REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 25, No. 1 (2024)
http://www.veterinaria.org
Article Received: 08 July 2024 Revised: 04 August 2024 Accepted: 29 August 2024

Effect of Giloy (*Tinospora cordifolia*) on the performance of Broiler Chicken

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ABSTRACT
Background: The present study was conducted to entitle "Effect of Giloy (Tinospora cordifolia) on the performance of broiler chicken".
Aim: The study was carried out to determine the productive performance, feed intake, feed efficiency, liveability, carcass traits and the economy of rearing broiler chicken by supplementing different levels of giloy stem powder.
Materials and Methods: A total of one hundred and sixty day- old straight run Cobb 430Y strain of broiler chicks were randomly divided into four treatment groups namely T_1, T_2, T_3 and T_4 with five replications per treatment following Completely Randomized Design and were subjected to four dietary treatments containing 0%, 0.50%, 0.75% and 1% of Giloy stem powder, respectively. The birds were fed with commercial broiler starter from 0-21 days followed by finisher ration up to 42 days. Body weight, weight gain and feed efficiency were recorded on weekly basis while feed intake was recorded daily. At the end of the trial period, five birds from each treatment were sacrificed for evaluation of carcass characteristics. The result of the experimental data was subjected to statistical analysis in order to draw a valid interpretation and to see the effect of dietary supplementation of Giloy stem powder at different levels on various parameters using ANOVA in a completely randomized design as described by Gomez and Gomez (1984). The mean values were separated by Duncan's Multiple Range Test (DMRT).
Results: Dietary supplementation of Giloy stem powder affected the body weight, body weight gain, feed conversion efficiency, performance index and dressing percentage with the increase in the level of Giloy powder
Conclusion: On the basis of the above findings, supplementation of Giloy powder at 1.0 per cent of feed can be recommended of broilers under Nagaland's agro-climatic conditions.

Key words: Broiler, Giloy powder, Carcass yield, Organ weight and performance index.

INTRODUCTION

Poultry farming is one of the fastest and most encouraging sectors in modern Indian Agriculture. The word 'poultry' refers to the domesticated birds which are reared for their eggs and meat which include chicken, duck, turkey and geese. Poultry meat is a cheap source of high quality protein, vitamins and minerals which balances the human diet. Currently, there are various strains of poultry with the traits of fast growing and high feed conversion efficiency which makes poultry farming more profitable and ideal income generation activity. Broilers are easy to rear. Due to their short generation interval, broiler rearing is one the fastest way to make money than any other poultry enterprise as they are ready for market by 5-6weeks of age. It not only ensures availability of animal protein to the majority of the population but provides gainful employment and income throughout the year. Broilers require very less space to grow hence, rearing on commercial scale can be taken up even with limited space. It is highly remunerative and versatile. Broiler farming in India is making tremendous growth during the last four decades evolving from backyard farming with the development of improved strains, technological advancements in nutrition, rearing practices, integration and healthcare. Today, poultry production in India can distinctly be categorized into two sectors such as commercial and backyard poultry. The growth in the broiler segment is expected to remain strong even in the coming years due to consumer preference for broiler birds as a nutritive food and with the coming of change of eating processed foods habits (DAHD, 2019).

In broiler farming, feed is the single most expensive component which accounts for 70 to 75 percent of the total cost of production of broiler meat. The main focus of most of the poultry development activity largely centres on the upgrade of feed efficiency level of birds to maximize profit. Optimum utilization of the available feed is therefore important to lower the feed cost. Originally, antibiotics were popularly being used as growth promoters in animal feeds in order to increase the feed conversion efficiency (Barton *et al*., 2000 and Snel *et al*., 2002). However, uses of antibiotics have shown many disadvantages such as side effect on health, residual effect and buildup of resistance and carcinogenic effect (Butaye *et al*., 2003). As a result, use of natural feed additives or phylogenic plants is on the rise as a useful resource for improving productivity of broilers particularly due to its non-residual effect. Some plant extracts are

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helpful in supporting both health and general status of the animal by efficient utilization of feed, safety for the animal and environment leading to better performance and return in gaining higher weight and decreased in mortality percentage. Animals positive health and production can be enhanced by stimulating appetite and feed consumption, antioxidants, the upgrade of instinctual digestive enzyme secretion, stimulation of immune response and antihelminthic actions (Omar *et al*., 2016 and Upadhaya *et al.,* 2016).

