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Research Article

Impact of Dietary Feed Additives on Productivity in Broiler Chickens

[1]Gaukhar Moldakhmetova, [1]Zhanar Kussainova, [2]Shohkan Alpeisov, [2,3]Ulzhan Nuralieva, [3]Aigul Tajiyeva, [4]Mukhtar Baibatshanov and [5]Maxat Toishimanov

[1]*Department of Pharmacology and Pathology of Animals, Faculty of Veterinary and Zooengineering, Kazakh National Agrarian Research University, Almaty, Kazakhstan*
[2]*Department of Zooengineering and Biotechnology, Faculty of Veterinary and Zooengineering, Kazakh National Agrarian Research University, Almaty, Kazakhstan*
[3]*Kazakh Scientific Research Institute of Animal Husbandry and Feed Production LLP, Almaty, Kazakhstan*
[4]*Department of Forest Resources, Game Management and Fishery, Faculty of Forestry and Land Resources, Kazakh National Agrarian Research University, Almaty, Kazakhstan*
[5]*Food and Environment Safety Laboratory, Kazakh National Agrarian Research University, Almaty, Kazakhstan*

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Corresponding Author:
Maxat Toishimanov
Food and Environment Safety Laboratory, Kazakh National Agrarian Research University, Almaty, Kazakhstan
Email: maxat.toishimanov@gmail.com

Abstract: Proper feeding is a key aspect of poultry farming; a balanced diet supports flock health, prevents infectious diseases, and enhances product quality. A relevant issue in poultry farming is the use of various probiotics and feed additives that positively impact gut health and its microbiota, which in turn promotes the growth and development of birds. In a scientific-farm experiment, the productive effects of the probiotic Acidofilin V-143 and the feed additive Suvar were compared in the diets of Cobb-500 broiler chickens. Their use in broiler feeding up to 37 days increased slaughter weight by 3.8%. Feed input norms were established, and gains in live weight and meat quality were determined, alongside new indicators for the chemical composition and nutritional value of the chicken meat. A tasting evaluation was also conducted to determine the flavor qualities of broiler meat. The application of the probiotic Acidofilin V-143 and the feed additive Suvar increased the flock's survival rate by 3.0% and 5.0%, respectively.

Keywords: Broiler, Compound Feed, Live Weight, Feed Additive, Probiotic

Introduction

Poultry farming in Kazakhstan has been steadily recovering following previous outbreaks of avian influenza. This resurgence is largely attributed to the construction of new poultry farms and the expansion of existing facilities, contributing to a stable 8.8% increase in poultry meat production. Kazakhstan's poultry sector has been undergoing rapid modernization. In recent years, poultry meat production has increased steadily due to investments in infrastructure and a shift toward industrial-scale operations (Kopylova et al., 2023). As of 2023, the poultry population reached 3.727 million heads, representing a 37% increase compared to the same period in 2022. From January to October 2023, the production of fresh or chilled poultry meat totaled 118.3 thousand tons, an increase of 26.8% compared to the previous year. Of this, 54.2 thousand tons, including broiler carcasses, turkeys, ducks, geese, and guinea fowls, showed a 37.4% increase. With the expansion of intensive production, the need for effective and residue-free performance enhancers has become especially relevant. However, research evaluating the combined application of feed additives like Suvar and probiotics such as Acidophilus B-143 in commercial settings remains limited. Previous studies have largely focused on their effects in isolation or under controlled laboratory conditions, with minimal emphasis on carcass quality indicators or holistic performance metrics (Reda et al., 2024).

In parallel with production growth, poultry nutrition strategies have evolved significantly. In recent years, modern compound feeds have increasingly incorporated probiotics and organic acids. These biologically active additives help suppress pathogenic microorganisms, enhance gut health, and stimulate metabolic processes, ultimately improving flock survivability and productivity. Probiotics and organic feed additives have gained widespread attention in poultry nutrition for their ability to improve gut health, enhance nutrient absorption, and support immune function in broilers. These compounds offer a sustainable alternative to antibiotic growth promoters, addressing concerns over

antimicrobial resistance and consumer demand for safer poultry products (Proskina et al., 2021; Kwak et al., 2024).

