



## APPLICATION OF FENUGREEK ESSENTIAL OIL IN BROILER DIETS

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### ABSTRACT

This experiment was carried out to evaluate the response of broiler chicks to diets supplemented with different levels of fenugreek essential oil as natural feed additives. 112 day old, unsexed broiler chicks, Aber acre strain, were used. Chicks were divided into four groups (A, B, C and D) of 28 chicks in each and each treatment group was subdivided into three replicates. Group (A) was fed on control diet, groups (B, C and D) were fed on control diet supplemented with fenugreek essential oil at 200, 400 and 600mg/kg diet. The experiment parameters covered growth performance, carcass and non- carcass

values, serum constituents, enzyme activities and economical appraisal. The results showed that inclusion of fenugreek essential oil at 400mg/kg significantly improved body weight, body weight gain and feed intake compared to control group. However, there were no significant effects on the feed conversion ratio (FCR) and mortality rate. The results indicated that there were no significant differences among all treatment groups in internal organs, commercial cuts; their separable tissues and the subjective and objective of meat quality parameters. The results of serum metabolites showed that inclusion of fenugreek essential oil at different levels significantly reduced the total protein, cholesterol and uric acid. However, the treatments effect on electrolytes and enzymes (SGOT and SGPT) activities were not significantly compared to control group. The result of economical evaluation of the tested essential oil showed economical benefits. All levels of fenugreek essential oil (200, 400, and 600mg/kg) recorded profitability ratio (1.03, 1.02 and 1. 7) respectively.

**KEYWORDS:** Fenugreek essential oil, serum metabolite and electrolyte.

## INTRODUCTION

Antibiotic feed additives have been used for many years as growth promoter, but it caused unfavorable side effects (Weiss *et al.*, 2007). The emergence of antibiotic resistant bacteria has created the necessity of replacement of antibiotic with other safety products such as prebiotics, probiotics and herbal extracts and essential oils (Windisch, *et al.*, 2008).

Essential oils derived from herbs and spices, have antimicrobial effects (Dorman and Deans, 2000), stimulate the digestive systems (Williams and Losa 2001) due to the increase production of digestive enzymes, essential oils have the properties of antifungal, antiparasitic and antiviral beside the immune activation (Al- Habori and Raman, 2002), they possess various biological activities such as acting as anti oxidants (Botsoglou *et al.*, 2002); being hypercholesterolemia (Craig, 1999).

Fenugreek oil is obtained by steam distillation from the seeds of fenugreek (*Trigonella foenum- gracecum*). The oil contains volatile compounds which have unique health benefits.

Fenugreek oil just like the seeds has tremendous healing properties, anti-viral, anti-cancer, antioxidant, hypoglycemic (lowers blood glucose), phytoestrogen, Circulate and anti-inflammatory (Tariq *et al.*, 2014; Alloui *et al.*, 2012; Hernandez *et al.*, 2004).

Therefore the effect of including graded levels of dietary fenugreek oil as natural growth promoters on the performance, carcass characteristics, blood and serum metabolites and economical attributes of broiler chicks.

There are no earlier research finding is available in the literature to corroborate the findings of this experiment, no meaningful comparison could be possible as there is no traceable literature available in this field.

## MATERIALS AND METHODS

A total number of 112, day- old unsexed commercial broiler chicks, Ross 308 strain, were obtained from a commercial Poultry Breeders Company and transported to the student poultry premises, College of Agricultural Studies, Sudan University of Science and Technology, Sudan. After a week of adaptation period, chicks were divided randomly into four dietary groups, (A, B, C and D), each group was subdivided into three replicates each with seven chicks. Chicks were bought vaccinated against Gumboro disease at 14 then 23 days old and against Newcastle disease at 4 weeks age, soluble multivitamin compounds

(Pantominovit. Pantex Holland B. V. 5525 ZG Duizel Holland) given to the chicks before and after three days of the vaccination in order to guard against stress.

The experimental house was semi closed oriented in an east- west direction. The roof is well insulated from trapezoid corrugated aluminum sheet and insulated of glass wool with thermal conductivity of  $0.04 \text{ w/m}^2$ . The house was equipped with adjustable side wall curtains to control the flow of the air into the house. The top and the bottom of the curtain opening was equipped with a curtain rod to minimize draft when fully closed, the floor was tightly constructed.

