A Review on Positive Effects of Fenugreek as Feed Additive in Poultry Production

S. Adil, Saim Qureshi and R.A. Pattoo
Division of Livestock Production and Management, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shuhama, Srinagar-190006, Kashmir

Abstract: Following the prohibition on usage of antibiotics as growth promoters, the researchers used other alternatives. Nowadays, phytogenic feed additives like herbs are in vogue and are incorporated in the diet in order to enhance productivity by improvement of digestibility, nutrient absorption and elimination of pathogens residents in the gut. Among the various phytogenics available, this review will focus on one such herb known as Fenugreek (Trigonella foenum graecum), locally known as Methi. It is mainly cultivated in India, Pakistan and China. It is rich in protein, fat, total carbohydrates and minerals such as calcium, phosphorus, iron, zinc, magnesium, fatty acids predominantly linoleic, linolenic, oleic and palmitic. Fenugreek seeds are the most important and useful part of fenugreek plant having many therapeutic effects like hypoglycaemic, antibacterial, anti-inflammatory, antipyretic, antimicrobial and antioxidant properties. They have a role in improving the performance of poultry birds by their antibacterial activity and positive effect on gut morphology. Besides, they help in decreasing the blood cholesterol levels in poultry, hence have a potential role in prevention of arteriosclerosis.

Key words: Additive, fenugreek, gut, poultry, performance

INTRODUCTION

AFCO (American Feed Control Officials) defines feed additive as "an ingredient or combination of ingredients added to the basic feed mix to fulfill a specific need and usually used in micro quantities and requires careful handling and mixing." The European Union officially banned the usage of antibiotics as growth promoters in poultry and livestock in 2006 (Halfhide, 2003) that led the researchers to look for other alternatives. One of the possible alternatives reported in poultry production are phytogenic additives which include a group of natural feed additives; derived from herbs, spices or other plants or their extracts in the form of essential oils (Windisch et al., 2008). They are incorporated in the diet of animal feed in order to enhance productivity by improvement of digestibility, nutrient absorption and elimination of pathogens residents in the gut (Athanasiadou et al., 2007).

Among the various phytogenics available, this review will focus on one such herb known as Fenugreek (Trigonella foenum graecum), locally known as Methi. The various common names of Fenugreek in different languages are presented in Table 1. It is a well known medicinal plant that grows in nature and mainly cultivated in India, Pakistan and China (Allouei et al., 2012) and has strong spicy and seasoning type sweet flavor (Blank, 1996). It is used in functional food, traditional food, nutraceuticals as well as in physiological utilization such as antibacterial, anticancer, antiulcer, analgesic, hypolipidemic, hypoglycemic, antioxidant, antidiabetic agent and has beneficial influence on digestion and ability to modify food texture (Muridhar and Goswami, 2012). It is rich in protein, fat, total carbohydrates and minerals such as calcium, phosphorus, iron, zinc, magnesium (Gupta et al., 1996), fatty acids predominantly linoleic, linolenic, oleic and palmitic (Schryver, 2002). It also has neuretin, biotin, trimethylamine which tends to stimulate the appetite by their action on the nervous system (Michael and Kumawat, 2003).

Composition of fenugreek: The taxonomical position of Fenugreek is presented in Table 2. It grows to a height of about three feet, has three part leaves, the long slender stems bear triplicate, toothed, grey-green obovate leaves, 20-25 mm (3/4-1 in) long (Snehlata and Payal, 2012). Its main chemical constituents are fibers, flavonoids, polysaccharides, saponins, flavonoids and polysaccharides fixed oils and some identified alkaloids viz., trigonelline and choline (Jayaweerar, 1981; Yoshikawa et al., 1997). Fenugreek seeds are the most important and useful part of fenugreek plant having golden-yellow colour, small size, hard and four-faced stone like structure (Altuntas et al., 2005). Biologically, its seeds are endospermic in nature (Jani et al., 2009) and as a thumb rule harvested 150 to 170 days after sowing or 30 to 35 days after flowering (Kakani et al., 2009). Fenugreek seeds are used as spices (Altuntas et al.,