Broilers raised in intensive farming systems are exposed to numerous stress factors, including high stocking densities and elevated ambient temperatures. These conditions promote the proliferation of pathogenic bacteria in the gastrointestinal tract, often leading to suppressed growth and poor immune responses. The main mechanism of action of probiotics and organic feed additives lies in their ability to stabilize intestinal microflora, inhibit pathogens, and support immune modulation.

The objective of this study was to evaluate the feasibility and effectiveness of incorporating the feed additive Suvar and the probiotic Acidophilus B-143 into broiler diets. The research focused on assessing their influence on live weight gain, feed conversion, survival rate, and meat quality in Cobb-500 broilers under industrial rearing conditions.

Materials and Methods

Feeding was carried out with starter crumb compound feed (0-21 days), growth pellet feed (22-31 days), and growth crumb finishing feed (32-37 days). The experimental and control groups of birds were kept under identical conditions. Technological parameters, humidity, air speed, and lighting regime, were the same for both experimental and control groups and complied with Cobb-500 recommendations.

Samples

During the experiment, the live weight of broiler chickens was measured weekly using individual weighing. Based on these data, the average daily weight gain was calculated for each group over the rearing period. The uniformity of growth within each group was assessed using the coefficient of variation (CV%), which represents the standard deviation of live weight as a percentage of the group mean. This indicator was used to evaluate the consistency of growth and flock performance.

The safety (survival rate) of broiler chickens was monitored daily by recording mortalities and culls. Feed consumption was tracked to calculate the feed cost per kilogram of live weight gain. At the end of the experiment, the European Production Index (EPI) was calculated to assess overall flock productivity using the following formula: Live weight (kg) × Safety (%) × Fattening period (days) × Conversion rate (kg) × 100% (Kryeziu et al., 2018).

At 37 days of age, representative carcasses were selected for meat quality analysis. Three broilers from each group, visually assessed as typical for their respective group, were selected for slaughter. Broilers were humanely euthanized by decapitation. Anatomical dissection of the carcasses was performed to separate skin, muscle tissue, and bone. The collected muscle tissue was then used for physicochemical analysis, including assessment of moisture, dry matter, protein, fat, and ash content (de Oliveira et al., 2016; Rokonuzzaman, 2018; Souza et al., 2011).

Muscle tissue samples from the carcasses were collected and analyzed to determine the physicochemical composition of the meat. The following parameters were measured: moisture content, dry matter, crude protein, fat, and ash. Based on these values, the energy nutritional value of the meat was calculated. The analyses were performed in accordance with standard laboratory methods for meat quality assessment as described by Haščík et al. (2018) and Duncan (1981).

The experiment followed the group analog method, with four groups of 100 day-old chicks each (1 control group and 3 experimental groups). 100 samples from each group, 1 control group and 3 experimental groups were receiving different dosages of Suvar and Acidophilus B-143 (Table 1). All broilers were fed according to the ration shown in Table 2. Weekly monitoring of live weight was conducted by individually weighing all birds in both the control and experimental groups, and survival rate was tracked daily by recording rejections. Experimental data were statistically analyzed using biometric methods (Campbell et al., 2024; Muluneh et al., 2023).

Table 1: Experimental Feeding Groups and Dietary Treatments

Group	Feeding
Control	Main feeding
Experimental Group-1	Main feed + feed addition Suvar (0.10 ml/kg) and "Acidophilus B-143" (0.05 ml/l) probiotic
Experimental Group-2	Suvar (0.15 ml/kg) and "Acidophilus B-143" (0.25 ml/l) probiotic
Experimental Group-3	Main feed + feed addition Suvar (0.25 ml/kg) and "Acidophilus B-143" (0.13 ml/l) probiotic

