International Journal of Sustainability and Advanced Integrated Research
Volume 2, Issue 2 (April-June 2026) | ISSN: 3107-7854
DOI: https://doi.org/10.65339/ijsair.V2.I2.356

Response of Broilers to Phytobiotic-Fortified Diets Enriched with Lactic Acid Bacteria Serum (LABS)

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Publication history: Received: April 18, 2026; Revised: April 27, 2026; Accepted: May 4, 2026
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Abstract

This study evaluated the effectiveness of phytobiotic-fortified diets combined with lactic acid bacteria serum (LABS) as sustainable alternatives to antibiotic growth promoters in broiler production under tropical conditions. Grounded in the concept of gut microbiota modulation and synergistic action of natural feed additives, the research employed a Completely Randomized Design (CRD) involving 150 Cobb 500 broiler chicks distributed across five treatments with three replicates each. Treatments included a control group and four groups receiving diets fortified with moringa, guava, oregano, and lagundi leaf meals at 5% inclusion, supplemented with 2% LABS in drinking water. Data on growth performance, carcass characteristics, environmental conditions, mortality, and economic returns were collected and analyzed using Analysis of Variance (ANOVA) and Least Significant Difference (LSD) tests. Results showed that phytobiotic-LABS supplementation significantly improved body weight and weight gain during later growth stages, with the moringa-fortified group achieving the highest final weight. Feed and water consumption were not significantly affected, indicating improved nutrient utilization rather than increased intake. Carcass characteristics and organ development remained comparable across treatments, confirming physiological safety. Mortality rates were lower in supplemented groups, suggesting enhanced resilience to heat stress. Economically, supplementation increased gross returns, though higher production costs influenced profitability, with the guava-based treatment demonstrating the best cost efficiency. The findings conclude that phytobiotic-fortified diets with LABS are viable and effective alternatives to antibiotics, improving productivity, survivability, and economic outcomes when optimized. This study supports SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-Being), and SGD 12 (Responsible Consumption and Production) by promoting sustainable poultry production and reducing reliance on antibiotics. The sustainability impact lies in enhancing food security, improving farmer income, reducing antimicrobial resistance risks, and supporting environmentally responsible and health-conscious broiler production systems.

Keywords: Antibiotic Alternatives; Broiler Production; Lactic Acid Bacteria Serum; Phytobiotics; Sustainable Agriculture; Tropical Conditions

1. Introduction

Broiler production remains a critical component of global and Philippine food systems due to its efficiency, affordability, and capacity to meet increasing protein demand. However, rising production costs, antimicrobial resistance concerns, and regulatory restrictions on antibiotic growth promoters necessitate sustainable alternatives. This study evaluates phytobiotic-fortified diets combined with lactic acid bacteria serum (LABS) as potential solutions to improve growth performance, carcass yield, and economic returns in broiler production while supporting sustainable and antibiotic-free poultry systems.

1.1 Background of the Study on Phytobiotic-Fortified Diets and LABS in Broiler Production

Broilers are widely preferred for meat production due to their rapid growth and efficiency, with the global poultry market projected to reach USD 328.05 billion in 2026 (Global Poultry Market Size Share, Trends, and Growth Analysis Report… , n.d.). In the Philippines, the broiler sector is the fastest-growing livestock sub-sector, contributing significantly to food security and economic output (Acosta, 2022). Chicken production is expected to reach 1.81 MMT by 2026, driven by population growth, urbanization, and demand for affordable protein (Ipac & Jateng, 2025; Sy, n.d.). Despite growth, the industry faces challenges such as high feed costs, disease risks, and reliance on imports (Acosta, 2022; Gomez, 2024; Ipac & Jateng, 2025). Historically, Antibiotic Growth Promoters (AGPs) improved growth and feed efficiency (Castanon, 2007; Fernández Miyakawa et al., 2024), but their use has been linked to antimicrobial resistance (AMR) (Evans & Wegener, 2003). Global and national restrictions now limit AGP use (FAO - United Nations, 2024) Valenzuela et al., 2025), necessitating alternative feed strategies. Phytobiotics and LABS have emerged as promising natural alternatives. Phytobiotics exhibit antimicrobial, antioxidant, and growth-promoting properties (Aminullah et al., 2025), while LABS improve gut health and nutrient utilization (Abd El-Hack et al., 2020; Markowiak & Śliżewska, 2018).