Mechanical ventilation system was used in the house to generate on one direction air flow to provide the requirement levels of uniformity of air distribution over wide range of climatic condition.

Fenugreek seeds were purchased from the local market, cleaned; fenugreek essential oil is obtained by steam distillation from the seeds (*Trigonella foenum- graecum*). The chemical composition of oil is determined by gas chromatography. Four experimental diets (A, B, C and D) were formulated to meet feed requirements of broiler chicks according to (NRC, 1994). Chicks on group (A) were fed on control diet, while chicks in groups B, C and D were fed on control diet supplemented with 200, 400 and 600 mg/kg fenugreek essential oil respectively.

Average body weight and feed consumption for each group were determined weekly throughout the experimental period. Body weight gain and feed conversion ratio (FCR) were calculated also weekly. Health of the experimental chicks was closely observed and the mortality recorded daily.

At the end of the experiment, 6 weeks old, the chicks were fasted overnight except water. Birds were weighed individually before slaughter by severing the right and left carotid and jugular vessels, trachea and esophagus. After bleeding, they were scaled in hot water, feathers removed manually, head removed closed to skull, feet and shank were removed at the hock joint, the visceral organs, liver, gizzard and heart were removed and weighed. Carcasses were washed and each one was divided into right and left sides by mid sawing along the ventral column. The left side was divided into three commercial cuts, breast, thigh and drumstick, each cut was weighed separately and deboned, then the meat and bone for each cut were

weighed separately, the meat was frozen and stored for meat subjective and objective analysis.

Samples from the commercial cuts meat were thawed before cooking for sensory evaluation. The meat trapped in aluminum foil and roasted at 176°C and about 80°C internal muscle temperature. The cooked meat allowed cooling to room temperature. Ten well-trained panelists were instructed to evaluate meat samples for tenderness, juiciness, flavor and color following recommended procedure (Cross *et al.*, 1978). Panelists used water between sample to clear the palate and pause between samples evaluated.

## RESULTS

The results of fenugreek essential oil revealed (15) compounds, alpha- tocopherol, lanol, oxirane, octane and benzopyran were found to be the major compounds.

Feeding different levels of fenugreek essential oil as natural growth promoter ; improved significantly ( $P < 0.05$ ) the body weight and body weight gain of broiler chicks Compared to group fed on control diet, however, chicks group fed on 600mg/kg showed significantly ( $P < 0.05$ ) the highest weight gain compared to tested groups (table, 1).

Data concerning feed intake and FCR observed no significantly ( $p > 0.05$ ) difference compared to other tested groups all throughout the experimental period.

Feeding broiler chicks on diets supplemented with different levels (200, 400 and 600mg/kg) of fenugreek essential oil showed no significant ( $P > 0.05$ ) difference on the commercial cuts, and their meat yield (table,2) and non- carcass components (abdominal fat, liver, gizzard, heart and intestine).

Table 1: Effect of adding different levels of fenugreek on overalls

Treatment (gm/kg)	Body weight	Feed intake	Body weight gain	Feed conversion ratio
Control	2263.67 <sup>d</sup> ±15.26	3604.00 <sup>a</sup> ±13.15	2086.00 <sup>c</sup> ±0.06	1.73 <sup>a</sup> ±0.03
200	2313.33 <sup>b</sup> ±27.88	3666.65 <sup>a</sup> ±9.10	2139.00 <sup>b</sup> ±0.02	1.76 <sup>a</sup> ±0.02
400	2296.33 <sup>c</sup> ±16.44	3637.05 <sup>a</sup> ±12.06	2118.33 <sup>b</sup> ±0.05	1.72 <sup>a</sup> ±0.01
600	2365.33 <sup>a</sup> ±14.70	3648.00 <sup>a</sup> ±11.02	2185.33 <sup>a</sup> ±0.00	1.67 <sup>a</sup> ±0.05
Lsd <sub>0.05</sub>	26.5264*	18.4153 <sup>n.s</sup>	21.6275*	0.8254 <sup>n.s</sup>
SE±	5.1987	3.2176	4.5241	0.1967

