



ISSN: 2456-2912

NAAS Rating (2025): 4.61

VET 2026; 11(1): 99-103

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www.veterinarypaper.com

Received: 13-10-2025

Accepted: 22-11-2025

G Bhuvaneswari

Department of Livestock
Production and Management,
Rajiv Gandhi Institute of
Veterinary Education and
Research, Puducherry, India

P Ponnuvel

Department of Livestock Farm
Complex, Rajiv Gandhi Institute
of Veterinary Education and
Research, Puducherry, India

S Venugopal

Department of Livestock Farm
Complex, Rajiv Gandhi Institute
of Veterinary Education and
Research, Puducherry, India

V Rajaganapathy

Department of Livestock
Production and Management,
Rajiv Gandhi Institute of
Veterinary Education and
Research, Puducherry, India

PK Mandal

Department of Livestock
Products and Technology, Rajiv
Gandhi Institute of Veterinary
Education and Research,
Puducherry, India

George Dominic

Department of Animal
Nutrition, Rajiv Gandhi
Institute of Veterinary
Education and Research,
Puducherry, India

Corresponding Author:

G Bhuvaneswari

Department of Livestock
Production and Management,
Rajiv Gandhi Institute of
Veterinary Education and
Research, Puducherry, India

Effect of phytobiotic mixture on production performance of broiler chickens

G Bhuvaneswari, P Ponnuvel, S Venugopal, V Rajaganapathy, PK Mandal and George Dominic

DOI: <https://www.doi.org/10.22271/veterinary.2026.v11.i1b.2930>

Abstract

The present study evaluated the effect of dietary supplementation of different levels of a phytobiotic mixture containing *Phyllanthus niruri* and *Curcuma longa* on the growth performance of broiler chickens. A total of 180 day-old broiler chicks were randomly allotted to five treatment groups with three replicates of 12 birds each: control (C), antibiotic reference (R), and phytobiotic-supplemented groups at 0.5% (T₁), 1.0% (T₂), and 1.5% (T₃) inclusion levels. The experiment was conducted for six weeks under uniform management conditions. Growth performance parameters were recorded throughout the experimental period. Broilers fed the 0.5% phytobiotic mixture (T₁) showed significantly higher ($p < 0.05$) final body weight (2072.78 ± 26.71 g) and cumulative body weight gain (2029.14 ± 20.83 g) compared to the control and reference groups. The best cumulative feed conversion ratio was observed in T₁, while the poorest FCR was recorded in the reference group. The study indicates that 0.5% phytobiotic supplementation improves growth performance in broilers.

Keywords: Phytobiotics, *Phyllanthus niruri*, *Curcuma longa*, growth performance, feed conversion ratio

1. Introduction

Enhancing growth performance in broiler chickens is a primary objective of poultry production, as feed efficiency directly influences production cost and profitability (Mehta and Nambiar, 2008) [1]. Antibiotic growth promoters have been widely used to improve growth rate and feed utilization in broilers; however, increasing concerns regarding antimicrobial resistance and antibiotic residues in poultry products have resulted in restrictions on their use. Consequently, the search for safe and effective alternatives to antibiotics has become an important focus in poultry nutrition.

Phytogenic feed additives derived from medicinal plants have gained attention as natural alternatives due to their growth-promoting, antimicrobial, antioxidant, and digestive-stimulating properties (Raza *et al.*, 2019) [2]. Several studies have reported that phytobiotics improve nutrient digestibility, gut health, and growth performance in broiler chickens (Lillehoj *et al.*, 2018; Wickramasuriya *et al.*, 2024) [4, 3]. Turmeric (*Curcuma longa*) and *Phyllanthus niruri* are medicinal plants rich in bioactive compounds and have been shown to support digestion, modulate gut microbiota, and enhance growth performance when included individually in poultry diets (Jagadeeswaran *et al.*, 2011; Ayalew *et al.*, 2022; Pasaribu *et al.*, 2023) [5, 7, 6].

Although the beneficial effects of turmeric and *Phyllanthus niruri* have been documented, limited information is available on their combined supplementation at different inclusion levels on broiler growth performance. Therefore, the present study was conducted to evaluate the effect of dietary supplementation of a phytobiotic mixture containing *Curcuma longa* and *Phyllanthus niruri* on the growth performance of broiler chickens.

