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Review Article

Health Benefits, Chemical Constituents and and Therapeutic Pharmacological Effects of Fenugreek

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Abstract

All around the world fenugreek (*Trigonella foenum graecum*) used as medicinal herb and green leafy vegetable. It is cultivated mostly in India, Africa, Egypt, Pakistan and etc. Fenugreek is highly rich in nutritional source contains vitamins, minerals, proteins, alkaloids, flavonoids, fibers, gums and volatile compounds. It has been used in food items like pickles, chips and bakery products as preservative. Fenugreek has multiple therapeutic pharmacological effects like anticancer, anti-obesity, cardiac protective, gastro protective, antifungal-antimicrobial property, cholesterol lowering agent, anti-diabetic, ant carcinogenic and helps In reducing blood sugar levels, improvement of sexual function and galactogogue functions. The aim of this article is to review the various experiments, reports and literature that investigate multiple therapeutic pharmacological effects, health benefits and chemical constituents of fenugreek.

Keywords: *Trigonella foenum graecum*, Classification of fenugreek, Constituents of fenugreek, Traditional use of fenugreek, Pharmacological benefits of fenugreek, Fabaceae

INTRODUCTION

In the all over world herbs are used not only in food but also used as medicines. They don't show their effects like chemical drugs and they also don't having any substitute. Medicinal plants 80% used by people to get cure and improve general health problems. Fenugreek is an annual herb cultivated in many countries around the globe (Al-Asadi, 2014). Some parts of India, China, Africa, parts of Europe and Argentina where fenugreek mostly cultivated. Fenugreek seeds are rich in chemical constituents gum, fibers, alkaloids, flavonoids, saponin and volatile contents. Fenugreek contains 20%-25% proteins 45%-50% dietary fibers 20%-25% mucilaginous soluble fibers 2%-5% steroidal saponins 6%-8% fixed fatty acid and some essential oils. It also contains some small minor substances of alkaloids such as onoline, choline, gentianine, carpaine and etc (Gupta, et al., 1998).

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LITERATURE REVIEW

Fenugreek has various potential pharmacological uses in modern medicines for anti-diabetic, anti-lipid emic, antioxidant, hypo cholesterol emic and antifungal, anti-inflammatory, anti-bacterial, anti-carcinogenic, antiulcer and neuron protective nature effects in clinical trials and humans as well as experimental animals. It has also having important role in baby development. Researcher suggests that fenugreek was conventionally advised for increasing milk production in lactating women. The end and ideal of this composition review are to punctuate the crucial chemical ingredients, health benefits and multiple pharmacological parcels of fenugreek on mortal health (Table 1) (Trivedi, et al., 2007).

Table 1. Common names of fenugreek.

Language	Common names
Kannada	Menthya
Tamil	Meti
Telugu	Menthulu
Malayalam	Uluva
Sinhalese	Uluhaal
Persian	Shanbalileh
Oriya	Hulba
Hindi, Urdu, Punjabi	Methi
Burmese	Penantazi
English	Fenugreek
Hindi	Methi, Saag methi, Kasuri methi
French	Fenugreec, Trigonelle
Galician	Alforfa
German	Bockshornklee, Griechisch Heu
Georgian	Solinji, Chaman
Japanese	Koruha, Fenu-guriku
Dutch	Fenugriek
Romanian	Molotru, Molotru comun, Schinduf
Assamese	Methi, Mithi
Sanskrit	Methika

Biological and morphological classification of fenugreek

Fenugreek is an every yearly plant in family of fabaceae. Table 2 described the biological classification of fenugreek. Morphologically fenugreek roots are huge finger like structure, leaves are pinnate trifoliate, its flower have five petals known as wing, kneel and banner (Ghedira, et al., 2010). Ovary is deep green in color and pollen grains are circular or oval in shape fenugreek flower exhibits yellowish brown to brownish color and 15 cm long having 2-8 pods. Each pod contains 10-20 seeds and seeds are 5 mm-6 mm long hard and brownish in color (Smith, 2003).

Table 2. Biological classification.

Biological classification	
Kingdom	*Plantae*
Subkingdom	Tracheobionta (Vascular Plants)
Division	Magnoliophyta (Flowering Plants)
Class	Magnoliophyta (Flowering Plants)
Clade	Tracheophytes
Clade	Angiosperms
Clade	*Eudicots*
Clade	*Rosids*
Order	*Fabales*
Family	*Fabaceae*
Genus	*Trigonella*
Species	*T. foenum-graecum*

DISCUSSION

Chemical constituents of fenugreek

Fenugreek contains lots of chemical constituents which are very essential for human body like proteins, vitamins, minerals, alkaloids, fibers, volatile compounds (Figure 1) (Jani, et al., 2009).