1.2 Themes and Insights from Related Literature on Phytobiotics and LABS

Literature consistently highlights the importance of poultry in global food security due to its efficiency and affordability (Ayalew et al., 2022b; Ullah, 2023). However, AGP use, while effective in improving growth, contributes to antimicrobial resistance and public health risks (Paul S. S. et al., 2022; Monika et al., 2024). Phytobiotics, derived from plant-based compounds, demonstrate antimicrobial, anti-inflammatory, and immunomodulatory effects (Cyrille Houketchang Ndomou & Kuietche Mube, 2024a; Pandey et al., 2023). Studies show their ability to improve growth performance, feed efficiency, and gut health (Obianwuna et al., 2024). Specific plants such as moringa, guava, oregano, and lagundi contain bioactive compounds that enhance immunity, digestion, and microbial balance (Limbe et al., 2024; Granados-Chinchilla, 2017; Babinszky et al., 2021; Akue et al., 2024). Similarly, LABS and probiotics enhance intestinal health, nutrient absorption, and immune response while suppressing pathogenic bacteria (Fernández Miyakawa et al., 2024; Gadde et al., 2018). Evidence suggests that probiotics can improve growth performance and carcass traits, although results may vary depending on strains and conditions (Sugiharto, 2021; Maquiné et al., 2024).

1.3 Local, National, and Global Context of Broiler Production and Antibiotic Alternatives

Globally, poultry production continues to expand to meet the protein demands of a growing population projected to reach 9.8 billion by 2050 (Kleyn & Ciacciariello, 2021). The Philippine poultry sector contributes significantly to the agricultural economy, accounting for a substantial portion of national output (Monleon, 2024). However, antimicrobial resistance has prompted regulatory restrictions on AGPs worldwide, including in the Philippines, where antibiotic use is now limited to therapeutic purposes under veterinary supervision (Pineda-Cortel et al., 2024). The Philippine National Action Plan on Antimicrobial Resistance (2024–2028) emphasizes reducing non-therapeutic antibiotic use (Inter-Agency Committee on Antimicrobial Resistance (ICAMR), 2025). These developments have accelerated the adoption of alternative feed additives such as phytobiotics and probiotics to maintain productivity while ensuring food safety (Haque et al., 2020; Rahman et al., 2022).

1.4 Theoretical or Conceptual Basis on Synergistic Effects of Phytobiotics and LABS

The study is grounded in the concept that natural feed additives enhance broiler performance through gut microbiota modulation, improved digestion, and immune enhancement. Phytobiotics act through antimicrobial activity, enzyme stimulation, and antioxidant effects (Windisch et al., 2008; Urban et al., 2025). LABS contribute by maintaining microbial balance, lowering intestinal pH, and promoting beneficial bacteria (Markowiak & Śliżewska, 2018). The potential synergistic interaction between phytobiotics and LABS is based on complementary mechanisms phytobiotics suppress pathogens and enhance digestion, while LABS improve gut microbial stability and nutrient absorption leading to improved growth performance and health outcomes.

1.5 Research Gaps and Rationale for Combined Phytobiotic and LABS Application

Despite extensive studies on phytobiotics and probiotics individually, inconsistencies remain due to variations in formulation, dosage, and experimental conditions (Abdelli et al., 2021; Ayalew et al., 2022). LABS, particularly locally produced variants, remain underexplored compared to commercial probiotics. There is limited research on the synergistic effects of combining phytobiotics and LABS, especially under local production conditions. Additionally, few studies address the economic viability of these alternatives, which is critical for adoption by small-scale producers. This study addresses these gaps by evaluating the combined effects of phytobiotic-fortified diets and LABS on growth performance, carcass yield, and cost-return efficiency in broiler production.

