

*Original Research***Effect of Dietary Supplementation of Gooseberry/ Amla (*Emblica officinalis*) Powder on the Performance of Commercial Broiler Chicken****Kashmiri Begum^{1*}, Jitendra Kumar Talukdar¹, Kula Prasad Kalita¹, Tapan Chandra Roy², Rita Nath³ and Mokidur Rahman⁴**

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Abstract

A total of 180 broiler chicks were randomly divided into four groups consisting of 45 numbers, sub divided into 3 replicates consisting of 15 chicks in each sub group. The chicks under T0, T1, T2 and T3 groups were fed amla powder at the rate of 0.00, 0.25, 0.50 and 0.75% in the feed, respectively. The experiment was conducted for a period of six weeks and per cent livability was found to be cent per cent. The total feed consumption per broiler was found to be highest in T3 group (3694.77g) and the lowest in T0 group (3679.46g). At 6 weeks of age, the body weight per broiler was highest in T3 group (2087.56±29.10g) and T2 group (2074.44±17.00g) gained significantly ($P<0.05$) higher body weights as compared to T1 (2070.44±11.88g) and T0 (2012.13±20.45g). The overall FCR was best in T3 group (1.76), followed by T2 (1.77), T1 (1.78) and T0 (1.82) groups. The cost of production per broiler was highest in T3 (INR 201.32) and lowest in T0 (INR 197.99) groups. Similarly, gross profit was found to be highest in T3 group (INR 17.18) and lowest in T0 (INR 13.06) groups. From the results obtained it can be concluded that amla powder can be used effectively and economically as natural feed additive at the rate of 0.75% to improve the overall performance of the broiler chicken.

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Introduction

Broiler industry in India has emerged as the most dynamic and fastest expanding segment in animal husbandry sector due to its low investments and quick returns (Shivaji, 2012). Broilers chickens has high biological value and can be considered as one of the cheapest sources of animal protein compared to other animal sources. The poultry meat production is estimated to be 3.26 million tonnes (Rath *et al.*, 2019). India's per capita consumption of poultry meat is forecast at 2.2 kg per annum in 2014 (Devi *et al.*, 2014). The yearly per capita requirement is 11 kg of meat which is much less than the recommendation of Indian Council of Medical Research (ICMR) (Saini, 2014). To meet the required meat demand, broiler production is a prerequisite. However, feeding cost is of great concern in economic broiler production because 80 % of the entire expenditure is on the procurement of feed (Anurag *et al.*, 2018). Moreover, various long and short term stressors viz. heat stress, immune challenges, catching, transport may alter their internal homeostasis and oxidant/antioxidant balance, leading to oxidative stress, potentially having detrimental effects on meat quality and shelf life (Young *et al.*, 2003). The effects of heat stress might possibly can be minimized through nutritional management by using additives like amla which is most easy and cost effective approach to minimize heat stress. Amla or Indian Gooseberry (*Embllica officinalis*) is thought to have its origin in India has extensive adaptability to grow in diverse climatic and soil conditions and mostly found in lower Assam, Meghalaya, Mizoram and Tripura (Yadav *et al.*, 2001). Amla powder is an important source of ascorbic acid, minerals, amino acids, tannins, and phenolic compounds. Indian Research shows that 8.75 mg of natural vitamin C complex from amla is equivalent to 100 mg of the most commonly used synthetic vitamin C (Shivaji, 2012). Use of amla as feed additives for enhancing growth, reducing feed cost by improving feed efficiency and for building better immunity has already reported (Ghavate, 2009). Therefore, the present study was designed to evaluate dietary effect of amla powder as feed additives on the performance of commercial broiler chicken and its cost benefit analysis in broiler production.

Materials and Methods

The present study was conducted from the month of October 15th to 25th November 2017 in the experimental poultry shed of the Instructional Poultry Farm, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati. Local varieties of raw amla were procured from the Beltola market of Guwahati city of Assam. The amla fruits were first washed thoroughly and sundried. The seed of the fruits were removed and then grinded properly and were stored at room temperature. The experimental diets viz., pre starter (1- 12 days), starter (13-28 days) and finisher (29-42 days) diets were divided into T₀, T₁, T₂ and T₃ groups. Diet T₀ served as control (with no amla powder supplementation) while diet T₁, T₂ and T₃

contained 0.25, 0.50 and 0.75% of amla powder, respectively. The nutrient compositions of the commercial basal diets (pre starter, starter and finisher ration) and amla powder are shown in Table 1.