. Values are mean±SD

Any two mean value(s) bearing different superscript(s) in a column are sig

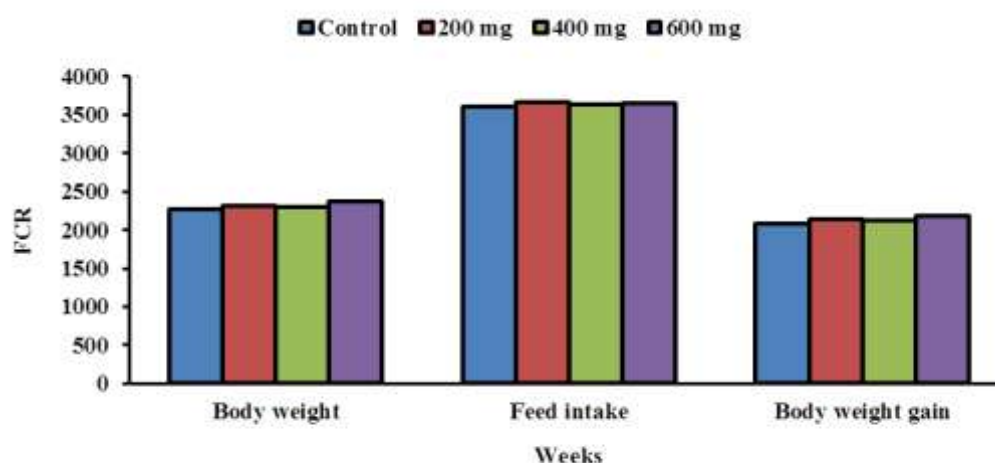


Fig. 1: Effect of fenugreek on overalls.

Table 2: Effect of adding different levels of fenugreek on commercial cuts and internal organs (giblets).

Treatments (gm/kg)	Wing	Breast	Drum stick	Thigh	Liver	Heart	Gizzard	Abdominal fat
Control	11.20 <sup>b</sup> ±0.78	34.37 <sup>a</sup> ±3.95	17.33 <sup>a</sup> ±1.15	15.47 <sup>a</sup> ±1.10	1.74 <sup>a</sup> ±0.45	0.403 <sup>a</sup> ±0.03	1.96 <sup>a</sup> ±0.23	0.94 <sup>a</sup> ±0.06
200	10.43 <sup>a</sup> ±0.59	37.00 <sup>a</sup> ±2.46	17.40 <sup>a</sup> ±0.53	13.33 <sup>b</sup> ±1.26	1.76 <sup>a</sup> ±0.25	0.393 <sup>a</sup> ±0.03	2.22 <sup>a</sup> ±0.33	0.45 <sup>b</sup> ±0.04
400	10.57 <sup>a</sup> ±0.40	34.60 <sup>a</sup> ±0.87	17.47 <sup>a</sup> ±1.80	13.70 <sup>ab</sup> ±1.15	2.05 <sup>a</sup> ±0.07	0.440 <sup>a</sup> ±0.03	2.35 <sup>a</sup> ±0.07	0.66 <sup>a</sup> ±0.07
600	10.47 <sup>a</sup> ±0.40	35.80 <sup>a</sup> ±1.74	17.73 <sup>a</sup> ±1.51	13.60 <sup>ab</sup> ±0.20	1.64 <sup>a</sup> ±0.22	0.487 <sup>a</sup> ±0.18	2.32 <sup>a</sup> ±0.18	0.43 <sup>a</sup> ±0.06
Lsd <sub>0.05</sub>	1.065 <sup>n.s</sup>	4.749 <sup>n.s</sup>	2.517 <sup>n.s</sup>	1.919 <sup>*</sup>	0.5258 <sup>n.s</sup>	0.1684 <sup>n.s</sup>	0.4252 <sup>n.s</sup>	0.7944 <sup>n.s</sup>
SE±	0.3266	1.456	0.7718	0.5885	0.161	0.0516	0.1304	0.2436

The blood serum analysis of broiler chicks fed on different levels (200, 400 and 600mg/kg) showed that the total protein and cholesterol concentration decreased significantly ( $P>0.05$ ) with the increase of fenugreek oil level; (table,3) however, chicks fed on control group recorded the highest serum TP, cholesterol and uric acid concentrations while chicks fed on 600mg/kg oil showed significantly ( $P>0.05$ ) the lowest concentration in the previous parameters. Albumin concentration showed no significant among tested groups. Serum phosphorus concentration showed significantly decrease ( $P>0.05$ ) with the increase of essential oil level in the diet however, chicks group fed on 600mg/kg recorded significantly ( $P<0.05$ ) the highest level of concentration although control group recorded significantly ( $P>0.05$ ) the lowest concentration value. Serum Ca concentration value showed significantly negligible values.