2. Materials and Methods

Day-old commercial broiler chicks (Vencobb-400) were procured from a reputed private

hatchery, and the experiment was conducted after approval of the Institutional Animal Ethics Committee (IAEC) at the Animal Experimental Shed, Livestock Farm Complex (LFC), Rajiv Gandhi Institute of Veterinary Education and Research (RIVER), Puducherry. A total of 180 day-old broiler chicks were randomly allotted to five dietary treatments with 36 birds per treatment. Each treatment consisted of three replicates, each with 12 birds. The experimental groups included Control (C), Reference (R), Treatment 1 (T₁), Treatment 2 (T₂), and Treatment 3 (T₃). The Control group was fed a standard basal diet, while the Reference group received the basal diet supplemented with an antibiotic growth promoter (Avilamycin). Treatments T₁, T₂, and T₃ were fed the basal diet supplemented with a phytobiotic mixture containing *Curcuma longa* and *Phyllanthus niruri* at inclusion levels of 0.5%, 1.0%, and 1.5%, respectively. The phytobiotic mixture was prepared by drying and finely grinding turmeric rhizomes and whole plants of *Phyllanthus niruri*, which were mixed uniformly and incorporated into the feed. Experimental diets were formulated as per Bureau of Indian Standards (BIS, 2007) recommendations. Birds were fed a three-phase feeding schedule consisting of pre-starter (0-7 days), starter (8-21 days), and finisher (22-42 days) diets. Feed and clean drinking water were provided ad libitum throughout the experimental period.

2.1 Housing and management

Birds were reared under a deep litter system in well-ventilated pens. Proper brooding management was followed during the initial period, and standard biosecurity and management

practices were maintained throughout the experiment.

2.2 Growth performance parameters

Body weight, feed intake, and mortality were recorded weekly for all treatment groups. Body weight gain, feed conversion ratio (FCR), and livability were calculated on both weekly and cumulative bases.

2.3 Statistical analysis

The data obtained on growth performance parameters were analyzed using one-way analysis of variance (ANOVA). Treatment means were compared, and differences were considered significant when $p < 0.05$ and non-significant when $p > 0.05$.

3 Results and Discussion

During the six-week feeding trial, dietary supplementation with a phytobiotic mixture containing *Phyllanthus niruri* and *Curcuma longa* significantly influenced the growth performance of broiler chickens.

3.1 Average weekly Body weight gain & average weekly body weight:

The initial body weights of chicks did not differ significantly among the treatment groups ($p > 0.05$), indicating uniformity at the beginning of the experiment (Table 1 and figure 1). During the first and second weeks, body weight and weight gain were statistically similar ($p > 0.05$) across all groups (Tables 1 and 2), suggesting that phytobiotic supplementation had minimal influence during the early growth phase.

Table 1: Effect of feeding different levels of phytobiotic mixture on average weekly body weight (g/bird) in broiler chicken

Week	Treatments					Significance	p-value
	C (Control)	R (Reference)	T ₁ (0.5%)	T ₂ (1%)	T ₃ (1.5%)		
0	45.38 ± 0.75 ^a	44.31 ± 0.54 ^a	43.64 ± 0.69 ^a	44.08 ± 0.52 ^a	44.86 ± 0.63 ^a	NS	0.32
1	158.36 ± 2.04 ^a	161.72 ± 2.08 ^a	158.47 ± 2.61 ^a	155.86 ± 2.16 ^a	156.78 ± 2.11 ^a	NS	0.39
2	394.47 ± 7.90 ^a	423.33 ± 8.29 ^a	390.28 ± 9.97 ^a	415.81 ± 8.54 ^a	412.11 ± 9.43 ^a	NS	0.14
3	770.28 ± 17.06 ^a	771.81 ± 16.30 ^a	802.50 ± 18.92 ^a	821.39 ± 15.99 ^a	809.72 ± 17.45 ^a	NS	0.13
4	1272.50 ± 21.02 ^a	1246.78 ± 23.41 ^a	1356.11 ± 23.44 ^b	1292.39 ± 26.08 ^{ab}	1306.94 ± 25.95 ^{ab}	*	0.02
5	1583.33 ± 24.31 ^{ab}	1545.06 ± 23.72 ^a	1696.94 ± 23.74 ^c	1601.11 ± 25.31 ^{ab}	1645.28 ± 22.72 ^{bc}	**	0.01
6	1936.94 ± 22.37 ^a	1931.44 ± 15.62 ^a	2072.78 ± 20.76 ^b	1933.67 ± 13.71 ^a	1980.28 ± 15.07 ^a	**	0.01

Means with different superscripts within a row differ significantly ($P < 0.05$). n = 36 values C - Control, R -Reference (antibiotic), T₁ - 0.5%, T₂ - 1%, T₃ - 1.5% phytobiotics mixture respectively.

