



## EFFECT OF FENUGREEK SEED POWDER ON THE PERFORMANCE, CARCASS CHARACTERISTICS AND SOME BLOOD SERUM ATTRIBUTES

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### ABSTRACT

A total of 112 day-old unsexed broiler chicks (Ross 308) were used to investigate the effect of graded levels (0, 1, 2 and 3%) of fenugreek seed powder (FSP) on the performance, carcass characteristics and some blood serum attributes. Chicks were randomly distributed in a complete randomized design into four groups (A, B, C and D) each group having four replicates with seven chicks per each. Chicks in group A fed control diet, groups B, C and D fed on diets containing 1, 2 and 3% FSP respectively. The results obtained revealed that chicks fed on 1% FSP recorded significantly ( $P < 0.05$ ) the heaviest body weight compared to all tested groups, while those fed on control diet recorded significantly the lowest body weight value. There were no significant differences in body weight gain among groups fed on FSP, but they observed significantly high body weight gain compared to control group. Chicks fed on diets supplemented with FSP consumed significantly more feed, and the best feed conversion ratio (FRC) values compared to untreated group. Treatments had no significant effect on the health of the experimental chicks. The addition of FSP significantly effect on the dressing percentage and with no significant effect on carcass characteristics and the values of subjective meat quality. Supplementation of FSP on the broiler diets significantly decreased serum cholesterol, total protein, albumin and calcium. It can be concluded that FSP supplementation to diets improve the serum cholesterol, carcass characteristics and reduce serum cholesterol of broiler chicks. Economically chicks fed on diets supplemented with FSP recorded the highest profits.

**Keywords:** Fenugreek seed powder, Serum cholesterol, Serum cholesterol.

### INTRODUCTION

Use of antibiotics as growth promoters in animal nutrition have been banned due to their adverse and side effects on both animal and human health [1]. So there has been an increasing trend towards using natural feed additives which noted to improve the performance, increase the dietary protein, energy utilization and to maintain health of birds [2].

Fenugreek (*Trigonella foenum-graecum*), is an annual legume, cultivated all over the world, it is one of the herbs having multi-functional characteristics. It is a good source of dietary protein for consumption by human and animals. Nazar and ElTinay [3] reported that fenugreek seeds contained 28.4% protein, 9.3% crude fiber and 7.1% crude fat and have many chemical compounds.

Chemical composition and antioxidant activity of husk (seed coat) and endosperm of fenugreek seeds have revealed that endosperm has the highest content of saponin (4.63%) and protein (43.8%) [4]. In contrast, husk (seed coat) contains higher amount of polyphenols (103.8 mg of gallic acid equivalent) and total dietary fiber (77.1%).

Seeds are considered as an appetizer and helps in digestion; improve growth performance and health. Seeds also have many therapeutic effects like hypoglycemic, antibacterial, anti-inflammatory, antipyretic, antimicrobial and antioxidant properties [5] and sufficient vitamins [6].

Several investigators reported that supplementation of poultry diets with fenugreek seed powder reduced plasma total lipids and total cholesterol in

broiler chicks [7] and improve the reproductive and physiological performance of broiler breeder males [8].

Therefore, this study was designed to examine the effect of graded levels of fenugreek seed powder supplementation on the performance, carcass characteristics, plasma blood constituents and economical attributes of broiler chicks.

## MATERIALS AND METHODS

This experiment was conducted in the student poultry premises, College of Agricultural Studies, Sudan University of Science and Technology, during the period from 10 to 15/12/2012.

A total of 112 one-day unsexed broiler chicks (Ross-308) were purchased from a commercial hatchery. The chicks were assigned at random into four experimental treatments each had four replicates of seven chicks they were kept in an open wire mesh-sided poultry house. The pens ( $\text{m}^2$ ) inside the house were prepared using wire mesh partitioning. Light was provided 24 hours in a form of natural light during the day and artificial during night. Fenugreek seeds were purchased from the local market, cleaned, milled, then a sample was analyzed for approximate composition [9]. Four experimental A, B, C and D diets were formulated to meet the nutrient requirements of broiler chicks according to NRC. Diet A used as control, diets B, C and D were supplemented with 1, 2 and 3% of raw fenugreek seeds flour (Table 1).

Feed and water were provided *ad libitum*. Chicks were vaccinated against Gumboro disease at 9 days of age and against Newcastle disease at 22 days of age. Soluble multivitamins compounds (pantominovit-pantex Holland B.V.5525.ZG Duiz el. Holland), and antibiotic (Colidat), were given to chicks before and after three days of the vaccination in order to guard against stress.