Giloy (Tinospora cordifolia) is an ancient herb used in traditional and Ayurvedic medicines for several ailments and metabolic disorders (Ashok *et al.,* 2011 and Prince *et al*., 2004). In Hindi it is known as 'Guduchi' and in Ayurveda 'amrita', which means the root of immortality. It is popular due to its immunity boosting and therapeutic properties. It belongs to the family of Menispermaceae and it can be found growing and climbing on hedges, trees and buildings throughout tropical regions of India, Sri Lanka and Myanmar. It is perennial, large, glabrous and deciduous climbing shrub that can grow up to 300 meters having succulent papery, gray brown and watery bark, succulent stem, yellow auxiliary flowers with shortly stalked, sub globose drupes and pea-sized fruit. However, the taste is not enjoyable and is full of alkaloid that gives various pharmacological activities. The stem is highly nutritious and apart from stem, one can use its roots and leaves to reap many benefits. It has antioxidant and neutraceutical properties (Jan *et al*., 2018) and (Pandey *et al*., 2020) that can boost the health status and improve general performance of animals (Omar *et al.*, 2016) and has been proved by several researchers who have reported the favorable effects of Giloy on the performance of broiler birds (Singh *et al*., 2009; Joshi *et al.* 2015 and Gupta *et al*., 2018).

Though Giloy has a range of benefits, lack of trials limits the potential use of this plant as an alternative herbal feed additive in poultry. Taking advantage of the pharmacological action of Giloy, antibiotic free broiler meat can be obtained by using it in broiler feed. However, determining the optimum level of Giloy as a feed additive is important for its effective use and to achieve the desired results in performance and profitability. Hence, the present study entitled "Effect of Giloy (Tinospora cordifolia) on the performance of broiler chicken.

2. MATERIALS AND METHODS

The present study was undertaken to study the effect of dietary supplementation of Giloy on the growth performance, feed intake, feed conversion efficiency, performance index, mortality, liveability, carcass characteristics and economics of rearing broiler chickens following the standard management practices. A total number of 160 day-old, straight run, commercial broiler strain Cobb 430Y from a single hatch was used for the trial. The birds were procured from S.K. Poultry shop, Burma camp, Dimapur, Nagaland which is a reliable supplier of poultry chicks and feed. The experimental birds were fed with good quality commercial broiler starter and finisher feeds with healthy Giloy stems were collected from local source. The stems were washed and chopped into small pieces and were sun dried. After drying thoroughly, it was ground into fine powder using a blender. The Giloy stem powder was then stored in air tight container at room temperature. The experimental birds were subjected to four levels of dietary treatment from day old to 42 days of age. Group T_1 (control) was provided with the basal diet while T_2, T_3 and T_4 were also provided with the same basal diet but supplemented with Giloy powder at the rate of 0, 0.5, 0.75 and 1 per cent of feed, respectively. Accurate quantity of Giloy powder was measured using a digital weighing balance and it was mixed properly with the feed which was then kept in separate feed bags as per the treatment. The details of dietary supplementation of Giloy powder are summarized in Table 1.

Table.1. Details of dietary supplementation of Giloy powder.

Experimental Group	Level of Giloy
T1	Basal diet
T2	Basal diet + Giloy powder at the rate of 0.5% per kg of feed
T3	Basal diet + Giloy powder at the rate of 0.75% per kg of feed
T4	Basal diet + Giloy powder at the rate of 1% per kg of feed

To give immediate energy and reduced stress, glucose water was provided to the day- old birds immediately after arrival. The chicks were made to drink the glucose water individually by assisting them and gradually they were released in the brooding area. Starter mash was provided to the chicks which were sprinkled on the newspaper till the chicks learn to eat from the feeders. During the experimental period, the birds received feed and water ad libitum. Strict sanitation and hygiene was maintained throughout the trial period. The birds were vaccinated against Ranikhet disease with Lasota/ F1 strain vaccine and Infectious Bursal Disease vaccine during the first and second week, respectively.

