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Dietary supplementation of amla (*Emblica officinalis*) and shatavari (*Asparagus racemosus*) for improved growth performance in commercial broiler chickens

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Abstract

India's rich traditional heritage includes the widespread use of Ayurvedic medicine for its therapeutic benefits in both human and animal health. This study evaluated the effects of *Asparagus racemosus* (Shatavari root powder, SRP) and *Emblica officinalis* (Amla powder, AP) supplementation on growth performance, nutrient utilization, and economic viability in broiler chickens. A total of 288-day-old Cobb broiler chicks were randomly assigned to eight treatment groups (four replicates of nine chicks each). The control group (T₀) received a basal diet, while the other treatments were supplemented with varying levels of SRP and AP. Results demonstrated that SRP and AP supplementation significantly ($P < 0.05$) improved body weight gain, reduced feed intake and feed conversion ratio (FCR), and enhanced nutrient retention (dry matter, crude protein, and ether extract) compared to the control. Economically, SRP and AP inclusion lowered feed costs and increased net profit. The study concludes that supplementing broiler diets with 0.5 g/kg of SRP + AP is a cost-effective strategy for enhancing productivity in poultry farming.

Keywords: Broilers, body weight gain, feed efficiency, nutrient retention, phytochemical supplements, poultry economics

Introduction

Poultry refers to domesticated bird species raised for meat, eggs, and other valuable by-products. Among livestock enterprises, poultry farming is recognized for its quick returns and cost-effectiveness. Remarkably, broiler chickens can achieve a market-ready weight of 1.8 kg within just seven weeks of rearing.

Broilers are particularly important in poultry production due to their efficient feed conversion and high-protein dietary requirements. As health awareness increases globally, poultry products (meat and eggs) have gained prominence in human diets, positively influencing India's poultry market. Lifestyle changes promoting healthier diets and active living, despite health challenges like diabetes and obesity, further support this trend. The Indian government encourages poultry farming through financial support and initiatives like the Entrepreneurship Development and Employment Generation (EDEG) scheme to promote qualitative and quantitative production.

The broiler meat act as a pivotal animal protein source, helping meet nutritional demands. Recent years have seen broiler production emerge as the fastest method to increase high-quality protein availability. However, feed expenses account for 70-75% of total production costs, making feed efficiency improvement essential for economic sustainability.

Globally, poultry farming has evolved into a highly organized agribusiness sector. India ranks as the world's 3rd leading egg producer and 5th in broiler meat production. Despite this, there exists a significant difference between recommended and genuine meat consumption in India. The National Institute of Nutrition (NIN) suggests per capita meat consumption of 11 kg, while actual availability stands at only 3.8 kg. This contrasts sharply with global averages (17 kg) and developed nations like the United States (43 kg), (FAO, 2016) [3].

India's traditional Ayurvedic system offers valuable medicinal plants with therapeutic applications for both humans and animals. Among these, Indian gooseberry (Amla, *Emblica officinalis*) holds particular significance. This deciduous tree, known regionally as 'Usiri' or 'Nellikai', has been documented in ancient Ayurvedic texts for its medicinal properties.

Modern research confirms Amla's benefits as:

- A powerful natural antioxidant with high vitamin C content.
- An effective immune modulator.
- An antimicrobial agent with antiviral, antibacterial, and antifungal properties.

In poultry production, Amla serves as:

- A growth promoter
- An immunomodulator
- An antioxidant supplement

Similarly, Shatavari (*Asparagus racemosus*) is valued for its galactagogue and anabolic properties. Its active components, particularly Shatavarins (saponins), function as nutritive tonics and anti-stress agents.

Various herbal preparations, including Amla, Shatavari, Tulsi, and ginseng, have demonstrated effectiveness as anti-stress solutions in animal health management. These natural alternatives offer promising solutions for enhancing poultry productivity while addressing modern challenges in the industry.

Materials and Methods

The study was conducted from November 25, 2021, to January 7, 2022, at the experimental poultry farm of the Department of A.H & Dairying, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, and Uttar Pradesh. Locally sourced dried Amla powder (*Emblica officinalis*) and Shatavari root powder (*Asparagus racemosus*) were procured from Kanpur markets.