Chicks of each replicate were group weighed weekly and feed intake was determined at the time of weighing. Mean body weight gain and feed conversion ratio (FCR) were calculated weekly. Mortality was recorded daily throughout the experimental period.

Blood samples were collected from the wing of birds (one from each replicate) before slaughter in heparinized tubes. Blood serum was separated (centrifuged at 3000 rpm for 15 min), and plasma obtained was stored at  $-20\text{C}^\circ$  until analysis. Plasma total protein, albumin, total lipids, total cholesterol, creatine and triglycerides were determined using spectrophotometry. At the end of the experiment, the chicks were fasted overnight except from water. One chick from each replicate was randomly selected, individually weighed and slaughtered then scaled in hot water, feather plucked manually then washed and drained, eviscerated and individual organs (the liver, heart, gizzard and legs) were separately weighed and they were expressed as % of live weight.

The carcasses were chilled at  $4\text{C}^\circ$  for 24 hours for carcass characteristics and meat yield. Carcasses sawed

into two halves. The left side divided into the commercial cuts (breast, thigh and drumstick). Each cut was weighed individually, deboned and the meat was frozen for panel taste.

The stored meat samples were cut into small pieces, wrapped individually in aluminum foil and roasted at  $190\text{C}^\circ$  for 70 minutes with average internal temperature of  $88\text{C}^\circ$  and served warm. Ten well-trained taste panel were used to score color, flavor, tenderness and juiciness of meat [10].

The data collected were subjected to analysis of variance (one-way ANOVA), and where significant differences were observed, means were further subjected to Duncan's multiple range test [11].

## RESULTS

Approximately analysis revealed that fenugreek seeds contain 95.9% DM, 25.68% CP, 27.6% EE and 0.4% C F.

Data concerning the growth performance of different experimental treatments was displayed in Table (2). Results showed that broiler chicks feed on diets containing fenugreek seeds flour (FSF) recorded significantly ( $p<0.05$ ) higher values for growth performance.

Chicks fed on diet containing 1% FSF recorded significantly ( $p<0.05$ ) the heaviest body weight compared to the tested groups, while those fed on control diet recorded significantly ( $p>0.05$ ) the lowest weight. Groups fed on diets containing FSF observed significantly ( $p<0.05$ ) high weight gains, feed intake and feed conversion ratio (FCR) compared to the control group.

Data obtained for carcass traits were presented in Table (3) chicks fed on 1% and 2% FSF recorded significantly ( $P < 0.05$ ) high dressing percentage compared to control group. The gizzard weights decreased significantly ( $P > 0.05$ ) with the addition of FSF in the diets, however, treatments had no significant ( $p>0.05$ ) effects on the intestine weights.

No significant ( $p<0.05$ ) differences were observed between the treatments with regard to the percentages of commercial cuts (breast, thigh and drumstick), their meat yield, internal organs (liver, gizzard, heart) and the average subjective meat quality scores (color, flavor, tenderness and juiciness), although, scores given for all attributes were above moderate acceptability level.

Addition of FSF in the broiler chicks diets significantly ( $P>0.05$ ) decreased plasma cholesterol, total protein, albumin and calcium, while there was an increase in the level of phosphorus and triglyceride compared to control group (Table3).The economic calculation revealed that, chicks fed on diets containing FSF recorded profit compared to control group. However chicks fed on diet containing 1% FSF recorded the highest profit (25.643) followed by those fed on diet containing 3% FSF (24.27) compared to control group (9.193).

**Table 1. Percent inclusion rates of dietary ingredients Used in the experimental**

Ingredients	Control	1% Fs	2% Fs	4% Fs
Sorghum	65.75	65.50	64.68	64.16
Groundnut cake	13.00	12.00	12.00	10.70
Sesame cake	15.00	14.00	14.00	15.00
Super conc.	05.00	05.00	05.00	05.00
Shell	1.00	0.58	0.57	0.53
Salt	0.25	0.25	0.25	0.25
Fs	-	1.00	2.00	3.00
lysine	-	0.13	0.07	0.02
Methionine	-	0.08	0.07	0.05
Vit.	-	0.2	0.2	0.2
Veg. oil	-	1.26	0.98	1.09
<b>Calculated:</b>				
CP	-	22.19	22.54	22.05
ME	3133.11	3110.5	3121.37	3175.0
lysine	1.148	1.300	1.250	1.3
Methionine	0.467	0.540	0.640	0.540
Ca	1.18	1.0	1.18	1.0
P	0.65	0.63	0.63	0.63

