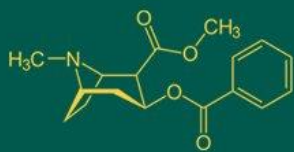


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Effect of supplementation of herbal growth promoters on the growth performance in broilers

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Abstract

A biological experiment was conducted to evaluate the efficacy of a herbal growth promoter (HGP) comprising equal proportions of *Andrographis paniculata*, *Boerhaavia diffusa*, *Achyranthes aspera*, and *Azadirachta indica* on the growth performance of commercial broiler chickens. A total of 420 day-old straight-run Cobb-400 broiler chicks were randomly allotted to seven dietary treatment groups (T₁-T₇), each consisting of four replicates with 15 chicks per replicate. The treatment groups included a basal diet control (T₁), basal diet supplemented with antibiotic growth promoter (Enramycin 10%) at 100 g/ton of feed (T₂), and basal diet supplemented with the herbal growth promoter at 200, 400, 600, 800, and 1000 g/ton of feed in T₃, T₄, T₅, T₆, and T₇, respectively. Growth performance parameters, including weekly cumulative body weight, feed consumption, feed conversion ratio (FCR) and European Production Efficiency Factor (EPEF), were recorded throughout the experimental period. Birds supplemented with the herbal growth promoter at 400 g/ton of feed (T₄) exhibited significantly improved growth performance compared to the other treatment groups. Feed conversion ratio was significantly lower in T₄ and T₅, with no significant difference observed between these two groups. The highest EPEF values were recorded in T₂ and T₄, indicating superior production efficiency. The results of the study indicate that supplementation of the herbal growth promoter at 400 g/ton of feed can effectively enhance broiler performance and may serve as a viable natural alternative to antibiotic growth promoters in commercial broiler production.

Keywords: Broiler, feed consumption, herbal, antibiotic, body weight

Introduction

The rearing of poultry provides supplementary income to millions of farmers and landless labourers of rural India. As per BAHs (2019) [5], the population of poultry in India was 851.81 million. In India, the total meat production is 10.50 million tonnes and poultry contributing about 49% of total meat production during the year 2024-25 (BAHS, 2025) [6]. Feed accounts for 60-70% of poultry production costs (Eniwaye *et al.*, 2026) [8]. Phase feeding strategies have significantly improved weight gain and feed conversion ratio in broilers. To sustain growth in the poultry industry, exploring alternative feed resources and additives are essential. Phytochemical feed additives (PFA) derived from plants, herbs, or extracts contain bioactive compounds such as phenolics, terpenoids, glycosides, and alkaloids, contributing to their antimicrobial effects (Aminullah *et al.*, 2025) [2]. Recent studies have shown that PFAs can be effectively used in poultry to improve growth performance, feed efficiency, immunity, gut health, product quality and economic returns, acting as alternatives to antibiotics by decreasing oxidative stress, pathogenic microbes, and enhancing nutrient utilization (Gosai *et al.*, 2023) [10] and (Chaudhary *et al.*, 2026) [7].

In poultry diets, antimicrobial compounds are frequently used as antibiotic growth promoters (AGPs) to stimulate growth, control diseases at subtherapeutic antibiotic doses, and treat sick conditions at therapeutic doses. The risk of potential drug resistance in human pathogenic bacteria, such as methicillin-resistant *Staphylococcus aureus* (MRSA), Vancomycin-resistant *Enterococcus* (VRE), multi-drug-resistant *Mycobacterium tuberculosis* (MDR-TB) and Carbapenem-resistant *Enterobacteriaceae* (CRE), a gut bacterium, has led the European Union has banned feed-grade antibiotic growth promoters. Reduced growth performance was the result of not using antibiotics in the diets of the chickens. As a result, there is a great need for natural compounds that improve growth in the same way and have positive effects on the