1.6 Alignment with Relevant Sustainable Development Goals (SDGs)

This study aligns with several United Nations Sustainable Development Goals (SDGs), particularly SDG 2 – Zero Hunger, SDG 3 – Good Health and Well-Being, SDG 8 – Decent Work and Economic Growth, and SDG 12 – Responsible Consumption and Production. By improving broiler productivity through phytobiotic-fortified diets and lactic acid bacteria serum, the study supports SDG 2 by contributing to a stable and sustainable supply of affordable animal protein. It addresses SDG 3 by reducing dependence on antibiotic growth promoters, thereby minimizing antimicrobial resistance risks and promoting safer food systems. Furthermore, the evaluation of cost-effectiveness contributes to SDG 8 by enhancing income opportunities and economic efficiency for poultry producers. Lastly, the use of natural feed additives supports SDG 12 by promoting sustainable and responsible agricultural production practices that reduce chemical inputs and encourage safer consumption patterns.

1.7 Importance of the Study to Multidisciplinary Sustainability in Broiler Production

This study contributes to multidisciplinary sustainability by addressing interconnected economic, environmental, public health, and agricultural concerns in broiler production. From a socio-economic perspective, it enhances farmer profitability through improved feed efficiency and cost-return outcomes. In terms of public health sustainability, the reduction in antibiotic use helps mitigate antimicrobial resistance and ensures safer poultry products for consumers. Environmentally, the use of natural feed additives such as phytobiotics and LABS can reduce chemical residues and improve manure quality, thereby minimizing environmental pollution. Agriculturally, the study promotes sustainable farming practices through the use of locally available plant-based and probiotic resources. Additionally, it supports technological and innovation sustainability by advancing alternative feeding strategies that improve productivity without compromising animal welfare or food safety. Overall, the research fosters a more resilient, sustainable, and health-conscious broiler production system.

2. Material and methods

2.1 Research Design

The study employed a Completely Randomized Design (CRD) with five treatments replicated three times, resulting in fifteen experimental units. Each unit consisted of ten broiler chickens, totaling one hundred fifty (150) day-old Cobb 500 chicks. The treatments included a control group and four groups receiving phytobiotic-fortified diets using moringa, guava, oregano, and lagundi leaf meals at 5% inclusion, combined with 2% LABS supplementation in drinking water. Random allocation ensured unbiased distribution of birds across treatments.

2.2 Locale of the Study

The experiment was conducted in a poultry facility constructed from locally available materials in a well-ventilated area surrounded by trees. The structure was designed to allow adequate airflow and protection from environmental stress through the use of netting, curtains, and ventilation support systems, ensuring suitable rearing conditions for broilers.

2.3 Respondents of the Study

The experimental subjects consisted of one hundred fifty (150) day-old Cobb 500 broiler chicks, selected due to their rapid growth rate, efficient feed conversion, adaptability to tropical environments, and uniform carcass yield.

2.4 Sample and Sampling Procedure

The chicks were randomly distributed into five treatment groups with three replicates each. Each replicate contained ten birds to ensure uniform representation. For carcass evaluation, two birds per treatment per replicate were randomly selected at the end of the study to obtain representative data for carcass characteristics.

2.5 Research Instrument

The study utilized formulated feeds, phytobiotic leaf meals, LABS, and standard poultry equipment such as feeders, drinkers, weighing scales, and housing facilities. Phytobiotic leaf meals were prepared from moringa (*Moringa oleifera*), guava (*Psidium guajava*), oregano (*Origanum vulgare*), and lagundi (*Vitex negundo*). Leaves were selected based on quality, air-dried under shaded conditions, ground into powder, and subjected to proximate analysis to determine crude protein, crude fiber, crude fat, moisture, and ash content. LABS was prepared through fermentation of rice wash and pasteurized milk, followed by the addition of molasses to sustain microbial activity, and allowed to ferment under controlled conditions before use (Rodriguez et al., 2013). Feed formulation followed the Philsan Feed Reference Standards for both starter and finisher phases for broiler.

