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Dietary Supplementation of Triphala on Production Performance of Commercial Broiler Chicken

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A B S T R A C T

The biological experiment was carried out with Three hundred commercial sexed, one day-old, broiler chicks that were randomly grouped into six treatments with five replicates for each treatment and containing ten chicks per replicate. The chicks were reared from day-old to thirty five days of age in deep litter system in a gable roofed, open sided poultry house. All the chicks were reared under standard management conditions throughout the experimental period. The treatment groups were fed with basal diet without supplementation of antibiotic growth promoter/Triphala (T_1) or with supplementation of oxytetracycline at 0.004 per cent (T_2), or with supplementation of Triphala at 0.025 per cent (T_3), 0.05 per cent (T_4), 0.075 per cent (T_5) or 0.10 per cent (T_6). The experiment revealed that the group supplemented with antibiotic growth promoter (T_2) had significantly ($P<0.01$) higher body weight (1934.12g) and weight gain (1885.26g) than control (T_1), which recorded lowest body weight (1825.12g) and weight gain (1777.92g). The groups supplemented with Triphala at 0.025 per cent (T_3), 0.05 per cent (T_4), 0.075 per cent (T_5) and 0.10 per cent (T_6) did not differ significantly with T_2, whereas, the group supplemented with Triphala at 0.10 per cent (T_6) had the highest body weight (1889.98g) and body weight gain (1842.42g) among the Triphala supplemented groups. The groups T_5 and T_6 had significantly ($P<0.05$) lowest feed intake (3013.86g and 3018.00g, respectively) among the treatment groups, the control group (T_1), T_3 and T_4 were intermediary in observations, whereas, significantly highest feed intake was observed in the T_2 group (3086.00g). The feed conversion ratio of broilers was significantly ($P<0.05$) better (1.64) in T_2 and T_6 followed by T_5, T_3 and T_4, whereas the control (T_1) recorded poor feed conversion ratio (1.73). There was no difference in livability among treatment groups. Hence, it is concluded that Triphala could be supplemented at 0.10 per cent in broiler diet, as an alternate to antibiotic growth promoter for improving production performance of broiler chicken.

Introduction

Triphala (in Sanskrit, “tri” means three, and “phala” means fruits), is an important rasayana drug in the traditional Indian System of Medicine, the Ayurveda (Baliga *et al.*, 2012). Triphala supplementation in general could improve growth rate and better feed

conversion ratio in broiler chicken. It is a mixture of the dried powders of the three fruits such as *Emblica officinalis* (*Amla*/ *Nellikkaai*), *Terminalia chebula* (*Haritaki*/ *Kadukkaai*) and *Terminalia bellerica* (*Bibhitaki*/ *Thaandrikkaai*) and in which dried pericarps of the three myrobalans are included at 1:1:1 proportion. Triphala is rich in various phytochemicals including the tannins, phenolics, saponins, flavonoids, gallic acid, chebulagic acid, chebulinic acid, vitamin C *etc*.

Triphala is normally ingested for therapeutic purposes in human health and hence, it could be safe to be used in the animal feed. Antioxidant, immunogenic, hypolipidemic and other properties of Triphala could have beneficial effect on performance of broiler chicken. Keeping this in view, the study was planned and designed to assess the effect of Triphala on production performance in broiler chicken.

Materials and Methods

Biological experiment

The biological experiment was carried out with three hundred, sex separated and commercial (Vencobb 400) broiler chicken belonging to single hatch. The whole experimental period was divided into three phases *viz.*, pre-starter (1 to 12 days), starter (13 to 24 days) and finisher phase (25 to 35 days). All the chicks were reared from 0 days to five weeks of age under deep litter in an open sided housing system under standard management conditions. The experimental chicks were wing banded, weighed and randomly allotted into six treatment groups. Each treatment had five replicates with ten chicks per replicate comprising fifty chicks per treatment. The experimental broiler chicks were vaccinated intra-ocularly with New Castle disease vaccine (B_1 strain), Infectious Bursal disease vaccine (Intermediate Georgia live strain) and New Castle disease vaccine *('La Sota'* strain) at 7^{th}, 14^{th} and 21^{st} day of age, respectively.

