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# Effects of Adding Dietary Fenugreek (*Trigonella foenum graecum* L.) Powder on Productive Performance and Egg Quality of Laying Hens

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**Abstract:** The present study was conducted to evaluate the effect of adding different dietary levels of fenugreek (0.0, 0.1, 0.2 and 0.4%) powder on productive performance and egg quality of laying hens from 52 to 60 weeks of age. Two hundred 52-week old Hisex laying hens were randomly distributed in four dietary treatments with ten replicates with five hens per each replicate. Body weight gain, egg production, feed consumption, feed conversion ratio, egg weight, egg mass, egg specific gravity, Haugh units and egg yolk color were measured. Results obtained from the present study showed that no significant differences were observed in body weight gain, egg production, egg weight, egg specific gravity, egg yolk color and Haugh unit by adding 0.0, 0.1, 0.2, or 0.4% dietary levels of fenugreek powder. Feed consumption of hens fed with diets containing 0.4% decreased significantly compared with those fed diets containing 0.0, 0.1 and 0.2% dietary levels of fenugreek powder. However, hens fed diets containing 0.1, 0.2 and 0.4% fenugreek powder showed lower (better) feed conversion ratio and lower egg mass than those fed diets containing 0.0% fenugreek powder. It was concluded that adding dietary fenugreek powder at the level of 0.4% had some positive effects on productive performance and egg quality of laying hens from 52 to 60 weeks of age.

**Key words:** Egg quality, fenugreek powder, laying hens, productive performance

## INTRODUCTION

Using synthetic antibiotics have been banned as growth promoter in poultry diets to avoid their harmful effects on animal and human health (Hertrampf, 2001; Humphrey *et al*., 2002). Therefore, the poultry nutritionists have been focused on research to found some non-antibiotic natural growth promoter alternatives to use in poultry nutrition (El-Gendi, 1996; Abaza, 2007). Fenugreek is one of the possible phytobiotics that can be used as natural feed additives to replace using antibiotics in poultry nutrition (Sabra and Mehta, 1990; Wegener *et al*., 1998; Shea, 2003; Abaza, 2007; Windisch *et al*., 2008).

Fenugreek (*Trigonella foenum* graecum) is an annual herb with aromatic strong smell and bitter taste belonging to the family Leguminosea (Alarcon-Aguilara *et al*., 1998), widely grown in Mediterranean region, Indian and China. Fenugreek seed contains about 11.7% moisture, 20 to 30% crude protein rich in lysine and tryptophan, 5 to 10% lipids rich in essential fatty acids (mainly linoleic, linolenic, oleic and palmitic acids), 45 to 65% total carbohydrates with 15% of galactomannan mucilage (a soluble fiber), 3.2% ash, 6.24% crude fiber, 0.015% volatile oils, 35% alkaloids mainly trigonelline, 0.6 to 4.8% steroidal saponins, glycosides, flavonoids, cholesterol, vitamins, calcium, phosphorous, iron, zinc and manganese (Abd EL-Aal and Rahma, 1986; Rao and Sharma, 1987; Schryver, 2002; Kochhar *et al*., 2006; Motamedi and Taklimi, 2014). Fenugreek contains phytoestrogens having important estrogenic effect (Mazur *et al*., 1998). Also, fenugreek has been recognized as a potential source of diosgenin, hemisynthesis of steroidal sapogenins such as cortisone and sex hormones (Brenac and Sauvaire, 1996a, b). Moreover, fenugreek also contains neurin, biotin, trimethylamine which stimulate the appetite by affecting the nervous system (Al-Habori and Roman, 2002; Michael and Kumawat, 2003). Therefore, fenugreek seeds are considered as appetizers and digestion enhancer.