health of chickens. In response to these challenges, the utilization of herbal growth promoters (HGP) has gained considerable attention as a promising and sustainable alternative to antibiotic growth promoters (AGP) in commercial broiler production. AGPs have historically been instrumental in achieving these goals by improving feed efficiency, reducing disease prevalence, and promoting overall growth in broiler chickens. However, concerns over the development of antibiotic resistance, potential negative effects on human health and stringent regulatory restrictions have prompted the search for alternative growth-promoting strategies in the poultry industry. HGPs, derived from various medicinal plants and herbs, have exhibited a range of beneficial properties, including immunomodulation, antimicrobial activity and improved digestion. Among these herbal options, *Andrographis paniculata*, *Boerhaavia diffusa*, *Achyranthus aspera*, and *Azadirachta indica* have emerged as potential candidates for enhancing broiler performance while reducing reliance on antibiotics.

Materials and Methods

A biological experiment was conducted to evaluate the effects of herbal growth promoters, namely *Andrographis paniculata*, *Boerhaavia diffusa*, *Achyranthus aspera*, and *Azadirachta indica*, on the growth performance of broiler chickens from 0 to 6 weeks of age. A total of 420 day-old straight-run Cobb-400 broiler chicks were procured from a commercial hatchery. The chicks were individually weighed, wing-banded, and randomly allocated into seven treatment groups (T₁-T₇), each comprising four replicates with 15 chicks per replicate, resulting in 60 chicks per treatment. The birds were reared under a deep litter system following standard management practices up to six weeks of age. A standard vaccination schedule was implemented throughout the experimental period. The study was carried out at the Department of Livestock Production and Management, Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar. All experimental procedures

were conducted in accordance with the guidelines approved by the Institutional Animal Ethics Committee of Veterinary College, Bidar, Karnataka, under project proposal No. VCB/IAEC/LPM-09/2023-24.

Table 1: Description of experimental design from 0-42 days period

T ₁	Basal diet (Without Antibiotic)
T ₂	Basal diet + AGP (Enramycin 10%) at 100 g/ton of feed
T ₃	Basal diet + Herbal Growth Promoter (200 g/ton of feed)
T ₄	Basal diet + Herbal Growth Promoter (400 g/ton of feed)
T ₅	Basal diet + Herbal Growth Promoter (600 g/ton of feed)
T ₆	Basal diet + Herbal Growth Promoter (800 g/ton of feed)
T ₇	Basal diet + Herbal Growth Promoter (1000 g/ton of feed)

Herbal growth promoter are *Andrographis paniculata*, *Boerhaavia diffusa*, *Achyranthus aspera* and *Azadirachta indica* at equal proportion.

1. Body Weight (Weekly cumulative)

The chicks were weighed individually on day one and at the end of each week for the entire six weeks. Weekly body weight and cumulative body weight were recorded till the end of the trial.

2. Feed Consumption (Weekly cumulative)

The feed consumption in each replicate was recorded weekly by subtracting the weight of residual feed from the total quantity of feed supplied during the respective week.

3. Feed Conversion Ratio (FCR)

The feed conversion ratio (FCR) expressed as the relationship between the amount of feed consumed (kg) to the body weight gain (kg) under each treatment of birds was determined. The weekly feed conversion ratio and cumulative feed conversion ratio was calculated at the end of the trial. The FCR was calculated by using the following formula,

$$\text{FCR (weekly)} = \frac{\text{Average feed consumption per bird during the week (kg)}}{\text{Average weight gain per bird during the week (kg)}}$$

$$\text{FCR (Cumulative)} = \frac{\text{Average feed consumption per bird at the end of trial (kg)}}{\text{Average weight gain per bird at the end of trail (kg)}}$$

4 European Production Efficiency Factor (EPEF)

The EPEF was calculated by dividing the product of livability percentage and live weight (kg) by the product of age in days and FCR, and then multiplying the result by 100. The EPEF was calculated by using the following formula,

$$\text{EPEF (Cumulative)} = \frac{\text{Livability (\%)} \times \text{live weight (Kg)}}{\text{Age (d)} \times \text{FCR}} \times 100$$