The effect of treatments on subjective meat attributes is shown in table (4). The average subjective meat quality score color, tenderness juiciness and flavor did not differ significantly ( $P>0.05$ ) among the dietary treatments. The score given for all attributes are above moderate acceptability.

The total selling values of meat is the total revenues obtained. Profitability ratio (1.7) of group fed on diet supplemented with 600mg/kg was the highest of the tested groups economically, however, all groups fed on supplemented diets recorded profit compared to control group.

**Table 3: Effect of adding different levels of fenugreek on blood serum.**

Treatments (gm/kg)	SGOT ( $\mu$ L)	SGPT ( $\mu$ L)	T.P (g/dL)	Alb. (g/dL)	Cholest. (mg/dL)	Uric acid (mg/dL)	Ca (mg/dL)	PO <sub>4</sub> (mg/dL)
Control	28.50 <sup>d</sup> ±0.28	4.60 <sup>b</sup> ±0.85	4.95 <sup>a</sup> ±0.19	1.97 <sup>a</sup> ±0.26	107.50 <sup>a</sup> ±5.36	9.25 <sup>b</sup> ±4.24	6.95 <sup>b</sup> ±4.56	3.15 <sup>c</sup> ±0.13
200	58.90 <sup>b</sup> ±3.11	3.00 <sup>c</sup> ±0.0	3.27 <sup>b</sup> ±0.39	1.14 <sup>a</sup> ±0.42	92.28 <sup>b</sup> ±1.50	11.52 <sup>a</sup> ±1.86	8.90 <sup>a</sup> ±0.0	3.35 <sup>c</sup> ±0.13
400	73.50 <sup>a</sup> ±2.12	6.00 <sup>a</sup> ±1.41	2.85 <sup>c</sup> ±0.26	1.42 <sup>a</sup> ±0.22	87.11 <sup>c</sup> ±3.66	7.80 <sup>c</sup> ±0.98	3.00 <sup>c</sup> ±1.73	4.05 <sup>b</sup> ±0.99
600	43.25 <sup>c</sup> ±3.18	4.35 <sup>b</sup> ±1.20	2.82 <sup>c</sup> ±0.15	1.56 <sup>a</sup> ±0.57	79.50 <sup>d</sup> ±2.12	3.05 <sup>d</sup> ±0.10	5.30 <sup>bc</sup> ±2.98	5.08 <sup>a</sup> ±0.15
Lsd <sub>0.05</sub>	11.936 <sup>*</sup>	0.826 <sup>*</sup>	0.415 <sup>*</sup>	0.683 <sup>n.s</sup>	2.965 <sup>*</sup>	1.074 <sup>*</sup>	0.953 <sup>*</sup>	0.703 <sup>*</sup>
SE±	4.725	0.035	0.017	0.018	0.822	0.361	0.045	0.062

**Table 4: Fenugreek oil on the subjective meat quality and Economical appraisal**

	subjective meat quality				Economical appraisal	
	juiciness	Color	Flavor	Tender-ness	Profit	Profit ability ratio
0.00	5.00	5.00	5.00	5.00	32.063	1.00
200	5.10	5.20	5.10	5.20	33.297	1.03
400	5.00	5.00	5.00	5.00	32.612	1.02
600	5.00	5.20	5.10	5.20	34.464	1.7

## DISCUSSION

The fenugreek essential oil chemical analysis showed (15) compounds; alph- tocopherol, exirane were found to be the major compounds. The composition depends upon environmental factors, season of collection, age of the plants (Bernath, 1999). The results obtained showed positive improvement in the performance of broiler chicks; which may be due to that fenugreek seed contains neurin, biotin, trimethylamine which tend to stimulate the appetite by their action on nervous system (Michael and Kumawat, 2003), or due the presence of the fatty acids(Murray *et al.*, 1991), or to its stimulating effect on the digestive system of broilers (Hernandez *et al.*, 2004).

These findings were in line with that of Azouz (2001) Alloui *et al.*, (2012) Abou El- Wafa *et al.*, (2003) they noted that adding fenugreek seed powder to broiler diets increased live body weight, feed intake and FCR. The improvement in feed intake with the fenugreek EO supplementation could be attributed to the carbohydrates and their main component (galaitomanna) which stimulate the appetizing and digestive process (Steiner, 2009), or due to the fenugreek therapeutic effects like antibacterial, anti- inflammatory, antimicrobial and antioxidant properties (Xue *et al.*, 2007).