NS = Non-significant, * - $P < 0.05$; ** - ($p < 0.01$).

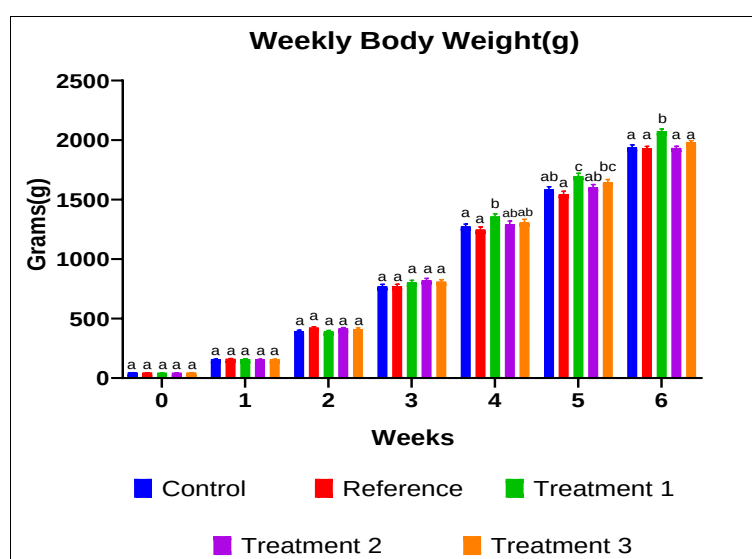


Fig 1: Effect of feeding different levels of phytobiotic mixture on average weekly body weight (g/bird) in broiler chicken

Bars representing means with different superscripts within a row differ significantly ($p < 0.05$)

Table 2: Effect of feeding different levels of phytobiotic mixture on average weekly body Gain

Week	Treatments					Significance	P-value
	C (Control)	R (Reference)	T ₁ (0.5%)	T ₂ (1%)	T ₃ (1.5%)		
1	112.97 ± 1.76 ^a	117.42 ± 1.81 ^a	114.83 ± 2.30 ^a	111.78 ± 1.93 ^a	111.92 ± 1.89 ^a	NS	0.210
2	236.11 ± 6.96 ^a	261.61 ± 7.61 ^a	231.81 ± 8.53 ^a	259.94 ± 7.39 ^a	255.33 ± 8.08 ^a	NS	0.13
3	375.81 ± 14.65 ^{ab}	348.47 ± 11.04 ^a	412.22 ± 17.46 ^b	405.58 ± 10.72 ^{ab}	397.61 ± 18.78 ^{ab}	**	0.01
4	502.22 ± 14.75 ^{ab}	474.97 ± 16.67 ^a	553.61 ± 17.84 ^b	471.00 ± 19.21 ^a	497.22 ± 20.46 ^{ab}	**	0.01
5	310.83 ± 12.15 ^a	298.28 ± 13.71 ^a	340.83 ± 13.46 ^a	308.72 ± 10.21 ^a	338.33 ± 12.01 ^a	NS	0.154
6	353.61 ± 13.77 ^{ab}	386.39 ± 11.28 ^b	375.83 ± 10.49 ^{ab}	332.56 ± 14.36 ^a	335.00 ± 12.70 ^a	**	0.01
Cumulative body weight gain							
CBWG	1891.56 ± 22.38 ^a	1887.14 ± 15.57 ^a	2029.14 ± 20.83 ^b	1889.58 ± 13.67 ^a	1935.42 ± 15.08 ^a	**	0.01

From the third week onward, broilers fed phytobiotic-supplemented diets exhibited improved growth performance compared to the control and reference groups. Birds receiving the 0.5% inclusion level (T₁) consistently recorded higher body weight and cumulative body weight gain, with significant differences ($p < 0.05$) becoming evident during the later stages of growth (Table 1 and 2 & figure 1). In contrast, higher supplementation levels (1.0% and 1.5%) resulted in moderate improvements, indicating a dose-dependent response to the phytobiotic mixture.

