



Effect of Incorporation of Fenugreek Seed Powder and Turmeric Rhizome Powder on Performance of Broilers

Yerragudi Pravallika^{1*}, B Devasena¹, S Venkateswarlu¹, S Shakila²

¹Department of Animal Nutrition, CVSc, SVVU, Tirupati, India

²Department of Poultry Science, CVSc, SVVU, Tirupati, India

*Corresponding Author: Yerragudi Pravallika, Department of Animal Nutrition, CVSc, SVVU, Tirupati, India.

DOI: 10.31080/ASVS.2024.06.0879

Received: April 30, 2024

Published: May 03, 2024

© All rights are reserved by Yerragudi Pravallika, et al.

Abstract

The experiment was carried out on 270 day old broiler chicks which were randomly allocated into six treatments (T₁, T₂, T₃, T₄, T₅ and T₆) with three replicates of each containing 15 birds. The basal diet (maize and soybean meal) was control (T₁), while the other experimental diets T₂, T₃, T₄, T₅ and T₆ were formulated with incorporation of 1% fenugreek seed powder, 1% turmeric rhizome powder, 0.25% fenugreek seed powder and 0.75% turmeric rhizome powder, 0.5% fenugreek seed powder and 0.5% turmeric rhizome powder and 0.75% fenugreek seed powder and 0.25% turmeric rhizome powder, respectively along with the basal diet. Body weight gain was significantly (P<0.01) highest in T₆, T₅ and T₄ groups and lowest in T₁. Feed intake was highest (P<0.01) in T₃ group followed by T₁, T₄, T₂, T₅ and lowest in T₆. FCR was significantly (P<0.01) improved in combination groups (T₆, T₅ and T₄ groups) as compared to other groups. No significant effect on retention (%) of DM, EE and CF as compared to control. Whereas, CP retention (%) was highest (P<0.05) in T₂ and T₆ groups as compared to other groups. Feed cost per kg live weight gain was lowest (P<0.01) in T₆, T₅ and T₄ groups and highest in T₁.

Keywords: Fenugreek Seed Powder; Turmeric Rhizome Powder; Body Weight Gain; Feed Intake; FCR; Nutrient Retention; Broilers

Abbreviations

DM: Dry Matter; CP: Crude Protein; EE: Ether Extract; CF: Crude Fiber; FCR: Feed Conversion Ratio; CRD: Completely Randomized Design; SPSS: Statistical Package for the Social Sciences

Introduction

In the recent time there has been a significant reduction in the use of antibiotics as growth promoters due to the development of drug resistance. Therefore, using phytochemicals have received a greater attention as antibiotic substitutes because these products were found safe, less toxic and residue free [1]. Hence, the use of Phytochemicals or their constituents have been considered as a relatively new class of natural herbs that gained popularity and acceptability among the poultry farmers. The herbs such as ginger, fenugreek, turmeric, onion and garlic are such phytochemical feed additives known for their useful medicinal properties since ancient times.

Fenugreek seeds are rich in protein, fat, total carbohydrates and minerals viz. calcium, phosphorus, iron, zinc, magnesium [2] and fatty acids predominantly linoleic, linolenic, oleic, and palmitic

acids [3]. Fenugreek seeds have many therapeutic effects like hypoglycaemic, anti-diabetic, anti-fertility, anti-cancer, anti-parasitic, anthelmintic, antibacterial, anti-inflammatory, antipyretic and antimicrobial properties [4]. Curcumin is the major bioactive component of turmeric powder [5] and has a wide spectrum of biological actions, including anti-inflammatory [6], antioxidant [7], antibacterial, antiprotozoal, antiviral, anticarcinogenic, antihypertensive and hypocholesteric activities [8]. Several studies reported that using phytochemicals in broiler diets improved body weight gain, feed conversion efficiency and reduced the feed cost [9]. In view of the above the present study is aimed to evaluate the effect of dietary incorporation of fenugreek seed powder and turmeric rhizome powder and their combination in broilers.

Materials and Methods

The experiment was carried out at the Poultry unit of the Department of Livestock Farm Complex, SVVU, Tirupati to study the effect of incorporation of two herbs namely, fenugreek seed powder and turmeric rhizome powder on the performance of broilers.