Table 1. Feed Formulation for starter and finisher feeds

Ingredients, %	Starter					Finisher				
	T_1	T_2	T_3	T_4	T_5	T_1	T_2	T_3	T_4	T_5
Yellow Corn	49.9	52	52	52	52	52	60.11	60.11	60.11	60.11
Soybean Meal	25.85	26.6	26.6	26.6	26.6	21.8	23.91	23.91	23.91	23.91
Rice Bran (D1)	10	3	3	3	3	13	0	0	0	0
Fish Meal	5	5	5	5	5	5	5	5	5	5
Vegetable Oil	0.65	1	1	1	1	0.04	0.1	0.1	0.1	0.1
Molasses	5.5	5.5	5.5	5.5	5.5	5.5	3.5	3.5	3.5	3.5
Limestone	0.68	0.59	0.59	0.59	0.59	0.57	0.58	0.58	0.58	0.58
DicaPhos (Cecical)	1.1	1	1	1	1	0.96	1.05	1.05	1.05	1.05
Vit. & Min. Premix	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Salt	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Toxin Binder	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
L-lysine HCL	-	-	-	-	-	-	-	-	-	-
DL- Methionine	0.04	0.04	0.04	0.04	0.04	-	-	-	-	-
Moringa Leaf Meal	-	5	-	-	-	-	5	-	-	-
Guava Leaf Meal	-	-	5	-	-	-	-	5	-	-
Oregano Leaf Meal	-	-	-	5	-	-	-	-	5	-
Lagundi Leaf Meal	-	-	-	-	5	-	-	-	-	5
TOTAL	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Calculated Composition										
Energy, ME, *Kcal/kg*	2889.8	2840	2840	2840	2840	2876.1	2850.5	2850.5	2850.5	2850.5
Crude Protein, *%*	20.69	20.36	20.36	20.36	20.36	19.27	19.29	19.29	19.29	19.29
Calcium, *%*	0.86	0.81	0.81	0.81	0.81	0.8	0.8	0.8	0.8	0.8
Phosphorus, *%*	0.43	0.4	0.4	0.4	0.4	0.41	0.41	0.41	0.41	0.41
Lysine, *%*	1.05	1.05	1.05	1.05	1.05	0.96	0.98	0.98	0.98	0.98
Methionine, *%*	0.41	0.4	0.4	0.4	0.4	0.36	0.36	0.36	0.36	0.36
Total Met + Cys, *%*	0.75	0.73	0.73	0.73	0.73	0.68	0.67	0.67	0.67	0.67
Crude Fat, *%*	4.97	4.44	4.44	4.44	4.44	4.81	3.43	3.43	3.43	3.43
Crude Fiber, *%*	3.14	2.85	2.85	2.85	2.85	3.21	2.62	2.62	2.62	2.62

The starter ration consisted primarily of yellow corn, soybean meal, rice bran, fish meal, molasses, vegetable oil, and mineral supplements, with phytobiotic leaf meals incorporated at 5% depending on treatment. The finisher ration maintained similar ingredients with adjusted proportions to meet nutritional requirements for later growth stages. Both rations were balanced in terms of metabolizable energy, crude protein, calcium, phosphorus, lysine, methionine, crude fat, and crude fiber. Feed ingredients were accurately weighed, manually mixed to ensure uniformity, and stored properly to maintain quality. Experimental cages were constructed using welded round bars and plastic netting, divided into chambers measuring approximately one meter in width and length and half a meter in height. Each unit accommodated ten birds and was equipped with feeders, drinkers, and lighting systems to facilitate proper management.