Table 1: Nutrient composition of commercial basal diet (broiler pre starter, starter and broiler finisher) and amla powder

Nutrient Composition	Commercial Basal Diet			Amla Powder (AP)
	Prestarter (0-12 days)	Starter (13-28 days)	Finisher (29-42 days)	
Dry matter (%)	89.50	89.65	88.49	90.01
Crude Protein (%)	23.46	23.04	20.65	5.54
Ether extract (%)	3.47	4.01	5.15	1.62
Crude fiber (%)	4.23	4.45	3.82	18.83
Nitrogen free extract (%)	61.37	62.49	66.99	68.45
Total ash (%)	7.10	7.00	6.74	8.52

A total of 180-day-old commercial broiler chicks (Hubbard) hatched in a single hatch procured from a local hatchery of Guwahati city were weighed and randomly divided into four groups, *viz.* T₀, T₁, T₂ and T₃ containing 45 chicks in each group. Each group was further subdivided into 3 replicates of 15 chicks. The feeding trial was conducted for a period of 6 weeks using broiler pre starter (1-12 days), starter (13-28 days) and finisher (29-42 days) ration. The chicks were wing banded and reared under deep litter system of management following standard and uniform management practices. All the biosecurity measures were adopted during the experimental period. Chicks were vaccinated against Ranikhet Disease (RD) and Infectious Bursal Disease (IBD) as per standard schedule. During the period of the experiment, the different production traits *viz.* weekly feed consumption and weekly body weight gain and feed conversion ratio at different stages were recorded. The average cost of production per broiler in various treatment groups was calculated by formula described by Narahari and Kumararaj (2008) and the profitability was assessed based on the current market price during the study period. Completely Randomized Design (CRD) was followed for the analysis of the recorded data. The mean, SE were calculated as per standard statistical procedures (Snedecor and Cochran, 1994).

Results and Discussions

The data on average weekly feed intake and total feed consumption are presented in Table 2. The table indicated that during the first weeks of age, the feed intake was highest in T₂ group and the lowest in T₃ group whereas, in the second week feed intake was highest in T₃ group and the lowest in T₁ group. During the third and fourth weeks of age, feed intake was the highest in T₃ group and lowest in T₀ group. On the fifth weeks of age, the highest feed intake was recorded in T₁ group and the lowest in T₀ group. At the end of the sixth weeks of age, the highest feed intake was observed in T₃ group and the lowest in T₀ group.

From the result obtained in the present study it can be inferred that the weekly feed intake was the highest in T₃ group as compared to control group and can be concluded that supplementation of amla powder at 0.25, 0.50 and 0.75% level improved feed intake as compared to control group. The total feed consumption per broiler for different experimental groups was found to be the highest in T₃ group (3694.77 g) and lowest in T₀ group (3679.46 g).

Table 2: Mean weekly feed intake (g/bird) and total feed consumption (g/bird) under different treatment groups

Groups Age in weeks	T ₀ (Control)	T ₁ (AP-0.25%)	T ₂ (AP-0.50%)	T ₃ (AP-0.75%)
1st	165.26	166.62	169.06	164.17
2nd	372.26	370.91	371.15	372.64
3rd	583.40	583.64	584.06	585.60
4th	763.15	763.15	765.71	766.40
5th	886.95	892.42	889.91	890.82
6th	908.42	912.06	912.40	915.13
Total	3679.46	3688.82	3692.31	3694.77

The feed intake obtained in the present study were found to be similar with the findings of Ghavate *et al.* (2009), Patel *et al.* (2016) and Tiwari *et al.* (2016), Yadav *et al.* (2014) concluded in their research findings that amla when supplemented with aloe vera, maximum feed consumption was observed. However, the findings of the present study were contradictory to the findings of Sanjyal and Sapkota (2011), Patil *et al.* (2012), Kumar *et al.* (2013) and Gaikwad *et al.* (2016), who reported higher feed consumption in control group compared to the amla treated group of broiler chicken. The increase in feed intake in the amla fed group could be explained by the fact that amla is known to act as a stomachic (Bhandari *et al.*, 2012) and good appetizer (Patel *et al.*, 2016). The mean weekly body weight of broiler in different treatment groups are presented in Table 3.

