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A Review on: Pharmacological action of Fenugreek

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Research Article

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ABSTRACT

A fenugreek seed is one of the most ancient medicinal herbs. *Trigonella foenum graceum* is traditional herbs belong to family Leguminosae. The seed and leaves are well known medicinal applications. It is native to the eastern Mediterranean but is cultivated worldwide. This plant has medicinal alkaloids, steroid compounds, and sapogenins and many uses have been mentioned for this plant in traditional medicine. It is also containing protein, fats and fibre. This plant has been used to ease childbirth, to aid digestion, and as a general tonic to improve metabolism. Trigonelline is considered as the most important metabolite of fenugreek, which is very effective in treating diabetes and decreasing blood cholesterol. Important chemical constituent of Fenugreek seeds including steroidal sapogenins, Diosgenin constituents has been found in the oily embryo of fenugreek seeds. Pharmacological action of fenugreek are antioxidant action, gastroprotective activity, appetite stimulation and antirheumatism. Many studies have been performed on the therapeutic effects and identification of chemical compounds of this plant. In this article, the most important biological effects and reported compounds about fenugreek seed are reviewed and its therapeutic applications are investigated.

INTRODUCTION

Fenugreek seeds is one of the most ancient medicinal herbs. It is one of the oldest known medicinal plants which has been documented in ancient herbal history. (Table 1) Fenugreek is an annual plant belongs to the family Fabaceae (Leguminosae). The biological name of fenugreek is *Trigonella foenum graecum*. The fenugreek seed is the famous spices in human food. The fenugreek seeds and green leaves are used in food as well as in medicinal application that is the old practice of human history. Fenugreek is a aromatic, (Table 3) 30-60 cm tall, annual herb, cultivated throughout the country. (Figure 1, 2) A nearly smooth erect annual. Stipules not toothed. Leaflets 2-2.5 cm long, oblanceolate-oblong, toothed. Flowers 1-2, axillary, sessile. Calyx-teeth linear. Corolla much exserted. Pod 5-7.5 cm long, with a long persistent beak, often falcate, 10-29 seeded, without transverse reticulations.[1,2,3] dried seeds have been traditionally used in India, China, Egypt and in some parts of Europe for their beneficial health effects as anti-inflammatory, insulinotropic, and rejuvenating effects The seeds have been used to increase the flavoring and color and modifies the texture of food materials. The fenugreek seeds have many medicinal properties such as hypocholesterolemic, lactation aid, antibacterial, gastric stimulant, for anorexia, antidiabetic agent, galactagogue, hepatoprotective effect and anticancer. These beneficial physiological effects of fenugreek seeds including the antidiabetic and hypocholesterolemic effects are mainly attributable to the intrinsic dietary fiber constituent which have promising nutraceutical value [4,5,6]. The fenugreek seeds are well known for its fiber, gum, other chemical constituents, and volatile contents. The fenugreek seeds containing dietary fiber which is responsible for the changes the texture of food. It is also used as food stabilizer, adhesive, and emulsifying agent due to its high fiber, protein, and gum content. The protein of fenugreek seed is found to be more soluble at alkaline pH [7]. The seed of fenugreek is having beneficial influence on digestion and could modify the food. It has been used also to promote labor before delivery during Greek period. Fenugreek seeds can be used to treat Lymphedema (oedema of the legs) according to Chinese traditional medicine.

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Table 1 : Scientific classification of *Trigonella foenum graecum*.

Kingdom	Plant
Family	Fabaceae
Genus	Trigonella
Species	T. foenum graecum
General name	Fenugreek
English name	Fenugreek
Arabic name	Hhulbah Hhelbah
French name	Trigonelle, Senegrain, Foingrec
German name	Gemeiner, Homklee, Bockshomklee
Indian name	Sagmethi, Methi, Kasurimethi
Italian name	Fienogreco, Erbamedica
Persian name	Shanbelileh

Table 2 : Chemical constituents of fenugreek seeds [8,9].

