

Effects of Fenugreek (*Trigonella foenum-graecum L.*) seed powder, as a feed supplement, on broiler carcass and meat characteristics

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ABSTRACT

The use of natural products in herbs to improve the efficiency of feed utilization and meat quality is important than antibiotics. The objectives of this study were to assess the effect of supplementation fenugreek seed powder on processed broiler chicken meat and carcass characteristics. A total of hundred and eight day-old male broiler chicks (Ross 308) were used at Elbashair farm in Wad Medani, Sudan. Chicks were randomly assigned in a completely randomized design into three groups (A, B and C) with three replicates. The experimental diets (starter and finisher) were formulated to satisfy the nutritional requirements of broiler chicks. The control birds (C) were fed a balanced broiler starter diet *ad lib*. Group (A) was fed basal diets supplemented with fenugreek seed powder (FSP) at 1% *ad lib* in the first three days weekly for two weeks. Group (B) was fed basal diets supplemented with FSP at 1 % *ad lib* for the first 3 days through the entire period of the experiment (6weeks). At the end of the experiment, the birds live body weights were recorded and body weight gain was calculated. Two birds from each replicate were slaughtered, chilled and then weighed. Carcass weight, breast, thigh, deboned breast and deboned thigh weights were taken. Taste, flavor, tenderness, number of chewings and juiciness were determined using a taste panel. The results revealed that birds fed on 1% FSP recorded no significant differences in body weight gain compared to groups fed on control diet. Treatments had no significant effects on breast and thigh weight. Moreover, there were no significant effects on breast and thigh bones. Broiler fed FSP had no significant differences in tenderness, juiciness, flavor and taste and number of chewings of thigh meat. Also, no significant differences were found in breast meat tenderness, flavor and taste. There were significant differences in juiciness and highly significant differences in number of chewings. There were no significant difference in moisture content but there were significant difference in ash and highly significant differences in fat and protein. The study recommended using 1% fenugreek seed powder for improving broiler carcass weight and meat quality.

INTRODUCTION

The use of antibiotics as animal growth promoters in animal nutrition has been banned due to their adverse effects on both animal and human health (Marzo, 2001). So, there has been an increasing trend towards using natural feed additives to improve the performance, increase the dietary protein, energy utilization and to maintain health of birds (El-Katcha, 1990). Herbs and plant extracts are good alternatives to antibiotics (Tuncer Kutlu, 2007). Fenugreek seeds are considered as an appetizer and help in digestion; improve growth performance and health. Supplementation of poultry diets with fenugreek seed lowered plasma total lipids and total cholesterol in broiler chicks (Azoua, 2001). Inclusion of fenugreek seeds in the diet significantly improved the body weight of broiler chicken (Abaza, 2001; Guo *et al.*, 2004; Yattoo *et al.*, 2012; Qureshi *et al.*, 2015). Nadir *et al.* (2012) found that addition of fenugreek seeds to broiler chicken diets significantly affected live body weight, feed intake and feed conversion ratio; however, there were no significant difference among slaughter parameters and mortality.

Abdel-Azeem (2006) reported best results by fenugreek seeds when supplemented with 0.5% level in the diet of the broiler chicken. Rabia (2010) studied the effect of fenugreek, parsley and sweet basil seeds as natural feed additives on broiler performance. She observed that chicks fed basil diet had significantly the heaviest body weight than those fed Fenugreek seeds. However, carcass characteristics had no significant differences. Alloui *et al.* (2012) studied the effect of fenugreek seeds at (3g/ kg) as natural growth promoter for broiler chicken. They found that fenugreek significantly affected live body weight, feed intake and feed conversion ratio. However, there was no significant difference for the slaughter parameters and mortality and attributed the effect of increasing feed intake to the presence of galactomannans and neurin which stimulated the appetite and improvement in feed conversion ratio (FCR) due to the beneficial effect on gut microflora. However, Weerasingha and Atapattu (2013) concluded that 1 % dietary fenugreek had some growth promoting effects in broiler chicken.