The enhancement in growth performance observed in the present study may be attributed to the synergistic effects of bioactive compounds present in *Curcuma longa* and *Phyllanthus niruri*. Curcumin possesses antioxidant and anti-inflammatory properties that help maintain intestinal integrity and enhance nutrient absorption. Meanwhile, *P. niruri* contains bioactive compounds such as phyllanthin and hypophyllanthin, which support hepatic function and exhibit antimicrobial activity, thereby improving overall metabolic efficiency. Similar improvements in body weight and weight

gain following supplementation with turmeric and *P. niruri* have been reported by Jagadeeswaran *et al.* (2011) [5], Hussein (2013) [9], Osman *et al.* (2017) [10], Ahlawat *et al.* (2018) [8], Pasaribu *et al.* (2021) [11], and Purnamasari *et al.* (2024) [12]. The reduced response observed at higher inclusion levels may be associated with decreased palatability or impaired nutrient utilization, as suggested earlier by Wang *et al.* (2015) [13].

3.2 Feed intake: Feed intake was moderately influenced by phytobiotic supplementation. Weekly feed intake did not differ significantly ($p > 0.05$) among treatments during the initial weeks (Table 3 and figure 2); however, during the mid-growth phase, birds in the T₁ and T₂ groups consumed comparatively higher amounts of feed. Cumulative feed intake was also higher in phytobiotic-supplemented groups, particularly at the 0.5% inclusion level (Table 4), indicating improved palatability and digestive efficiency. These findings are consistent with previous reports by Jagadeeswaran *et al.* (2011) [5], and Wang *et al.* (2015) [13], who observed increased feed consumption in broilers fed phyto-genic additives.

Table 3: Effect of feeding different levels of phytobiotic mixture on average weekly feed intake (g/bird) in broiler chicken

Week	Treatments					Significance	P-value
	C (Control)	R (Reference)	T ₁ (0.5%)	T ₂ (1%)	T ₃ (1.5%)		
1	165.13 ± 5.71 ^a	162.97 ± 2.25 ^a	160.53 ± 2.42 ^a	165.00 ± 2.79 ^a	160.57 ± 1.17 ^a	NS	0.41
2	332.93 ± 0.98 ^a	324.13 ± 9.93 ^a	318.30 ± 10.45 ^a	330.13 ± 11.84 ^a	311.87 ± 8.52 ^a	NS	0.16
3	555.53 ± 18.26 ^b	561.37 ± 22.59 ^b	524.13 ± 18.16 ^{ab}	567.70 ± 10.01 ^b	487.20 ± 30.15 ^a	*	0.02
4	647.20 ± 52.99 ^a	649.13 ± 33.01 ^a	664.10 ± 65.53 ^a	614.80 ± 6.59 ^a	634.10 ± 31.23 ^a	NS	0.20
5	687.47 ± 16.91 ^a	843.40 ± 26.73 ^{ab}	891.37 ± 5.65 ^{ab}	906.90 ± 18.98 ^b	842.73 ± 19.81 ^{ab}	*	0.03
6	910.63 ± 10.6 ^a	977.47 ± 19.24 ^a	878.53 ± 16.54 ^a	842.13 ± 10.18 ^a	806.43 ± 9.93 ^a	NS	0.11

Mean of 3 values.

Different superscripts (a, b, c) in the same row indicate significant difference ($p \leq 0.05$).

NS - non-significant ($p > 0.05$), * -significant ($p < 0.05$); ** - ($p < 0.01$).

C - Control, R -Reference (antibiotic), T₁ - 0.5%, T₂ - 1%, T₃ - 1.5% phytobiotics mixture respectively.

Table 4: Effect of feeding different levels of phytobiotic mixture on cumulative feed intake (g/bird) in broiler chicken

Week	Treatments					Significance	P-value
	C (Control)	R (Reference)	T ₁ (0.5%)	T ₂ (1%)	T ₃ (1.5%)		
1	165.13 ± 5.71 ^a	162.97 ± 2.25 ^a	160.53 ± 2.42 ^a	165.00 ± 2.79 ^a	160.57 ± 1.17 ^a	NS	0.41
2	498.07 ± 4.75 ^a	487.10 ± 11.99 ^a	478.83 ± 11.01 ^a	495.13 ± 14.59 ^a	472.43 ± 7.43 ^a	NS	0.12
3	1053.60 ± 17.71 ^c	1048.47 ± 14.06 ^{bc}	1002.97 ± 18.15 ^{ab}	1014.83 ± 17.15 ^{bc}	959.63 ± 15.14 ^a	**	0.01
4	1700.80 ± 12.14 ^{ab}	1697.60 ± 17.47 ^{ab}	1667.07 ± 17.93 ^{ab}	1677.63 ± 16.44 ^b	1593.73 ± 11.18 ^a	*	0.02
5	2388.27 ± 12.52 ^a	2541.00 ± 19.28 ^{ab}	2558.43 ± 18.77 ^{ab}	2568.53 ± 15.30 ^b	2436.47 ± 13.59 ^{ab}	*	0.05
6	3298.90 ± 16.58 ^{ab}	3518.47 ± 15.49 ^b	3436.97 ± 4.66 ^{ab}	3426.53 ± 14.92 ^b	3242.90 ± 13.79 ^a	**	0.01