Corresponding Author: S. Adil, Division of Livestock Production and Management, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology Kashmir, Shuhama, Srinagar-190006, Kashmir
Table 1: Common names of Fenugreek in various languages

<table>
<thead>
<tr>
<th>Language</th>
<th>Common name</th>
</tr>
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<tbody>
<tr>
<td>Persian</td>
<td>Shanbaileh</td>
</tr>
<tr>
<td>Arabic</td>
<td>Hulba, Hilbeh</td>
</tr>
<tr>
<td>Urdu, Hindi,</td>
<td>Methi</td>
</tr>
<tr>
<td>Punjabi, Bangla</td>
<td></td>
</tr>
<tr>
<td>Nepali</td>
<td>Menthiyam</td>
</tr>
<tr>
<td>Burmese</td>
<td>Penantazi</td>
</tr>
<tr>
<td>English</td>
<td>Fenugreek</td>
</tr>
<tr>
<td>Hindi</td>
<td>Methi, Sag methi (fresh leaves), Kasuri methi (dried leaves)</td>
</tr>
<tr>
<td>French</td>
<td>Fenugrec, Senegre, Trigonelle</td>
</tr>
<tr>
<td>German</td>
<td>Bockshornklee, Griechisch Heu</td>
</tr>
<tr>
<td>Georgian</td>
<td>Solinji, Chaman</td>
</tr>
<tr>
<td>Japanese</td>
<td>Koruha, Fenu-guriku</td>
</tr>
<tr>
<td>Dutch</td>
<td>Fenegrek</td>
</tr>
<tr>
<td>Romanian</td>
<td>Molotu, Molotru comun, Schinduf</td>
</tr>
<tr>
<td>Russian</td>
<td>Pahhitik grecheki, Shambala, Pahhitik cemno</td>
</tr>
<tr>
<td>Sanskrit</td>
<td>Methika</td>
</tr>
</tbody>
</table>

Source: Nathiya et al. (2014)

Table 2: Taxonomical classification of Fenugreek

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Plantae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Division</td>
<td>Magnoliophyta</td>
</tr>
<tr>
<td>Class</td>
<td>Magnoliopsida</td>
</tr>
<tr>
<td>Order</td>
<td>Fabales</td>
</tr>
<tr>
<td>Family</td>
<td>Fabaceae</td>
</tr>
<tr>
<td>Genus</td>
<td>Trigonella</td>
</tr>
<tr>
<td>Species</td>
<td>T. foenum graecum</td>
</tr>
</tbody>
</table>

Source: Verma et al. (2013)

2005) and have many therapeutic effects like hypoglycaemic, antibacterial, anti-inflammatory, antipyretic, antimicrobial and antioxidant properties (Xue et al., 2007). The proximate composition of fenugreek seeds has been reported as 11.7% moisture, 25.8% crude protein, 6.5% ether extract, 3.2% ash, 6.24% crude fibre (Kochhar et al., 2006) and 35% alkaloids, primarily trigonelline (Mullaicharam et al., 2013).