Alkaloids	Trimethylamine, Neurin, Trigonelline, Choline, Gentianine, Carpaine and Betain.
Amino acids	Isoleucine, 4-Hydroxyisoleucine, Histidine, Leucine, lysine, L-tryptophan, Argenine.
Saponins	Graecunins, fenugrin B, fenugreekine, trigofoenosides A-G.
Steroidal sapinogens	Yamogenin, diosgenin, smilagenin, sarsasapogenin, tigogenin, neotigogenin, gitogenin, neogitogenin, yuccagenin, saponaretin.
Fibers	Gum, neutral detergent. Fibre
Other	Coumarin, lipids, vitamins, minerals. 28% mucilage; 22 % proteins; 5 % of a stronger-swelling, bitter fixed oil.

Table 3 : Morphology of the fenugreek seeds [2,3].

Appearance	Solid- rhomboidal seeds,3 to 5 mm long,2 mm thick. Hard,pebble-like.
Colour	Colour: Yellowish brown-light brown 3. Odour: characteristic spicy
Odour	characteristic spicy
Taste	Bitter and mucilaginous

Figure 1. Leaves of Fenugreek.

Figure 2. Seeds of Fenugreek

Phytochemistry

The seed is a good source of calcium, minerals, iron, β-carotene and several vitamins like vitamins A and D. It is rich source of dietary fiber. It is consisting of free amino acids; 4-hydroxyisoleucine, lysine, histidine, and arginine (25.8%), protein (20-30%), moisture (11.76%), fat (6.53%), crude fiber (6.28%), ash content (3.26%) and energy (394.46 Kcal/100 g seed). Fenugreek seeds also contains lecithin, choline, minerals, B. Complex, Phosphates, and Para-Amino Benzoic acid (PABA). In addition, the main chemical compounds in fenugreek are saponins, fenugreekine, trigonelline, coumarin, scopoletin, phytic acid and nicotinic acid. In (Table 2) Important chemical constituent of Fenugreek seeds including steroidal sapogenins, Diosgenin constituents has

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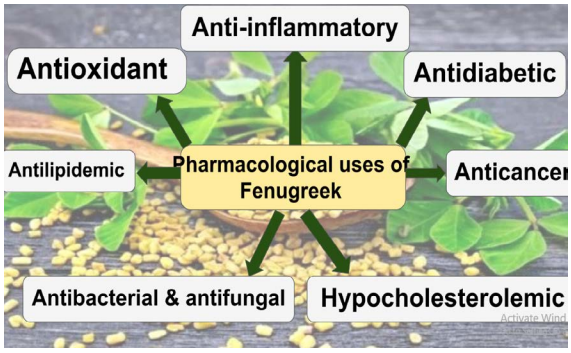

Figure 3. Pharmacological action of Fenugreek.

been found in the oily embryo of fenugreek seeds. There are two furastanol glycosides, F-ring opened precursors of diosgenin that have been reported in fenugreek also as hederagin glycosides. The stem of the fenugreek plant containing Alkaloids such as trigocoumarin, nicotinic acid, trimethyl coumarin and trigonelline. The fenugreek seeds also containing 28%mucilage. The stem of the fenugreek plant containing yellow color substance. Fenugreek seeds also contains, 6–7% fat and 58% carbohydrates of which about 25% is dietary fibers. Fenugreek is also a rich source of iron, containing 33 mg/100 g dry weight. It provides natural food fiber and other nutrients required in human body. [8,9]

According to AYUSH system, fenugreek seed are used in:-

According to Ayurveda and Unani system of medicine, fenugreek seeds are used in different ways

1. Fenugreek seeds are rich in vitamin E and is one of the earliest spices known to man.as preservative and adds to pickles.
2. Fresh fenugreek leaves are beneficial in the treatment of indigestion, flatulence, and a sluggish liver.
3. The dried leaf of the fenugreek is used as a quality flavor for meat, fish, and vegetable dishes.
4. An infusion of the leaves is used as a gargle for recurrent mouth ulcers. A gargle made from the seeds is best for ordinary sore throat.
5. Fresh Fenugreek leaves paste applied over the scalp regularly before bath helps hair grow, preserves natural color, keeps hair silky and cures dandruff.
6. Fenugreek seeds made in gruel, given to nursing mothers increase the flow of milk.
7. Topically, the gelatinous texture of fenugreek seed may have some benefit for soothing skin that is irritated by eczema or other conditions. It has also been applied as a warm poultice to relieve muscle aches and gout pain.
8. Fenugreek seeds reduces the amounts of calcium oxalate in the kidneys which often contributes to kidney stones. In animal studies, fenugreek appeared to lessen the chance of developing colon cancer by blocking the action of certain enzymes.
9. Traditional Chinese herbalists used it for kidney problems and conditions affecting the male reproductive tract.
10. Fenugreek is currently used as a source of the steroid diosgenin, one of its active constituents from which other steroids can be synthesized.