Experimental birds and diets

Two hundred and seventy commercial straight run day old broiler chicks were randomly (CRD) allocated into six treatments (T_1 , T_2 , T_3 , T_4 , T_5 and T_6) with three replicates of each containing 15 birds. The experiment was carried out from day-old to 42 days of age in three phases (pre-starter, starter and finisher). Isocaloric and isonitrogenous experimental diets were formulated for broiler pre-starter (0-14 days), starter (15-21 days) and finisher (22-42 days) phases as per the nutrient requirements of broilers (ICAR,

2013). The basal diet (maize and soybean meal) was control (T_1), while the other experimental diets T_2 , T_3 , T_4 , T_5 and T_6 were formulated with incorporation of 1% fenugreek seed powder, 1% turmeric rhizome powder, 0.25% fenugreek seed powder and 0.75% turmeric rhizome powder, 0.5% fenugreek seed powder and 0.5% turmeric rhizome powder and 0.75% fenugreek seed powder and 0.25% turmeric rhizome powder, respectively along with the basal diet. The chemical composition (% DM) of feed ingredients used in experimental diets is presented in table 1.

Nutrient	Ingredients			
	Maize	Soybean meal	Fenugreek seed powder	Turmeric rhizome powder
Dry matter	89.20	89.11	93.52	86.95
Crude protein	9.01	45.33	29.94	6.90
Ether extract	3.58	1.22	3.57	4.83
Crude fiber	1.88	7.52	10.83	5.23
Total ash	3.45	11.45	6.06	4.73
Acid insoluble ash	0.28	4.22	0.47	0.68
Nitrogen free extract	82.08	34.48	49.60	78.31
Calcium	0.01	0.21	0.52	0.28
Phosphorous	0.13	0.37	0.33	0.35

Table 1: Chemical composition (% DM) of feed ingredients used in experimental diets.

Data collection

Body weight gain

The individual body weight of the birds was recorded at weekly intervals up to 6 weeks of age. From this average weekly body weight gain per bird was calculated in all the replicates of the six treatments.

Feed intake

Weekly feed consumption was recorded replicate-wise in every treatment.

Feed conversion ratio

Feed conversion ratio was calculated based on the total feed intake and total weight gain of each replicate.

$$FCR = \text{Feed intake (g)} / \text{The gain in body weight (g)}$$

Metabolism trail

The metabolism trial was conducted during the last five days of the finisher phase of the growth trial. From each replicate, two birds were randomly selected, thus a total of six birds per treatment were kept in metabolic cages where the facilities for feeding and watering were available and the same was followed for all the treatments. Birds in the cages were fed with the respective

experimental diets consecutively for five days. The total feed offered, leftover feed and faeces voided were weighed and recorded daily for each cage. Representative faecal samples were collected and pooled for five days for further analysis. The representative samples of experimental diets offered and faecal samples were analyzed for various nutrients as per [10]. The nutrient retention (%) of dry matter, crude protein, ether extract and crude fiber was calculated by using the following formula.

$$\text{Nutrient retention (\%)} = \frac{\text{Nutrient in feed} - \text{Nutrient in faeces}}{\text{Nutrient in feed}} \times 100.$$

Cost economics

The relative economics of raising commercial broilers to six weeks of age with dietary incorporation of fenugreek seed powder and turmeric rhizome powder was calculated based on the present actual input costs, total feed intake and body weight gain.

Statistical analysis

The data obtained in this experiment were subjected to a one-way analysis of variance [11] and the significant differences between the means were tested by using Duncan's multiple range test [12]. All the statistical procedures were done using SPSS, version 20.

Body weight gain (g)	Treatments					
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆
Pre-starter (0-14 days) *	374.59 ^{abc} ± 7.62	364.72 ^c ± 3.34	387.07 ^a ± 2.08	383.12 ^{ab} ± 4.55	370.63 ^{bc} ± 3.80	371.20 ^{bc} ± 3.77
Starter (15-21 days) **	375.03 ^b ± 2.59	375.78 ^b ± 4.09	377.35 ^b ± 1.60	378.48 ^b ± 3.88	403.73 ^a ± 2.32	408.75 ^a ± 2.90
Finisher (22-42 days) **	1465.13 ^c ± 12.57	1516.16 ^b ± 6.73	1542.10 ^{ab} ± 7.67	1550.29 ^a ± 10.89	1562.44 ^a ± 4.55	1561.87 ^a ± 6.70
Overall (0-42 days) **	2214.75 ^d ± 16.54	2256.66 ^c ± 5.00	2306.52 ^b ± 6.83	2311.89 ^{ab} ± 11.70	2336.80 ^{ab} ± 6.19	2341.82 ^a ± 9.37

Table 2: Effect of incorporation of fenugreek seed powder and turmeric rhizome powder on body weight gain (g) in broilers.