Experimental diet

A basal diet was formulated according to the Vencobb standard, without supplementation of antibiotic growth promoter or Triphala. The experimental diets were prepared by supplementing the basal diet with antibiotic growth promoter (Oxytetracycline @ 0.004 per cent) or Triphala at 0.025, 0.050**,** 0.075 or 0.10 per cent levels. The control group (T_1) was fed with basal diet without any supplementation and the treatment groups were fed with antibiotic growth promoter (T_2) and Triphala at 0.025, 0.05, 0.075 and 0.10 percent (T_3, T_4, T_5 and T_6) in the basal diet, respectively.

Production performances

Data on body weight and feed consumption were recorded every week and mortality was recorded at occurrence. From the above data, weekly body weight gain, feed efficiency and livability were calculated. The data collected on various response criteria were subjected to statistical analysis in Completely Randomized Design (CRD) as per the methods suggested by Snedecor and Cochran (1989).

Results and Discussion

Body weight

The mean (± S.E.) cumulative body weight (g) of broiler chicken during the study period of five weeks of age as influenced by dietary supplementation of graded levels of Triphala is presented in Table 1.

The analysis of variance of data on mean weekly body weight of broilers revealed

significant differences among treatment groups throughout the study period except at first week, due to dietary supplementation of graded levels of Triphala. On 14th day of age, the group supplemented with antibiotic growth promoter (T_2) had significantly ($P<0.05$) higher body weight than the control (T_1) and groups supplemented with Triphala at 0.05 (T_4) or 0.075 per cent (T_5) levels in diet. The groups supplemented with Triphala at 0.025 (T_3) and 0.10 per cent (T_6) levels in diet did not differ significantly either with the control or the group supplemented with antibiotic growth promoter (T_2). On 21st and 28th day of age, the group supplemented with antibiotic growth promoter (T_2) had significantly higher body weight than the control (T_1) and the groups supplemented with Triphala at 0.025 (T_3), 0.05 (T_4) and 0.075 per cent (T_5) levels in diet. However, the group supplemented with Triphala at 0.10 per cent in diet did not differ significantly with the group supplemented with antibiotic growth promoter (T_2). On 35th day of age, the control group recorded significantly ($P<0.01$) lower body weight and group supplemented with antibiotic growth promoter (T_2) had the highest body weight among all the treatment groups. Supplementation of Triphala increased the body weight in dose dependant fashion with highest body weight in T_6.

The result is in agreement with earlier findings of Sanjyal and Sapkota (2011), Patil *et al.,* (2012), Kumar *et al.,* (2013), Bhattacharya *et al.,* (2015), Gaikwad *et al.,* (2016) and Patel *et al.,* (2016) who also found that the supplementation of *amla* powder or other phytogenic growth promoter containing at least one of the Triphala constituents increased the average weight of the broiler birds. The result of present study indicates that supplementation of Triphala promotes the growth of broiler birds, wherein, inclusion of Triphala in broiler diet at 0.10 per cent level produces statistically comparable improvement in body weight to that of the antibiotic growth promoter. Hence, it could be reasonably concluded that Triphala at 0.10 per cent level in broiler diet could be used as an alternate to the antibiotic growth promoter.

Body weight gain

The mean (± S.E.) cumulative body weight gain (g) of broiler chicken during the study period of five weeks of age as influenced by dietary supplementation of graded levels of Triphala is presented in Table 2. Statistical analysis on mean cumulative body weight of broilers revealed significant differences among treatment groups throughout the study period in all the weeks except at first week, due to dietary supplementation of graded levels of Triphala. On 14th day of age, the group supplemented with antibiotic growth promoter (T_2) had significantly ($P<0.05$) higher body weight gain than the control (T_1) and group supplemented with Triphala at 0.05 and 0.075 per cent level in diet, whereas the other groups supplemented with Triphala 0.025 and 0.10 per cent in diet (T_3 and T_6) did not differ significantly either with control or higher body weight gain group.

On 21st day of age, the antibiotic growth promoter supplemented group (T_2) with significantly ($P<0.01$) highest body weight gain had no significant difference with the group supplemented with Triphala at 0.10 per cent in diet (T_6), but the control (T_1) and the groups supplemented with Triphala at 0.025, 0.05 and 0.075 per cent (T_3, T_4 and T_5) had significantly lower body weight gain than the highest body weight gain groups. On 28th day of age, the antibiotic supplemented group (T_2) and the Triphala (0.10 per cent in diet) supplemented group (T_6) had significantly ($P<0.05$) higher body weight gain than the control (T_1) and Triphala supplemented groups at other levels (T_3, T_4 and T_5).