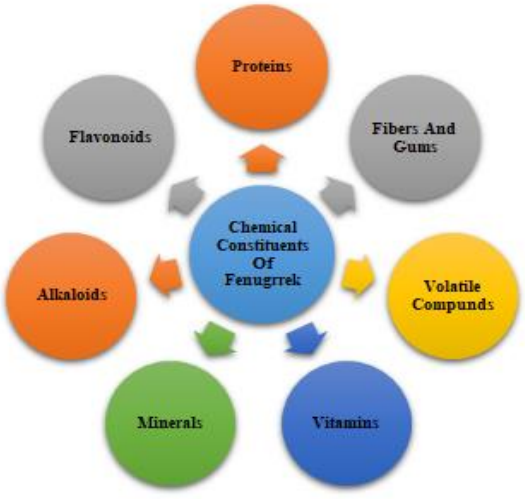

Figure 1. Chemical constituents of fenugreek.

Proteins: According experiments 100 g of fenugreek seeds contained 24.4 g of protein approx. Fenugreek proteins having great properties of absorption they can easily absorbed oils and water and having large bulk density. The endosperm of fenugreek contains variety of proteins such as albumin, globulin, histidine and lecithin proteins of fenugreek have good potential for insulin stimulating properties (Mathur, et al., 2009).

Vitamins: Fenugreek seeds especially highly rich in vitamins A, B_1, B_2, C, niacin, nicotinic acid, biotin, folic acid and ascorbic acids. Fenugreek leaves contains (52 mg per 100 g), β-carotene (2.3 per 100 g), thiamine (40 microgram per 100 g), riboflavin (310 microgram per 100 g), nicotinic acid (800 microgram per 100 g), folic acid (0 microgram per 100 gram). There is 9% to 10% reduction in vitamins contents due to boiling and heating process are used for cooking purposes and there is also reduction in concentration of vitamin C. Sulphur containing amino acids, threonine valine and methionine also present in little amount (Mirzaei, et al., 2012).

Minerals: Fenugreek is low in minerals content except phosphorus, iron, sulphur, calcium and zinc are present in good concentration. These minerals are very crucial and essential for daily needs for human body for functioning physiological activities.

Alkaloids: Fenugreek contains trigonelline alkaloid which is extracted from plant source and gentanin and carpaine choline is sort out from seeds of fenugreek. Trigonelline is pyridine alkaloid and it contains quaternary ammonium compounds which show zwitter ion properties. Trigonelline is very useful for activation of estrogen receptor due to this ability it is also called as phytoestrogen. It was first found in fenugreek in 1885 (El Nasri, et al., 2007).

Flavonoids: The main flavonoids which are present in fenugreek are glycoside, orientin, isoorientin, vitexin, epigenin and quercetin. Flavonoids are present in the complex form with by conjugating with carbohydrates. These are isolated from each part of the whole plant. Each part of plant contains little amount of flavonoid concentration. Flavonoids of fenugreek has (anti-tumorigenic) property which induce apoptosis (death of cells) in the human lung tumor cell lines, stomach cancer cells, prostate cancer cells, breast cancer cells, head and neck squamous carcinoma 3 and cervical cancer cells these cells having effects on macrophages. Diosgenin is very useful in cancer therapy (Joshi, et al., 1960).

Fibers and gums: About 50% fry weight of seeds is edible dietary fiber and 30% is gel forming soluble fiber and 20 % is bulk forming property. Fibers of fenugreek is very stable and having more self-life with drying, frying, baking and freezing.

Fenugreek fibers are used for making foods like pizza, bread, muffins and cakes. They were having very important part in preparation of wafers (papads), chips and flat bread. They having anti-bacterial properties due to these properties food item not gated spoiled and remain in good conditions for long periods of time.

Fenugreek fibers bound to toxins in the foods and help to protect mucus membrane from cancer toxins. They reduced the rate of glucose absorption in the intestine and regulate the normal level of blood sugar. Fenugreek gum is utilized for thickening, stabilizing and emulsifying food agents. It is obtained from endosperm of seeds. Fenugreek fibers and phenolic acids having great effect source of antioxidant property (Aggarwal, et al., 2004).