Health benefits of fenugreek seeds and leaves

- ✓ Help control diabetes
- ✓ Stimulates breast milk production
- ✓ Cures constipations
- ✓ Cures joint pains
- ✓ Balance cholesterol level
- ✓ Improves heart health.
- ✓ Fights the flu and colds.
- ✓ Reduce menstrual discomforts.

Pharmacological action of Fenugreek

Fenugreek is known to have several pharmacological effects such as hypoglycemic, antilipidemic activities[4,5]. However, the exact mechanism of action is still unclear. Furthermore, this plant has an antioxidant action[6], gastroprotective activity [7] appetite stimulation [8] , and antirheumatism[9].

Hypoglycemic action

Diabetes melllitus is a chronic metabolic disorder characterized by chronic hyperglycemic either because the pancrease does not produce enough insulin or peripheral target tissue are unable to respond to the normal concentration of insulin [10,11].it is a major cause of morbidity and mortality with an increasing prevalence and the fastest growing disease worldwide [12,13]. Diabetes is a major health concern, and its burden is increasing globally. Herbal medicine plays an important role in treatment of diabetes [14,15]. Fenugreek seeds, leaves and extracts had been used as an anti-diabetic [16].

Mechanisms for these effects have not been fully elucidated. Fenugreek seed contain 45.4% dietary fiber, and the gum is composed of galactose and mannose. The latter compounds are associated with reduced glycemic effect. The hypoglycemic effect of fenugreek has been documented in humans and animals with type 1 and 2 diabetes mellitus [17]

Anticarcinogenic action

Cancer is one of the leading causes of mortality worldwide. Many reported studies have shown the protective effect of fenugreek seeds in experimental models of cancer using cell lines[18]. Consumption of fenugreek was accompanied with decreased polyamines content in tumor tissue [19] Fenugreek seed extract significantly inhibited 7,12-dimethylbenz(a)anthracene-induced mammary hyperplasia and reduces its incidence in rats and advised that anti-breast cancer protective effect of fenugreek could be due to increased apoptosis [20]. According to the investigation treatment with fenugreek extract showed growth inhibitory effects on breast, pancreatic and prostate or immortalized prostate cells remained unaffected. Inhibition of cancer cell growth by Fenugreek is a attributed to its ability to induce death of cell, despite simultaneous upregulation of growth stimulatory pathways in normal cells [21].

Hypocholesterolemic action

The abnormal deficiency of cholesterol level in blood is known as hypocholesterolemic problem. The oral administration of methanolic and aqueous extracts of seeds at a dose of 1gm/kg body weight resulted in hypoglycemic effect in mice [22]. Fenugreek seeds contain the large amount of fiber galactose and mannose are the main composition of gum. The latter compounds are associated with reduced cholesterolemia [23]. Fenugreek extract has been investigated for its effects on blood lipid, and in experimental rats with diabetes .The streptozotocin-induced diabetic rats were administrated by oral intragastric intubation separately with low dose, middle dose, and high dose of fenugreek extract, and Metformin HCl for about one and half month(6 weeks). As compared to diabetic group, rats treated with fenugreek extract had lower triglycerides, total cholesterol, and higher HDL cholesterol in a dose-dependent manner [24]

