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ISSN 1680-5194
ansinet.com/pjn

PAKISTAN JOURNAL OF
NUTRITION



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Research Article

Effect of Supplementation of Fenugreek Seeds to the Broiler Chicks Diet on the Growth Performance and Carcass Characteristics

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Abstract

Objective: This study was conducted to investigate the effects of supplementation of fenugreek seeds to the diet on the growth performance and carcass quality of broiler chicks. **Materials and Methods:** A total of 120 one-day-old unsexed broiler chicks (Ross 308) were used in this study. The experiment lasted 5 weeks (8-42 day). Three isocaloric and isonitrogenous experimental diets were prepared. In the first experimental diet 0.50% fenugreek seeds were added. In the second diet 0.75% fenugreek seeds were added. The third diet (control) was free of fenugreek. Each experimental diet was fed to 40 chicks (10 chicks \times 4 replicates). The experiment was carried out at an open-house system. **Results:** The diet supplemented with fenugreek seeds had non significant effect ($p \geq 0.05$) on feed conversion ratio, protein efficiency ratio, feed consumption, live body weight, body weight gain and carcass characteristics of broiler chicks. **Conclusion:** The inclusion of fenugreek seeds to the broilers diet at the levels of 0.50 and 0.75% had no significant effect on broiler growth performance and carcass yields, therefore, more researches are needed to examine higher inclusion levels of fenugreek seeds.

Key words: Fenugreek, growth performance, broilers, carcass, poultry feed

Citation: Huda M. Elamin, Talha E. Abbas, Tamador A. Algam and Mohamed E. Ahmed, 2020. Effect of supplementation of fenugreek seeds to the broiler chicks diet on the growth performance and carcass characteristics. Pak. J. Nutr., 19: 485-490.

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

One of the major problems that limit the development of poultry industry in the Sudan is the higher cost of poultry feed. Poultry feed accounts for about 75% of total feed cost. The poultry industry uses antibiotics to improve meat production, due to their detrimental effects on animal and human health the European Union has banned their use as growth promoters since January 2006¹. Hence, the ban on the use of antibiotics has forced poultry producers to find viable alternatives with similar benefits to antibiotics. Recently, herbs are used in a wide range as a feed supplements to enhance growth performance. Fenugreek (*Trigonella foenum graecum*) is one of these herbs that have a role in improving the growth performance of poultry birds by their antibacterial activity and positive effect on gut morphology. Yasothai² reported that fenugreek seeds contain crude protein (12.9-34.1%), crude fiber (4.7-14.8%), ether extract (4.5-12%), total ash (2.6-7.6) and nitrogen free extract (36.8-57.5%). Xue *et al.*³ reported that fenugreek seed reduce the blood glucose and blood lipid levels and improve hemorheological effects in diabetic rats. Also, Murlidhar and Goswami⁴ observed its anticarcinogenic, antioxidant, antibacterial, gastric stimulant and anti-anorexia effects in addition to its uses as food stabilizer, adhesive and emulsifying agent. Improvement in broilers growth performance has been recorded due to inclusion of fenugreek seed to their diets. Khan *et al.*⁵ stated that the addition of fenugreek at the rate of 30 mL L⁻¹ aqueous extract accelerate muscle growth of broilers. Toaha *et al.*⁶ studied the influence of addition of fenugreek to the broilers diet versus addition of antibiotic growth promoters. Authors⁶ observed that the diet supplemented with fenugreek improved the productive performance, reduced the feed cost and increased profit as compared to diet supplemented with antibiotic growth promoters. Tag El-Din *et al.*⁷ observed the increase in rabbit growth due to the use of dietary fenugreek.

The main objective of the present study was to determine the effect of dietary supplementation of fenugreek seeds on the growth performance and carcass characteristics of broilers.

MATERIALS AND METHODS

The site and experimental birds: The experiment was conducted at the poultry unit (open-house system) of Faculty of Agricultural Technology and Fish Sciences, University of Alneelain, Jebal-Awlia, Khartoum, South.

A total of 120 one-day-old unsexed commercial (Ross 308) broiler chicks were purchased from a commercial hatchery. Birds were weighed (43.5 ± 1.7 g) and randomly assigned to 12 floor pens (1 m² each) littered with wood shavings.