Experimental Design

- Dietary treatments included pre-starter (1-12 days), starter (13-28 days), and finisher (29-42 days) phases.
- Eight experimental groups (T₀-T₇) were established, with T₀ serving as the control group (no supplementation).
- Detailed dietary formulations are presented in Table 1.

Broiler Management:

- 288-day-old Vencobb-400 broiler chicks from a first hatch (Kanpur hatchery) were weighed and unintentional allocated.
- Birds were divided into 8 treatment groups (36 chicks/group), each with 4 replicates of 9 chicks.
- Standard deep litter management system was followed throughout the 6-week trial
- Strict biosecurity protocols were maintained during the experimental period

Health Management: All chicks received standard vaccinations for

- The Ranikhet Disease (RD).
- The Infectious Bursal Disease (IBD).

Data Collection: Parameters recorded weekly included

1. Feed consumption weekly

2. Body weight gain weekly
3. Feed Conversion Ratio (FCR) at different growth stages

Economic Analysis: Production costs and profitability were calculated

- Using the method described by Narahari and Kumararaj (2008).
- Based on prevailing market prices during the study period

Statistical Analysis: Data was analyzed using

- The Completely Randomized Design (CRD)
- Standard procedures for mean and standard error calculation (Snedecor and Cochran, 1994) ^[16].

Experimental Results

Weekly Feed Intake

The data on lasting a week average feed uptake and total feed using up are presented in Table 2. In the initial weeks, the T₇ group showed the highest feed uptake, whereas the T₀ group had the minimal. During the 2nd week, feed uptake rest relatively consistent across all treatment groups. By the 3rd and 4th weeks, the T₀ group uptake the most feed, while the T₆ group recorded the less uptake. This trend continued into the 5th and 6th weeks, with T₀ again exhibiting the highest feed uptake and T₆ the lesser.

Over the entire 6-week period (weeks I to VI), mean feed uptake varied among treatment groups as follows: T₀: 4292 g, T₁: 4039 g, T₂: 4060 g, T₃: 4051 g, T₄: 4065 g, T₅: 4063 g, T₆: 3988 g, and T₇: 4088 g. Notably, by the end of the sixth week, all treatment groups had significantly lower feed intake compared to the control group (T₀). The highest intake (4292 g) was observed in T₀, while the lowest (3988 g) was recorded in the T₆ group, which received a diet containing 0.50% SRP + 0.50% AP.

These findings are consistent with previous research. Kumari *et al.* (2012) ^[6] reported reduced feed intake in chicks supplemented with SRP, showing a linear decrease with increasing supplementation levels. Similarly, Wadhwa *et al.* (2007) ^[18] observed comparable differences in feed consumption when amla powder was added to broiler rations, with natural vitamin C (from amla) enhancing intake more effectively than synthetic vitamin C. Positive results were also noted by Singh *et al.* (2009) ^[15] using Superliv DS containing *Emblica officinalis* documented a significant increase in feed consumption with *Emblica officinalis* supplementation.

Weekly live body weight gain

The data on average weekly live body weight gain are presented in Table 3. Over the 6-week period, mean body weight gains across treatment groups were as follows: T₀: 2234 g, T₁: 2283 g, T₂: 2300 g, T₃: 2296 g, T₄: 2304 g, T₅: 2324 g, T₆: 2409 g, and T₇: 2362 g.

All treatment groups demonstrated significantly higher body weight gains compared to the control group (T₀). The maximum gain (2409.28 g, representing a 7.84% increase) was observed in T₆, which received the full supplement combination (SRP + AP) in the basal diet. This was followed by T₇ (2362 g), T₅ (2324 g), T₄ (2304 g), T₂ (2300 g), T₃ (2296 g), T₁ (2283 g), and T₀ (2234 g). The lowest gain was recorded in the control group (T₀).

Throughout the experiment, a clear trend emerged, with herbal-supplemented groups outperforming the control group in weight gain. The T₆ group achieved the highest gain, while

T₀ showed the lowest, and this difference was statistically significant.