In addition, several studied claimed that the fenugreek have several biological activities (Sharma *et al*., 1991; Petit *et al*., 1995; Deshpande *et al*., 1998; Mazur *et al*., 1998; Sowmya and Rajyalakshmi, 1999; Bash *et al*., 2003; Osman, 2003; Chattopadhyay *et al*., 2004; Mohamed *et al*., 2004; Moustafa, 2006; Badreldin *et al*., 2008; Abdul-Rahman *et al*., 2010).

Although, lot of studies have been carried out to determine the effect adding dietary fenugreek powder on productive performance of broiler chicks, a little information is available about the effect of adding fenugreek powder into laying hen diets on their productive performance and egg quality. Therefore, the objective of the present study was carried out to evaluate the effects of adding different dietary levels (0.0, 1.0, 2.0 and 4.0%) of fenugreek powder on productive performance and egg quality of laying hens from 52 to 60 weeks of age.

## MATERIALS AND METHODS

Commercial fenugreek powder used in the present study was purchased from local market in Al-Ahsa, Kingdom of Arabia Saudi.

**Experimental design:** The current study was conducted from September till December, 2015 at the Agriculture Research and Training Station of King Faisal University, Al-Ahsa, Kingdom of Saudi Arabia. Two hundred Hisex White® laying hens with similar body weight and egg production were used over 8-week trail experimental period from 52 to 60 weeks of age. Hens were reared in a close sided laying hen house in battery group cages (100 x 60 x 30 $cm^3$) separated by a 1.0 m aisle, equipped with galvanized-iron trough feeders covering the entire front length of metal cages and nipple drinkers. Hens were randomly distributed among four dietary treatments containing either 0.0, 0.1, 0.2, or 0.4% of fenugreek powder with ten replicates with five hens for each treatment. The laying hen diets used in this study were calculated to be isocloric containing 2762 Kcal metabolizable energy and isonitrogenus containing 16.89% crude protein/kg feed to meet the recommended nutrition requirements of Hisex laying hens as shown in Table 1. The diets used were formulated and their chemical compositions were calculated before adding the different levels of fenugreek powder into the different treated diets. By starting the study at 52 weeks of age, each hen was fed 120 g once daily and water was provided *ad libtum*. All the hens were subjected to 16 h light throughout the entire experimental period.

**Measurements:** The initial and final body weight of laying hens used in the study were individually measured at the starting and ending of the experimental study at 52 and 60 weeks of age, respectively. Egg production (%), feed consumption (kg), feed conversion ratio (kg feed consumed/kg egg mass produced) were measured per each replicate from 52 to 60 weeks of age. Three eggs were collected from each replicate during the last 3 consecutive days at biweekly intervals and individually weighed to the nearest 0.01 g. Then, the same eggs were stored overnight at room temperature to determine egg specific gravity according to the method described by Hempe *et al*. (1998) in which saline solutions ranged from 1.060 to 1.10 g/mL with 0.005 increment were used. Egg albumen height was measured by using an Ames micrometer (model S-6428, Ames, Waltham, MA) at a point halfway between the egg yolk and the edge of the albumin widest expanse. Egg Haugh unit was determined by applied the following formula reported by Panda (1996):

$$\text{Haugh unit} = 100 \times \log (H + 7.57 - 1.7W^{0.37})$$

where, H is egg albumin height (mm) and W is egg weight (g). In addition, egg yolk color was determined by using a Roche colorimetric fan (DSM nutritional products Co.) using color scales ranged from 1 (pale yellow) to 15 (intense orange) as described by Well (1968).