On 35th day of age, the control group recorded significantly (P<0.01) lowest body weight gain and group supplemented with antibiotic growth promoter (T_2) had the highest body weight gain among all the treatment groups. Supplementation of Triphala increased the body weight gain in dose dependant fashion with highest body weight in T_6.

Table.1 Mean (± S.E.) cumulative body weight (g) of broiler chicken as influenced by dietary supplementation of graded levels of Triphala

Treatment	Hatch weight	Age in weeks				
		I	II	III	IV	V
T_1	47.60 ± 0.49	143.94 ± 2.09	350.74^{b} ± 4.86	706.70^{B} ± 9.42	1262.28^{b} ± 19.24	1825.12^{B} ± 28.24
T_2	48.86 ± 0.56	148.48 ± 1.60	365.00^{a} ± 3.81	758.30^{A} ± 10.08	1334.16^{a} ± 17.60	1934.12^{A} ± 28.60
T_3	48.90 ± 0.47	143.92 ± 1.56	357.64^{ab} ± 3.55	715.54^{B} ± 8.79	1264.70^{b} ± 16.71	1842.38^{AB} ± 21.05
T_4	47.94 ± 0.54	142.66 ± 2.05	351.02^{b} ± 3.94	713.12^{B} ± 10.18	1265.78^{b} ± 19.41	1841.72^{AB} ± 23.62
T_5	47.78 ± 0.54	144.40 ± 1.79	352.14^{b} ± 3.93	711.14^{B} ± 12.17	1264.30^{b} ± 22.98	1853.39^{AB} ± 30.34
T_6	47.56 ± 0.56	143.86 ± 2.17	357.52^{ab} ± 4.47	745.62^{AB} ± 10.29	1313.80^{ab} ± 16.53	1889.98^{AB} ± 26.26

Value given in each cell is the mean of 50 observations
^{a,b} Means within a column with no common superscript differ significantly (P<0.05)
^{A,B} Means within a column with no common superscript differ significantly (P<0.01)

Table.2 Mean (± S.E.) cumulative body weight gain (g) of broiler chicken as influenced by dietary supplementation of graded levels of Triphala

Treatment	Age in weeks				
	I	II	III	IV	V
T_1 -	96.34 ± 1.91	303.14^{b} ± 4.70	659.50^{B} ± 9.45	1214.68^{b} ± 19.13	1777.92^{B} ± 28.20
T_2	99.62 ± 1.66	316.14^{a} ± 3.83	709.44^{A} ± 10.05	1285.30^{a} ± 17.52	1885.26^{A} ± 28.59
T_3	95.02 ± 1.37	308.74^{ab} ± 3.37	666.64^{B} ± 8.67	1215.80^{b} ±16.66	1793.48^{AB} ± 21.02
T_4	94.72 ± 1.93	303.08^{b} ± 3.83	665.18^{B} ± 10.21	1217.84^{b} ± 19.51	1793.78^{AB} ± 23.64
T_5	96.62 ± 1.73	304.36^{b} ± 3.88	663.36^{B} ± 12.21	1216.52^{b} ± 22.99	1805.60^{AB} ± 29.74
T_6	96.30 ± 1.99	309.96^{ab} ± 4.41	698.06^{AB} ± 10.30	1266.24^{a} ± 16.49	1842.42^{AB} ± 26.21

Value given in each cell is the mean of 50 observations
^{a,b} Means within a column with no common superscript differ significantly (P<0.05)
^{A,B} Means within a column with no common superscript differ significantly (P<0.01)

Table.3 Mean (± S.E.) cumulative feed intake (g /bird) of broiler chicken as influenced by dietary supplementation of graded levels of Triphala

