

Review Article

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Fenugreek (*Trigonella foenum-graecum*) and its Antimicrobial Activity - A Review

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ABSTRACT

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Fenugreek (*Trigonella foenum-graecum*) is a legume and it has been used as a spice throughout the world to improve the sensory quality of foods. It is a medicinal plant that uses in disease some therapy. The plant contains active constituents such as alkaloids, flavonoids, steroids, Saponins etc. Fenugreek is known to have antidiabetic, anticarcinogenic, hypocholesterolemic, antioxidant, and immunological activities. Modern research has recognized fenugreek as a valuable medicinal plant with potential for curing diseases and also as a source for preparing raw materials of pharmaceutical industry, like in steroidal hormones. Use of fenugreek has been found to be lethal against hazardous bacteria, specifically coli forms, *Pseudomonas* spp., *Shigella dysenteriae* and *Salmonella typhi*. These properties probably make fenugreek a valuable ingredient in food and pharmaceutical applications.

Introduction

Fenugreek (*Trigonella foenum-graecum*) is self-pollinated an annual plant belongs to the family Leguminosae. It was called as “*Trigonella*” from Latin language that means “Little triangle” due to its yellowish-white triangular flower (Flammang *et al.*, 2004) and species name “*Foenum-graecum*” means “Greek hay” indicating its use as a forage crop in the past. Fenugreek have originated in the Mediterranean region of the parts of Asia and newly it was suggested so as to fenugreek originated in Turkey. Fenugreek is famous all

over the world. About 260 species are currently available in *Trigonella* genus. Most of the species include *Trigonella foenum-graecum* L. are diploids with $2n=16$ chromosomes but some other species may include 18, 30, 32 or 44, 99 chromosomes (Acharya *et al.*, 2014).

Fenugreek has been used both as a herb (the leaves) and as a spice (the seed) and also used to increase the flavor, colour and texture of the food materials, these days it is used as food stabilizer, adhesive and emulsifying agent due to its high fiber, protein and gum

content (Meghwal and Goswami, 2012). Seed of fenugreek contain a substantial amount of phospholipids, glycolipids, oleic acid, linolenic acid, linoleic acid (Suliaman *et al.*, 2000; Chatterjee *et al.*, 2010), choline, vitamin A, B1, B2, C, nicotinic acid, niacin (Leela and Shafeekh, 2008), and many other functional elements. It also has some medicinal properties such as antioxidant, anticancer, antidiabetic, lactation aid, hypocholesterolemic, antimicrobial, gastric simulant for anorexia and hepatoprotective (Srinivasan, 2006).

Chemical constituents of fenugreek (*Trigonellafoenum-graecum*)

Fenugreek has been referred to as a medicinal herb both in Indian ayurvedic and traditional Chinese medicines (Tiran 2003). It contains a number of chemical constituents protein, starch, neutral detergent fiber, ash and lipids (Gupta *et al.*, 1998). Generally, three important chemical constituents of fenugreek are very important; i.e. 1) steroidal sapogenins; 2) galactomannans and 3) isoleucine. These constituents have placed fenugreek among the most commonly recognized "nutraceutical" or health food products (Srichamroen *et al.*, 2008). Three main constituents of fenugreek are saponins, flavonoids and alkaloids. The bitter taste and specific smell of fenugreek is due to alkaloids and some other volatile compounds (Altuntas *et al.*, 2005).

Fiber

The fiber content of fenugreek seed extract plays a role in its ability to moderate metabolism of glucose in the digestive tract. Fenugreek can be used as source of natural antioxidants because of the fiber content (Raju *et al.*, 2001). The 100 g of seeds gives more than 65% of dietary fibers. Dietary fiber of fenugreek can exert short term beneficial

effects by reducing energy intake and increasing satiety as per one of the study conducted on obese people. It was reported that fiber of the fenugreek binds to cancer causing toxins of the intestine and removes them; it also lowers the rate of glucose absorption and helps in controlling blood sugar level (Meghwal and Goswami, 2012).