Mean of 3 values.

Different superscripts (a, b, c) in the same row indicate significant difference ($p \leq 0.05$).

NS - non-significant ($p > 0.05$), * -significant ($p < 0.05$); ** - ($p < 0.01$).

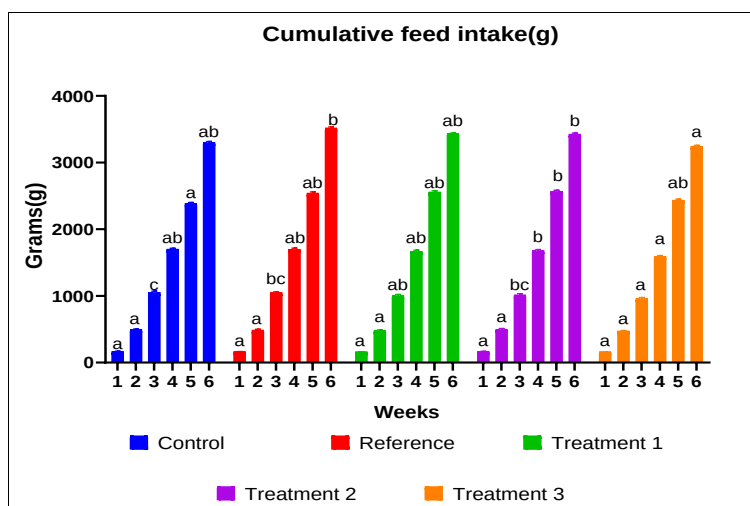


Fig 2: Effect of feeding different levels of phytobiotic mixture on cumulative feed intake (g/bird) in broiler chicken

Bars representing means with different superscripts within a row differ significantly ($p < 0.05$)

3.3 Feed conversion ratio (FCR) was significantly improved with phytobiotic supplementation, especially during the later growth stages. Broilers receiving the 0.5% phytobiotic mixture exhibited significantly lower FCR values ($p < 0.05$) compared to the control group (Table 5 and figure 3), indicating enhanced feed utilization efficiency. This

improvement may be associated with improved gut health, increased digestive enzyme activity, and stabilization of intestinal microflora promoted by phytochemical compounds. Comparable improvements in FCR with turmeric and *P. niruri* supplementation have been reported by Hussein (2013), Osman *et al.* (2017) ^[10], Yesuf *et al.* (2017) ^[16], and El-Gogary *et al.* (2025) ^[15].

Table 5: Effect of feeding different levels of phytobiotic mixture on cumulative feed conversion ratio (Cumulative FCR) of broiler chicken

Week	Treatments					Significance	P-value
	C (Control)	R (Reference)	T ₁ (0.5%)	T ₂ (1%)	T ₃ (1.5%)		
1	1.46 ± 0.01 ^a	1.39 ± 0.05 ^a	1.40 ± 0.03 ^a	1.47 ± 0.04 ^a	1.43 ± 0.03 ^a	NS	0.06
2	1.43 ± 0.10 ^a	1.29 ± 0.10 ^a	1.38 ± 0.09 ^a	1.33 ± 0.02 ^a	1.29 ± 0.08 ^a	NS	0.22
3	1.46 ± 0.09 ^a	1.44 ± 0.06 ^a	1.33 ± 0.10 ^a	1.38 ± 0.04 ^a	1.25 ± 0.10 ^a	NS	0.57
4	1.39 ± 0.01 ^a	1.42 ± 0.11 ^a	1.27 ± 0.03 ^a	1.38 ± 0.04 ^a	1.26 ± 0.07 ^a	NS	0.07
5	1.55 ± 0.08 ^a	1.70 ± 0.14 ^a	1.48 ± 0.07 ^a	1.66 ± 0.03 ^a	1.53 ± 0.10 ^a	NS	0.09
6	1.74 ± 0.12 ^{ab}	1.86 ± 0.06 ^b	1.62 ± 0.09 ^a	1.77 ± 0.06 ^{ab}	1.66 ± 0.09 ^{ab}	**	0.01

Mean of 3 values.