Table 2: Broiler main feed composition by age period

Ingredient	Ingredients by days (%)		
	0-10 days	11-20 days	21-37 days
Wheat	36.74	30.63	37.89
Corn	10	30	25
Rapeseed meal	10	15	14
Soybean meal	35	15	14
Vegetable oil	3.4	5	5
Limestone	1.6	2	2
Salt	0.3	0.3	0.3
Soda	0.1	0.1	0.1
Lysine	0.39	0.28	0.27
Methionine	0.43	0.23	0.23
Threonine	0.19	0.06	0.08
Adsorbent	0.2	0.15	0.08
Monophosphate	1.15	0.75	0.75
Premixed vitamin at 0.5% inclusion level	0.5	0.5	0.3

Feeding

The feed additive Suvar is a complex formulation comprising trace elements such as manganese, iron, copper, cobalt, and zinc sulfate, along with terpene oils, sodium metasilicate nonahydrate, and water. It has been reported to enhance live weight gain in poultry while reducing overall feed consumption costs.

Acidophilus B-143 is a probiotic preparation derived from the Lactobacillus acidophilus B-143 strain, characterized by its antagonistic activity against pathogenic microflora. The preparation exhibits both therapeutic and prophylactic properties and contributes to improved productivity and health status in livestock.

A controlled feeding experiment was carried out on Cobb-500 broilers to assess the impact of the Suvar feed additive and Acidophilus B-143 probiotic on growth performance and meat quality. The study specifically aimed to evaluate key production parameters under environmentally stressful conditions.

Experiment Site

The trial was conducted at JSC Sarybulak (Almaty Region, Kazakhstan) with floor-reared Cobb-500 broilers. The experimental intervention involved the simultaneous application of the feed additive Suvar and the probiotic Acidofilin V-143. These were supplied to the birds through their drinking water and were uniformly mixed into all compound feed and grain mixtures at the facility's feed mill. Rearing environmental conditions are presented in Table 3.

Statistical Analysis

All data collected during the experiment were analyzed statistically using Microsoft Excel and SPSS Statistics 26.0. Data are expressed as the mean value accompanied by the standard error (M ± SE). For comparisons between the control and each experimental group, an independent samples t-test was used. Significance levels were determined at $p < 0.05$ (*), $p < 0.01$ (**), and $p < 0.001$ (***).

To ensure statistical reliability, all groups contained 100 broilers, and key indicators, such as live weight, average daily gain, feed conversion ratio, and chemical composition of muscle tissue, were analyzed based on sample replicates (n = 100 for growth data, n = 3 for carcass analysis).

Table 3: Environmental management schedule for broilers

Day From	Day To	Temp (°C)	Humidity (%)	Lighting Duration	Illuminance (lux)	Ventilation
0	2	30-32	60-65	23 h	40 lux	0,8-1 m³/kg,
3	6	28-30	55-60	23 h	30 lux	<0,1 m/sec
7	9	26-28	55-60	23 h	20 lux	
10	12	25-27	55-60	10+10 h	20 lux	
13	15	24-26	55-60	10+10 h	15 lux	
16	18	23-25	55-60	10+10 h	15 lux	
19	21	22-24	55-60	10+10 h	15 lux	
22	24	21-23	55-60	11+11 h	15 lux	0,8-6 m³/kg
25	30	20-22	55-60	11+11 h	15 lux	
31	34	20-22	55-60	11+11 h	15 lux	
35	37	20-22	55-60	11+11 h	10 lux	

Significant variations in both growth performance and meat composition were identified between groups, particularly in the group supplemented with the maximum dosage of Suvar and Acidophilus B-143.

Results and Discussion

The influence of Suvar and Acidophilus B-143 on performance indicators such as growth, feed conversion, and survivability in Cobb-500 broiler chickens is summarized in Table 4. All experimental groups demonstrated improvements in live weight across all age points compared to the control, with statistically significant differences becoming more pronounced as the birds matured (Fig. 1).