Experimental diets: Three experimental diets were formulated, diet A (control diet) was free of fenugreek seeds (0.0%), diets B and C were supplemented with 0.50% and 0.75% fenugreek seeds respectively. Each dietary treatment was fed to 40 birds (10 birds \times 4 replicates). Four isocaloric and isonitrogenous starter and finisher diets were formulated according to nutrient specifications of National Research Council⁸. Pre-starter diet was offered for the first 5 days. Then chicks were fed on starter diets till the third week. After that chicks were offered a finisher diets. The composition of starter and finisher diets are presented in Table 1 and 2, respectively.

Table 1: Composition of broilers starter diet supplemented with different levels of fenugreek

Ingredients (%)	Different levels of fenugreek		
	0% control (A)	0.50% (B)	0.75% (C)
Sorghum	64.00	63.50	63.25
Ground nut	24.60	24.60	24.60
Wheat bran	0.50	0.50	0.50
Super concentrate*	5.00	5.00	5.00
Vegetable oil	3.30	3.30	3.30
Lysine	0.12	0.12	0.12
Methionine	0.15	0.15	0.15
Limestone	1.30	1.30	1.30
Dicalcium phosphate	0.13	0.13	0.13
Choline	0.20	0.20	0.20
Enzyme	0.20	0.20	0.20
Mycotoxin binder	0.20	0.20	0.20
Fenugreek	0.00	0.50	0.75
NaCl	0.30	0.30	0.30
Calculated analysis			
ME (kcal kg ⁻¹)	3180.00	3178.00	3173.00
CP %	23.07	23.11	23.13
Crude fiber (%)	4.19	4.26	4.29
Ether extract (%)	7.00	7.01	7.02
Ca (%)	1.01	1.00	1.02
Available phosphorus (%)	0.45	0.45	0.45
Lysine (%)	1.09	1.10	1.10
Methionine (%)	0.56	0.56	0.56
Methionine+cystine (%)	0.78	0.78	0.78

*Cp 35%, ME 1900 kcal kg⁻¹, C.fiber: 2.50%, EE: 1.5%, Ash: 35%, Ca: 7.0%, Av. P: 4.5%, Lysine: 11%, Methionine: 4.2%, Methionine+Cystine: 4.3%. Vitamin A stabilised: 250.000 I.U. kg⁻¹, Vitamin D3 stabilised: 50.000 I.U. kg⁻¹, Vitamin E stabilised: 500 mg kg⁻¹, Vitamin K3 (hetrazan): 40 mg kg⁻¹, Vitamin B1: Thiamin 20 mg kg⁻¹, Vitamin B2: Riboflavin 100 mg kg⁻¹, Vitamin B6: Pyridoxine⁻¹ 30 mg kg⁻¹, Vitamin B12: Cyanocobalamin 300 mcg kg⁻¹, Niacin 600 mg kg⁻¹, Folic acid 15 mg kg⁻¹, DL-Ca. Pantothenate 160 mg kg⁻¹, Choline Chloride 7.000 mg kg⁻¹, Biotin 1.000 mcg kg⁻¹, Copper 300 mg kg⁻¹, Zinc 1.100 mg kg⁻¹, Iron 600 mg kg⁻¹, Manganese: 1.200 mg kg⁻¹, Cobalt 4.0 mg kg⁻¹, Iodine: 20.0 mg kg⁻¹, Selenium 4.0 mg kg⁻¹, Anti-oxidant Added, Phytase Added, Mould inhibitor Added, Salinomycin: 1200 mg kg⁻¹

Management: Each pen was equipped with 1 metallic drinker and 1 metallic tubular feeder. Feed and water were provided *ad libitum*. Drinkers and feeders were kept clean and regularly leveled using red brick, cuboids. A continuous lighting was used throughout the experimental period by a combination of natural and artificial light. The bulbs were hanged about one foot above the floor during the first two weeks and then maintained to about 6 feet. The birds were vaccinated (IB+Newcastle clone) at 5 days of age, and infections bursal disease (Gumboro) vaccine was given at 14 days of age, and replicated at 21 days of age and Newcastle disease vaccine at 28 days of age.