Effect on production performance: Since long Fenugreek is being used as a growth promoter particularly in broiler chicken. Inclusion of Fenugreek seeds in the diet significantly improves the body weight of broiler chicken (Abaza, 2001; Guo et al., 2004; Yatoo et al., 2012; Qureshi et al., 2015). Further, it improves the feed efficiency with reduction in feed cost when used as natural feed additive in broiler chicken diets (Azoua, 2001). Abdel-Azeem (2006) reported best results by fenugreek seeds when supplemented at 0.5% level in the diet of the broiler chicken. However, Weerasingha and Atapattu (2013) and Mamoun et al. (2014) reported 1% level and 1.5% Magda (2012) inclusion levels useful for improving live body weight, body weight gain, feed conversion ratio, protein efficiency ratio, feed consumption and efficiency of energy utilization. Rabia (2010) however reported 3 g/kg of feed as best inclusion level for enhancing the performance and body weight of broiler chickens. Abdul-Rahman et al. (2010) reported activation of reproductive performance and improved semen quality by inclusion of Fenugreek seeds in the diet of broiler breeder chicken. EL-Mallah et al. (2005) noted that fenugreek seeds at 2% in the diet of turkey chicks caused a significant increase in digestibility and absorption of nutrients and there was a significant improvement in body weight gains. Alloui et al. (2012) reported that feeding Fenugreek seeds at 3 g/kg of feed in broiler chicken significantly increases feed intake due to the presence of galactomannans and neurin which stimulates the appetite and improvement in FCR (feed conversion ratio) due to the beneficial effect on gut microflora. The improvement in body weights has been attributed to the presence of essential fatty acids and high quality proteins in the Fenugreek seeds (Murray et al., 1991) and stimulating effect on the digestive system (Hernandez et al., 2004; Hind et al., 2013). Nevertheless, Petit et al. (1995) reported that isolated steroid saponin fraction of fenugreek seeds increases feed intake and motivation to eat in normal rats and Abo El-Nor (1999) suggested that fenugreek seeds may have an effect on hypothalamus gland to stimulate hungerness center in the brain and increase the desire for eating. Improved appetite and feed consumption might in turn lead to improved body weights and performance.

Role in reproductive performance: Abdul-Rahman et al. (2010) reported activation of reproductive performance and improved semen quality by inclusion of Fenugreek seeds in the diet of broiler breeder chicken. Supplementation of Fenugreek seeds have also been reported to improvement the reproductive performances of aged layer chicken (Alobaidy, 2012). The productive performance, egg mass and egg quality of laying hens under the effect of dietary fenugreek seeds (ungerminated and germinated) showed significant improvement (Hanan and Mona, 2010). Abaza (2007) found that hens fed diet supplemented with 0.5% fenugreek had numerically highest values of shell thickness and albumen percentage. Further, Awaddeen et al. (2010) observed that hens supplemented with 0.5% fenugreek showed less time to reach the sexual maturity. In laying quails, supplementation of 10 g fenugreek seeds/kg feed showed a significant increase in fertility and hatchability percentages; total egg number, daily egg mass and egg quality traits such as egg shell weight, albumin, eggshell thickness and specific gravity compared with the control group (El-Shafei et al., 2012). The phytoestrogen content of fenugreek stimulate aromatase activity and promotes estradiol synthesis which in turn may have beneficial effect on secretory activity.

Influence on carcass characteristics: Mamoun et al. (2014) reported that the 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 has been documented due to dietary inclusion of fenugreek seeds (Duru et al., 2013). However, Weerasingha and Atapattu (2013) reported that supplementation of fenugreek seeds had no significant effect on intestinal length per when calculated in terms of per 100 g of body weight. Moreover, Bhaisare et al. (2014) found that dietary inclusion of Fenugreek seeds at 0.5% level in the diet of Nandnam Turkey poults for eight weeks duration resulted in significant (p<0.05) improvement in dressed weight and attributed it to the antimicrobial properties of the fenugreek. The positive effect on intestinal morphology could prolong the contact between the digesta and mucosal epithelium, which may be more effective for nutrient absorption (Boguslawska-Tryk et al., 2012).