The experiment was carried out as per Completely Randomized Design (CRD). One hundred and sixty (160) broiler chicks were randomly divided into four (4) dietary treatment groups of forty (40) birds each and were designated as T1 for control, T2, T3 and T4. Each treatment group was further divided into 5 replications having 8 birds in each replicate .The result of the experimental data was subjected to statistical analysis in order to draw a valid interpretation and to see the effect of dietary supplementation of Giloy stem powder at different levels on various parameters using ANOVA in a completely randomized design as described by Gomez and Gomez (1984). The mean values were separated by Duncan's Multiple Range Test (DMRT).

3. RESULTS AND DISCUSSION

3.1. Body weight

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The observation on average body weight for different treatment groups from day- old to 42 days i.e. up to 6th week of age are presented in table 2. The average body weight of the day-old chicks for different treatment groups T_1, T_2, T_3, and T_4 was recorded as 40.45, 40.48, 40.28 and 40.05 g per bird, respectively. The corresponding body weight in different treatment groups recorded at the end of 6th week was 2610.08, 2613.98, 2535.55 and 2702.35 g per bird, respectively.

Table .2. Effects of Giloy stem powder on the body weight of broiler chicken.

Treatments	Body weight (g/bird)							Mean
	Day old	1st week	2nd week	3rd week	4th week	5th week	6th week	
T_1	40.45	143.00	394.73	831.25	1547.75	1901.98	2610.08^{ab}	1067.03
T_2	40.48	138.60	399.20	824.75	1586.73	1926.33	2613.98^{ab}	1093.00
T_3	40.28	139.90	393.38	819.30	1581.95	1928.05	2535.55^{b}	
T_4	40.05	143.63	392.60	820.03	1592.20	1960.15	2702.35^{a}	
SEm±					35.69	33.61	**35.36**	
CD 5%					NS	NS	**106.01**	

a,b Means bearing different superscript within column differ significantly (P<0.05).

Statistical analysis had revealed that supplementation of Giloy powder had significant (P<0.05) effect on the body weight of broilers. The final body weight has found to be significantly higher in T_4 followed by T_2, T_1 and the least in T_3. However the body weight did not differ significantly among the treatment groups T_1 to T_3 and among T_1, T_2 and T_4. These findings were in close agreement with the findings of Baishya *et al*. (2008), Sharma *et al.* (2008) ; Gupta *et al*. (2018) and Singh *et al.* (2018) who observed increased body weight due to Giloy powder supplementation.

3.2. **Body Weight Gain**

The average weekly gain in body weight and the mean gain in weight in different treatments groups are given in Table.3. The average weekly gain ranged from 102.55 to 716.50; 98.12 to 761.98; 99.62 to 762.65 and 103.58 to 772.17 g/bird for T_1, T_2, T_3 and T_4, respectively while the overall mean gain in weight at 6th weeks of age was 428.28, 428.92, 415.88, 443.72g/ bird, for T_1, T_2, T_3 and T_4, respectively.

Table .3. Effects of Giloy stem powder on the body weight gain of broiler chicken.

Treatments	Body weight gain (g/bird)						Mean
	1st week	2nd week	3rd week	4th week	5th week	6th week	
T_1	102.55	251.73	436.52	716.50	354.23	708.10^{a}	428.27
T_2	98.12	260.60	425.55	761.98	339.60	687.65^{a}	428.92
T_3	99.62	253.48	425.92	762.65	346.10	607.50^{b}	415.88
T_4	103.58	248.97	427.43	772.17	367.95	742.20^{a}	443.72
SEm±				35.69	15.98	25.42	
CD (P=0.05)				NS	NS	76.21	

a,b Means bearing different superscript within column differ significantly (P<0.05)

Statistical analysis had revealed that Giloy stem powder had significant (P<0.05) effect on the weight gain of broilers. The body weight gain was found to be significantly (P<0.05) higher in T_4 followed by T_1, T_2 and the least in T_3. However, the difference in weight gain among treatment groups T_1, T_2, and T_4 was found to be non-significant. Similar findings were reported Gupta *et al.* (2018), Singh *et al*. (2018) and Saeed *et al*. (2020) who observed significantly higher body weight gain due to Giloy supplementation in broiler diet. This is indicative of the beneficial effects of Giloy due to its chemical constituents resulting in better digestibility and utilization of feed leading to enhancement of growth. Kichu *et al.* (2023) also statistical analysis showed that there was significant using the turmeric powder of body weight gain among the treatments in the 4th and 5th weeks.