Experimental procedures: Weekly feed intake, live body weight and body weight gain were determined on replicate basis. Feed conversion ratio (FCR) was calculated as feed intake per weight gain. Protein efficiency ratio (PER) was calculated as weight gain per protein consumed. Mortality was recorded as it occurred. At the end of the experiment (6 weeks of age), the birds were weighed after overnight fasting. Two birds from each pen were randomly selected and manually slaughtered for carcass characteristics determination.

Experimental design and statistical analysis: The data were analyzed using the General Linear Model procedure of Statistical Analysis System (SAS)⁹ with a Completely Randomized Design (CRD). Duncan's multiple range test¹⁰ was used to test the significant difference among treatment means. The level of statistical significance was pre-set at $p < 0.05$.

RESULTS

Starter period (0-3 weeks): Effect of fenugreek seeds supplementation in the diet of broilers on the feed consumption, weight gain, feed conversion ratio and protein efficiency ratio during starter period are shown in (Table 3). Broiler diet supplemented with 0.75% of fenugreek seeds increased feed consumption and weight gain when compared to the control diet, however, differences were non-significant

($p \geq 0.05$). The diet supplemented with 0.50% of fenugreek seeds increased ($p \geq 0.05$) feed conversion ratio compared to the control diet, but the increase was not significant. However, the diet supplemented with 0.50% of fenugreek seeds produced non-significant improvement ($p \geq 0.05$) in protein efficiency ratio.

Table 2: Composition of broilers finisher diet supplemented with different levels of fenugreek

Ingredients %	Different levels of fenugreek		
	0% control (A)	0.50% (B)	0.75% (C)
Sorghum	67.81	67.81	67.81
Ground nut	17.70	16.57	16.32
Wheat bran	3.88	3.880	3.880
Super concentrate*	5.00	5.0000	5.0000
Vegetable oil	3.70	3.7000	3.7000
Lysine	0.09	0.0900	0.0900
Methionine	0.12	0.1200	0.1200
Limestone	1.43	1.430	1.430
Dicalcium phosphate	0.00	0.000	0.000
Choline	0.20	0.200	0.200
Enzyme	0.20	0.200	0.200
Mycotoxin binder	0.20	0.200	0.200
Fenugreek	0.00	0.500	0.750
NaCl	0.30	0.300	0.300
Calculated analysis			
ME (kcal kg ⁻¹)	3189.00	3189	3189
CP%	20.25	20.04	20.18
Crude fiber (%)	3.99	3.98	3.980
Ether extract (%)	7.01	7.03	7.040
Ca %	1.00	1.00	1.010
Available phosphorus (%)	0.42	0.42	0.420
Lysine (%)	1.00	1.00	1.000
Methionine (%)	0.51	0.52	0.520
Methionine+cystine (%)	0.70	0.71	0.710

*Cp 35%, ME 1900 kcal kg⁻¹, C.fiber: 2.50%, EE: 1.5%, Ash: 35%, Ca: 7.0%, Av. P: 4.5%, Lysine: 11%, Methionine: 4.2%, Methionine+Cystine: 4.3%. Vitamin A stabilised 250.000: I.U. kg⁻¹, Vitamin D3 stabilised: 50.000 I.U. kg⁻¹, Vitamin E stabilised 500 mg kg⁻¹, Vitamin K3 (hetrazan) 40 mg kg⁻¹, Vitamin B1: Thiamin 20 mg: kg, Vitamin B2: Riboflavin 100 mg kg⁻¹, Vitamin B6: Pyridoxine 30 mg kg⁻¹, Vitamin B12: Cyanocobalamin 300 mcg kg⁻¹, Niacin: 600 mg kg⁻¹, Folic acid: 15 mg kg⁻¹, DL-Ca. Pantothenate: 160 mg kg⁻¹, Choline Chloride: 7.000 mg kg⁻¹, Biotin 1.000 mcg kg⁻¹, Copper 300 mg kg⁻¹, Zinc 1.100 mg kg⁻¹, Iron 600 mg kg⁻¹, Manganese 1.200 mg kg⁻¹, Cobalt 4.0 mg kg⁻¹, Iodine 20.0 mg kg⁻¹, Selenium 4.0 mg kg⁻¹, Anti-oxidant Added, Phytase Added, Mould inhibitor Added, Salinomycin 1200 mg kg⁻¹

Table 3: Effects of supplementation of fenugreek to broiler chicks diet during the starter period (0-3 weeks)