These results align with existing literature. Rekhate *et al.* (2004) [13], Bhardwaj *et al.* (2008) [1], Kumari *et al.* (2012) [6] all reported enhanced weight gain with Shatavari supplementation. Additionally, Patel *et al.* (2016) found a significant increase in body weight in broilers fed *E. officinalis* powder, while Kumari *et al.* (2012) [6] and Patil *et al.* (2014) [8] also documented improved growth performance with similar supplementation strategies.

Feed Conversion Ratio

The study evaluated the effects of Shatavari and amla powder supplementation on broiler feed conversion ratio (FCR) from weeks 1-6, with results presented in Table 4 and Figure 3. Mean FCR values across the 6-week period showed variation between treatment groups: T₀ (control) at 1.77, T₁-T₃ at 1.64, T₄ at 1.65, T₅ at 1.63, T₆ at 1.54 and T₇ at 1.60. All supplemented groups demonstrated significantly improved FCR compared to the control, with the most efficient conversion (1.54) occurring in the T₆ group receiving 0.50% SRP + 0.50% AP. While no significant differences appeared in weeks 1-2, the enhanced FCR in supplemented groups likely relates to the same mechanisms that improved body weight gain.

These findings align with previous research by Bhardwaj *et al.* (2008) [1] and Pedulwar *et al.* (2007) [9] documenting FCR improvements with Shatavari supplementation.

Nutrient Utilization

Nutrient utilization data (Table 5) revealed significant differences between groups. Dry matter utilization percentages were: T₀ (70.61%), T₁ (71.43%), T₂ (71.63%), T₃ (72.60%), T₄ (72.84%), T₅ (73.15%), T₆ (73.85%) and T₇ (73.40%). Groups T₄-T₇ showed significantly higher dry matter absorption than the control, with T₆ demonstrating the highest utilization. Crude protein utilization followed a similar pattern: T₀ (54.42%), T₁ (56.92%), T₂ (57.15%), T₃ (58.09%), T₄ (58.52%), T₅ (58.92%), T₆ (59.42%), and T₇ (58.85%). All supplemented groups outperformed the control in protein utilization, with visible improvements in muscling corresponding to body weight gains.

Ether extract utilization showed comparable enhancements: T₀ (72.16%), T₁ (75.02%), T₂ (76.11%), T₃ (76.54%), T₄ (77.20%), T₅ (77.70%), T₆ (78.96%), and T₇ (77.82%). The supplemented groups exhibited significantly better fat utilization than the control, evidenced by superior fleshing characteristics in broilers receiving SRP and Amla powder supplements.

Mortality Percentage

The study recorded mortality rates among broiler chicks across different treatment groups. Out of the total 288 chicks reared, 26 mortalities occurred during the experimental period, resulting in an overall mortality rate of 9.02%. Mortality percentages varied between treatment groups, ranging from 2.77% to 13.88%, with the highest mortality observed during the second week of the trial.

Economics of Broiler Production

The economic analysis of broiler production examined the cost-effectiveness of supplementing diets with SRP (Shatavari Root Powder) and Amla powder, either individually or in

combination. The calculation considered both the initial cost of day-old chicks and feed consumption throughout the rearing period.

For the control group (T₀), the total feed cost per bird was Rs. 120.12, while supplemented groups ranged from Rs. 116.47 (T₃) to Rs. 125.82 (T₇). When including the cost of chicks, total production expenses varied from Rs. 176.47 (T₃) to Rs. 185.82 (T₇), with the control group (T₀) at Rs. 180.12.

Net profit was calculated based on the market rate of Rs. 110 per kg of live weight. The T₆ group, which received a combination of 0.5% SRP and 0.5% Amla powder, achieved the highest net profit of Rs. 91.44 per bird-representing a 27.29% increase over the control group's Rs. 70.57. Other supplemented groups showed profits ranging from Rs. 75.32 (T₂) to Rs. 83.03 (T₅).

These results demonstrate that the T₆ dietary supplementation not only improved feed efficiency and nutrient utilization but also delivered superior economic returns compared to both the control and other treatment groups. The findings support the economic viability of using combined SRP and Amla powder supplementation in commercial broiler production systems.