Results and Discussion

Growth parameters

1 Body weight

The effect of dietary supplementation of herbal growth promoter at different doses on the weekly cumulative body weight of broilers is presented in Table 4. Significant differences ($p < 0.05$) were observed among the treatment groups across all six weeks of the study. The results indicate that supplementation of herbal growth promoter at 400-600

g/ton of feed (T₄ and T₅) produced body weight gains comparable to the antibiotic growth promoter (T₂, Enramycin 10%), suggesting its potential as an effective natural alternative. These results of the present study are in agreement with the growth promoting effect of supplementation of *Azadirachta indica* (Hady and Zaki 2012; Mahejabin *et al.*, 2015; Mahmood *et al.*, 2016; Ihsan *et al.*, 2017, Al-Jebory *et al.*, 2023 and Nawaz *et al.*, 2023) [11, 16, 17, 12, 1, 19], supplementation of *Andrographis paniculata* (Laing *et al.*, 2013) [13] and (Arify *et al.*, 2019) [3], supplementation of *Boerhaavia diffusa* (Somvanshi *et al.*, 2020) [21], supplementation of *Achyranthes aspera* (Asif *et al.*, 2011) [4], and combination of herbal growth promoters containing above ingredient (Nety *et al.*, 2017; Somvanshi *et al.*, 2021; Giannenas *et al.*, 2020 and Lonkar *et al.*, 2023) [20, 21, 9, 15]. The higher cumulative body weight observed in broiler chickens supplemented with herbal growth promoters at 400-600 g/ton of feed could be attributed to several factors such as better nutrient absorption and

utilization of feed by improving intestinal morphology, consequently increasing the growth rate of the chickens. The findings suggest that the herbal growth promoters positively influenced broiler performance by enhancing gut health, liver stimulating effect and nutrient utilization, ultimately contributing to higher body weight gain.

2 Feed consumption

The weekly cumulative feed consumption (g/bird) of broilers supplemented with herbal growth promoter (HGP) at varying doses is presented in Table 3 which shows the significant differences ($p < 0.05$) among treatment groups in most weeks of the study. The birds supplemented with HGP at moderate doses of 400-600 g/ton (T_4 and T_5) consumed feed at levels comparable to the antibiotic growth promoter group (T_2), reflecting similar appetitive responses. These results of the present study are in agreement with the increased in feed consumption with supplementation of *Azadirachta indica* (Mahmood *et al.*, 2016) [17]; Al-Jebory *et al.*, 2023 [1] and Nawaz *et al.*, 2023 [19], supplementation of *Andrographis paniculata* (Laing *et al.*, 2013) [13], supplementation of *Boerhavia diffusa* (Tomar *et al.*, 2020) [22], supplementation of *Achyranthes aspera* (Monika *et al.*, 2017) [18].

3 Feed conversion ratio

The weekly cumulative feed conversion ratio (FCR) of broilers fed diets supplemented with herbal growth promoter (HGP) at varying doses is presented in Table 4. Lower FCR values indicate better feed utilization efficiency. Significant differences ($p < 0.05$) were observed among treatment groups in most weeks of the study. These results of the present study are in agreement with the growth promoting effect of

supplementation of *Azadirachta indica* (Al-Jebory *et al.*, 2023 and Nawaz *et al.*, 2023) [1, 19], supplementation of *Andrographis paniculata* (Laing *et al.*, 2013 and Arify *et al.*, 2019) [13, 3], supplementation of *Boerhavia diffusa* (Somvanshi *et al.*, 2020) [21], supplementation of *Achyranthes aspera* (Monika *et al.*, 2017) [18], and combination of herbal growth promoters containing above ingredient (Nety *et al.*, 2017 and Lonkar *et al.*, 2023) [20, 15].