Magda (2012) found that 1.5 % fenugreek was useful for improving live body weight, body weight gain, feed conversion ratio, protein efficiency ratio, feed consumption and efficiency of energy utilization. Fenugreek powder has been shown to decrease plasma total lipids and cholesterol level in commercial broiler (Duru *et al.*, 2013; Mamoun *et al.*, 2014). Some studies also showed that supplementation of either FSP extract (Khan *et al.*, 2011), seed powder (Elagib *et al.*, 2013), seeds blended with turmeric (Abdel-Rahman *et al.*, 2014) or seeds with enzyme (Qureshi *et al.*, 2015) improved the performance of broiler chicks. However, 2.0% FSP recorded significantly ($P < 0.01$) the highest productive performances followed by broilers which received 1.0% and 3% FSP (Toaha *et al.*, 2016). Inclusion of FSP at 2% level resulted in higher dressed carcass, breast, high and drumstick meat weight compared to other treatments. They added that, unlike the antibiotic growth promoters, addition of 2% FSP to the diet significantly reduced abdominal fat.

Mamoun *et al.* (2014) reported that supplementation of fenugreek seeds at 1% level in the diet of broiler chicken caused significant improvement in the carcass percentage and intestinal length. A significant effect on the digestive parts and increase in length and weight of intestines had been documented due to dietary inclusion of fenugreek seeds (Duru *et al.*, 2013). The positive effect on intestinal morphology could lead to long contact between the digesta and mucosal epithelium, which maybe more effective for nutrient absorption (Boguslawska-Tryk *et al.*, 2012). Khadr and Abdel-Fattah (2007) concluded that supplementation of broiler diet with 1% fenugreek seed improved broiler performance, oxidation stability of broiler meat and modulated cholesterol profile in the serum which could be reflected in the meat and make an advantage for human diets.

This study was designed to examine the effect of adding 1% fenugreek seed powder as feed supplement on broiler carcass characteristics, chemical composition and physical properties of broiler meat.

MATERIALS AND METHODS

The experimental site

The experiment was carried out at Elbashair farm in Elshukaba area about 10 kilometers south of Wad Medani, Gezira State, Sudan. The experiment was carried out during 19th May to the 4th July, 2016. The prevailing temperature ranged from 26° to 34°C at night and from 37° to 45°C at day time.

Experimental pens

Small pens (1×1.5 m) were used. Chicks were kept in an open wire mesh-side poultry house. The pens were cleaned, washed and disinfected with formalin and phenol solutions before the commencement of experiments. A layer of wood shavings was laid on the pen floor as a litter material. Each pen was provided with 2.5- gallon drinker and 5 kg feeder which were cleaned and disinfected before starting the trial. The feeders and drinkers height was adjusted according to the progressive growth of the chicks. Light was provided 24 hours as natural light during the day and artificial during night.

Experimental birds

One hundred and eight, one-day old commercial male broiler chickens, Ross 308 strain were used. The chicks were divided into three treatment groups of 36 birds each and randomly assigned to three treatment diets (A, B, and C). Each treatment group was further subdivided into three replicates of 12 chicks per replicate.

Experimental diets

Table 1 shows starter and finisher diets. The experimental diets were formulated according to NRC (1994).

Feeding management

(1) The control (C)

The birds were fed a balanced broiler starter diet *ad libitum* at 2nd - 3rd week of age. A finisher diet was offered from 4th – 6th week of age.

(2) Group A

The birds were fed *ad libitum* a balanced broiler starter diet with added fenugreek seed powder (FSP) at 1% of the ration during the first three days through a period of 2 weeks. A basal finisher diet was offered during the period of 4th – 6th week of age.

(3) Group B

The birds were fed *ad libitum* a balanced broiler starter diet with added fenugreek seed powder (FSP) at 1% of the ration during the first three days through the entire period of the experiment (6 weeks).

Table 1. Ingredients and chemical composition of the starter and finisher diets.