Table 1: Experimental Dietary Treatments

Treatment Group	Dietary Composition
T ₀	Basal diet (control, no supplementation)
T ₁	Basal diet + 0.50% Shatavari root powder (SRP)
T ₂	Basal diet + 1.00% SRP
T ₃	Basal diet + 0.50% Amla powder (AP)
T ₄	Basal diet + 1.00% AP
T ₅	Basal diet+0.25% SRP+0.25% AP (combined low-dose)
T ₆	Basal diet+0.50% SRP+0.50% AP (combined moderate-dose)
T ₇	Basal diet+0.75% SRP+0.75% AP (combined high-dose)

Table 2: Weekly Feed Intake (g/bird) across treatment groups

Treatment	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Total Intake
T ₀	134	283	607	816	1088	1363	4292
T ₁	133	280	589	770	1029	1237	4039
T ₂	135	281	591	771	1040	1242	4060
T ₃	135	278	589	774	1039	1234	4051
T ₄	136	281	590	780	1033	1243	4065
T ₅	136	280	594	776	1037	1239	4063
T ₆	135	281	587	760	1019	1203	3988
T ₇	136	283	600	771	1045	1251	4088

Table 3: Weekly Body Weight Gain (g/bird) across treatment groups

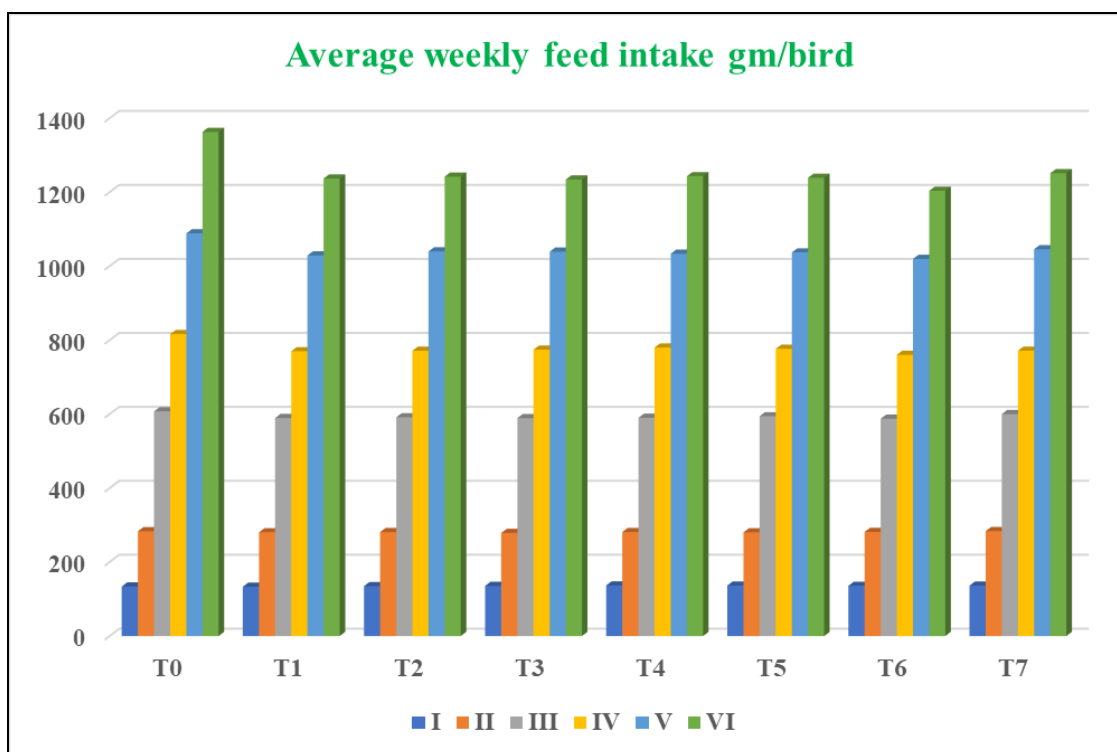
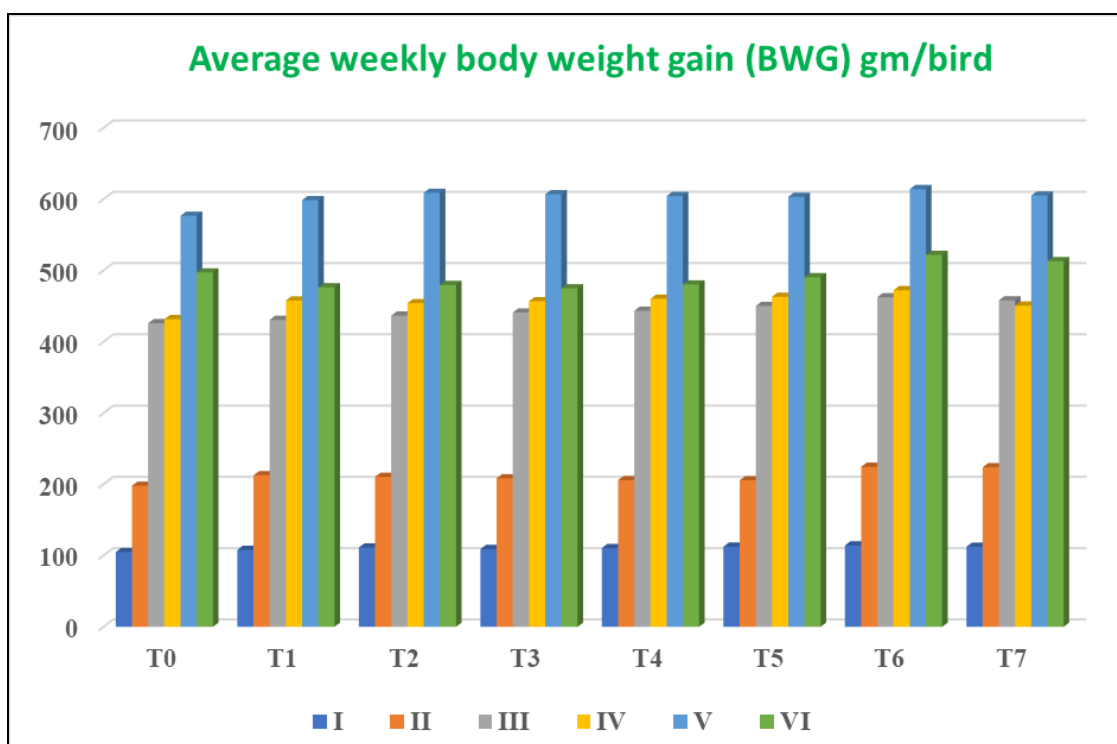
Treatment	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Total Gain
T ₀	104	197	425	431	576	497	2234
T ₁	107	212	430	457	598	476	2283
T ₂	111	210	436	454	608	479	2300
T ₃	109	208	440	456	606	474	2296
T ₄	110	205	443	460	604	480	2304
T ₅	112	205	450	463	603	490	2324
T ₆	114	224	462	472	614	521	2409
T ₇	112	223	457	450	604	513	2362