Table 3: Average weekly body weights (g) of broilers under different treatment groups

Groups Age in weeks	T ₀ (Control)	T ₁ (AP-0.25%)	T ₂ (AP-0.50%)	T ₃ (AP-0.75%)
1st	135.31 ^a ±1.91	136.56 ^a ±2.17	137.78 ^a ±2.44	139.00 ^a ±2.69
2nd	314.09 ^a ±3.44	325.51 ^a ±5.62	310.29 ^a ±6.08	311.91 ^a ±4.84
3rd	602.07 ^a ±8.67	620.13 ^a ±10.47	607.16 ^a ±8.20	611.13 ^a ±9.96
4th	1050.11 ^b ±14.63	1102.71 ^a ±12.18	1093.89 ^a ±14.48	1097.84 ^a ±14.38
5th	1529.89 ^b ±17.86	1585.53 ^a ±14.44	1587.40 ^a ±13.46	1590.36 ^a ±21.77
6th	2012.13 ^b ±20.45	2070.44 ^a ±11.88	2074.44 ^a ±17.00	2087.56 ^a ±29.10

Means bearing same superscripts in a row did not differ significantly ($P < 0.05$)

The differences associated with treatments for mean weekly body weights in first, second and third week of age were found to be non-significant ($P>0.05$). However, significant ($P<0.05$) differences of body weight was observed between the treatment groups and control group during fourth, fifth and sixth week of age. Similar findings were also obtained by Ghavate (2009), Shivaji (2012), Patel *et al.* (2016) and Tiwari *et al.* (2016). The higher body weights observed in amla supplemented groups might be attributed to anabolic and antioxidant effect of ascorbic acid, gallic acid and tannic acids present in *E. officinalis* (Mcdowell, 1989). The weekly body weight gain of broiler in different treatment groups represented in Table 4.

Table 4: Mean weekly body weight gains (g/bird) of broilers under different treatment groups

Groups Age in weeks	T ₀ (Control)	T ₁ (AP-0.25%)	T ₂ (AP-0.50%)	T ₃ (AP-0.75%)
1st	88.88 ^a ±1.66	89.34 ^a ±2.28	90.93 ^a ±2.06	92.72 ^a ±2.42
2nd	178.78 ^a ±3.52	188.96 ^a ±6.04	172.51 ^a ±6.15	172.91 ^a ±5.07
3rd	287.98 ^a ±8.20	294.62 ^a ±9.61	296.87 ^a ±7.87	299.22 ^a ±9.00
4th	448.04 ^b ±14.60	482.58 ^a ±7.74	486.73 ^a ±11.88	486.71 ^a ±10.29
5th	479.78 ^a ±8.39	482.82 ^a ±10.14	493.51 ^a ±8.54	492.51 ^a ±14.18
6th	482.24 ^a ±8.54	484.91 ^a ±10.82	487.04 ^a ±8.70	497.20 ^a ±12.93

Means bearing same superscripts in a row did not differ significantly ($P<0.05$)

There was no significant ($P>0.05$) difference between different treatment groups for weekly body weight gains during first, second and third weeks of age. Similar observations were also put forward by Shivaji (2012) and reported that the body weight gain of broiler chicken was not affected by the supplementation of amla powder in the first, second and third weeks of age. However, the body weight gain in the entire treatment groups (T₁, T₂ and T₃) were found to be significantly higher than that of T₀ group only in 4th week of age. This might be due to higher feed intake in the amla fed groups. This finding was in agreement with the reports of Patil *et al.* (2012), Kaleem *et al.* (2014), Yadav *et al.* (2014), Gaikwad *et al.* (2016) and Patel *et al.* (2016). Although there was no significant differences among treatment groups during fifth and sixth week of age for weekly body weight gains, the mean body weight gain of T₁, T₂ and T₃ groups were observed to be higher than the T₀ group. Mandal *et al.* (2017) found that overall body weight gains due to dietary addition of amla powder during 0-6 week of age remained statistically non-significant.