\*ME (Metabolizable energy): calculated by the following equation by Ellis (1981: Kuku Bultotini)  $ME_p = 1.549 + 0.0102(CP) + 0.0275(EE) - 0.0148(NFE) - 0.0034(CF)$ . \*Super concentrate: crude protein 40%, ME 2000 Kcal/kg, crude fiber 3%; calcium 8%, lysine 12%, Methionine 3%, available phosphorus 8%. \*Vitamins: vit. A 2500 I.U./Kg; D3 2500 I.U./Kg; E 25 mg/Kg; C 400 mg/Kg; B2 100 mg/Kg. \*Iron 800mg/kg, folic acid 30 mg/Kg, choline 1000 mg/Kg, Carcass 21%.

**Table 2. The average performance of chicks fed fenugreek seeds**

Items	Groups				SEM±	LSD
	Control	1% Fs	2% Fs	3% Fs		
Initial weight g/bird	150 <sup>a</sup>	150.25 <sup>a</sup>	150.25 <sup>a</sup>	150.5 <sup>a</sup>	2.13	6.56
Final Weight g/bird	1382.25 <sup>a</sup>	2578 <sup>b</sup>	2328.5 <sup>c</sup>	2192.25 <sup>a</sup>	93.42	287.87
Weight Gain g/bird	1238.75 <sup>b</sup>	2365.25 <sup>a</sup>	2178.25 <sup>a</sup>	2042.00 <sup>a</sup>	93.14	287.02
Feed Intake g/bird	3132 <sup>c</sup>	4627 <sup>a,b</sup>	4809 <sup>a</sup>	4382.5 <sup>b</sup>	89.31	275.22
Feed Conversion Ratio FI/ WG	2.54 <sup>a</sup>	1.96 <sup>b</sup>	2.23 <sup>c</sup>	2.145 <sup>a</sup>	0.07	0.22

a, b, c means with the same letters on the same column are in not significantly difference (p>0.05).

**Table 3. Effect of feed of broiler chicks on diets contained Fs on carcass traits**

Items	Control	1% Fs	2% Fs	3% Fs	SEM±	LSD
Live body weight	1801.67 <sup>a</sup>	2971.67 <sup>b</sup>	2661.67 <sup>c</sup>	2665.00 <sup>c</sup>	227.39	741.54
Liver% of body weight	2.24 <sup>a</sup>	2.08 <sup>a</sup>	2.22 <sup>a</sup>	2.05 <sup>a</sup>	0.22	0.498
Heart	0.53 <sup>a</sup>	0.47 <sup>a</sup>	0.50 <sup>a</sup>	0.50 <sup>a</sup>	0.073	0.238
Gizzard	1.87 <sup>a</sup>	1.39 <sup>b,c</sup>	1.31 <sup>b</sup>	1.57 <sup>c</sup>	0.17	0.55
Dressing%	70.39 <sup>a</sup>	77.06 <sup>b</sup>	73.14 <sup>c</sup>	68.85 <sup>a</sup>	2.18	7.13
Intestine (wt)	207.67 <sup>b</sup>	228.00 <sup>a</sup>	225.67 <sup>a</sup>	234.67 <sup>a</sup>	15.62	50.92
Legs	4.31 <sup>a</sup>	3.77 <sup>b</sup>	3.82 <sup>b,c</sup>	4.00 <sup>a</sup>	0.113	0.37
Breast*	28.22 <sup>a</sup>	30.31 <sup>a</sup>	29.13 <sup>a</sup>	29.76 <sup>a</sup>	1.62	5.29
Thigh*	13.55 <sup>a</sup>	14.60 <sup>a</sup>	14.61 <sup>a</sup>	14.28 <sup>a</sup>	0.86	2.80
Drumstick*	15.31 <sup>a</sup>	14.17 <sup>a</sup>	14.45 <sup>a</sup>	14.98 <sup>a</sup>	0.54	1.76
wing *	11.06 <sup>a</sup>	10.46 <sup>a</sup>	10.48 <sup>a</sup>	10.76 <sup>a</sup>	0.72	2.33

a, b, c means with the same letters on the same column are in not significantly difference (p>0.05). \*as % of hot carcass

**Table 4. Serum analysis of experimental chicks fed on diets containing FS**

Items	Ca <sup>++</sup> mg/dl	Posp. mg/dl	Chol. mg/dl	TP mg/dl	Glucose mg/dl	Alb g/Levels	Tri mg/dl
Control	11.3	5.5	122.1	2.2	203.8	1.1	81.0
1% Fs	10.4	7.6	98.3	2.1	181.3	2.4	119.5
2% Fs	0.9	8.1	104.6	1.0	171.3	0.2	96.2
3% Fs	8.8	8.9	102.2	1.7	185.5	0.7	91.2

a, b, c means with the same letters on the same column are in not significantly difference (p>0.05).