3.3. Feed Intake

The average weekly feed intake and total feed intake of different experimental groups up to six weeks of age during the experimental period for 42 days, given table no 4. Total feed intake for T_1, T_2, T_3 and T_4 group were 4014.5, 4007.36, 4070.39 and 4096.76 g/bird respectively. At 4th week, the feed intake for T_1, T_2, T_3 and T_4 was 679.95, 694.63, 722.28 and 701.95g per bird respectively. The corresponding value at 5th week was 1019.53, 1001.55, 1057.00 and 1039.43 g per bird, respectively. While at 6th week the values for the respective groups were 1223.70, 1197.80, 1207.53 and 1240.90 g per bird.

Table.4. Effects of Giloy stem powder on the feed intake of broiler chicken.

Treatment	Daily feed intake (g/bird)						Total	Mean
	1st week	2nd week	3rd week	4th week	5th week	6th week		

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T_1	112.63	357.10	621.68	679.95	1019.53	1223.70	4014.58	669.10
T_2	146.93	356.60	609.85	694.63	1001.55	1197.80	4007.36	667.89
T_3	105.15	354.05	624.38	722.28	1057.00	1207.53	4070.39	678.40
T_4	123.60	354.43	636.45	701.95	1039.43	1240.90	4096.76	682.79
SEm±0(P=0.05)				23.03	18.43	22.78		

Statistical analysis had revealed that feed intake was unaffected by Giloy powder supplementation in broiler birds which corroborated with the findings of Amad *et al*.(2011) and Patel *et al*. (2016) who observed non- significant difference in feed intake due to addition of natural feed additives. Similarly reported by Dozo *et al.* (2023) using black pepper of broiler chicken feed intake did not show significant difference. Meanwhile, contradictory to the present findings, Gujral *et al.* (2002), Kulkarni *et al*. (2011) and Gupta *et al*. (2018) have reported that inclusion of Giloy stem powder in the broiler diet increased the feed intake of broilers.

3.4. **Feed Conversion Efficiency (FCE)**

The average weekly feed conversion efficiency and mean feed efficiency of the different experimental groups up to six weeks of age are depicted in Table.5 and their statistical analysis are shown in Appendix B. The average weekly feed conversion efficiency in various groups up to six weeks of age. From Table 5, it was revealed that the overall mean feed conversion efficiency of broiler birds in different treatment groups was 1.60, 1.67, 1.66 and 1.59 for T_1, T_2, T_3 and T_4, respectively. The average feed conversion efficiency (FCE) from 1st to 6th week for the respective groups ranged from 0.97 to 2.89, 0.92 to 3.04, 0.96 to 3.07, and 0.92 to 2.84.

Table.5. Effects of Giloy stem powder on the feed conversion efficiency of broiler chicken.

Treatment	Feed conversion efficiency						Total	Mean
	1st week	2nd week	3rd week	4th week	5th week	6th week		
T_1	1.10	1.42	1.43	0.97	2.89	1.77^b	9.58	1.60
T_2	1.50	1.37	1.44	0.92	3.04	1.76^b	10.03	1.67
T_3	1.06	1.40	1.47	0.96	3.07	2.00^a	9.95	1.66
T_4	1.19	1.42	1.49	0.92	2.84	1.69^b	9.56	1.59
SEm±				0.04	0.17	0.07		
CD (P=0.05)				NS	NS	0.21		

a,b Means bearing different superscript within column differ significantly (P<0.05)

The statistical analysis had revealed that supplementation of Giloy had significant (P<0.05) effect on feed conversion efficiency. The best mean feed conversion efficiency was observed in T_4 while T_2 had poorer feed efficiency. However, the FCE did not vary among the groups T_1, T_2 and T_4. The improvement in feed conversion efficiency due to Giloy supplementation was consistent with the findings of Gupta *et al*. (2018) and Tiwari and Rahal (2019) who also reported that dietary incorporation of Giloy powder at the level of 1% in the diet of broiler chicks had significantly improved the feed conversion ratio. This could be attributed to the fact that phytogenic have positive effects on nutrient utilization perhaps by stimulating the digestive enzymes and improving the gastrointestinal function.