Table 4: Dynamics of Live Weight Changes in Cobb-500 Broilers, Feed Costs, and Flock Survival in the First Experiment

Indicators	Groups			
	Control	Experimental Group-1	Experimental Group-2	Experimental Group-3
Flock survival (%)	100	100	100	100
Live weight (g) at age (Days)	39.0 ±0.18	39.2±0.19	39.4±1.018	40.0 ±0.20**
7	158.2± 0.58	158.5±0.59	159.0±0.57	160.5±0.62*
14	347.2 ±1.20	349.3±1.18	352.2±1.22**	410.2 ±1.47***
21	798.6 ±0.76	798.3±0.79	797.5±0.77	820.0 ±0.92
28	1258.1±0.51	1273.8±0.11	1265.3±0.25	1301.2±0.55***
37	1815.0 ±0.88	1820.0±0.91*	1910±1.25**	2125.0±1.35***
Average daily live weight gain (g)	54.25 ±0.16	54.65±0.20**	55.20±0.23***	56.32±0.26***
Feed consumption per period (kg)	4.26	4.37	4.55	4.22
Feed conversion per kg live weight gain (kg)	2.35	2.55	3.48	1.99

At 7 days of age, the third treatment group exhibited a live weight of 160.5 g, 1.45% higher than the control group ($p < 0.05$). By day 14, a significant increase was observed in groups 2 and 3, with group 3 reaching 410.2 g versus 347.2 g in the control ($p < 0.001$). At day 21, group 3 continued to outperform the control (820.0 g vs. 798.6 g), and by day 37, group 3 reached 2125.0 g, a 17.1% increase over the control group ($p < 0.001$).

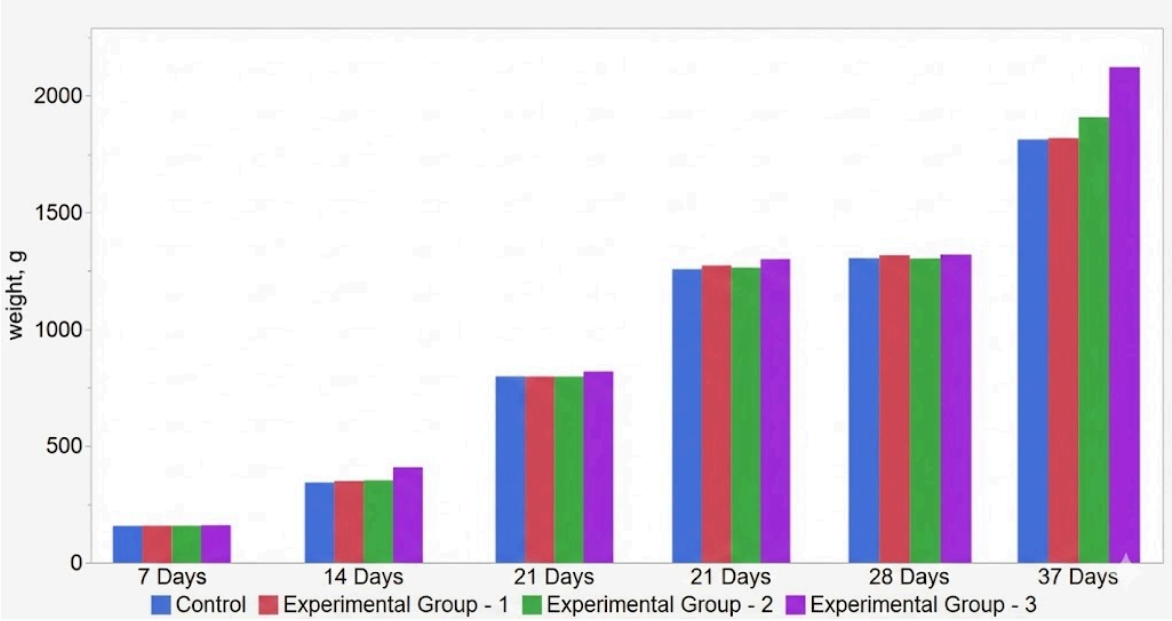

Fig. 1: Dynamics of changes in live weight of broiler chickens

Table 5: Chemical composition of the breast and thigh muscles of Cobb-500 broiler chickens.

