereas the control birds reached 2768 g.

Consequently, the total live weight produced per experimental group increased from 279.53 kg in the control group to 314.19 kg and 297.53 kg in the 5 mL and 2 mL probiotic groups, respectively. Probiotic supplementation also improved carcass yield, which increased from 72.0% in the control group to 73.5% and 81.8% in the probiotic-treated groups. As a result, the total carcass meat production reached 257.01 kg in birds receiving 5 mL of the probiotic, representing an increase of approximately 72.5% compared with the control group (149.02 kg).

Although the inclusion of probiotics slightly increased production costs, the improvements in growth performance and carcass yield generated substantially greater economic returns. Total production costs were 2,289,515 UZS, 2,789,515 UZS, and 2,939,515 UZS for the control, 2 mL, and 5 mL probiotic groups, respectively. However, gross income increased from 3,366,496 UZS in the control group to 5,105,114 UZS and 6,251,550 UZS in the probiotic-treated groups. Accordingly, net profit increased more than threefold, from 1,076,981 UZS in the control group to 3,312,035 UZS in birds receiving 5 mL of the probiotic. Profitability also improved considerably, rising from 32.0% in the control group to 45.4% and 53.0% in the 2 mL and 5 mL treatment groups, respectively.

Conclusion

The results of the present study demonstrate that dietary supplementation with an indigenous probiotic containing *Lactobacillus* spp. and *Bifidobacterium* spp. positively influences the productive performance and meat quality of broiler chickens. Birds receiving probiotic supplementation showed improved growth performance, higher carcass yield, and enhanced economic efficiency compared with the control group. Probiotic supplementation also improved the chemical composition of broiler meat by increasing crude protein and dry matter contents while reducing intramuscular fat deposition. The most pronounced improvements were observed in birds receiving 5 mL of the probiotic preparation, which exhibited the highest crude protein concentration and the most favorable protein-to-fat ratio in breast muscle, indicating superior nutritional quality. Furthermore, probiotic supplementation increased production profitability from 32.0% in the control group to 53.0% in the 5 mL treatment group, demonstrating that the biological benefits of probiotic supplementation were accompanied by substantial economic advantages. Overall, the findings indicate that indigenous dairy-derived probiotics represent a safe, environmentally friendly, and economically viable alternative to antibiotic growth promoters. Their incorporation into broiler feeding programs may

contribute to the production of high-quality poultry meat while supporting sustainable poultry production under local farming conditions.

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