2.6 Data Gathering Procedure

Phytobiotic leaf meals were collected, processed, and analyzed for proximate composition. LABS was prepared through fermentation and administered in drinking water at a rate of 20 ml per liter for treatment groups (Lamug, 2024), while the control group received plain water. Brooding and acclimatization were conducted in stages, including preparation of cages, provision of heat and lighting, and administration of electrolytes and chick boosters to reduce stress and support early development. Birds were gradually introduced to formulated feeds and maintained under monitored environmental conditions. Feeding was done *ad libitum*, with starter feed provided up to the third week and finisher feed until the sixth week. Gradual feed shifting was implemented to minimize feeding stress. Daily records of feed and water consumption were obtained by subtracting leftovers from the quantities provided. Body weights were recorded weekly to monitor growth performance. At the end of the study, selected birds were fasted for 12 hours prior to slaughter. Slaughtering involved bleeding, scalding, plucking, and evisceration. Carcass data collected included dressed weight, dressing percentage with and without giblets, cut-up parts weight, and giblets weight. Growth performance data included initial weight, weekly body weight, weight gain, feed conversion ratio, feed conversion efficiency, and percentage growth rate. Cost and return data were also gathered, including feed costs, LABS costs, chick costs, net return, cost per kilogram gain, and return on investment.

2.7 Data Analysis Techniques

All collected data were organized, collated, and analyzed using Analysis of Variance (ANOVA) under a Completely Randomized Design (CRD) with the Statistical Tool for Agricultural Research (STAR) and Microsoft Excel. Significant differences among treatments were further analyzed using the Least Significant Difference (LSD) Test to determine treatment effects.

3. Observations, Results and Discussion

3.1 Observations

3.1.1 Environmental Conditions and Bird Response

Temperature ranged from approximately 34.2°C to 37.9°C, while relative humidity reached up to 86% in the morning and remained above 50% in the afternoon. Birds exhibited signs of heat stress, including panting and wing spreading, particularly in later weeks. These environmental conditions exceed the thermal comfort zone and likely affected performance and mortality. High temperature and humidity reduce feed intake and growth while increasing physiological stress (Apalowo et al., 2024; Liu L. et al., 2020; Kpomasse et al., 2021; Omomowo & F. R., 2021). Observed mortality patterns and behavioral responses confirm the impact of heat stress.

3.1.2 Mortality and Livability

Mortality rates varied among treatments, with the highest observed in the control group (16.67%) and lower rates in supplemented groups (6.67–10%). Lower mortality in supplemented treatments suggests improved resilience to environmental stress. Heat stress likely contributed to higher mortality in certain groups (Liu L. et al., 2020), while better management and supplementation improved survivability (Apalowo et al., 2024; Kpomasse et al., 2021; Department of Agriculture – Bureau of Animal Industry (DA BAI), 2020).

3.2 Growth Performance

3.2.1 Body Weight Development

Broilers across all treatments had similar initial body weights after brooding, ranging from approximately 75.10 to 76.73 g, with no significant differences observed during the first two weeks. Significant differences emerged during the third and fourth weeks, where birds fed phytobiotic-fortified diets showed higher body weights than the control. The moringa-fortified group (T2) consistently recorded the highest weights, reaching 1937.55 g at six weeks, compared to 1625.94 g in the control group. These results indicate that phytobiotic-LAB supplementation enhanced growth performance, particularly during the later stages. The delayed response suggests that improvements occur as gut microbial populations and digestive systems mature (Kikusato, 2021). Enhanced growth may be attributed to improved nutrient digestion, enzyme activity, and immune function associated with phytobiotics (Department of Agriculture – Bureau of Animal Industry (DA BAI), 2020; Food and Agriculture Organization of the United Nations, 2010; Urban et al., 2025). The findings align with studies showing improved growth efficiency without increased feed intake (Landuay et al., 2020), supporting the use of such additives under tropical conditions where heat stress limits performance (Lara & Rostagno, 2013).