4 European production efficiency factor

The mean European production efficiency factor for T_1 , T_2 , T_3 , T_4 , T_5 , T_6 and T_7 group's are 257.41 ± 7.30 , 298.48 ± 4.17 , 268.88 ± 0.84 , 300.00 ± 1.42 , 284.83 ± 6.66 , 271.96 ± 2.78 and 257.11 ± 3.08 respectively in table 5. Significantly highest ($p < 0.05$) European production efficiency factor were observed in the T_2 and T_4 groups whereas significantly lowest ($p < 0.05$) European production efficiency factor were observed in T_1 (control) group. However, there were no significant difference in mean European production efficiency factor among T_1 (control) and other treatment groups (T_3 , T_6 and T_7). Laing *et al.* 2013 [13] evaluated the effects of *Andrographis paniculata* and *Zingiber cassumunar* mixture revealed that productive index had improved higher than the control group in broilers. Lipinski *et al.* [14] observed that statistical analysis of Superliv (*Andrographis paniculata*, *Azadirachta indica*, *Achyranthes aspera*, *Boerhavia diffusa* etc) had a beneficial influence on European Efficiency Index (EEI). Lonkar *et al.* 2023 [15] conducted an experiment on effect of polyherbal liver stimulant containing *Andrographis paniculata*, *Boerhavia diffusa* etc on production performance of commercial broiler chickens and observed that polyherbal liver stimulant has improved EPEF by 19.2%.

Table 2: Effect of herbal growth promoters and their combination on weekly cumulative body weight (mean $\pm$ SE) in broilers

Treatment	Weekly cumulative body weight in (g)					
	I	II	III	IV	V	VI
T_1	86.17 ± 1.28^{bcd}	275.14 ± 6.24^b	587.08 ± 13.23^b	1110.16 ± 24.41^{abc}	1763.85 ± 33.93^{bc}	1995.52 ± 35.41^c
T_2	89.43 ± 1.37^{ab}	301.20 ± 4.81^a	645.85 ± 14.54^a	1183.04 ± 15.50^a	1885.64 ± 28.17^a	2124.04 ± 29.30^{ab}
T_3	81.63 ± 1.55^d	272.73 ± 5.64^b	599.93 ± 15.66^{ab}	1133.73 ± 24.29^{ab}	1808.16 ± 35.46^{ab}	2065.46 ± 36.82^{bc}
T_4	86.94 ± 1.70^{bc}	279.17 ± 7.26^b	604.09 ± 15.46^{ab}	1120.57 ± 29.16^{ab}	1790.43 ± 38.50^{ab}	2200.17 ± 47.71^a
T_5	93.48 ± 1.88^a	312.46 ± 9.77^a	643.85 ± 20.33^a	1164.57 ± 33.88^a	1894.07 ± 53.14^a	2158.99 ± 53.25^{ab}
T_6	81.54 ± 1.57^d	264.07 ± 8.59^b	575.22 ± 15.66^b	1039.17 ± 25.06^c	1755.51 ± 37.72^{bc}	2064.24 ± 39.81^{bc}
T_7	84.21 ± 1.79^{cd}	268.55 ± 8.54^b	584.52 ± 17.37^b	1055.24 ± 30.36^{bc}	1673.04 ± 34.48^c	1983.86 ± 32.10^c

Values bearing different superscripts (a, b, c, d) differ significantly ($p < 0.05$) between groups

Table 3: Effect of herbal growth promoters and their combination on weekly cumulative feed consumption (g/bird) in broilers