^{abcd}: Values bearing different superscripts in a row differ significantly **($P < 0.01$), *($P < 0.05$).

Feed intake (g)	Treatments					
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆
Pre-starter (0-14 days) **	468.91 ^a ± 1.53	444.41 ^e ± 1.59	460.17 ^b ± 1.43	455.84 ^{bc} ± 2.06	447.39 ^{de} ± 2.53	452.67 ^{cd} ± 1.66
Starter (15-21 days) **	595.20 ^a ± 4.64	579.93 ^{ab} ± 5.77	576.02 ^b ± 4.29	580.97 ^{ab} ± 4.06	577.07 ^b ± 2.70	585.64 ^{ab} ± 5.87
Finisher (22-42 days) **	2916.94 ^b ± 7.05	2925.37 ^b ± 6.46	3006.66 ^a ± 7.80	2920.67 ^b ± 7.72	2908.15 ^b ± 5.06	2851.01 ^c ± 4.32
Overall (0-42 days) **	3981.05 ^b ± 8.62	3949.71 ^{cd} ± 4.17	4042.85 ^a ± 3.20	3957.48 ^c ± 7.23	3932.61 ^d ± 3.22	3889.32 ^e ± 10.59

Table 3: Effect of incorporation of fenugreek seed powder and turmeric rhizome powder on feed intake (g) in broilers.

^{abcde}: Values bearing different superscripts in a row differ significantly **($P < 0.01$).

Feed Conversion Ratio	Treatments					
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆
Pre-starter (0-14 days)	1.25 ± 0.022	1.22 ± 0.014	1.19 ± 0.003	1.19 ± 0.019	1.21 ± 0.017	1.22 ± 0.015
Starter (15-21 days) **	1.59 ^a ± 0.015	1.54 ^{ab} ± 0.016	1.53 ^b ± 0.018	1.54 ^{ab} ± 0.016	1.43 ^c ± 0.010	1.43 ^c ± 0.024
Finisher (22-42 days) **	1.99 ^a ± 0.016	1.93 ^b ± 0.006	1.95 ^b ± 0.006	1.88 ^c ± 0.012	1.86 ^c ± 0.003	1.83 ^d ± 0.007
Overall (0-42 days) **	1.80 ^a ± 0.013	1.75 ^b ± 0.003	1.75 ^b ± 0.004	1.71 ^c ± 0.010	1.68 ^d ± 0.003	1.66 ^d ± 0.009

Table 4: Effect of incorporation of fenugreek seed powder and turmeric rhizome powder on FCR in broilers.

^{abcd}: Values bearing different superscripts in a row differ significantly **($P < 0.01$).

Results and Discussion

The body weight gain, feed intake and FCR in broilers fed experimental diets during pre-starter, starter, finisher and overall growth phases are presented in table 2, 3 and 4 respectively.

Body weight gain

The results indicated that body weight gain was significantly ($P < 0.01$) highest in T₆, T₅ and T₄ groups and lowest in control group (T₁). The results are in agreement with the findings of [13] and [14] who reported significantly higher body weight gain in the birds fed fenugreek seed powder and turmeric powder, respectively. The improvement in body weight gain might be due to the presence of essential fatty acids as well as high quality protein in the fenugreek seeds [15] and anti-inflammatory, antimicrobial, gastroprotective effect of curcumin and turmerones present in turmeric and their synergic effects [16].

Feed intake

The feed intake was highest ($P < 0.01$) in T₃ group followed by T₁, T₄, T₂, T₅ and lowest in T₆. These results are in line with the

findings of [17] who observed reduction in feed intake when fenugreek seed powder was incorporated at 0.5 to 1% level in broilers whereas [18] observed 1% turmeric powder supplementation significantly improved feed intake but 0.5% supplementation reduced the feed intake as compared to control. The reduction in the feed intake due to the incorporation of FSP is attributed to the reduced palatability which is due to the two main constituents (volatile oils and alkaloids) that cause strong odour and bitter taste [19]. Turmeric powder possesses appetite stimulant, stomachic and carminative properties [20] which resulted in increased feed intake.

Feed Conversion Ratio (FCR)

The FCR was significantly ($P < 0.01$) highest in T₆ and T₅ groups whereas T₄, T₃ and T₂ groups indicated moderate FCR, while the control group (T₁) resulted in lowest FCR. The result of this study corroborated with the findings of [17] and [14] who recorded better FCR in birds fed diets containing fenugreek seed powder and turmeric powder, respectively. Improved FCR of broiler chicks fed diets containing FSP is reported due to the gut morphological

changes [21] as well as due to the differences in the gut microbiota including their metabolites [22]. Turmeric could control and limit the growth and colonization of numerous pathogenic and non-pathogenic species of bacteria in chicken’s gut resulting in balanced gut microbial ecosystem [23] that leads to better absorption and utilization of nutrients as indicated by improved FCR [24].