Ingredient %	Starter	Finisher
Sorghum grain	68	69
Groundnut cake	24	21
Super concentrate*	5	5
Oil	1	3
Premix	0.5	0.5
Oyster shell	0.8	0.8
Choline chloride	0.2	0.2
Protect program	0.2	0.2
Anti-bacterial	0.1	0.1
Anti-toxic and fungal	0.2	0.2
Calculated Chemical composition		
Dry matter	93.6	92.7
CP	21.9	20.1
EE	3.8	3.5
Fiber	4.2	3.9
Ash	3.8	3.4
NFE	56.6	56.4
Metabolisable energy (ME) kcal/kg**	3053	3195
Ca	0.7	0.8
P	0.6	0.5

* Super concentrate contains the following: 35% CP, 2% EE, 4% CF, 10% calcium, 4.5% available phosphorus, 5.7% lysine, 4.5% methionine and 4.9% methionine + cystine. Metabolisable energy 2000 kcal/kg, 2.6% sodium, with added vitamins and minerals.

** Metabolisable energy (ME K cal/kg) was calculated according to the formula derived by Lodhi *et al.* (1976). $ME\ kcal/kg = 32 \cdot 95 (\% \text{ crude protein} + \% \text{ ether extract} \times 2 \cdot 25 + \% \text{ available carbohydrate})$ 29·20.

Carcass preparation

At the end of the experiment, two birds were taken from each replicate and weighed. The birds were slaughtered according to Islamic ritual. Carcasses weights were recorded in grams. Then the dressing percentages were obtained and the birds were cut into three cuts (breast, thigh and wings) and deboned. Meat and bones were weighed for all cuts and samples were taken for analysis (protein, ash, moisture and fat). The cuts were stored at -10°C for a taste panel.

Taste Panel

The-chilled meat samples were cut into small pieces from breast and thigh then cooked using an oven. Taste Panel was done after cooking using 30 panelists to assess taste, flavor, tenderness, number of chewing and juiciness.

Statistical analysis

Data were analysed using standard analysis of variance procedures. Means were separated using Duncan's multiple range test 5% level of significance.

RESULTS AND DISCUSSION

Effect of fenugreek seed powder on carcass and carcass cuts weight

The dressed weight of the carcass and weight of its various cuts, lean meat and bone were shown in Table 2. Broiler chicks fed on diets containing 1% fenugreek seeds powder (FSP) recorded no significant differences in carcass and carcass cut weights. These findings are in line with those of Alloui *et al.* (2012) who found no significant difference in the slaughter parameters when fenugreek seeds were added at 3g/ kg as natural growth promoter for broiler chicken.

These findings also agreed with those of Nadir *et al.* (2012) who found that fenugreek seeds supplementation to broiler chicken diets had no significant effects on slaughter parameters. However, these findings are in contrast with those obtained by Toaha *et al.* (2016) who recorded that inclusion of dietary FSP at 2% level resulted in higher dressed carcass, breast, thigh and drumstick meat weight compared to other treatments. This might be attributed to the fact that they used different levels of FSP 2.0% .Moreover, the findings of this study are in line with those of Magda (2012) who found that 1.5 % inclusion level was useful for improving broiler performance, protein efficiency ratio and efficiency of energy utilization.

Also the result of this study contradicted with those of Rabia (2010) who reported that 3 g/kg of FSP enhanced broiler chickens growth. It seems that,1% inclusion level in this study is below the

effective level of fenugreek in broiler diet. These findings are in accordance with those of Elkhider (2002) who found that addition of FSP significantly affected the dressing percentage but had no significant effects on carcass characteristics and meat quality.

Table 2. Effects of feeding fenugreek seeds on carcass and carcass cuts weight (g).