3.5. Mortality, Liveability and Performance Index

The average mortality, liveability percent and performance index (PI) of different treatment groups from day old to 6th week of age are shown in Table 6. It was observed that irrespective of the treatment, mortality per cent throughout the experimental period was nil. Hence, 100 per cent livability was observed in all the treatment groups which might be attributed to favorable climatic condition, quality feed and good management practices. It also indicated that incorporation of Giloy did not have negative effect on the survivability of the birds. Hence, use of Giloy as feed additive could therefore enhance immunity (Rajkumar *et al*., 2009) and prevent mortality (Joshi *et al*., 2015).

Table.6. Effects of Giloy stem powder on mortality, liveability and performance index of broiler chicken.

Groups	Mortality (%)	Liveability (%)	Performance index
T_1	0.00	100	382.39
T_2	0.00	100	375.92
T_3	0.00	100	357.90
T_4	0.00	100	396.18

The performance index for the treatment groups T_1, T_2, T_3 and T_4 was calculated as 382.39, 375.92, 357.90 and 396.18, respectively. The best performance was observe in T_4 (396.18) followed by T_1, T_2, and the least in T_3. The present finding was in agreement with Gupta *et al.* (2018); Tiwari and Rahal (2019) who reported significantly higher performance index when broilers were fed with diet incorporated with 1% Giloy.

3.6. Dressing percentage, Carcass yield and Organ weight

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Vol 25, No. 1 (2024)
http://www.veterinaria.org
Article Received: 08 July 2024 Revised: 04 August 2024 Accepted: 29 August 2024

The average dressing percentage, carcass yield and organ weight in different treatment groups are presented in Table 7. The average carcass weight for the groups T_1, T_2, T_3, and T_4 was 2143.60, 2012.60, 1974.40 and 1958.20 g, respectively while the corresponding mean dressing percentage was recorded as 75.00, 75.75, 76.36 and 74.52. Statistical analysis had revealed that the carcass weight did not differ significantly however, supplementation of Giloy had significant ($P<0.05$) effect on the dressing percentage which was found to be higher in T_3 followed by T_2, T_1 and the least in T_4.

Table.7. Effects of Giloy stem powder on the carcass characteristics of broiler chicken.

Treatment	Carcass characteristics					
	Carcass weight (g)	**Dressing (%)**	**Liver weight (g)**	**Spleen weight (g)**	**Gizzard weight (g)**	**Heart weight (g)**
T_1	2143.60	75.00^{ab}	57.48^{b}	2.68	45.34^{b}	12.86
T_2	2012.60	75.75^{ab}	61.35^{a}	2.92	48.63^{ab}	12.54
T_3	1974.40	76.36^{a}	62.41^{a}	3.40	50.25^{a}	12.31
T_4	1958.20	74.52^{b}	61.89^{a}	3.24	52.23^{a}	12.29
SEm±	**69.03**	**0.46**	**1.21**	**0.17**	**1.44**	**0.58**
CD (P=0.05)	**NS**	**1.39**	**3.64**	**NS**	**4.32**	**NS**

a,b Means bearing different superscript within column differ significantly ($P<0.05$)

The average liver weight was 57.48, 61.35, 62.41 and 61.89 g for T_1, T_2, T_3, and T_4, respectively. The liver weight was found to be significantly ($P<0.05$) higher in Giloy supplemented group as compared to the control. The average spleen weight for T_1, T_2, T_3, and T_4 was 2.68, 2.92, 3.40 and 3.24g. Numerically, the values were found to be higher in groups fed with Giloy. The average gizzard weight was 45.34, 48.63, 50.25 and 52.23g for the treatment groups T_1, T_2, T_3, and T_4, respectively. The value was significantly higher in T_4 followed by T_3, T_2 and the least in T_1. However, there was no significant difference between T_1 and T_2 and among the Giloy supplemented groups T_2, T_3 and T_4. The average heart weight was similar in all the treatment groups which was recorded as 12.86, 12.54, 12.31and 12.29 for T_1, T_2, T_3, and T_4, respectively. From Table 7, it is evident that supplementation of Giloy powder had positive effect on the carcass traits particularly for dressing percentage, liver, spleen and gizzard weight. Similar to the present findings, Sharma *et al*. (2008); Eevuri and Putturu (2013); Gupta *et al*. (2018) and Saeed *et a*l. (2020) have also reported higher values for these traits and were of the view that addition of Giloy and other natural feed additives had positive effect on the dressing percentage and organ weights.