Volatile compounds: Volatile oils are having bad odor and bitter taste volatile oils are present in 39 different types. The main compounds are n- hexanol, dihydroactiniolide, dihydrobenzofuran and heptatonic acid oils are easily dissolved in benzene, ether and petroleum ether. Fenugreek oils having good antimicrobial activity. 1997 study detected many volatile compounds with the help of gas chromatographic techniques.

Traditional use of fenugreek in different countries

Fenugreek has mentioned in Ayurveda text, Greek and Latin also. In modern Vaidyas it is used for digestive and respiratory problems. In ancient time (methi) fenugreek is used for increase milk flow in women for the development of baby. In modern time Egyptian females used fenugreek to relieve menstrual cramps. Egyptian people make hilba tea for treating abdominal pain. In winter methi is used as winter vegetable and it is cooked at homes of people. Fenugreek used as preservatives for pickles and spices (masala).

The Roman and Greek peoples used fenugreek for cattle fodder. In China it is traditional medicine used for treatment for weakness and edema of legs medicine is in the form of liquid tonic. Fenugreeks are rich in vitamin E and used as flavoring agent in vegetable dishes, meat, fish. In India the tea of methi with honey and lemon are very effective for curing fever it is used as home remedy for burns, eczema and gout. The plants are used for getting prevention from kidney diseases and other conditions. In China seeds are used as pessary to cure cervical cancer. The seeds are consumed as orally insulin substitute for reducing blood glucose and maintain the blood sugar level.

Health and pharmacological benefits of fenugreek

Fenugreek is a medicinal herb. It's having multiple pharmacological benefits which are having very beneficial impact on human health those having different types of health issues. It is not costly and nor having many adverse effects.

Those who consumed fenugreek they get maximum proteins and minerals required by normal body of human for performing physiological activities (Figure 2).

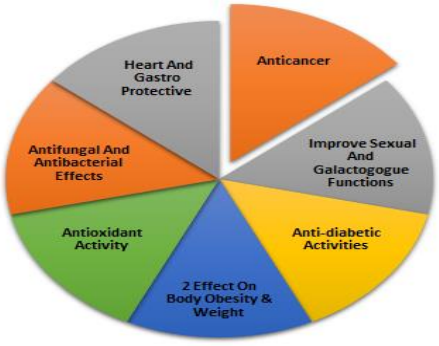

Figure 2. Pharmacological therapeutic effects of fenugreek.

Antioxidant activity: Flavonoids present in fenugreek possesses anti-oxidant activities. They are having abilities to prevent cell layers from oxidation damage. Fenugreek having high antioxidant activity. It shows effect on liver and pancreas due to presence of phenolic and flavonoids. Fenugreek reduces lipids peroxidation in Red Blood Cells (RBC).

Experimental work reported that fenugreek seeds showed antihyperglycemic and hypoglycemic activities in diabetic rats that are due to antioxidant compounds present in the species. The activity of antioxidant of fenugreek extracts and performed by the evaluation of b-carotene methods. Fenugreek seeds husk and endosperm contains 72%, 64% and 56% antioxidant activity by free radical scavenging activity.

Effect on body obesity and weight: It was studied in research that fenugreek rich in dietary fibers and proteins increase the secretion of anorexigenic, insulinotropic hormones and glucagon-like peptide to improve glucose and reduce the body weight. Fenugreek plays essential role in reducing body and adipose tissue mass it directly flush out carbs forms the human body before reaching the stream of blood and that results loss in body weight. Fenugreek seeds contains high fraction of soluble fibers. That fibers shows gelatinous structure which shows impact on digestion and absorption of food from intestine and promotes weight loss. 4-hydroxyisoleucine present in fenugreek reduces plasma triglyceride due to that prevents obesity induced by fat diet.

Anti-diabetic activities: The natural medicinal herbs shows effectiveness as an anti-diabetic agents. Common fenugreek shows effects for reducing blood sugar level and gain in the insulin response. Dietary fibers called galactomannan brings down the level of blood sugar in diabetics objects (Kaviarasan, et al., 2004).