Parameters	Treatments			SE \pm	CV%
	C	A	B		
Carcass	1520.6	1578.4	1518.3	35.70	7.58
Breast	433.0	436.2	406.3	13.85	10.61
Thigh	394.7	398.9	400.7	8.61	7.45
Wings	170.5	187.3	172.6	7.99	14.77
Breast lean meat	353.4	355.5	367.9	7.91	7.32
Thigh lean meat	311.8	305.6	314.5	7.21	7.91
Wing lean meat	106.8	116.2	99.0	8.06	24.77
Breast bone	71.6	90.2	63.1	7.80	27.02
Thigh bone	67.0	85.2	81.3	2.46	8.88
Wing bone	58.7	62.8	63.1	1.36	6.56

A=treatment2 fed FSP at1% of diet for 2weeks B=treatment3 fed FSP at1%of diet for 6weeks C= control fed basal diets *ad libitum*.

Chemical analysis

Table 3 shows no significant differences in moisture content while there were significant ($P \leq 0.05$) differences in ash and highly significant ($P \geq 0.01$) differences in protein and fat. This finding is in line with that of Azoua(2001) who reported that supplementation of poultry diets with fenugreek seed lowered plasma total lipids and total cholesterol in broiler chicks. Also, the results agreed with those Duru *et al.* (2013) and Mamoun *et al.* (2014) who reported that FSP powder decreased plasma total lipids and cholesterol level in commercial broiler.

Toaha *et al.* (2016) recorded that feeding FSP at 2% level reduced abdominal fat content. The authors claimed that the difference may be due to the beneficial effect of fenugreek seeds on gut microflora or may have been attributed to the presence of essential fatty acids and high quality proteins stimulating effect on the digestive system.

Table 3. Effects of feeding fenugreek seeds on chemical composition of broiler chicks meat.

Parameters	Treatments			SE \pm	CV%	P
	C	A	B			
Moisture	67.7 ^a	67.6	67.4 ^a	3.3 2	15.98	NS
Protein	23.5 ^c	24.0 ^b	24.4 ^a	0.1 1	0.59	* *
Fat	6.9 ^a	6.2 ^b	6.1 ^b	0.1 5	3.98	* *
Ash	1.9 ^b	2.2 ^a	2.1 ^a	0.0 6	5.08	*

A=treatment2 fed FSP at1% of diet for 2weeks B=treatment3 fed FSP at1%of diet for 6weeks C= control fed basal diets *ad libitum*.

*, ** and NS indicate significance at $P \leq 0.05$, 0.01 and not significant, respectively.

Means in row followed by the same letters are not significantly different according to Duncan's Multiple Range Test at 5% level

Effect of fenugreek seed powder on sensory attributes

Sensory parameters are presented in Table 4. Results show no significant differences on tenderness, juiciness, flavor, taste and number of chewings of thigh meat. These results are in agreement with those of Al-Beitawi and El-Ghousein (2008) who reported that supplementation of different levels of crushed or uncrushed fenugreek seed did not affect any of the carcass characteristics parameters.

Table 4. Effect of feeding fenugreek seeds on sensory attributes of the broiler thigh meat.

Parameters	Treatments			SE	CV%
	C	A	B		
Tenderness	24.00	29.00	26.00	1.49	18.46
Juiciness	25.500	25.33	27.33	1.52	20.58
Flavour	26.50	26.00	28.00	1.34	17.56
Taste	29.50	29.33	30.67	1.01	11.92
No of chews	21.30	26.00	26.00	1.56	20.42

A=treatment2 fed FSP at1% of diet for 2weeks B=treatment3 fed FSP at1% of diet for 6weeks C= control fed basal diets *ad libitum*.

Table 5 revealed no significant difference among treatments on tenderness, flavour and taste of breast meat. However, there were significant difference among treatments in juiciness and number of chewings which may be due to low content of fat.

Table 5. Effect of feeding fenugreek seeds on sensory attributes of the broiler breast meat.