Posp.=phosphorus, Chol.= cholesterol

## DISCUSSION

Fenugreek seed powder addition in various levels to broiler diets in this study improved the performance of the experimental chicks compared to unsupplemented group.

The apparent health of the experimental chicks was good throughout the experimental period and in all treatments. Environmental temperature during the experimental period fell within thermo neutral zone, no mortality was recorded. This might be due to good sanitation or that supplementation of fenugreek did not affect on mortality rate. The result was in a agreement with findings Marinho *et al* [12] and Rays *et al* who reported that the pharmacological properties of fenugreek have been explored to identify a role in cardiovascular health.

Result showed that supplementation of fenugreek seed powder in various levels improved significantly ( $p < 0.05$ ) live body weight. This might be due to the presence of the fatty acids, or due to stimulating effect on the digestive system of broilers [13]. These findings were also in agreement with those of Nadir Alloui *et al* [14] who noted that addition of fenugreek seed in broiler diets increased live body weight. Results also revealed a significant improvement in body weight gain of the chicks on treated groups compared to those fed on the basal diet. This may be attributed to increase of feed intake or to the fenugreek contents of active compounds such as antibacterial, antifungal, anti-inflammatory, carminative and antioxidant activities. The result was in line with findings Abou-EL-Wafa *et al* [15] and Hamen *et al* [16].

Results appeared that of FSF supplementation in broiler diets significantly ( $p < 0.05$ ) improved feed consumption. This positive effect of fenugreek seeds in feed consumption can be evaluated on the basis of different perspectives, that fenugreek as natural feed additives improved diet palatability and could be attributed to the carbohydrates and their main components (galactomannan) which stimulating the appetizing and digestive process, this result was comparable with that of Micheal and Kumawat [16] and Nadir Alloui *et al* [14] on contrast Moustafa [17] indicated that fenugreek seeds at level of 0.05% revealed no significant effect on feed consumption compared to the control group.

## REFERENCES

1. Marzo I. New strategies in rabbit feed, Additives and alternatives to antibiotic use. 26<sup>th</sup> Symp. ASESUCU, Aveiro, (Portugal), 2001, 51-68.
2. Abdel-Aal ESM and Attia RS. Characterization of black cumin (*Nigella sativa*) seeds Proteins *Alex.Sci.Exch*, 14, 1993, 483-496.
3. Nazar AE and EL Tinay. Functional properties of fenugreek (*Trigonella foenum-graecum*) protein concentrate. *Fd. Chem*, 103, 2007, 582-589.
4. Madhava Naidu M, Shyamala, BN, Pura Naik J, Sulochanamma G & Srinivas P. Chemical composition and antioxidant activity of husk and endosperm of fenugreek seeds. *LWT-Food Science and technology*, 44, 2010, 451-456.
5. Xue, WL, Li, XS, Zhang J, Liu YH, Wang Z and Zhang R. Effect of *Trigonella foenum graecum* (fenugreek) extract on blood glucose, blood lipid and hemorheological properties in streptozotocin induced diabetic rats. *Asia Pac. J. Clin. Nutr*, 16(1), 2007, 422-426.

Fenugreek seeds supplementation improved significantly ( $p < 0.05$ ) FCR of broiler chicks, this might be related to the development of the broiler chicks gut morphological changes of gastrointestinal tissues can be induced by differences in gutflod of microbial content including their metabolites, the result was in line with findings of Nadir *et al* [14] Mukhtar *et al* [15] and Amal *et al* [19] who reported improvement of broiler feed conversion ratio fed on diets supplemented with lemon grass oil and Halfa bar essential oil respectively.