Different superscripts (a, b, c) in the same row indicate significant difference ($p \leq 0.05$).

NS - non-significant ($p > 0.05$), * -significant ($p < 0.05$) ** - ($p < 0.01$).

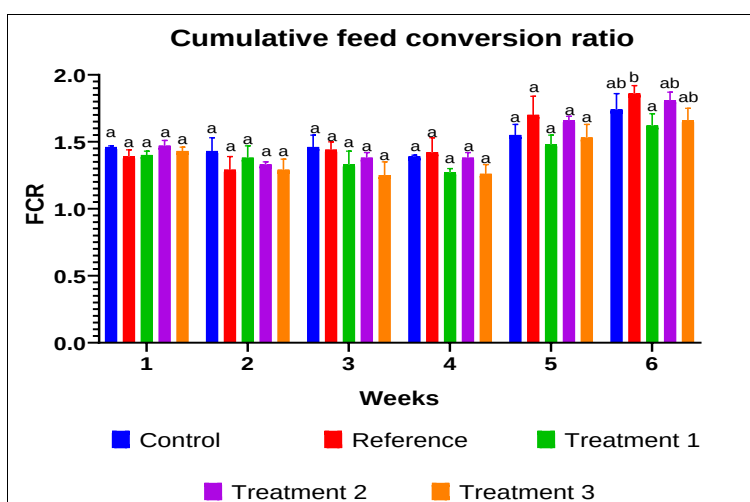


Fig 3: Effect of feeding different levels of phytobiotic mixture on cumulative feed conversion ratio (Cumulative FCR) of broiler chicken

Bars representing means with different superscripts within a row differ significantly ($p < 0.05$)

3.4 Livability: Livability remained high throughout the experimental period across all treatment groups (Table 6). Birds fed phytobiotic-supplemented diets recorded 100%

survivability, indicating the safety of the phytobiotic mixture and its beneficial role in maintaining bird health. The antimicrobial and immunomodulatory properties of *Curcuma longa* and *Phyllanthus niruri* may have contributed to improved survivability by reducing subclinical infections and enhancing immune competence. Similar observations have

been reported by Durrani *et al.* (2006) ^[17], Hussein (2013) ^[9], and Purnamasari *et al.* (2024) ^[12].

Table 6: Effect of feeding different levels of phytobiotic mixture on mean livability percentage in broiler chicken

Treatment groups	Mean Livability (%)
Control	100
Reference	97.22
Treatment 1	100
Treatment 2	100
Treatment 3	100

Overall, the results indicate that dietary supplementation with a phytobiotic mixture containing *Phyllanthus niruri* and *Curcuma longa*, particularly at the 0.5% inclusion level, effectively improved growth performance and feed efficiency in broiler chickens without adversely affecting feed intake or survivability.

Conclusion

The findings of the present study indicate that dietary inclusion of a phytobiotic mixture comprising *Phyllanthus niruri* and *Curcuma longa* had a beneficial effect on the production performance of broiler chickens. Among the evaluated inclusion levels, supplementation at 0.5% produced the most desirable results, as evidenced by increased body weight, higher cumulative weight gain, and improved feed conversion ratio, without negatively affecting feed intake or bird survivability. Inclusion levels above 0.5% resulted in comparatively moderate responses, suggesting that optimal performance is achieved at lower supplementation rates. The enhanced growth and feed efficiency may be attributed to the synergistic effects of the bioactive compounds present in the phytobiotic mixture, which likely improved gut health, nutrient absorption, and metabolic efficiency. Overall, the results support the use of *Phyllanthus niruri* and *Curcuma longa*-based phytobiotic mixtures as a safe and effective natural alternative to antibiotic growth promoters for improving production performance in broiler chickens.

Conflict of Interest: Not available.

Financial Support: Not available.

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How to Cite This Article

Bhuvaneswari G, Ponnuvel P, Venugopal S, Rajaganapathy V, Mandal PK, Dominic G. Effect of phytobiotic mixture on production performance of broiler chickens. International Journal of Veterinary Sciences and Animal Husbandry. 2026; 11(1): 99-103.

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