Table 4: Weekly Feed Conversion Ratio (FCR) by treatment group

Treatment	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Overall Mean
T ₀	1.27	1.43	1.42	1.88	1.88	2.74	1.77
T ₁	1.23	1.31	1.36	1.67	1.71	2.59	1.64
T ₂	1.21	1.33	1.35	1.69	1.70	2.58	1.64
T ₃	1.23	1.33	1.33	1.69	1.70	2.59	1.64
T ₄	1.23	1.37	1.33	1.69	1.70	2.58	1.65
T ₅	1.21	1.36	1.31	1.67	1.71	2.52	1.63
T ₆	1.18	1.25	1.26	1.60	1.65	2.30	1.54
T ₇	1.21	1.26	1.30	1.70	1.72	2.43	1.60

Table 5: Nutrient utilization efficiency (%) by treatment group

Treatment	Dry Matter	Crude Protein	Ether Extract
T ₀	70.61	54.42	72.16
T ₁	71.43	56.92	75.02
T ₂	71.63	57.15	76.11
T ₃	72.60	58.09	76.54
T ₄	72.84	58.52	77.20
T ₅	73.15	58.92	77.70
T ₆	73.85	59.42	78.96
T ₇	73.40	58.85	77.82

**Fig 1:** Mean weekly feed intake (g/bird) under different treatment groups**Fig 2:** Mean weekly body weight gain (BWG) of Broiler chicks