These results were in line with results of Alloui *et al.*, (2012) who reported a significant increasement in feed intake and improved FCR when added fenugreek seeds at 3g/kg. In contrast El- Husseiny *et al* (2002) reported no significances in live BW and BWG among chicks fed on diets supplemented with fenugreek.

Fenugreek EO treatments at different levels did not affect significantly on FCR of experimental chicks. These results were in line with Tariq *et al.*, (2014) and Mukhtar *et al.*, (2013a) findings who found significant improvement in FCR, when they added fenugreek seeds in broiler diets. These results were disagree with the findings of Alloui *et al.*, (2012), who recorded significant affect in FCR for chicks fed diets supplemented with fenugreek

seeds. Results showed that dietary treatments did not affect on the relative weights of giblet; commercial cuts; their meat and meat subjective values. These results were in line with the findings of Alloui *et al.*, (2012); Tariq *et al.*, (2014 and Mukhtar *et al.*, 2013a).

Feeding fenugreek EO significantly decreased blood serum cholesterol, total protein, uric acid and serum calcium with the increase of fenugreek EO level in the diets. However, serum phosphorus level increased significantly with the increasing of fenugreek oil in the diets. The reduction in serum cholesterol levels might be due to the presence of saponins and resins in fenugreek which inhibit bile acid and cholesterol absorption from intestine, also it might be due to the improvement in immune responsiveness (Abd- El Hakim *et al.*, 2002).

These results were agree with the findings of Tariq *et al.*, (2014) and Duru *et al.*, (2013) noted significant decrease in serum cholesterol, total protein, albumin and calcium for broiler chicks fed on diet supplemented with 1% fenugreek seed; however serum phosphorus concentration showed a significant increase with the increase of fenugreek oil level in the diets. It might be due to that fenugreek oil is rich in phosphates, leithin, nucleo albumin and organic iron.

## REFERENCES

1. Abdel-Azeem, F. (2006). Effect of using fenugreek and fennel seeds as natural feed additives on performance of broiler chicks. *Egypt. J. Nutr. and Feeds*, 9: 277-297.
2. Abd-El Hakim AS, Sedki AA, Ismail AM, 2002. Black seed forms and its effect on rabbits performance and blood constituents. *3rd Science Conference on Rabbit Production in HotClimate*, 8-11 October, Hurghada, Egypt, 579-588.
3. Abou EL-Wafa S, Sayed MAM, Ali SA, Abdallah AG. (2003). Performance and immune response of broiler chicks as affected by methionine and zinc or commercial Fenugreek supplementations. *Egypt Poult Sci*, 23(III): 523-540.
4. Adil, S. Saim Qureshi and R.A. Pattoo (2015). A Review on Positive Effects of Fenugreek as Feed Additive in Poultry Production. *International Journal of Poultry Science*, 14(12): 664-669.
5. Al-Habori M, Raman A. (2002). Pharmacological Properties. In: Petropoulos GA, editor. *Fenugreek—The Genus Trigonella*. 1st edition. Vol. 10. London, UK: Taylor & Francis, 163–182.
6. Alloui N, Ben Aksa S, Alloui MN. (2012). Utilization of Fenugreek (*Trigonella Foenum-Graecum*) as Growth Promoter for Broiler Chickens. *J World's Poult Res*, 2(2): 25-27.