The mean weekly feed conversion ratio calculated during the experimental period was presented in Table 5. The mean weekly feed conversion ratio during the first weeks of age was found to be lowest in T₃ group and highest in T₁ group. In the second week, T₁ group showed better FCR as compared to T₀, T₂ and T₃ groups. In the third week, T₃ group was found with better FCR values whereas T₀ group showed the highest value. On the fourth week, T₂ and T₃ group showed the lower FCR values compared to T₀ and T₁ group. In the fifth week of age T₂ and T₃ groups showed better FCR values than T₀ and T₁ groups. At the end of the sixth week, T₃ showed improved FCR value compared to T₀, T₁ and T₂. The overall FCR during the entire

period of the experiment was best in T₃ group (1.76), followed by T₂ (1.77), T₁ (1.78) and T₀ (1.82) groups. The feed conversion ratio of the broiler chicken improved gradually due to dietary supplementation of amla powder in the basal diet compared to the control group which indicated efficient utilization of feed by reducing the stress. Similar conclusions were drawn by Ghavate *et al* (2009), Patil *et al.* (2012), Shivaji (2012), Kumar *et al.* (2013), Gaikwad *et al.* (2016) and Mandal *et al.* (2017) in broiler chickens.

Table 5: Mean weekly FCR of broilers under different treatment groups

Groups Age in weeks	T ₀ (Control)	T ₁ (AP-0.25%)	T ₂ (AP-0.50%)	T ₃ (AP-0.75%)
1st	1.85	1.86	1.85	1.77
2nd	2.08	1.96	2.15	2.15
3rd	2.02	1.98	1.96	1.95
4th	1.70	1.58	1.57	1.57
5th	1.84	1.84	1.80	1.80
6th	1.88	1.88	1.87	1.84
Overall	1.82	1.78	1.77	1.76

Table 6: Cost of amla powder in feed for different treatment group (Cost are calculated in India Rupees)

Groups	Total feed consumption per group(Kg)	Quantity(kg) of amla powder (AP) used	Total cost (INR)	Cost per broiler (INR)
T ₀ (Control)	165.57	---	---	---
T ₁ (AP-0.25%)	165.99	0.41	41.49	0.92
T ₂ (AP-0.50%)	166.15	0.83	83.07	1.84
T ₃ (AP-0.75%)	166.26	1.24	124.69	2.77

Table 7: Cost of production and gross profit per broiler under different treatment groups (Figures are given in Indian Rupees)

Parameters	T ₀ (Control)	T ₁ (AP-0.25%)	T ₂ (AP-0.50%)	T ₃ (AP-0.75%)
I. Expenditure				
Chick cost (A) = 1.05 × cost of one day-old chick	51.45	51.45	51.45	51.45
Feed cost (B) = Live weight(kg) × FCR × Cost per Kg of feed	120.72	121.59	121.14	121.21
Miscellaneous expenditure (C) = Add 15% of (A+B)	25.82	25.95	25.88	25.89
Additional cost of Amla powder (D)	—	0.92	1.84	2.77
Production cost per broiler (A+B+C+D)	197.99	199.91	200.31	201.32
II. Return				
Sale of one live broiler @ INR 105.00 per Kg	211.05	217.35	217.77	219.13
III. Gross profit per broiler				
	13.06	17.44	17.46	17.81

The cost of production per broiler including the additional cost of amla powder was found to be INR 197.99, 199.91, 200.28 and 201.34 for T₀, T₁, T₂ and T₃ groups, respectively (Table 7). The additional cost of amla powder per broiler was calculated to be INR 0.92, 1.84 and 2.77 for T₁, T₂ and T₃ group respectively (Table 6). The cost of production per broiler was numerically higher by about INR 4.38, 4.40 and 4.75 in T₁ and T₂ and T₃ as compared to T₀ group. However, gross profit per broiler was found to be the highest in T₃ group (INR 17.81), followed by T₂ (INR 17.46), T₁ (INR 17.44) and T₀ (INR 13.06) group. The better gross profit per broiler in T₃ group could be attributed to the better growth performance and improved FCR of broilers due to addition of amla powder in the ration. These findings were similar with the results of Gaikwad *et al.* (2016), who found that the net profit per bird was highest in amla supplemented groups and lowest in unsupplemented groups.

Conclusion

The results of the study indicated that inclusion of amla powder as feed supplement was found to be useful in respect of feed intake, average weekly body weight gain and feed conversion ratio as well as also rewards higher gross profit in commercial broilers production. Among the different treatment groups feeding the broiler chickens with amla at the rate of 0.75% levels showed the higher production performances in terms of body weight and FCR which in turn provided economic returns. Thus dietary supplementations of amla powder may have a great impact in economic commercial broiler production.

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