Treatment	Age in weeks				
	I	II	III	IV	V
T_1	112.58^{B} ± 0.47	403.56^{A} ± 5.49	958.00^{AB} ± 9.37	1926.60^{B} ± 13.60	3065.60^{ab} ± 17.34
T_2	122.04^{C} ± 0.34	430.14^{B} ± 3.54	970.40^{B} ± 5.74	1892.60^{AB} ± 19.72	3086.00^{b} ± 19.75
T_3	110.36^{A} ± 0.50	409.00^{A} ± 2.53	940.60^{A} ± 3.79	1852.40^{A} ± 14.34	3043.60^{ab} ± 16.42
T_4	109.32^{A} ± 0.63	408.24^{A} ± 1.24	942.80^{AB} ± 6.72	1838.20^{A} ± 17.03	3048.00^{ab} ± 15.49
T_5	114.24^{B} ± 0.77	408.48^{A} ± 1.93	963.80^{AB} ± 6.92	1875.20^{AB} ± 17.77	3013.86^{a} ± 19.55
T_6	114.20^{B} ± 0.54	409.52^{A} ± 2.73	955.20^{AB} ± 4.50	1895.00^{AB} ± 16.39	3018.00^{a} ± 16.67

Value given in each cell is the mean of 5 observations
^{a,b} Means within a column with no common superscript differ significantly (P<0.05)
$^{A-C}$ Means within a column with no common superscript differ significantly (P<0.01)

Table.4 Mean (± S.E.) cumulative feed conversion ratio of broiler chicken as influenced by dietary supplementation of graded levels of Triphala

Treatment	Age in weeks				
	I	II	III	IV	V
T_1	1.17 ± 0.03	1.33 ± 0.01	1.46^{b} ± 0.02	1.59^{b} ± 0.05	1.73^{b} ± 0.02
T_2	1.23 ± 0.03	1.36 ± 0.02	1.37^{a} ± 0.02	1.47^{a} ± 0.01	1.64^{a} ± 0.01
T_3	1.16 ± 0.01	1.33 ± 0.02	1.41^{ab} ± 0.01	1.52^{ab} ± 0.02	1.69^{ab} ± 0.01
T_4	1.15 ± 0.01	1.35 ± 0.01	1.42^{ab} ± 0.03	1.51^{ab} ± 0.03	1.70^{ab} ± 0.02
T_5	1.18 ± 0.03	1.34 ± 0.01	1.46^{b} ± 0.04	1.55^{ab} ± 0.05	1.67^{ab} ± 0.04
T_6	1.19 ± 0.03	1.32 ± 0.02	1.37^{a} ± 0.02	1.50^{ab} ± 0.02	1.64^{a} ± 0.02

Value given in each cell is the mean of 5 observations
^{a,b} Means within a column with no common superscript differ significantly (P<0.05)

The result is in agreement with earlier findings of Sanjyal and Sapkota (2011), Patil *et al.*, (2012), Bhattacharya *et al.*, (2015) and Gaikwad *et al.*, (2016), who found higher average body weight gain in the broiler birds supplemented with *amla* powder at various levels. However, Shivakumar *et al.*, (2005), Kumar *et al.*, (2013) and Mandal *et al.*, (2017) did not observe any improvement in the average body weight gain in the treatment groups.

The result of study clearly indicates that supplementation of Triphala at 0.10 per cent level could be used as an alternate to antibiotic growth promoter in broiler diet, as Triphala produced statistically comparable body weight gain with antibiotic growth promoter supplemented group. The phytoconstituents of Triphala might have improved the body weight and body weight gain through increased nutrient digestibility by way of improved gut health of the experimental broiler chicken.

Feed intake

The mean (± S.E.) cumulative feed intake (g/bird) of broiler chicken during the study period of five weeks of age as influenced by dietary supplementation of graded levels of Triphala is furnished in Table 3. The analysis of variance of data on cumulative feed intake (g/bird) of broilers revealed significant differences among treatment groups throughout the study period. On 7th day of age, the cumulative feed intake was significantly (P<0.01) lowest in groups T_3 and T_4 and was significantly (P<0.01) highest in T_2 group among all groups. Other three groups (T_1, T_5 and T_6) had intermediate feed intake.

On 14th day of age, the group supplemented with antibiotic growth promoter (T_2) had significantly (P<0.01) higher feed intake than all the other groups, including control, whereas there was no significant difference among Triphala supplemented group and with control group. On 21st day of age, the T_3 group had significantly (P<0.01) lower feed intake than the T_2 group, whereas the other groups (T_1, T_4, T_5 and T_6) did not differ significantly with either the lowest or the highest feed intake group. On 28th day of age, the T_3 and T_4 group had significantly (P<0.01) lower feed intake than the T_1 group, whereas the other groups (T_2, T_5 and T_6) had no significant difference with other treatment groups.