7. Azoua, H.M., (2001). Effect of Hot pepper and Fenugreek seeds supplementation on broiler diets. Ph. D.thesis submitted to Facult of Agriculture, Alexandria University, Egypt, 6-55.
8. Bernath J., Nemeth E., Petheo F., Mihalik E., Kalman K., Franke R. (1999). Regularities of the essential oil accumulation in developing fruits of fennel (*Foeniculum vulgare* Mill.) and its histological background, *J.Essent. Oil Res*, 11: 431- 438.
9. Botsoglou NA, Florou-Paneri P, Christaki E, Fletouris DJ, Spais AB. (2002). Effect of dietary oregano essential oil on performance of chickens and on iron-induced lipid oxidation of breast, thigh and abdominal fat tissues. *Brit Poult Sci*, 43: 223–30. doi: 10.1080/ 00071660120121436.
10. Craig WJ (1999). Health-promoting properties of common herbs. *The American Journal of Clinical Nutrition*, 70: 491-499.
11. Cross C.K, Bharucha K.R, Telling G.M. (1978). Determination of volatile N-nitrosamines in bacon cook-out fat by nitrite release and thin-layer chromatography of fluorescent amine derivatives. *J Agric Food Chem*, 26(3): 657-60.
12. Dorman HJ, Deans SG (2000). Antimicrobial agents from plants: Antibacterial activity of plant volatile oils. *J Appl Microbiol*, 88: 308-316.
13. Duru, M., E. Zeynep and D. Asuman, 2013. Effect of seed powder of a herbal legume *Fenugreek (Trigonella foenum-graceum* L.) on growth performance, body components, digestive parts and blood parameters of broiler chicks. *Pak. J. Zool*, 45: 1007-1014.
14. El-Husseiny, O., S.M. Shalash and H.M. Azouz, (2002). Response of broiler performance to diets containing hot pepper and/or Fenugreek at different metabolizable energy levels. *Egypt. Poult. Sci*, 22: 387-406.
15. Halfhide, B., (2003). Role of the European Probioti Association. *Proceedings: Role of probiotics in animal nutrition and their link to the demands of European consumers*, Lelystad, the Netherlands, 3-4.
16. Hamden K, Jaouadi B, Carraeo S, Bejar S, Elfeki AF. Inhibitory effect of Fenugreek Galactomannan on digestive enzymes related to Diabetes, Hyperlipidemia, and liver-Kidney dysfunctions. *Biotechnology and Bioprocess Engineering*, 2010; 15: 407-413.
17. Hernandez AI, Madrid J, Garcia V, Orengo J, Meglas MD. (2004). Influence of two plant extracts on broiler performances, digestibility and digestive organs size. *Poultry Science*, 83: 169-174.

18. 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*, 2004; 45: 793-797.
19. Michael D, Kumawat D. (2003). Legend and archeology of fenugreek, constitutions and modern applications of fenugreek seeds. *International Symposium, USA*, 41-42.
20. Mukhtar, M. A. 1, K.A. Mohamed1.Amal, O.A 2; Ahlam, A.H.(2013a). Response of Broiler Chicks to Different Dietary Levels of Black Cumin Oil as a Natural Growth Promoter .*University of Bakht Alruda Scientific Journal*, 7: 185-191.
21. Murray, RK, Granner DK, Mayes PA et Rodwell VW (1991). *The Text Book of Harpers Biochemistry*. 22 Edn. Appleton and large. Norwalk, Connecticut/Loss Altos, California.
22. Schryver T (2002). Fenugreek. *Total Health*, 24: 42-44.
22. NRC. (1994). *Nutrients requirements of poultry 8th ed.* Acad Washington–DC, newly developed high-protein genotypes of pigeon pea. *Journal of the Science of Food and Agriculture*, 50: 201-209.
23. Steiner T. (2009). *Phytogenics in Animal Nutrition. Natural Concepts to Optimize Gut Health and Performance.* Nottingham University Press.
24. Taha AT. (2008). *The Role of Vitamins A, C 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.
25. Tariq Mamoun, Mukhtar Ahmed Mukhtar, Mohamed H Tabidi, (2014). Effect of fenugreek seed powder on the performance, carcass characteristics and some blood serum attributes. *Adv. Res. Agri. Vet. Sci*, 1(1): 6-11.
26. Weiss C, Conte A, Milandrib C, Scortichini G, Semprini P, Usberti R and Migliorati G (2007). Veterinary drugs residue monitoring in Italian poultry: Current strategies and possible developments. *Food Control*, 18: 1068-1076.
27. William, P. and Losa, R. (2001) The use of essential oils and their compounds in poultry nutrition. *World Poult*, 17(4): 14-15.
28. Windisch, W., Schedle, K., Plitzner, C. and Kroismayr, A. (2008). Use of phytogenic products as feed additives for swine and poultry. *J. Anim. Sci*, 86: 140-148.
29. Xue WL, Li XS, Zhang J, Liu YH, Wang ZL, Zhang RJ. (2007). Effect of *Trigonella foenumgraecum* (fenugreek) extract on blood glucose, blood lipid and hemorheological properties in streptozotocininduced diabetic rats. *Asia Pac J Clin Nutr*, 16(Suppl.1): 422-426.