Treatment	Weekly cumulative feed consumption in (g)					
	I	II	III	IV	V	VI
T_1	112.17 ± 1.49^{cd}	395.46 ± 05.04^b	939.98 ± 3.41^{ab}	1777.34 ± 12.50	2773.67 ± 17.20^{cd}	3587.17 ± 22.91^c
T_2	122.74 ± 5.13^{ab}	419.54 ± 8.35^a	956.66 ± 7.96^a	1784.46 ± 14.24	2749.88 ± 25.88^d	3684.26 ± 29.26^{ab}
T_3	102.82 ± 3.47^d	384.52 ± 06.13^b	928.54 ± 4.31^b	1752.48 ± 12.17	2791.30 ± 10.62^{bcd}	3666.84 ± 33.65^b
T_4	130.86 ± 1.15^a	430.74 ± 10.97^a	959.14 ± 4.11^a	1761.20 ± 11.90	2826.66 ± 29.96^{abc}	3743.54 ± 14.46^a
T_5	125.87 ± 2.10^a	416.35 ± 05.07^a	941.07 ± 10.28^{ab}	1767.30 ± 24.89	2819.86 ± 17.45^{abc}	3702.33 ± 19.86^{ab}
T_6	107.65 ± 3.31^{cd}	395.98 ± 10.22^b	943.45 ± 13.87^{ab}	1732.93 ± 11.75	2837.86 ± 11.52^{ab}	3578.14 ± 13.08^c
T_7	114.43 ± 2.96^{bc}	394.34 ± 14.13^b	919.36 ± 9.92^b	1752.40 ± 15.77	2874.96 ± 14.87^a	3585.91 ± 14.57^c

Values bearing different superscripts (a, b, c, d) differ significantly ($p < 0.05$) between groups

Table 4: Effect of herbal growth promoters and their combination on weekly cumulative feed conversion ratio in broilers

Treatment	Weekly cumulative feed conversion ratio					
	I	II	III	IV	V	VI
T ₁	1.30±0.05 ^{bc}	1.44±0.03 ^{bc}	1.61±0.03	1.61±0.02 ^{bc}	1.58±0.03 ^{ab}	1.80±0.01 ^{bc}
T ₂	1.40±0.03 ^c	1.43±0.03 ^{bc}	1.53±0.04	1.51±0.04 ^a	1.46±0.04 ^a	1.72±0.08 ^a
T ₃	1.26±0.04 ^a	1.41±0.03 ^b	1.55±0.03	1.55±0.03 ^{ab}	1.53±0.05 ^{abc}	1.78±0.04 ^{abc}
T ₄	1.51±0.03 ^d	1.60±0.01 ^e	1.59±0.04	1.57±0.02 ^{ab}	1.58±0.01 ^{ab}	1.70±0.02 ^a
T ₅	1.35±0.04 ^{cd}	1.33±0.05 ^a	1.46±0.11	1.52±0.05 ^{ab}	1.49±0.05 ^{ab}	1.72±0.04 ^a
T ₆	1.33±0.03 ^{bcd}	1.52±0.03 ^d	1.65±0.02	1.68±0.03 ^c	1.63±0.04 ^c	1.73±0.03 ^{ab}
T ₇	1.36±0.02 ^{cd}	1.48±0.03 ^{cd}	1.58±0.05	1.67±0.02 ^c	1.74±0.04 ^d	1.81±0.26 ^c

Values bearing different superscripts (a, b, c, d) differ significantly ($p < 0.05$) between groups

Table 5: Effect of herbal growth promoters and their combination on European production efficiency factor in broilers

Treatment	European production efficiency factor
T ₁	257.41±7.80 ^c
T ₂	298.48±4.27 ^a
T ₃	268.88±0.94 ^{bc}
T ₄	300.00±1.62 ^a
T ₅	284.83±6.56 ^{ab}
T ₆	271.96±2.48 ^{bc}
T ₇	257.11±3.18 ^c

Values bearing different superscripts (a, b, c, d) differ significantly ($p < 0.05$) between groups

Conclusion

From the present study, it was found that the supplementation of various levels of herbal growth promoters in broilers had a significant effect on growth performance where T₄ (HGP @ 400 g/ton) recorded the highest cumulative body weight, the best feed conversion ratio, the highest total feed consumption, and the highest European Production Efficiency Factor, all of which were statistically comparable to the AGP group.

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