Protein

Fenugreek endosperm is highly rich in protein such as globulin, albumin, histidine and lecithin. Seed of fenugreek has a high proportion of protein ranging from 20 to 30% as well as amino acid, 4-hydroxyisoleucine, which contains high potential for insulin-stimulating activity (Isikli and Karababa, 2005). Fenugreek proteins are stable enough, and are not affected during cooking. Moreover, debitterized fenugreek seeds are rich in protein and lysine contents (Srinivasan, 2006).

Vitamins and Minerals

Fenugreek seed is a rich source of vitamins viz. vitamin A (3 ug/100g), B1 (0.43 mg/100g), B2 (0.36 mg/100g), C (12-43 Mg/100g), nicotinic acid (1.1 Mg/100g) and niacin (6 mg/100g). Its leaves also contain vitamins, but on boiling, steaming or frying, 7–11% of them may be lost. Fenugreek seeds contain of potassium (603.0 mg/100g), magnesium (42.0 mg/100g), calcium (75.0 mg/100g), Zinc (2.4 mg/100g) and iron (25.8 mg/100g) (AlJasass and Al Jasass, 2012).

Alkaloids, saponin and flavonoids in fenugreek (*Trigonellafoenum-graecum*)

Fenugreek contains a fairly high amount of alkaloids, saponins and flavonoids. Alkaloids and volatiles are the two major constituents of fenugreek seed which causes bitter taste. Fenugreek endosperm contains 35%

alkaloids, primarily trigonelline. Flavonoid constitutes more than 100 mg/g of fenugreek seed (Naidu *et al.*, 2011). All these compounds are classified as biologically active as these have pharmacological effects on the human body when ingested. Their use should, therefore, be promoted in daily diet to manage hypercholesterolemia, cancer and diabetes mellitus as they possess hypoglycemic, antilipidemic, anticarcinogenic and cholagogic properties (Meghwal and Goswami, 2012).

Antibacterial effect and Antifungal effect

The antifungal activity of fenugreek was reported. Based on the studies carried out in fenugreek, worldwide report shows that the seeds of this plant possess strong antibacterial activity (Palombo and Semple, 2001). However very few reports are available on antibacterial properties of fenugreek seed against the important human pathogenic bacteria so far (Farrukh and Iqbal, 2003). In the present study we confirmed antimicrobial activity of fenugreek against pathogenic bacteria.

The antibacterial and antifungal role of fenugreek is recently being shown. In a study by Haouala *et al.*, (2008), an aqueous extracts from various plant parts of fenugreek in various solvents include methanol, petroleum ether and ethyl acetate fractions of the aerial parts and determine their action against fungal strains such as *Fusarium graminearum*, *Botrytis cinerea*, *Alternaria sp.*, *Rhizoctonia solani* and *Pythium aphanidermatum*.

The effectiveness of extracts obtained from fenugreek against *Helicobacter pylori* has been reported by several studies (O'Mahony *et al.*, 2005; Randhir *et al.*, 2004; Randhir and Shetty, 2007).

In a study, honey samples with highest antibacterial activity against *Staphylococcus*

aureus, *Pseudomonas aeruginosa* and *Escherichia coli* show maximum pollens from fenugreek than other plants (Merican *et al.*, 2007). Cysteine-rich peptides, defensins are small with potent antifungal activity. The methanol soluble fraction of fenugreek extract showed nematicidal activity and caused significant mortality of *Meloidogy nejavanica* larvae, indicating the potential use against nematodes (Zia *et al.*, 2001).

The antibacterial activity of Fenugreek's leaves, seeds and stem in aqueous, methanol and acetone extract against *E. coli* and *Staphylococcus* isolated from to be spoiled cabbage which is mostly available at very low cost and widely used by the local street food corners. In further study Methanol extract exhibit the highest zone of inhibition as compared to the aqueous extract. In comparison of all the extracts the leaves extracts was found to be maximum as compare to the extracts of seeds and stems. The results were obtained during this experiment were highly effective and comparable with the commercial antibiotic at 100 µl concentration of Fenugreek extract (Sharma *et al.*, 2017).

In conclusion, the active chemical compounds present in fenugreek should certainly find place in treatment of various bacterial infections. The results from the present study are very encouraging and indicate this herb should be studied more extensively to explore its potential in the treatment of many infectious diseases.

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