Table 2. Growth performance of broilers fed phytobiotic-fortified diets and lactic acid bacteria serum per bird

Treatment	Cumulative Feed Consumption, grams	Cumulative Water Consumption, milliliters	Gain in Weight, grams	Weekly Rate of Growth						FCR	FCE, percent
				1st	2nd	3rd	4th	5th	6th		
T_1 – Control	3,548.42	10,932.67^{ab}	1550.84^{c}	69.06	68.37	45.97	50.86	36.44	27.79	2.29	43.77
T_2 – MLM fortified	3,678.25	10,002.00^{bc}	1860 .82^{a}	77.64	74.20	52.72	40.33	33.94	33.26	1.98	50.55
T_3 – GLM fortified	3,645.14	9,442.00^{c}	1686.91^{bc}	75.40	78.88	43.87	42.59	35.01	28.36	2.16	46.73
T_4 – OLM fortified	3,620.44	11,387.33^{a}	1798.21^{ab}	72.02	77.68	53.49	43.30	31.97	32.38	2.02	49.69
T_5 – LLM fortified	3,532.19	9,968.33^{bc}	1709.04^{abc}	69.57	79.81	49.29	42.80	35.38	27.76	2.06	48.62
MEAN	3,604.89	10,346.47	1721.16	72.74	75.79	49.07	43.98	34.55	29.91	2.1	47.87
RESULTS	ns	*	*	ns	ns	ns	ns	ns	ns	ns	ns
C.V. %	7.85	5.94	5.54	6.33	11.07	15.33	9.59	11.87	14.84	7.69	7.8
LSD	-	1118.863	173.5946	-	-	-	-	-	-	-	-

Note: Means with common letters are not significantly different with each other using the Least Significant Difference (LSD) Test. ns – not significantly different, * - significant at 5% level, ** - highly significant at 1% level

3.2.2 Feed Consumption

Feed consumption increased consistently across all treatments throughout the production cycle, with cumulative intake ranging from approximately 3,532.19 g to 3,678.25 g. No significant differences were observed among treatments. The lack of significant variation indicates that phytobiotic-LAB supplementation did not influence appetite. Instead, these additives likely improve feed efficiency rather than intake, as supported by previous findings (Yazar Soyadı & Abd El-Ghany, 2020; Landuay et al., 2020; González et al., 2024). This suggests that improved growth performance is due to enhanced nutrient utilization rather than increased consumption.

3.2.3 Water Consumption

Water consumption showed no significant differences among treatments during the first four weeks. However, significant differences emerged during weeks five and six, with the oregano-fortified group (T4) consuming the highest volume, while other supplemented groups showed relatively lower intake. This pattern suggests that water intake in later stages was influenced by environmental stress, particularly heat. Increased consumption in some treatments reflects thermoregulatory responses, while lower intake in others may indicate improved heat tolerance and physiological efficiency (Yahav et al., 2004; Urban et al., 2025a; Landuay et al., 2020). These findings confirm that phytobiotic-LAB supplementation does not negatively affect hydration behavior under tropical conditions.

3.2.4 Weight Gain

Weight gain did not differ significantly during the first two weeks but showed significant improvement in the third week, particularly in the moringa (T2) and oregano (T4) groups. Over the entire production period, total weight gain was significantly higher in supplemented groups, with T2 achieving the highest gain. This indicates that phytobiotic-LAB supplementation improves growth efficiency without increasing feed intake. Enhanced gut health, microbial balance, and nutrient absorption likely contributed to these results (Landuay et al., 2020; González et al., 2024; Urban et al., 2025). Such improvements are particularly beneficial under tropical conditions where stress can limit growth.

3.2.5 Feed Conversion Efficiency

No statistically significant differences were observed in feed conversion ratio and efficiency among treatments, although supplemented groups showed better numerical values, particularly the moringa-fortified diet. These numerical improvements suggest enhanced nutrient utilization due to the combined effects of phytobiotics and LAB on digestion and gut health (Landuay et al., 2020; Urban et al., 2025; Zeng et al., 2015). Even without statistical significance, such trends are economically important in poultry production, where small efficiency gains can reduce feed costs.