Effect on blood biochemistry: Abdul-Rahman (2012), Safaei et al. (2013) and Mamoun et al. (2014) reported that incorporation of dietary Fenugreek seeds in broilers at 1% level significantly decreased the blood cholesterol and glucose levels. The reduction in the serum glucose levels may be related to direct β-cell stimulation by amino acid (4-hydroxy isoleucine) which increases insulin secretion thus improves glucose tolerance when Fenugreek seeds are fed (Sauvage et al., 1998; Schryver, 2002). Reduction in blood cholesterol levels by supplementation of fenugreek seeds at 40 g/kg in diet of broiler chicken has also been reported by Duru et al. (2013). Clinical studies have demonstrated a statistically significant decline in the human serum total cholesterol, triglycerides and LDL cholesterol by Fenugreek supplementation (Mullaicharam et al., 2013). Abduloi et al. (2014) reported that ground fenugreek seeds given to laying hens at 6 g/hen/day resulted in reduction in serum cholesterol level. The reduction in the serum cholesterol level might be due to the presence of saponins and resins in fenugreek which inhibit bile acid and cholesterol absorption from intestine, thereby, decreasing cholesterol level in blood (Petit et al., 1995) and hence have a potential role in prevention of arteriosclerosis (Mullaicharam et al., 2013).

Abdul-Rahman (2012) investigated that feeding of Fenugreek seeds at 10 g/kg of diet in broiler breeder chicken significantly (p ≤ 0.05) improved the packed cell volume percentage, red blood cell and Hb concentration and attributed this improvement in erythropoiesis to the enhancement of antioxidant activity in RBCs which decreases the production of free radicals that destroy Hb and cause hemolysis of RBCs. Bhaisare and Thyagarajan (2014) reported that haemoglobin content were significantly (p<0.05) high when fenugreek seeds were used in turkey poults, indicating that certain bioactive principles in fenugreek seeds have positive effect on haemopoietic process in the body. Further, no effect on SGOT, SGPT and Alkaline phosphatase levels were recorded by fenugreek supplementation (Toppo et al. 2009; Ali and Ismail, 2012; Qureshi et al., 2015) indicating that it has no toxic effect.

Antibacterial effect: Qureshi et al. (2015) investigated the in vitro antibacterial activity of Fenugreek and reported the 2.1 mm of zone of inhibition for the concentration of 0.05 mg/ml of extract against E. coli on the Mueller Hinton agar. Similarly, in vitro antibacterial activity of methanolic extract of fenugreek against E. coli has been reported by Dash et al. (2011) and ascribed to the flavonoids, saponins and phenols present in it (Schryver, 2002). However, not much literature regarding the in vivo effect of fenugreek in poultry could be found.

Impact on gut histomorphology: Awadein et al. (2010) investigated that incorporation of fenugreek at 0.5% level in the diet of laying hens reduced total lipid content in liver. The hepatoprotective role of Fenugreek seeds have been attributed to the bioactive ingredients present in it, which enhance hepatic function and due to its antioxidant activity as reported by Bukhari et al. (2008) who reported the antioxidant capacity of the Fenugreek extracts. Abdel-Rahman et al. (2014) observed that the incorporation of fenugreek seeds at 5.33 kg per ton of broiler ration resulted in a significant (p ≤ 0.05) increase in the villus height and width, crypt depth and surface area of the intestine. Increased villus height helps to enhance the absorptive surface area for better utilization of nutrients Adil et al. (2010). The short or damaged villi impair the absorption of intestine, which might lead to poor performance of birds (Samanya and Yamauchi, 2002). The improvement in the villus height/crypt depth ratio is regarded as a good indicator of better intestinal health (Petroli et al., 2012). The beneficial effect on intestinal histomorphology by Fenugreek seeds might be attributed to their antimicrobial action as has been reported by Qureshi et al. (2015) which in turn has been reported to decreases the inflammatory reactions at the mucosa, thereby increasing the villus height (Loddi et al., 2004; Mahmoud et al., 2015).

Conclusion: A number of feed additives are available for inclusion in poultry diets in order to improve their performance, however, the unfavourable effect of chemical products especially antibiotics led to the use of natural products viz herbs to improve the efficiency of feed utilization and growth performance of poultry. Fenugreek in this regard has many beneficial effects particularly in improvement the growth performance and gut morphology of poultry without causing any harmful effect on their health.

REFERENCES