	Different levels of fenugreek			±SEM
	0% control (A)	0.50% (B)	0.75% (C)	
Feed Consumption (g bird ⁻¹ week ⁻¹)	854.63 ± 61.9	852.00 ± 114.9	899.94 ± 44.3	35.190
Weight Gain (g bird ⁻¹ week ⁻¹)	559.75 ± 61	521.63 ± 70.6	576.40 ± 49.8	23.530
Feed Conversion Ratio (kg feed kg ⁻¹ weight)	1.53 ± 0.26	1.63 ± 0.94	1.56 ± 0.21	0.046
Protein Efficiency Ratio (Body wt gain/protein consumed)	2.83 ± 1.2	2.66 ± 2.23	2.76 ± 0.97	0.078

-Values are mean of four replicate groups of 10 birds each. SEM: Standard error of the mean difference.

Table 4: Effects of supplementation of fenugreek to broiler chicks diet during the finisher period (4-6 weeks)

	Different levels of fenugreek			±SEM
	0% control (A)	0.50% (B)	0.75% (C)	
Feed consumption (g bird ⁻¹ week ⁻¹)	2044.6±118.3	2150.9±196.4	2226.0±161.8	73.390
Weight gain (g bird ⁻¹ week ⁻¹)	996.15±142.1	1020.38±80.1	1027.68±47.8	35.060
Feed conversion ratio (kg feed kg ⁻¹ weight)	2.06±0.51	2.10±0.64	2.16±0.63	0.089
Protein efficiency ratio (body wt gain/protein consumed)	2.10±0.62	2.06±0.69	1.99±0.69	0.065

-Values are mean of four replicate groups of 10 birds each. SEM: Standard error of the mean difference

Table 5: Effects of supplementation of fenugreek to broiler chicks diet during the whole period (0-6 weeks)

	Different levels of fenugreek			±SEM
	0% control (A)	0.50% (B)	0.75% (C)	
Live body wt (g bird ⁻¹)	1599.40±193.51	1585.50±25.6	1647.71±29.67	51.13
Feed consumption (g bird ⁻¹ week ⁻¹)	2899.30±180.2	3002.90±311.3	3125.90±206.1	95.73
Weight gain (g bird ⁻¹ week ⁻¹)	1555.90±203.1	1542.00±150.7	1604.08±97.6	51.12
Feed conversion ratio (kg feed kg ⁻¹ weight)	1.87±0.77	1.94±1.58	1.94±0.84	0.059
Protein efficiency ratio (Body wt gain/protein consumed)	2.31±1.82	2.23±2.92	2.22±1.66	0.066

-Values are mean of four replicate groups of 10 birds each. SEM: Standard error of the mean difference.

Table 6: Effects of supplementation of fenugreek to broiler chicks diet on the carcass quality of broilers

	Different levels of fenugreek			±SEM
	0% control (A)	0.50% (B)	0.75% (C)	
Dressing% on hot base	70.88±2.30	71.56±2.50	71.68±3.90	1.490
Absolute wt of heart (g)	6.05±0.33	6.40±1.04	5.97±0.84	0.400
Relative wt of heart	0.45±0.07 ^{ab}	0.51±0.06 ^a	0.40±0.06 ^b	0.032
Absolute wt of liver (g)	26.80±10.47	29.37±3.49	26.47±4.74	3.470
Relative wt of liver	1.91±0.49	2.44±0.87	1.80±0.06	0.280
Absolute wt of gizzard (g)	17.55±1.97	16.52±5.48	16.47±2.06	1.740
Relative wt of gizzard	1.31±0.24	1.30±0.22	1.11±0.12	0.100
Intestine length (cm)	163.75±17.56	151.75±13.57	167.25±15.73	7.850
Absolute wt of intestine (g)	58.05±16.64	49.02±10.69	65.57±14.34	7.050
Relative wt of intestine	4.24±0.73	3.90±0.43	4.45±0.91	0.360
Absolute wt of abdominal fat (g)	33.95±9.89	27.60±6.80	33.12±13.88	5.300
Relative wt of abdominal fat (g)	2.45±0.31	2.19±0.40	2.26±0.95	0.099

-Values are mean of four replicate groups of 10 birds each. SEM: Standard error of the mean difference. ^{a,b}Values in the same raw with different superscripts are significantly different (p<0.05)

Finisher period (4-6 weeks): Table 4 shows that broiler diet supplemented with 0.75% fenugreek seeds increased feed consumption, weight gain and feed conversion ratio, and decreased protein efficiency ratio. However, the differences between means were non-significant (p≥0.05).