Table 1: Composition experimental diets

| Ingredients | (%) |
|---|---|
| Yellow corn | 62.0 |
| Corn oil | 1.0 |
| Dehulled soybean meal (44.5% CP) | 26.4 |
| Limestone | 8.7 |
| Dicalcium phosphate | 1.0 |
| Antioxidant | 0.10 |
| L-Lysine | 0.10 |
| Choline chloride | 0.10 |
| DL-Methionine | 0.10 |
| Vitamin-mineral premix* | 0.25 |
| Salt | 0.25 |
| **Calculated nutritional composition** | |
| Dry matter (%) | 90.27 |
| Energy (Kcal ME/kg feed) | 2762 |
| Crude protein (%) | 16.89 |
| Crude fat (%) | 2.65 |
| Crude fiber (%) | 3.30 |
| Linolenic acid (%) | 1.57 |
| Calcium (%) | 3.62 |
| Available phosphorus (%) | 0.31 |

*Vitamin-mineral premix added at this rate yields: 149.60 mg Mn, 16.50 mg Fe, 1.70 mg Cu, 125.40 mg Zn, 0.25 mg Se, 1.05 mg I, 11,023 IU vitamin A, 46 IU vitamin E, 3,858 IU vitamin $D_3$, 1.47 mg minadione, 2.94 mg thiamine, 5.85 mg riboflavin, 20.21 mg pantothenic acid, 0.55 mg biotin, 1.75 mg folic acid, 478 mg choline, 16.50 μg vitamin $B_{12}$, 45.93 mg niacin and 7.17 mg pyridoxine per kg diet

**Statistical analysis:** Data obtained were subjected to one-way ANOVA using the GLM procedure of a statistical software package (SPSS 18.0, SPSS Inc., Chicago, IL). Experimental units were based on replicate averages. Treatment means were expressed as mean±standard error of means (Mean±SEM) and separated ($p \leq 0.05$) using the Duncan's multiple range test (Duncan, 1955).

## RESULTS AND DISCUSSION

Results obtained from the present study showed that no significant differences were observed in body weight gain, egg production, egg weight, egg specific gravity, egg yolk color and Haugh unit by adding fenugreek powder at the levels of 0.0, 0.1, 0.2, or 0.4% into laying hen diets. Feed consumption of hens fed diets containing 0.4% decreased significantly compared with those fed diets containing 0.0, 0.1 and 0.2% fenugreek powder. However, no significant differences were observed in feed consumption among hens fed diets containing 0.0, 0.1 and 0.2% fenugreek powder.

On the other hand, hens fed diets containing 0.1, 0.2 and 0.4% fenugreek powder showed lower (better) feed conversion ratio and lower egg mass than those fed control diets containing 0.0% fenugreek powder. However, no significant differences were observed in

Table 2: Effect of adding different dietary levels (0.0, 0.1, 0.2 and 0.4%) of fenugreek powder on productive performance and egg quality of laying hens from 52 to 60 weeks of age

| | Fenugreek powder (%) | | | |
|---|---|---|---|---|
| Productive and egg quality traits | 0.0 | 0.1 | 0.2 | 0.4 |
| Body weight gain (g) | 89.99±38.73 | 79.15±43.76 | 164.33±37.49 | 73.44±40.79 |
| Feed consumption (kg) | 5.78±0.01[a] | 5.74±0.06[a] | 5.71±0.02[a] | 5.52±0.07[b] |
| Egg production (%) | 60.37±2.42 | 66.23±4.46 | 55.85±3.79 | 63.66±4.32 |
| Egg weight (g) | 67.73±0.87 | 64.67±0.75 | 66.87±2.14 | 67.07±0.92 |
| Egg mass (kg) | 2.29±0.08[a] | 2.55±0.03[b] | 2.65±0.09[b] | 2.65±0.04[b] |
| Feed conversion ratio (kg feed/kg egg mass) | 2.54±0.09[a] | 2.25±0.03[b] | 2.17±0.07[b] | 2.08±0.03[b] |
| Egg specific gravity (g/cm$^3$) | 1.07±0.00 | 1.07±0.00 | 1.07±0.00 | 1.07±0.00 |
| Egg yolk color | 4.67±0.15 | 3.93±0.07 | 3.47±0.13 | 3.80±0.23 |
| Haugh unit | 87.79±2.56 | 85.67±2.08 | 87.20±2.34 | 86.67±3.69 |

[a-b]Means±standard error of mean within a raw that do not share a common superscript are significantly different ($p \leq 0.05$)

feed conversion ratio and egg mass among hens fed diets containing 0.1, 0.2 and 0.4% fenugreek powder.