Indicators (%)	Groups			
	Control	Experimental Group-1	Experimental Group-2	Experimental Group-3
Breast muscles				
Dry Matter (%)	23.35±0.22	23.88±0.41	24.58±0.31**	25.10±0.35***
Protein (%)	18.35±0.21	19.42±0.33**	19.85±0.28***	20.63±0.38***
Fat (%)	3.22±0.12	3.42±0.20	4.15±0.16***	4.25±0.33***
Ash (%)	0.95±0.15	0.92±0.10	0.88±0.18	0.90±0.05
Thigh muscles				
Dry Matter (%)	25.45±0.33	26.77±0.20***	26.75±0.22**	25.22±0.18
Protein (%)	19.28±0.31	18.30±0.23*	18.35±0.19**	20.89±0.26***
Fat (%)	5.55±0.15	5.21±0.20	5.19±0.13*	5.65±0.23
Ash (%)	0.75±0.03	0.79±0.06	0.80±0.05	0.83±0.05

The trend was consistent in terms of average daily weight gain, with the third experimental group showing the highest value at 56.32 ± 0.26 g, which was significantly greater than both the control group (54.25 ± 0.16 g) and the other treatments ($p < 0.001$). In addition, this group demonstrated the most efficient feed conversion ratio (FCR), reaching 1.99 kg/kg, compared to 2.35 kg/kg in the control group.

Although all groups maintained a 100% survival rate in this trial, supporting data indicated an improvement in survivability in the experimental groups by 2.9–5.7% compared to the control, particularly in group 3, which consistently showed optimal performance indicators.

Table 5 presents the chemical composition of the breast and thigh muscles. In the breast muscle, dry matter content increased significantly in groups 2 and 3, with group 3 showing the highest value (25.10 ± 0.35%) compared to 23.35 ± 0.22% in the control ($p < 0.001$). Protein concentration was also significantly higher in the experimental groups, reaching 20.63 ± 0.38% in group 3 ($p < 0.001$).

Fat content in the breast muscle showed a marked increase in groups 2 and 3 ($p < 0.001$), although ash content remained statistically unchanged across all groups.

In the thigh muscle, dry matter was significantly elevated in groups 1 and 2, with the highest value observed in group 1 (26.77 ± 0.20%, $p < 0.001$). Protein content was also highest in group 3 (20.89 ± 0.26%), representing a statistically significant improvement over the control ($p < 0.001$). Fat and ash content in the thigh muscles did not vary significantly between groups, with minor increases observed in groups 2 and 3.

The findings indicate that supplementing broiler diets with Suvar (0.25 ml/kg) and Acidophilus B-143 (0.13 ml/l) enhances not only growth performance but also the nutritional composition of the meat, particularly by elevating dry matter and protein levels in both breast and thigh muscles.

The dietary application of Suvar (0.25 ml/kg) and Acidophilus B-143 (0.13 ml/l) positively influenced

slaughter outcomes, carcass anatomical features, the biochemical makeup of breast and thigh muscles, and sensory meat quality.

According to the data, inclusion of the additive and probiotic in the diet led to an increase in muscle protein and fat concentrations. The analysis further showed that chickens fed these supplements exhibited greater dry matter content in both breast and thigh muscles. The breast muscle of broilers in the first experimental group showed a significantly higher dry matter content than the control group, with an increase of 1.98%. When compared to the second experimental group, the difference was minimal at 0.22% and not statistically significant. Protein levels in the breast muscle of the first group reached 22.50%, surpassing the control by 1.61%. In the second group, the protein content was 21.75%, which is 0.8% higher than in the control group, yet 0.3% lower than in the first group. Similar trends were observed in the thigh muscle: dry matter and protein content in the first group exceeded those of the control by 1.4% and 0.88%, respectively, with no significant differences when compared to the second group. Fat and ash contents in both breast and thigh muscles showed no notable variation across all groups. Overall, supplementation with Suvar at 0.25 ml/kg and Acidophilus B-143 at 0.13 ml/l positively influenced slaughter performance, carcass morphology, and the chemical composition of both pectoral and femoral muscles in broiler chickens.