Whole period (0-6 weeks): Findings obtained during whole period were similar to that obtained during finisher period (Table 5). Addition of fenugreek seeds at level of 0.75% to the broilers diet resulted in non-significant increase (p≥0.05) in feed consumption, weight gain, live body weight and feed conversion ratio, and non-significant decrease (p≥0.05) in protein efficiency ratio when compared to the control diet.

Carcass characteristics: Table 6 shows that the addition of 0.50% fenugreek seeds to the broilers diet significantly increased (p<0.05) the relative weight of heart, and non-

significantly increased (p≥0.05) absolute weight of heart, absolute weight of liver, relative weight of liver. When 0.75% of fenugreek seeds was added to the broilers diet, a non-significant increase (p≥0.05) was observed in dressing percentage, intestine length, absolute weight of intestine and relative weight of intestine; in addition, a non-significant decrease (p≥0.05) was observed in absolute weight of gizzard, relative weight of gizzard, absolute weight of abdominal fat and relative weight of abdominal fat.

DISCUSSION

Results obtained in the current study are in line with the findings of Kassu *et al.*¹¹, who reported that the addition of 1 and 2% of fenugreek seeds to the broiler diets had no significant effect (p≥0.05) on live body weight and body weight gain during starter and finisher periods. Also, Abbas¹²

reported that the addition of 3% fenugreek seeds to broilers diet had no significant effect ($p \geq 0.05$) on feed intake, live body weight and feed conversion ratio during starter period, and on live body weight during finisher period. In addition, Abbas¹² declared that inclusion of 3% fenugreek seeds to broilers diet had non-significant effect ($p \geq 0.05$) on dressing percentage, liver weight, gizzard weight, intestine weight and intestine length. Furthermore, similar results were also reported by Yesuf *et al.*¹³. Tag El-Din *et al.*⁷ conducted a study to evaluate the effect of diet supplemented with fenugreek seed on carcass characteristics and the obtained results were in accordance with the present study. Authors⁷ reported that the addition of 0.25 and 0.50% fenugreek seeds to the rabbits diet failed to induce significant effect ($p \geq 0.05$) on dressing percentage, liver weight and heart weight. In addition, similar opinion was expressed by Alloui *et al.*¹⁴ who stated that addition of fenugreek seeds to the diet of broilers had non-significant effects ($p \geq 0.05$) on their carcass characteristics. In contrast, Mamoun *et al.*¹⁵ reported that the broilers diet supplemented with fenugreek seeds significantly improved ($p \leq 0.05$) the final weight, weight gain, feed intake and feed conversion ratio; Elbushra¹⁶ and Amein *et al.*¹⁷ observed significant improvement ($p \leq 0.05$) in live body weight, body weight gain and feed conversion ratio; Alloui *et al.*¹⁴ reported that fenugreek seeds had significant effects on live body weight, feed intake and feed conversion ratio; Weerasingha and Atapattu¹⁸ declared significant improvement ($p \leq 0.05$) in feed conversion ratio; Khan *et al.*⁵ found significant increase ($p \leq 0.05$) in breast, thigh and leg weight; Toaha *et al.*⁶ reported significant increase ($p \leq 0.05$) in the dressed percentage and weights of carcass, thigh, drumstick and breast and significant decrease ($p \leq 0.05$) in weights of gizzard, liver and heart. This contradiction in results may be due to lower level (0.50 and 0.75%) of addition of fenugreek seeds to the broilers diet. It was concluded that, higher levels of fenugreek seeds are required to be added to broilers diet to enhance growth performance which are 1.5¹⁹ and 3%²⁰. Contradictory results may also be due to different factors such as location and environment where fenugreek was growing, varieties, active ingredients concentrations and biological activities and culture management.

CONCLUSION

It has been concluded that, inclusion of fenugreek seeds into the broiler diets at the levels 0.50 and 0.75% has no significant effect on growth performance and carcass yields of broiler and more researches are needed to examine inclusion of higher levels of fenugreek seeds on the performance and carcass yields.

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