On 35th day of age, the groups T_5 and T_6 had significantly (P<0.05) lowest feed intake when compared with T_2 group. Other treatment groups, such as control group (T_1), T_3 and T_4 groups, had observations that are comparable with the T_2 group, which had the significantly (P<0.05) highest feed intake among the treatment groups.

The results were in accordance with the experiments conducted by Shivakumar *et al.,* (2005), Mandal *et al.,* (2017), Gaikwad *et al.,* (2016), Patel *et al.,* (2016) and Priya (2016) who also found that the supplementation of *amla* powder or herbal growth promoter reduced mean feed consumption of broiler chicken. In contradiction to the results, Sanjyal and Sapkota (2011), Patil *et al.,* (2012) and Kumar *et al.,* (2013) found that the *amla* powder supplementation increased mean feed consumption per bird than control group.

The lower feed intake in Triphala supplemented group might be due to better digestion and absorption and lesser microbial activity in the gut caused by the supplementation of Triphala in the diet.

Feed conversion ratio

The mean (± S.E.) cumulative feed conversion ratio of broilers during the study period of five weeks of age as influenced by dietary supplementation of graded levels of Triphala is presented in Table 4.

Statistical analysis on mean feed conversion ratio of broilers revealed significant (P<0.05) differences among treatment groups during the last three weeks, due to dietary supplementation of graded levels of Triphala.

On day 21 of age, the T_2 and T_6 groups had significantly better feed conversion ratio than the control (T_1) and T_5 groups. The treatment groups T_3 and T_4 did not differ significantly with T_2 and T_6 or T_1 and T_5 groups. On day 28 of age, the T_2 group had significantly better feed conversion ratio than the control group (T_1). The treatment groups supplemented with Triphala (T_3, T_4, T_5 and T_6) had no significant difference within themselves and other treatment groups (T_2 and T_1). On 35th day of age, the group supplemented with antibiotic growth promoter and the group supplemented with Triphala at 0.10 per cent in diet (T_2 and T_6) had significantly ($P<0.05$) better feed conversion ratio than the control (T_1) group, whereas the other treatment groups (T_3, T_4 and T_5) did not differ significantly either with T_1 or with T_2 and T_6 groups.

In accordance with the results of the study, several studies made by Sanjyal and Sapkota (2011), Patil *et al.*, (2012), Kumar *et al.*, (2013), Bhattacharya *et al.*, (2015), Gaikwad *et al.*, (2016) and Mandal *et al.*, (2017) found better feed conversion ratio in the groups supplemented with at least one of the ingredients of Triphala compared to the unsupplemented groups. However, the authors, Shivakumar *et al.*, (2005), Patel *et al.*, (2016) and Priya (2016) found no significant differences in the feed conversion ratio among the treatment groups, due to supplementation of herbal ingredients.

Based on the result, it could reasonably be concluded that the antibiotic growth promoter can be replaced with Triphala at 0.10 per cent level, without compromising on feed conversion ratio. The better feed conversion ratio observed in this study might be due to increased nutrient digestibility by way of improvement in gut health, as evidenced by increased *villi* length in small intestine and improved gut microbial status in the experimental groups.

Livability

The livability of broilers during the study period of five weeks of age as influenced by dietary supplementation of graded levels of Triphala showed no significant differences among treatment groups. Only, one bird died due to ascites during last week in treatment group supplemented with 0.075 per cent Triphala (T_5).

The result is in agreement with Priya (2016), who suggested that the supplementation might not have influence on the livability of the bird. On the contrary, Patel *et al.*, (2016) found that dietary supplementation of *E. officinalis* fruit powder improved the livability of birds compared to the unsupplemented group.

Based on the salient research findings, it is concluded that dietary supplementation of the antibiotic growth promoter increased the body weight, weight gain and improved the feed conversion ratio than control. Supplementation of Triphala at 0.025, 0.05, 0.075 and 0.10 per cent levels also increased the body weight, weight gain as Triphala produced statistically comparable body weight gain with antibiotic growth promoter supplemented group and improved the feed conversion ratio than control, with maximum effect at 0.10 per cent Triphala supplementation.

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