By detaining gastric clearance of carbohydrates, prohibit digestive enzymes, rising bowel motion and balancing intestine. Trigonelline exhibit anti-diabetic activity by boosting insulin signaling pathway. Some experimental works reported that flavone c-glycosides prohibit digestive enzymes, forceful insulin signaling and shortened the generation of glycation end items. Reports suggested that in type 2 diabetes patients 100 g of fenugreek powder decreased 25% level of blood glucose level in 10 days. Fenugreek has high impact on dyslipidemia. That prohibits aggregation of platelets in type 2 diabetes in mice. Fibers having viscous gel forming activities that prevents macro-nutrients absorption, shortened glucose response and effects on several blood lipids. Fenugreek used in rice and wheat food items reduces the GI by slowing gastric emptying, reducing glucose absorption and interdicting starch digestion due to presence of fibers and galactomannans. The liquid isolated from the seeds of fenugreek stops diabetic nephropathy in rats by reducing level of blood glucose, improving kidney activities (Madar, et al., 2002).

Antifungal and antibacterial effects: Fenugreek is the primary source of biological active species for better antifungal antifungal medicines. The whole part of fenugreek plant contains antifungal and antimicrobial activity. In lots of studies and experiments reported that fenugreek has great effects on fungal and bacterial infections. The liquid materials eliminated from fenugreek plants inserted in various chemical like petroleum ethers, ethyl acetate and methanol. They show their effects mechanism and opposed the fungal and bacterial strains like *Rhizoctonia solani*, *Fusarium graminearum*, *Botrytis cinerea*, *Phythium aphanidermatum* and *Alternaria* sp. The compounds hydro alcoholic isolated from fenugreek rich in polyphenols and flavonoids shows antifungal activities fluconazole resistant *Candida albicans*. Ethanolic substances isolated from fenugreek seeds prohibit both positive and negative strains with MIC opposed to test bacteria *E.coli* and *Salmonella typhi*.

Heart and gastro protective: Fenugreek reduces the platelets aggregation and prevents the risk of abnormal blood clotting. This all process interrelated with heart strokes and attacks. In animal experiments studies proven that fenugreek shortened the myocardial damage and compressed the oxidative stress during isoproterenol brings myocardial infarction. Fenugreek used as for treatment of ulcer also due to presence of flavonoids contents sulfhydryl. Sulfhydryl prevents mucosa from the development of ulcerative lesions by several necrotic agents. Increase in gastric mucosa due to presence of sulfhydryl helps anti-ulcer property to fenugreek seeds. The sulfhydryl compound acts as antioxidant and useful in balancing the mucosal integrity in the stomach.

Improve sexual and galactogogue functions: Lots of experiments done for the purpose of these topics the experiment of Jiayou Materia explained that fenugreek works on kidney issues and much more factors. The liquid extract from fenugreek increases the sperm mortality and increase the cation sperms channel proteins in mice. A 6 years experimental work involved 60 fit males having age above 25 and below 52 years. They concluded that seeds of fenugreek enhanced male sexual functions, make better sexual life and balanced orchid hormones and lactogen. In 6 years experimental work concluded that 1200 women's directing 2-3 fenugreek tablets (580 mg-610 mg) thrice a day which makes them to generate more breast milk in 1 to 3 days.

Anticancer: Cancer is one of the leading causes of mortality all around the world. Many reported studies shown that fenugreek seeds are protective effect to give cancer using cell lines or animals. Alcoholic whole plant extracts of fenugreek show *in vitro* cytotoxicity against different human cancer cell lines such as neuroblastoma cell line and cancer line. According to study and treatment with fenugreek extract showed inhibitory effects on breast, pancreatic, prostate cancer cells but primary prostate cells remains unaffected. The chemo preventive activity of the methanolic extract of fenugreek seeds may due to rich in chemical constituents (alkaloids, saponins) that are present in seeds working synergistically at various stages of angiogenesis. Fenugreek seeds tea also has ability to inhibit the further growth of cancer cells to controlling power of body treatment with 10 mg-15 mg of fenugreek extract for 72 hours growth inhibitory to breast, pancreatic and prostate cancer cell lines.

CONCLUSION

Fenugreek is one of the most common and good traditional herb which is used in every person homes as used in food remedies. Fenugreek shows many important useful effects and actions against health problems and disorders like cancer, diabetes, gastric ulcer, cardiac problems. Fenugreek used for improvement in sexual functions, galactogogue functions, antifungal, antibacterial, cholesterol lowering agent, anti-obesity. Due to presence of chemical constituents and rich in nutritional sources are very beneficial to human body for performing physiological functions and getting mentally and physically strong. Based on this several health benefits and pharmacological therapeutic uses fenugreek can be recommended to be daily part for food diet and it may be more beneficial in future.

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