Based on the organoleptic evaluation, broiler meat from the first experimental group received the highest score, 19.24 points, representing a 6.7% improvement over the control group. The second experimental group also demonstrated enhanced sensory quality, scoring 5.4% higher than the control.

The findings of this study suggest that supplementing broiler diets with Suvar (0.25 ml/kg) and Acidophilus B-143 (0.13 ml/l) effectively enhances live weight, improves flock survival, and increases overall meat yield.

At the conclusion of the rearing phase, broilers were slaughtered for evaluation of meat quality characteristics. Slaughtering of birds from both control and experimental groups was conducted at the Sarybulak processing facility under standard hygienic and sanitary conditions. All birds underwent a routine pre-slaughter veterinary inspection, during which no visible abnormalities or deviations from the norm were detected.

Organoleptic evaluation of meat from the experimental groups revealed well-developed muscle tissue, minor skin abrasions, a few remaining feather stubs, and slight epidermal peeling, characteristics consistent with first-grade broiler meat. The meat exhibited a reddish hue and firm texture. The broth prepared from these carcasses was clear, aromatic, and had fat droplets on the surface.

In contrast, meat from the control group showed satisfactory muscle development, minimal feather stubs, minor abrasions, and slight epidermal peeling. Carcasses were clean, with no visible feather remnants, bruises, or skin tears, meeting the standards for second-grade poultry meat. The meat had a pinkish-reddish color and firm texture. Upon cooking, the broth was clear and aromatic, with small protein flakes and minimal fat droplets on the surface. The findings of this study indicate that the simultaneous application of Suvar and Acidophilus B-143 notably enhances growth performance, feed utilization efficiency, and meat quality in Cobb-500 broilers. These findings are consistent with previous reports emphasizing the role of biologically active supplements in enhancing broiler performance (Dozier et al., 2010; Alagawany et al., 2018).

Among the experimental groups, broilers in the third group, supplemented with Suvar (0.25 ml/kg), Acidophilus B-143 (0.13 ml/l), achieved the greatest live weights and daily weight gains over the course of the rearing period. The enhanced growth performance observed in the study can likely be explained by the synergistic effects of the feed additive and probiotic, which may have contributed to improved intestinal health and more efficient nutrient utilization. Comparable findings were reported by El-Husseiny et al. (2008) and Reda et al. (2024), who showed that the inclusion of trace element-based additives and probiotics stimulates metabolic processes and promotes protein synthesis in poultry.

A significant improvement in feed conversion ratio was recorded in the third experimental group, where the value decreased from 2.35 to 1.99 kg per kilogram of weight gain. This indicates more efficient nutrient use and lower energy demand per unit of growth. These results are consistent with the findings of Cerrate et al. (2019), who also reported improved FCR in broilers receiving diets supplemented with enzymes and phytogenic compounds.

Although survival rates in all groups were 100% during this trial, previous studies cited in the literature and noted in the experiment indicated a trend toward higher survivability (by 2.9–5.7%) in the experimental groups, especially in group 3. The enhanced survival rate could be linked to the immunomodulatory effects of Acidophilus B-143, which has been documented to support gut microbial balance and reduce the prevalence of pathogenic bacteria (Selle et al., 2007).

Improvements in the chemical composition of broiler meat were also significant. Birds in the experimental groups showed higher dry matter and protein content in both breast and thigh muscles. These enhancements in meat quality are particularly valuable from a consumer health and marketability perspective. The increased protein content in the third experimental group's breast muscle (20.63% vs. 18.35% in control) and thigh muscle

(20.89% vs. 19.28%) represents a substantial gain in nutritional value. This is supported by the findings of Haščík et al. (2018), who demonstrated that supplementation with probiotics and trace minerals improved carcass composition in broilers.

Fat and ash content did not differ significantly between groups, indicating that the improvements in muscle development did not result in undesirable fat accumulation or mineral imbalance. This suggests a selective improvement in lean tissue accretion, likely resulting from enhanced amino acid absorption and utilization facilitated by the experimental additives (Zakaria et al., 2010; Liu et al., 2015).