The results obtained from the present study was in agreement with the findings of Hassan (2000); El-Kaiaty *et al*. (2002); Tollba *et al*. (2005); Abaza (2007); Safaa (2007) who reported no significant effects of adding 0.5 or 2% fenugreek powder into laying hen diets in body weight gain, egg production and egg weight. In addition, Abaza (2007) found that adding 0.05 and 0.15% fenugreek powder into laying hen diets significantly increased the feed consumption and improvement in feed conversion ratio.

In contrast to the results obtained from the present study, Moustafa (2006) noted an improvement in body weight gain, egg production, egg weight and egg yolk color by adding 0.5, 0.05 and 0.15, 0.05, or 0.15% fenugreek powder, respectively. While noted a reduction in Haugh unit by adding 0.15% fenugreek powder into Hy-Line White laying hen diets from 40 to 49 weeks of age. Our results also were in disagreement with the findings of Safaa (2007), who found an improvement in egg yolk color by adding 2% fenugreek powder into Lohmann Brown laying hen diets from 31 to 35 weeks of age. Moreover, some studies reported no significant effects of adding 0.5 or 2% fenugreek powder into laying hen diets on egg mass, feed consumption and feed conversation ratio (Hassan, 2000; El-Kaiaty *et al*., 2002; Tollba *et al*., 2005; Safaa, 2007). In addition, Abaza (2007) noted that adding 0.5% fenugreek powder into the diet of laying hens did not have significant effects on egg mass, feed consumption and feed conversion ratio, but increased feed consumption. Awadein *et al*. (2010) noted that adding 0.5% fenugreek into laying hen diets enhanced the productive performance. In addition, Abdalla *et al*. (2011) indicated that egg weight, egg production and egg mass increased by adding fenugreek powder into laying hen diets.

In addition, El-Shafei *et al*. (2012) noted that body weight gain was not significantly affected by adding 1 or 2% fenugreek powder into laying hen and Japanese quail diets. However, they found a significant increase in feed consumption, egg mass and egg production by adding 1% fenugreek powder and a significant increase in egg weight, egg specific gravity, egg yolk color and Haugh unit by adding 2% fenugreek powder into laying hen and Japanese quail diets compared with control group.

The increasing feed consumption of hens fed 0.1 and 0.2% fenugreek powder compared with those fed diets containing 0.4% fenugreek powder might be attributed to the presence of galactomannans and neurin which stimulates the appetite and enhances the palatability of the diets containing fenugreek. However, the reduction in feed consumption of hens fed 0.4% compared with those fed diets containing 0.0, 0.1 and 0.2% fenugreek powder might be attributed to the increasing of the presence of steroidal saponins and the bitter taste of fenugreek powder resulted in the appetite inhibition.

The improvements in feed conversion ratio of hens fed diets containing 0.1, 0.2 and 0.4% fenugreek powder might be attributed to the positive effect of fenugreek powder on the gut beneficial microflora. In addition, the positive effect of adding fenugreek powder on feed conversion ratio may be due to the effective role of trigonelline content of the essential oil in fenugreek powder and the chemical composition of fenugreek in respect to the crude protein, crude fat and total carbohydrates. Results obtained from the present study indicated that the carotenoids presented in fenugreek powder at the level used was not high enough to affect egg yolk color.

The variations in the effects of adding fenugreek powder into laying hen diets among the different studies might be attributed to the differences in the concentration levels and periods of fenugreek powder supplemented, age and strain of laying hens used, fenugreek powder sources, stability of active compounds in fenugreek powder, drying method applied for fenugreek powder, experimental methods used.

**Conclusions:** It was concluded that adding dietary fenugreek powder at the level of 0.4% had some positive effects on productive performance and egg quality of laying hens from 52 to 60 weeks of age.

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