Antibacterial & antifungal action

The antibacterial and antifungal role of fenugreek has recently been shown. Plant derived compounds with antibacterial and antifungal activities have been identified and reviewed[25-,29].An aqueous extracts from various plant parts of fenugreek in various solvent include methanol, petroleum ether and ethyl acetate fractions of the aerial parts and determine their action against fungal stains such as Fusarium graminearum, Botrytis cinerea, Alternaria sp., Rhizoctonia solani and Pythium aphanidermatum. All parts of the fenugreek plant showed antifungal potential and the magnitude of effect varies with plant parts species of fungus. Fenugreek is an important source of biologically active compounds useful for developing better and novel antifungal drugs [30]. Fenugreek dried seed are known for their valuable antibacterial property. Fenugreek is rich with a wide variety of metabolites such as tannins, alkaloids, flavonoids, terpenoids and glycosides which are known to have antimicrobial properties [31].Various investigators have also showed effectiveness of Trigonella extracts against Helicobacter pylori [32-34].In One study, honey samples with highest antibacterial activity against Pseudomonas aeruginosa, Escherichia coli and Staphylococcus aureus shown maximum pollens from Trigonella, among other plants [35].

Antilipidemic action

Abnormalities in the lipid metabolism are associated with dyslipidemia, obesity, diabetes, cardiac diseases, inflammation, and their associated disorders [36]. Current treatment of dyslipidemia, obesity, and related metabolic disorders includes various drugs which causes untoward side effects and inflict economic burden [37,38].

Fenugreek seeds have been historically used for the treatment of various chronic human diseases. The studies concerned with application of fenugreek seeds in diabetes, dyslipidemia and obesity support this hypothesis [39-41]. Fenugreek showed lower serum TG and total cholesterol and hepatic lipid concentrations [42-44]. Mechanism-based studies on its efficacy in the prevention and management of dyslipidemia and obesity-related complications do not exist. Because fenugreek seeds are being used as a condiment and are known to have health benefits, novel thermostable extract of fenugreek seeds (TEFS) is used to deduce the hypolipidemic effect, 3T3-L1 cells and HepG2, human hepatoma cell line were used as in vitro models [45,46].

Antioxidant action

Human consume a lot of oxygen to live and survive, to derive energy by the oxidation of food molecules. The excessive production of oxidants in body is normally taken care of by the native antioxidant mechanism; however, in certain conditions these mechanisms become overwhelming for the cells leading to inflammation, tissue damage and disease [47]. Fenugreek leaves reduces oxidative stress in streptozotocin-induced diabetic rats. The antioxidant effect, determined by measuring thiobarbituric acid-reactive substances (TBARS) and reduced glutathione (GSH) levels, and activities of catalase on the one hand significantly lowered lipid peroxidation and, on the other hand significantly increased the antioxidant system [48].

Conclusion

Trigonella foenum graceum has been used for treating and preventing in different diseases from ancient times. It is AYUSH medicine. The conducted pharmacological studies also have confirmed many of these traditional applications and have shown clearly therapeutic value of this plant and abilities of the traditional medicine. Fenugreek seed has a significant antidiabetic effect. It can decrease the absorption of sugar in the gastrointestinal tract and stimulate insulin release, resulting in lowering the blood sugar in diabetic patients. It is different medicinal importants such as inflammation, loss of appetite, upset stomach, gastritis, atherosclerosis, and hypertension. Also used in another condition such as Breast-feeding women sometimes use fenugreek to promote milk flow. It is consisting of high level of iron and can be used for iron-deficient patients. Fenugreek seed used for kidney complications and some other toxicities. It also containing antioxidant activity and it seems that antioxidant property of this plant is one of the main effective factors in creating effects of fenugreek. The antioxidant property of the plant has been attributed to the presence of many active phytochemicals, including flavonoids, plant sterols, vitamins, cumarins, terpenoids, carotenoids, curcumins, lignin, and saponin. However, the phenolic compounds have had the highest contribution in this effect. So, there has been a significant correlation between the polyphenolic components present in the extract and its antioxidant activity. Medicinal plants—because they contain antioxidant compounds, bioactive compounds, phenols, flavonoids, and anthocyanin—have been shown to counteract these conditions and are capable of providing drug supply in complementary medicine. A lot of these plants have previously been used for preparation of new drugs or have shown promising results. Therefore, fenugreek, which possesses phenolic compounds and antioxidant activity should have the ability to counteract these situations and might be a good candidate for a herbal drug.

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