3.7. Cost of production

The economics of broiler production as influenced by Giloy stem powder supplementation in the broiler diet at different levels from the Table 8. The total cost of production per bird was rupees 316.96, 316.41, 320.35 and 320.58 for T1, T2, T3 and T4 groups, respectively. The corresponding values for average cost of production per kg live weight of bird was 121.45, 121.09, 126.37 and 118.65 rupees. The least cost of production per kg live weight was in T_4 followed by T_2, T_1 and the highest was in T_3.

Table.8. Relative economics of broiler birds in different treatment groups.

Items	Treatment Groups			
Cost of broiler (Rs./bird)	T_1	T_2	T_3	T_4
Cost of feed (Rs./bird)	55.00	55.00	55.00	55.00
Cost of labour (Rs./bird)	226.48	225.93	229.87	230.10
Miscellaneous (Rs./bird)	14.70	14.70	14.70	14.70
Cost of production (Rs./bird)	20.78	20.78	20.78	20.78
Average weight of broiler (Kg/bird)	316.96	316.41	320.35	320.58
Cost of production per Kg live weight (Rs./kg)	2.610	2.613	2.535	2.702
Receipt through sale of broiler @Rs.150 per Kg live weight	121.45	121.09	126.37	118.65
Sale of gunny bags (Rs.)	391.50	391.95	380.25	405.30
Gross income (Rs./ bird)	2.70	2.70	2.70	2.70
Profit per bird (Rs.)	394.20	394.65	382.95	408.00
Net profit per Kg live weight (Rs.)	77.24	78.24	62.60	87.42
Benefit cost ratio	29.60	29.95	24.70	32.36
	1.25	1.25	1.20	1.28

The net profit per bird was 77.24, 78.24, 62.60 and 87.42 rupees for T_1, T_2, T_3 and T_4 group, respectively while the corresponding value for net profit per kg live weight was 29.60, 29.95, 24.70and 32.36 rupees. Hence, the net profit per bird and net profit per kg live weight was highest in T_4 followed by T_2, T_1 and the least in T_3. The treatment group T_4 had the highest benefit cost ratio (1.28) and the least was in T_3 (1.20).

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Vol 25, No. 1 (2024)
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Similar to the present findings several researchers including Patel *et al*. (2016); Kafi *et al*. (2017); Singh *et al*.(2018) and Khaidem *et al.* (2019) have reported lower cost of production with higher net return as a result of using natural feed additives such as amla powder, turmeric, Giloy and garlic powder in broiler chicken. They have also stated that use of these additives had significantly improved the performance and nutrient utilization and thereby increased the profitability.

4. CONCLUSIONS

Giloy powder supplementation at a rate of 1.0 percent resulted in better performance in broiler production birds as compared to the control group. Based on the above findings on the effect of different levels of Giloy stem powder on the growth pattern, feed intake, feed conversion ratio, mortality/liveability, carcass characteristics, and relative economics of the broiler chickens, The values of live weight (2702.35 kg/bird) and gain in weight (742.20 g/week/bird) were highest in the T4 groups as compared to other treatment groups. The best feed conversion efficiency (1.59) was observed in the T_4 group. The liveability was 100 percent for all the treatment groups. The performance index (396.18) was the best in the T_4 group. The highest dressing percentage (76.36) was in the T_3 groups. The lowest cost of production per kg of live weight was in T_4 (118.65) and the highest in T_3 (126.37). Net profit per bird, net profit per kg live weight, and benefit-cost ratio were highest in T_4 and the least in T_3. From the results of the present study, it can be concluded that supplementation of Giloy at a rate of 1.0 percent resulted in a higher final body weight, an increased gain in weight, better feed conversion efficiency and performance index, the least cost of production per kg of live weight, and a higher net return and benefit-cost ratio. So, on the basis of the above findings, supplementation of Giloy stem powder at a rate of 1 percent may be recommended to enhance broiler performance and increase profitability.

ACKNOWLEDGEMENT

The Authors express gratitude to the funding agency, Nagaland University, for providing funds to carry out the Research Study. The authors also acknowledge the ICAR Research Complex, Jharnapani, Nagaland Centre for providing Broiler chicks to carry out the present study.

CONFLICT OF INTEREST: None

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