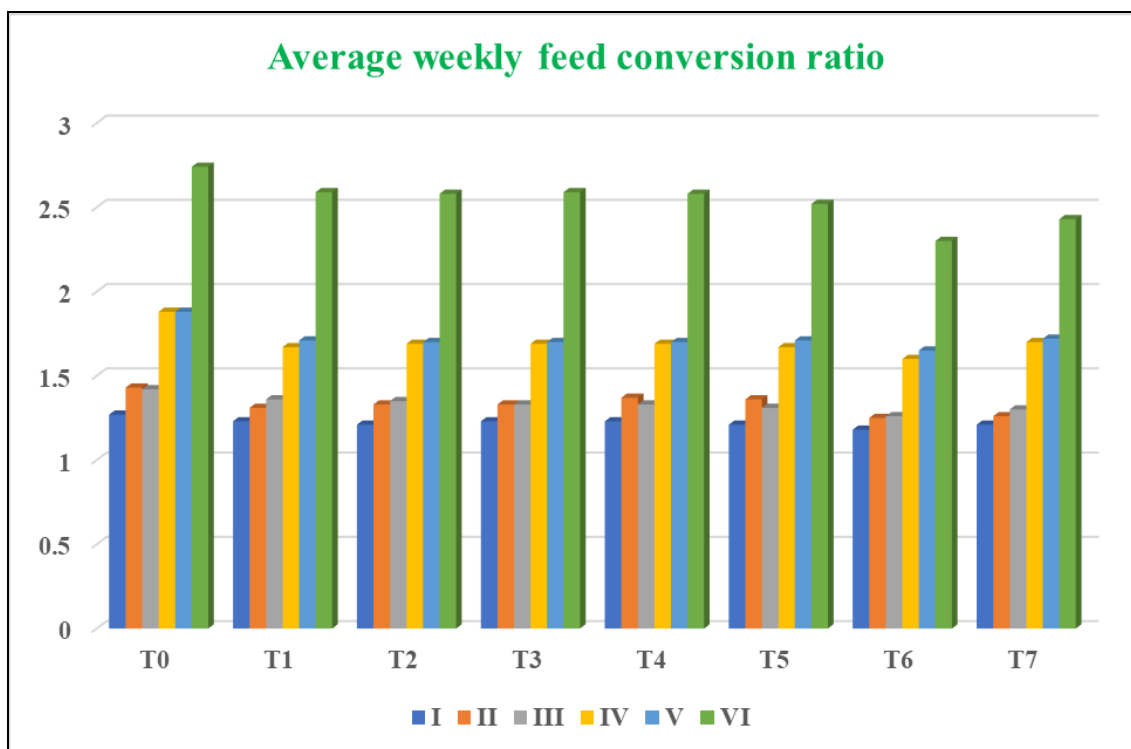


Fig 3: Mean weekly feed conversion ratio (FCR) of Broiler chicks

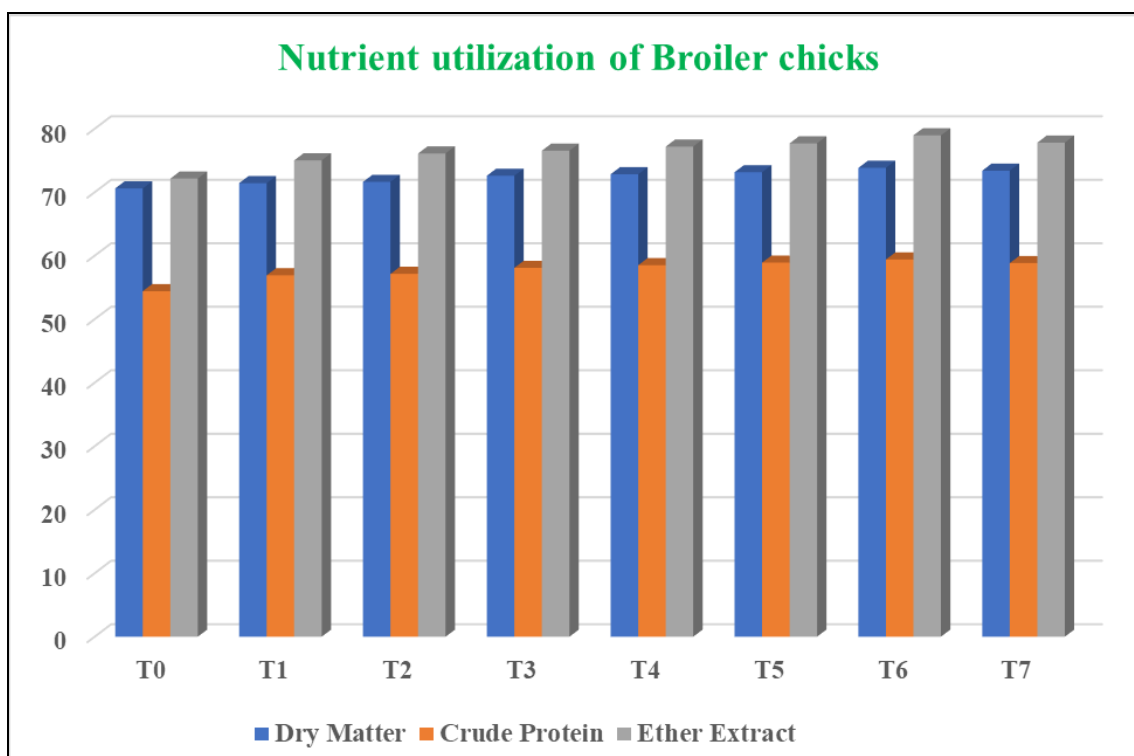


Fig 4: Nutrient utilization of Broiler chicks

Table 6: Economic analysis of broiler production with herbal supplementation

Treatment	Supplement Level	Total Feed Cost (₹)	Final Weight (kg)	Income (₹)*	Net Profit (₹)	Profit Increase vs Control (%)
T ₀	Control	120.12	2.28	250.80	55.57	-
T ₁	0.5% SRP	117.54	2.33	256.30	63.65	14.5
T ₂	1.0% SRP	122.63	2.35	258.50	60.32	8.5
T ₃	0.5% AP	116.47	2.34	257.40	66.15	19.0
T ₆	0.5% SRP+0.5% AP	119.05	2.46	270.60	76.44	37.5