3.2.6 Rate of Growth

The rate of growth was highest during the early weeks and declined progressively across all treatments. Supplemented groups showed higher growth rates during early and mid-stages, although differences were not statistically significant. This trend reflects normal growth patterns and suggests that phytobiotic-LAB supplementation enhances early metabolic efficiency and gut development (Kikusato, 2021; Yahav et al., 2004). Sustained growth under declining conditions indicates improved resilience to environmental stress.

3.3 Carcass Characteristics

3.3.1 Dressed Weight and Dressing Percentage

No significant differences were observed in dressed weight or dressing percentage among treatments. However, supplemented groups showed higher numerical values, with the moringa-fortified group recording the highest dressing percentage. These results indicate that phytobiotic-LAB supplementation does not negatively affect carcass yield while potentially improving meat recovery. Enhanced nutrient utilization and reduced physiological stress may contribute to improved carcass deposition (Landuay et al., 2020; Urban et al., 2025; Zeng et al., 2015).

3.3.2 Cut-Up Parts

Weights of cut-up parts did not differ significantly among treatments, although supplemented groups showed higher numerical values for economically important cuts such as breast and thigh. This suggests uniform muscle development across treatments. Improvements are likely due to better nutrient absorption and metabolic efficiency (Urban et al., 2025; Zeng et al., 2015). The lack of significant differences may also reflect environmental constraints such as heat stress (Yahav et al., 2004).

3.3.3 Giblet Weight

No significant differences were observed in giblet weights among treatments, although supplemented groups showed slightly lower values. This indicates that phytobiotic-LAB supplementation is safe and does not cause organ enlargement or stress. Stable organ weights suggest improved metabolic efficiency and balanced physiological function (Kikusato, 2021; Urban et al., 2025; Zeng et al., 2015; Landuay et al., 2020).

Table 3. Carcass characteristics of broilers fed phytobiotic-fortified diets and lactic acid bacteria serum per bird

Treatment	Dressing Percentage with Giblets, percent	Dressing Percentage without Giblets, percent	Breast, grams	Drumstick, grams	Thigh, grams	Wing, grams	Back, grams	Neck, grams	Live, grams	Gizzard, grams	Heart, grams	Spleen, grams	Total Giblets Weight, grams
T_1 – Control	72.14	71.75	375.43	157.1	176.02	135.46	225.16	80.5	43.07	46.83	9.75	4.68	104.33
T_2 – MLM fortified	79.95	75.07	439.33	184	188.67	175.5	268.5	92.33	37.83	37	10.17	3.17	88.17
T_3 – GLM fortified	76.56	71.06	397.33	167.33	166.33	133.67	243.67	63.33	38.5	37.5	10	4.5	90.5
T_4 – OLM fortified	78.06	72.31	374	183	196.5	159.5	227.83	78.83	41.17	40.67	10.5	4.67	97
T_5 – LLM fortified	75.46	70.01	373.67	186	198.67	155.17	255.17	80	44.83	38.83	10.17	3.67	97.5
MEAN	76.43	72.04	391.95	175.49	185.24	151.86	244.07	79	41.08	40.17	10.12	4.14	95.5
RESULTS	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
C.V. %	5.08	10.59	15.8	10.78	16.03	12.69	16.3	15.56	13.59	19.5	12.39	56.31	12.51
LSD	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: Means with common letters are not significantly different with each other using the Least Significant Difference (LSD) Test. ns – not significantly different, * - significant at 5% level, ** - highly significant at 1% level

3.4 Economic Performance

Table 4. Cost and return analysis of broilers fed phytobiotic-fortified diets and lactic acid bacteria serum per bird

Treatment	Final Weight, g	Gross Return, Php [1/]	Chick cost per bird, Php [2/]	Cost of booster feeds, Php [3/]	Cost of starter feeds, Php [4/]	Cost of finisher feeds, Php [5/]	Cost of LABS, Php [6/]	Total Cost, Php	Net Return, Php	Cost/kg Gain in Weight, Php	ROI, %
T1 – Control	1,603.33	288.6	45	3.33	42.15	98.54	0	189.02	121.49	99.58	52.69
T2 – MLM fortified	1,800.00	324	45	3.33	48.54	100.92	22.2	219.99	125.53	104.01	47.28
T3 – GLM fortified	1,645.00	296.1	45	3.33	45.97	102.03	20.96	217.3	136.02	78.8	36.27
T4 – OLM fortified	1,686.67	303.6	45	3.33	43.76	103.14	25.28	220.52	134.53	83.08	37.68
T5 – LLM fortified	1,781.67	320.7	45	3.33	44.52	98.9	22.13	213.88	123.33	106.82	49.95