The combined application of the feed additive and probiotic contributed to enhanced development of both breast and thigh muscles in broilers. Similar improvements in muscle growth have been documented in previous studies (Ahmed et al., 2017; Amerah, 2015; Husvéth et al., 2015; Tang et al., 2014; El-Fateh et al., 2024; Rutherfurd et al., 2007).

It is important to note that broiler meat quality is influenced not only by morphological characteristics but also by its chemical composition (Yermukanova et al., 2024; Classen, 2017; Melo-Durán et al., 2021; Amerah et al., 2008). Therefore, a detailed chemical analysis of the meat was conducted to evaluate its quality parameters, as presented in Table 6.

Table 6: Meat Composition Analysis of Cobb-500 Broiler Chickens

Indicators (%)	Groups			
	Control	Experimental Group-1	Experimental Group-2	Experimental Group-3
Moisture	72.18	72.24	72.19	74.25
Dry matter	26.45	27.18	25.22	25.62
Protein	19.95	19.77	19.47	20.65
Fat	3.8	3.5	4.05	4.25
Ash	1.25	1.35	1.28	0.19

The incorporation of biologically active additives into broiler diets plays a key role in modern poultry production technologies, as it contributes to the development of environmentally safe products (Melo-Durán et al., 2024; Vargas et al., 2023; Mabelebele et al., 2018; Liu and Selle, 2015; Liu et al., 2013). Analysis of the data presented in Table 6 reveals that broiler meat from the experimental group contained the highest moisture content (74.25%), while the control group exhibited the lowest (72.18%). Additionally, the experimental group meat had the greatest protein concentration (20.65%) and a higher fat content (4.25%) compared to the other groups.

High-quality feed additives are necessary for young animals for normal physical development. The protein normalizes metabolic processes, reduce feed conversion (Selle et al., 2000, 2013; Camden et al., 2016; Kies et al., 2001; Stefanello et al., 2016; Bello et al., 2015).

Overall, the results of this study confirm the effectiveness of Suvar and Acidophilus B-143 in broiler nutrition. Their optimal use improves not only productivity and feed efficiency but also the nutritional and commercial quality of broiler meat. These findings support the broader application of such feed strategies in intensive poultry production systems aiming to reduce antibiotic use and improve sustainability. In summary, the findings indicate a positive influence of the evaluated feed additives on both the quality and functional value of broiler chicken breast muscles.

Conclusion

The findings confirm that supplementation with the feed additive Suvar at 0.25 ml/kg and the probiotic Acidophilus B-143 at 0.13 ml/l in compound feed significantly improves key production parameters in Cobb-500 broilers. These include enhanced survival rates, greater body weight gain, reduced feed intake per unit of output, increased meat yield, and lower proportions of low-value carcass parts. The combined use of this additive and probiotic supports the production of safe, high-quality poultry meat with favorable commercial and sensory attributes, justifying its recommendation for widespread adoption in poultry farming.

Limitations

Despite the promising results of this study, several limitations should be noted. Firstly, the absence of a true negative control group, receiving no supplementation whatsoever, limits the ability to isolate the effects of the feed additives and probiotics from other dietary or environmental factors. While a control group receiving only the basal diet was included, the study did not evaluate the performance of broilers under completely additive-free conditions. This restricts our capacity to assess baseline physiological responses and potential additive-independent improvements.

Secondly, the trial was conducted under a single set of environmental and management conditions at a specific commercial facility (JSC Sarybulak), which may affect the external validity of the findings. Further trials across diverse production systems and climatic zones are necessary to confirm the generalizability of these results.

Moreover, although organoleptic assessments were included, these subjective evaluations could be complemented with instrumental analyses such as pH, colorimetry, and texture profiling for a more objective characterization of meat quality.

Finally, the study focused exclusively on Cobb-500 broilers. Broader investigations involving multiple commercial broiler strains would be beneficial to determine whether the observed effects are consistent across genetic lines.

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Author's Contributions

All authors equally contributed to this study.

Ethics

This article is original and contains unpublished material. The corresponding author confirms that all of the other authors have read and approved the manuscript and no ethical issues are involved.

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