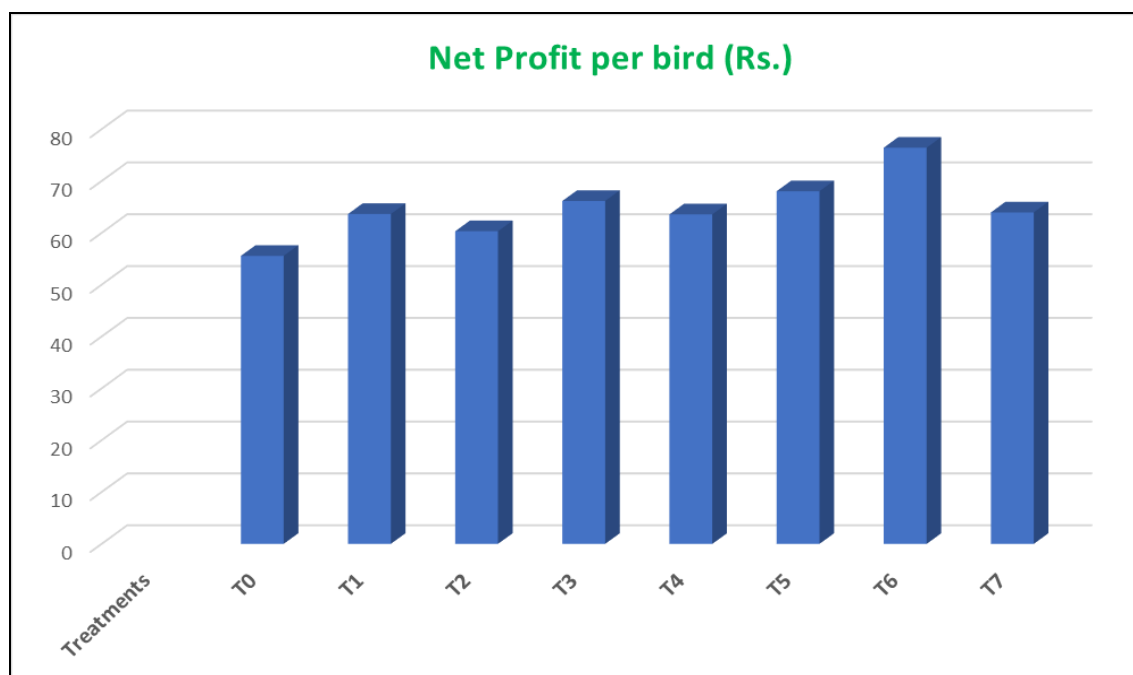


Fig 5: Net Profit per bird (Rs.)

The improved profitability in supplemented groups, particularly T₆, can be attributed to enhanced feed conversion efficiency and better nutrient absorption, as evidenced by the growth performance data. This combination of biological and economic benefits makes the supplemented feeding regimen particularly promising for poultry producers seeking to optimize both production performance and financial returns.

Discussion

The study aimed to assess the effects of supplementing Shatavari Root Powder (SRP) and Amla Powder (AP) on the growth performance of commercial broiler chickens. The findings revealed that the inclusion of SRP and AP in the diet significantly enhanced body weight gain while reducing feed intake and Feed Conversion Ratio (FCR). These results align with previous research, which has also demonstrated improved growth performance and feed efficiency in broilers supplemented with SRP and AP (Rekhate *et al.*, 2004; Bhardwaj *et al.*, 2008; Kumari *et al.*, 2012) [13, 1, 6].

Nutrient utilization, particularly the absorption of dry matter, crude protein, and ether extract, was significantly higher in groups supplemented with SRP and AP compared to the control group. This suggests that SRP and AP may enhance nutrient absorption and utilization, ultimately contributing to better growth performance. These findings are consistent with earlier studies reporting improved nutrient utilization in broilers supplemented with these natural additives (Wadhwa *et al.*, 2007; Singh *et al.*, 2009) [18, 15].

Interestingly, the study also noted a significant increase in nitrogen, phosphorus, and potassium content in poultry litter from the supplemented groups. This observation could have implications for waste management and environmental sustainability in poultry farming.

From an economic perspective, the study found that feed costs were reduced, and net profit over feed cost increased in the SRP and AP-supplemented groups. This suggests that dietary inclusion of these supplements could serve as a cost-effective strategy for poultry farmers.

However, it is important to acknowledge that this study was conducted under controlled conditions, and results may vary based on different farming practices and environmental

factors. Further research is necessary to validate these findings across diverse geographical locations and production systems.

Conclusion

This study provides valuable insights into the potential benefits of supplementing SRP and AP in broiler diets. It underscores the role of these natural supplements as viable alternatives to antibiotics, promoting growth performance, enhancing nutrient utilization, and improving profitability in broiler production.

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To promote broiler production with innate supplements

1. Enhance growth performance and Feed proficiency

- Dietary supplementation with *Asparagus racemosus* (Shatavari) and *Embllica officinalis* (Amla) significantly enhances broiler growth rates, feed conversion efficiency, and nutrient retention.
- These phytogetic additives offer a natural alternative to synthetic growth promoters, aligning with consumer demand for sustainable poultry production.

2. Economic benefits for farmers

- The study confirms cost-effectiveness, with reduced feed costs and increased net profit per bird in supplemented groups.
- Farmers should conduct localized cost-benefit analyses to optimize inclusion levels (e.g., 0.5 g/kg feed) for maximum ROI.

3. Practical Recommendations for Sustainable Production

- **Adoption:** Integrate Shatavari and Amla powder into standard broiler diets to improve performance metrics (e.g., weight gain, FCR) and potentially reduce mortality.

- **Sustainability:** These supplements support antibiotic-free farming, addressing global concerns about antimicrobial resistance.
- **Scalability:** Further trials under diverse farming conditions can validate widespread applicability.

Conflicts of Interest: There are no conflicts of interest between authors.

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Not available

Reference

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