Nutrient retention

The nutrient retention in broilers maintained on the diets containing fenugreek seed powder and turmeric rhizome powder is

presented in table 5. Incorporation of fenugreek seed powder and turmeric rhizome powder had no significant effect on retention (%) of DM, EE and CF as compared to control. Whereas, CP retention was significantly (P < 0.05) highest in T₂ and T₆ groups as compared to other groups. This finding is in accordance with [25] who reported addition of fenugreek seeds to broiler diets improved the digestibility of CP alone. Improving the digestibility of CP in birds fed diets supplemented with fenugreek seed powder might be due to long contact between digesta and mucosal epithelium might pro-

Parameter	Treatments					
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆
DM	72.39 ± 2.63	75.08 ± 3.36	74.70 ± 1.83	70.19 ± 2.85	69.92 ± 1.86	73.64 ± 2.37
CP *	64.37 ^b ± 1.48	73.50 ^a ± 1.76	67.51 ^b ± 1.67	65.22 ^b ± 2.79	65.05 ^b ± 0.10	73.86 ^a ± 0.41
EE	77.16 ± 1.16	81.17 ± 2.15	83.66 ± 1.64	77.42 ± 2.86	78.05 ± 1.97	81.76 ± 1.64
CF	29.50 ± 0.88	30.87 ± 1.24	31.05 ± 0.63	31.31 ± 1.47	31.42 ± 0.92	31.62 ± 0.59

Table 5: Effect of incorporation of fenugreek seed powder and turmeric rhizome powder on nutrient retention (%) in broilers.

^{ab}: Values bearing different superscripts in a row differ significantly *(P < 0.05).

long the positive impact on intestinal morphology, which may be more efficient for nutrient digestion and absorption [26].

Cost economics

The effect of incorporation of fenugreek seed powder and turmeric rhizome powder on cost economics in broilers is presented in table 6. Feed cost per kg live weight gain was significantly (P <

0.01) lowest in T₆, T₅ and T₄ groups and highest in T₁. These results are in congruence with [17] who reported that inclusion of fenugreek seed powder up to 1% level decreased the cost of feed per kg live weight as compared to control. [14] had also observed that the cost of production per kg live weight was lowest on turmeric supplementation.

Cost Economics	Treatments					
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆
Feed intake per bird for 6 weeks (g) **	3981.05 ^b ± 8.62	3949.71 ^{cd} ± 4.17	4042.85 ^a ± 3.20	3957.48 ^c ± 7.23	3932.61 ^d ± 3.22	3889.32 ^e ± 10.59
Cost of feed/bird (Rs.) **	153.40 ^c ± 0.39	153.63 ^c ± 0.32	159.03 ^a ± 0.59	155.15 ^b ± 0.33	153.74 ^c ± 0.59	151.65 ^d ± 0.34
Body weight gain (g) **	2214.75 ^d ± 16.54	2256.66 ^c ± 5.00	2306.52 ^b ± 6.83	2311.89 ^{ab} ± 11.70	2336.80 ^{ab} ± 6.19	2341.82 ^a ± 9.37
Feed cost/kg live weight gain (Rs.) **	69.26 ^a ± 0.57	68.08 ^{ab} ± 0.46	68.35 ^{ab} ± 0.37	67.11 ^{bc} ± 0.27	65.79 ^{cd} ± 0.48	64.76 ^d ± 0.43

Table 6: Effect of incorporation of fenugreek seed powder and turmeric rhizome powder on cost economics in broilers (42 days age).

^{abcd}: Values bearing different superscripts in a row differ significantly **(P < 0.01).

Conclusion

Based on the present study, it can be concluded that incorporation of fenugreek seed powder and turmeric rhizome powder at different combinations resulted in better productive performance and cost economics as compared to the individual incorporation and control group.

Conflicts of Interest

There is nothing to declare.

Bibliography

1. Hashemi SR. “Acute toxicity study and phytochemical screening of selected herbal aqueous extract in broiler chickens”. *International Journal of Pharmacology* 4.5 (2008): 352-360.
2. Gupta K. “Structural carbohydrate and mineral seeds”. *Indian Cacao, Arecanut and Spices Journal* 20 (1996):120.
3. T Schryver. “Fenugreek”. *Total Health* 24.4 (2002): 42-44.