The dressing percentages of chicks fed on 1% and 2% FSP showed significantly ( $p < 0.05$ ) heavy weights compared to unsupplemented group. The result was agreed with the findings of Guo *et al* [20] and Nadi Allouiet al [14]. Feeding fenugreek seed powder significantly decreased gizzard weight, no significant effect on intestine weights and non carcass components (liver, gizzard, heart), these results were in line with reports of Guo *et al* [20], Mukhtar *et al* [15].

The results of the study showed that meat yield and the average of subjective meat quality scores (color, flavor, juiciness and tenderness) was not affected by dietary treatment ad different levels all being at moderate values. These results were in line with the findings of Mukhtar *et al* [15].

The results of serum metabolite showed reduction in plasma total protein, total cholesterol and calcium in groups of chicks fed on FSP compared to control group. The hypocholesterolemic effect of FSP may be due to its active ingredients such as saponins, hemicelluloses, mucilage, tannin and pectin and these compounds help lower blood LDL-cholesterol levels by inhibiting bile salts. These results confirmed by reports of Mukhtar *et al* [15].

The results of economical evaluations of the experimental diets showed that the supplementation of FSP to broiler diets improved the performance of chicks and resulted economical benefits. Profitability ratio (2.79) for 1% FSP was the highest although all chicks fed on different levels recorded high ratio of profits compared to control group these results were in agreement with findings of Mukhtar *et al* [15].

6. Srinivasan K. Fenugreek (*Trigonella foenum-graecum*), a review of health beneficial physiological effects. *Food-Reviews-International*, 22, 2006, 203–224.
7. Azouz HMM. Effect of hot pepper and fenugreek seeds supplementation on broiler diets. Ph.D. Thesis, Poultry Nutrition Dept. Faculty of Agriculture, Cairo University. 2001
8. Taha AT. The Role of Vitamins AC and Fenugreek Seeds in Lowering Oxidative Stress Effect on Physiological and Reproductive Performance of Males Broiler Breeder. PhD. Thesis, College of Agriculture and forestry, University of Mosul. 2008.
9. AOAC. Official Methods of Analysis of the Association of Official Analytical Chemists, 16th Ed. 1995.
10. Cross HRR. moen and Staffield, M.S. Training and testing of judges for sensory evaluation of meat quality. *Food Technology*, 32, 1978, 48-52.
11. Duncan DB. Multiple ranges and Multiple (F-test). *Biometrics*, 11, 1955, 1-42.
12. Marinho MC, Lordelo MM, Cunha LF, Freire JPB. Microbial activity in the gut of piglets, Effect of prebiotic and probiotic supplementation. *Livestock science*, 108, 2007, 236-239.
13. Hernandez AI, Madrid J, Garcia V, Orengo J etMeglaz MD. Influence of two plant extracts on broiler performances, digestibility and digestive organs size. *Poultry Science*, 83, 2004, 169-174.
14. Nadir Alloui S. Ben Aksa (University of Batna, Algeria), M.N Alloui. Utilization of Fenugreek (*TrigonellaFoenum-Graecum*) as Growth Promoter for Broiler Chickens. *J. Worlds Poult. Res*, 2(2), 2012, 25-27, 2012.
15. Abou EL-Wafa S, Sayed MAM, Ali SA, Abdallah AG. Performance and immune response ofbroiler chicks as affected by methionine and zinc or commercial Fenugreeksupplementations. *Egypt. Poult. Sci*, 23 (III), 2003, 523-540.
16. Michael D and Kumawat D (2003). Legend and archeology of fenugreek, constitutions and modern applications of fenugreek seeds. *International Symposium, USA*, 41-42
17. Moustafa, kout El-Kloub. Effect of using commercial and natural growth promoters on the performance of commercial laying hens. *Egypt. poult. Sci*, 26, 2006, 941-965.
18. Mukhtar MA, KA Mohamed, Amal OA and Ahlam H. Response of Broiler Chicks to different Dietary Levels of Spearmint Oil(SPO) as a Natural Groth Promoter. *University of Bakht Alruda Scienfic Journal*, 6, 2013, 175-183.
19. Amal OA, Mukhtar AM, Mohamed KA and Ahlam AH. Use of Halfa Bar Essential Oil (HBO) as a Natural Growth Promoter in Broiler Nutrition. *International Journal of Poultry Science*, 12(1), 2013, 15-18, 2013.
20. Guo FC, Kwakel CRP, Soede J, Williams BA, Verstegen MW. Effect of a Chinese herb medicine formulation, as an alternative for antibiotics, on performance of broilers. *British Poultry Science*, 45, 2004, 793-797.