Parameters	Treatments			SE	CV %	P
	C	A	B			
Tenderness	28.67 ^a	26.67	22.67 ^a	1.56	17.20	NS
Juiciness	30.00 ^a	22.67 ^b	21.33 ^b	1.71	14.55	*
Flavour	29.00	26.00	26.00	0.91	9.80	NS
Taste	29.33	26.00	26.00	1.25	14.34	NS
No of chewing	27.33 ^a	24.67 ^b	24.67 ^b	0.75	4.64	**

A=treatment2 fed FSP at1% of diet for 2weeks B=treatment3 fed FSP at1%of diet for 6weeks C= control fed basal diets *ad libitum*.

*,** and NS indicate significance at $P \leq 0.05$, 0.01 and not significant, respectively

Means in a row followed by the same letter are not significantly different according to Duncan's Multiple Range Test at 5% level

CONCLUSION

The study concluded that fenugreek can be used in broiler ration at the level of 1% without any deleterious effects on broiler carcass characteristics and meat quality.

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تأثير مسحوق الحلبة كمضاف علفي على خصائص الذبيحة ولحوم فراخ اللحم

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الخلاصة

استخدام المنتجات الطبيعية كالأعشاب لتحسين الكفاءة الغذائية وجودة اللحوم أكثر إيجابية من المضادات الحيوية. هدفت هذه الدراسة إلى تقييم أثر مسحوق بذور الحلبة (1%) على لحوم الفراخ المصنعة وبعض صفات الذبيح استخدمت 108 كتكوت ذكور عمر يوم من سلالة روس 308 بمزرعة البشائر. قسمت الكناكيت عشوائياً إلى ثلاثة مجاميع (A,B,C) بثلاثة تكرارات. ركبت علبقة التجربة (بادي ونهاي) لتفي الاحتياجات الغذائية للدجاج اللحم. الطيور القياسية (C) غذيت بعليقه بادئة متوازنة. المجموعة (A) عليقه قياسية مضافة إليها مسحوق بذور الحلبة في الثلاث أيام الأولى أسبوعياً لمدة أسبوعين. المجموعة (B) غذيت على العليقة القياسية (بادي ونهاي) مضافة إليها مسحوق بذور الحلبة في الثلاثة أيام الأولى في عمر أسبوعين حتى نهاية التجربة في ستة أسابيع. ثم في نهاية التجربة سجل وزن الجسم الحي و ثم حسب الوزن المكتسب ومن تم ذبح اثنين طائر من كل تكرار ووزنت الفراخ في حالة جامدة. اخذ وزن الجسم والصدر والفخذ ولحم الصدر ولحم الفخذ لاختبار صفات الجودة التذوق والنكهة والطرارة وعدد المضغات والعصيرية. أوضحت النتائج أن الدجاج الذي تم تغذيته على مسحوق الحلبة انه لا توجد فروقات معنوية في وزن الجسم المكتسب لكل المجموعات التي تغذت على الحلبة وأشارت النتائج أيضاً إلى عدم وجود فروقات معنوية بين لحم الصدر ولحم الفخذ في أوزانهم. وأيضاً لا توجد فروقات معنوية بين عظمة الصدر وعظم الفخذ وأشارت النتائج أيضاً أن لحم الفخذ للفراخ التي غذيت على مسحوق الحلبة أنه لا توجد فروقات معنوية بين الصفات الطرارة والعصيرية والنكهة والطعم وعدد المضغات بالنسبة للحوم الصدور. لا توجد فروقات معنوية بين الصفات الطرارة والنكهة والطعم ولكن توجد فروقات معنوية ($P>0.05$) في العصيرية وفروقات عالية ($P<0.01$) في عدد المضغات. في التحليل الكيميائي لم تكن هناك فروقات معنوية ($P>0.05$) في الرطوبة، ولكن كانت هناك فروقات معنوية ($P>0.05$) في الرماد وتوجد فروقات معنوية عالية ($P<0.01$) في الدهن والبروتين. ومن نتائج البحث توصي الدراسة بان يتم استخدام نسبة 1% من مسحوق بذور الحلبة لتحسين الوزن وبعض صفات اللحم.