4. Bash E. "Therapeutic applications of fenugreek". *Alternative Medicine Review* 8 (2003): 20-27.
5. Pawar H. "Phytochemical evaluation and curcumin content determination of turmeric rhizomes collected from Bhandara District of Maharashtra (India)". *Journal of Medicinal Chemistry* 4.8 (2014): 588-591.
6. Holt PR. "Curcumin therapy in inflammatory bowel disease: a pilot study". *Digestive diseases and Sciences* 50.11 (2005): 2191-2193.
7. Hosseini-Vashan SJ. "Antioxidant status, immune system, blood metabolites and carcass characteristic of broiler chickens fed turmeric rhizome powder under heat stress". *African Journal of Biotechnology* 11.94 (2012): 16118-16125.
8. Chattopadhyay I. "Turmeric and curcumin: Biological actions and medicinal applications". *Current Science* (2004): 44-53.
9. Khan FU. "Effect of fenugreek (*Trigonella foenum-graecum*) seed extract on visceral organs of broiler chicks". *ARPJ Journal of Agricultural and Biological Science* 4 (2009): 58-60.
10. AOAC, Official methods of analysis of the Association of Official Analytical Chemists, Washington D.C (2007).
11. G Snedecor and W Cochran. "Statistical Methods". *Affiliated East West Press* 13 (1994): 1467-1473.
12. D Duncan. "Multiple range and multiple F tests". *Biometrics* 11.1 (1955): 1-42.
13. Ali AH. "Evaluation of dietary supplementation of fenugreek seed (*Trigonella foenum-graecum* L.) as a growth promoter in broiler diet and its impacts on growth performance, carcass quality and cost effectiveness". *Journal of Istanbul Veterinary Sciences* 5.1 (2021): 6-12.
14. Shohe A. "Performance of broiler chicken on diet supplemented with Turmeric powder (*Curcuma longa*)". *Livestock Research International* 7.2 (2019): 77-82.
15. Murray RK. "The text book of Harper's biochemistry, California: 22nd Appleton and Large" (1991).
16. Liju VB. "An evaluation of antioxidant, anti-inflammatory, and antinociceptive activities of essential oil from *Curcuma longa*". *Indian Journal of Pharmacology* 43.5 (2011): 526.
17. Gaikwad BS. "Effect of Fenugreek (*Trigonella foenum-gracum* L.) Seed Powder as Natural Feed Additive on Growth Performance of Broilers". *International Journal of Current Microbiology and Applied Sciences* 8.10 (2019): 1137-1146.
18. O Daramola. "Growth performance and serum metabolites of broiler chickens fed turmeric (*Curcuma longa*) powder supplemented diets". *Livestock Research for Rural Development* 32 (2020): 12.
19. Ahmad AH. "Fenugreek a multipurpose crop: Potentialities and improvements". *Saudi Journal of Biological Sciences* 23.2 (2016): 300-310.
20. Chakraborty PS. "Curcuma longa- A multicentric clinical verification study". *Indian Journal of Research in Homeopathy* 5.1 (2011): 19-27.
21. A Weerasingha and N Atapattu. "Effects of Fenugreek (*Trigonella foenum-graecum* L.) Seed powder on growth performance, visceral organ weight, serum cholesterol levels and the nitrogen retention of broiler chicken". *Tropical Agricultural Research* 24.3 (2013): 289.
22. S Yadav and R Jha. "Strategies to modulate the intestinal microbiota and their effects on nutrient utilization, performance, and health of poultry". *Journal of Animal Science and Biotechnology* 10.1 (2019): 1-11.
23. S Hussein. "Effect of turmeric (*Curcuma longa*) powder on growth performance, carcass traits, meat quality, and serum biochemical parameters in broilers". *Journal of Advanced Biomedical and Pathobiology Research* 3.2 (2013): 25-32.
24. Ong-ard L. "Antimicrobial activity of curcuminoids from *Curcuma longa* L. on pathogenic bacteria of shrimp and chicken". *Kasetsart Journal of Natural Science* 44 (2010): 364-371.
25. E Toson and M Latif. "Effect of using fenugreek seeds powder as a feed additive in broiler chicks diet on growth performance and some metabolic responses". *Egyptian Poultry Science Journal* 41.1 (2021): 31-43.
26. Bogusławska-Tryk M. "Dietary fructans and their potential beneficial influence on health and performance parameters in broiler chickens". *Journal of Central European Agriculture* 13.2 (2012).