[1/] - Computed based on the prevailing price per kilogram of broiler's final weight (Php 180.00/kg)
[2/] - Current price of broiler chick (Php 45.00/head)
[3/] - Computed based on the amount of feed consumed in the brooding stage (12.5 kg at Php 40.00/kg)
[4/] - Computed based on the starter feed consumption and cost of starter formulated ration per kg
[5/] - Computed based on the finisher feed consumption and cost of finisher formulated ration per kg
[6/] - Computed based on the cumulative water consumption and cost of 2% LABS per liter of water

Phytobiotic-LAB supplementation resulted in higher final body weights and gross returns, particularly in the moringa-fortified group. However, production costs were also higher due to feed and additive expenses. The guava-fortified treatment showed the highest net return and best cost efficiency, while the control had the highest ROI due to lower costs. These findings highlight the importance of balancing performance and cost. While supplementation increases expenses, improved efficiency and weight gain can offset these costs (Singh et al., 2020; Janjić et al., 2022; Landuay et al., 2020). The results demonstrate that phytobiotic-LAB supplementation can be economically viable when optimized for cost efficiency rather than maximum weight alone.

4. Conclusion and Recommendations

The study demonstrated that phytobiotic-fortified diets supplemented with lactic acid bacteria serum are a viable, safe, and effective alternative to antibiotic growth promoters in broiler production under tropical conditions. While no immediate effects were observed during the early growth phase, supplementation resulted in improved body weight, weight gain, rate of growth, and numerical feed efficiency beginning in the later stages, indicating enhanced nutrient utilization and metabolic efficiency. These improvements were achieved without affecting feed and water consumption, confirming that growth enhancement was due to better feed utilization rather than increased intake. Carcass yield, cut-up parts distribution, and organ development were not adversely affected, indicating physiological safety and maintained product quality. Economically, supplementation increased gross returns through improved growth performance but also raised production costs, highlighting that profitability depends on balancing efficiency and cost. Overall, phytobiotic-LAB combinations support improved productivity, carcass quality, and economic viability when properly optimized.

Phytobiotic-fortified diets supplemented with lactic acid bacteria serum are recommended as an effective antibiotic-free feeding strategy for broilers in tropical conditions. Moringa-based diets are suitable for maximizing growth and final body weight, while guava-based diets are recommended for improving cost efficiency and reducing cost per kilogram gain. The selection of phytobiotic-LAB combinations should align with the specific production and economic objectives of the producer. Further studies are recommended to determine optimal inclusion levels, evaluate long-term performance under commercial conditions, and assess additional parameters such as meat quality, physiological responses, and adaptation to environmental stress, as well as the potential of other phytobiotic sources.

The study was limited to a specific experimental period, location, and controlled conditions, which may not fully represent commercial production environments. Environmental factors such as high temperature and humidity during the trial may have influenced broiler performance and response to treatments. The evaluation focused primarily on growth performance, carcass characteristics, and economic outcomes, without extensive assessment of other parameters such as detailed physiological responses, long-term health effects, and broader environmental variability. These limitations suggest that results should be interpreted within the context of the study conditions.

Compliance with ethical standards

The study was conducted in accordance with institutional ethical standards, ensuring proper laboratory procedures and adherence to animal welfare considerations throughout the experimental period. No human participants were involved; therefore, voluntary participation and informed consent were not applicable, and all data were collected using non-invasive methods with strict confidentiality of research records. The authors declare no conflict of interest, and no external funding was reported for this study.

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