

A REVIEW ON TRIGONELLA FOENUM GRAECUM

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Abstract:

Fenugreek (Menthi / *Trigonella foenum graecum*) is a plant of Leguminosae family that grows annually and is cultivated in Mediterranean countries and Asia. The seeds of fenugreek are an excellent source of gum, fiber, alkaloids, flavonoids, saponins, and volatile compounds. The objective of this article is to review the use of fenugreek in foods and nutraceuticals.

Key Words: Fenugreek, Health Benefits, Antioxidants, Antidiabetic, Cholesterol, Cancer, Gastro Protection.

Introduction:

Fenugreek (*Trigonella foenum-graecum* L.) belongs to the legume family and has been used as an important spice since ancient times. About 70 to 97 different species of fenugreek are grown worldwide. As it is native to Greece, the species name *foenum-graecum* means "Greek hay". Best known as a spice added to human food, this natural tonic has been used to treat cardiovascular disease, hypercholesterolemia, hyperglycemia, cancer, liver disease, and sexual disorders such as testosterone. It has also been shown in the literature to cure various types of lifestyle-related diseases, deficiency syndrome. Numerous types of medicinal plants have shown the potential to be frequently used in the therapeutics due to the presence of several bioactive compounds. (Reddy et al., 2019) Among these, fenugreek is an important herb which has been recognized as an imperative medicinal plant by various scientists around the world. This herb has been widely reported as beneficial against numerous diseases such as cancer, hypercholesterolemia, diabetes, and inflammation. Due to its medicinal value, the extracts/powders from different parts of fenugreek have been effectively utilized in food and pharmaceutical industries. Accordingly, the present review is an attempt to highlight the important nutritional benefits and curative applications of fenugreek as an effectual therapeutic agent against different diseases. Current lifestyles, dietary habits, stress, environmental factors, and widespread use of synthetic chemicals in food processing and agriculture have sharply accelerated the progression of several human diseases. Researchers around the world are searching for natural therapeutic substances that can be used to treat or delay the onset of these lifestyle diseases. (Naglapalli et al., 2017)

Plant Profile:

Fenugreek plants are erect, loosely branched, less

than one meter tall, with trifoliate pale green leaves and small white flowers. Elongated pods up to 15 cm (6 in) long, curved, beaked, containing tawny seeds (marked by deep furrows, less than 0.5 cm (0.2 in) long) flattened rhomboids. Fenugreek seeds, which come in whole and ground forms and are mildly bitter and slightly sweet, are used as a flavoring for foods such as curry powders, breads, and other baked goods. The seeds are central hard, yellow embryo is encircled by a horny, comparatively thick layer of white, semi-transparent endosperm. (Hardmen *et al.*, 1969)

Taxonomical Classification:

Kingdom : Plantae
Clade : Tracheophytes
Clade : Angiosperms
Clade : Eudicots
Clade : Rosids
Order : Fabales
Family : Fabaceae
Subfamily : Faboideae
Genus : *Trigonella*

Morphological Characters:

Plant: Erectus or straight and Branched
Stem: Greenish, Slightly Quadrangular
Leaf: Simple and Trifoliate, Lamina leaf.
The petioles and leaf lamina forms greenish to pinkish colour.
Petiole: Pale Green, Pubescent
Calyx: Pale green, Pubescent
Flower: Yellow when young and White on maturity
Corolla: White
Seed: Rectangular to oval with Grooves. Varies in colour form pal brown to golden yellow.

Chemical Constituents:

It has been discovered that the fenugreek seed contains a variety of chemical substances known as phytochemicals. The main bioactive molecules in fenugreek seeds are known to be polyphenol chemicals like rhaponticin and isovitexin. They include various alkaloids, flavonoids, and saponin types, with saponins having the highest concentration (4.63 g per 10 g). About 35% of the alkaloids in fenugreek are trigonelline. Additionally, fenugreek seeds have a minor amount of volatile and fixed oils and more than 10 mg of flavonoid per gramme of seed. (Thorat R. M. *et al.*, 2009) Linoleic acid (42.71-42.80%), linolenic acid (26.03-26.15%), and oleic acid (14.24-14.40%) were all abundant in the oils. Neryl acetate (17.3%), camphor (16.3%), -Pinene (15.05%), -caryophyllene (14.63%), and 2,5-dimethylpyrazine (6.14%) are all abundant in the essential oil of fenugreek seeds (>5%). Most of the flavonoids in fenugreek are found as complex glycosides, which are a result of C- and O-glycosidic bonding with carbohydrates, according to the phytochemical analysis of the plant. Fenugreek contains flavonol glycosides such as apigenin-6-C-glucoside, vitexin-7-O-glucoside, and quercetin-3-O-rhamnoside (quercitrin) (isovitexin). (Duke *et al.*, 1986) The bitter taste and odour of the seeds are primarily brought on by the alkaloid and volatile compound present. Fenugreek seeds contain between 0.1 and 0.9% of diosgenin, a steroidal saponin.

Origin and Distribution:

Trigonella foenum-graecum L., also known as fenugreek, is an old and annual legume crop that is primarily grown for a variety of uses all through the world. *Trigonella* species and landraces can be found on the continents of Asia, Europe, Africa, and Australia. Moreover, parts of Europe, Northern Africa, West, and South Asia, North and South America, and Australia have been home to fenugreek cultivation. The wild *T. gladiata* Ste., which differs from *T. foenum-graecum* in respect of the entire aggregate of characters—of which seed tuberculation and the small size of the pods are only the most remarkable claimed by many authors to be the direct ancestor of cultivated fenugreek. The species *T. foenum-graecum* might have originally come from *T. gladiata*, which may have given rise to certain new extinct varieties of *T. foenum-graecum*. (Wani *et al.*, 2018, Jasass *et al.*, 2012)

Fenugreek is a plant that naturally grows in places like Punjab and Kashmir, the deserts of Mesopotamia and Persia, Asia Minor, and some nations in Southern Europe like Greece, Italy, and

Spain. fenugreek should have its origins in Asia rather than Southern Europe because if it were native to that region, it would be much more widespread and present in the insular floras of Sicily, Ischia, and the Balearic Islands. (Zandi *et al.*, 2017)

Agricultural Season of the Fenugreek:

Fenugreek is grown both as a Rabi and Kharif season crops in southern parts of India. It is successfully grown both in tropical and temperate regions due to its broad adaptability. It can withstand frost and freezing temperatures. It grows best in regions with moderate to light precipitation, but not in regions with heavy precipitation. Although it can be grown on a wide range of soils, clayey loam is generally preferable. The ideal soil pH range for better growth and development is between 6.0 and 7.0. In soil, germination typically takes 3 to 10 days. The seedlings of fenugreek produce their first leaf, which is typically simple, six to ten days after germination. There is usually no discernible epicotyl present when the first trifoliate leaf forms five to eight days later. In cooler and wetter environments, growth is slower, and prolonged exposure to these conditions may prevent plants from maturing in time to produce seeds. At the start of the growing season, fenugreek grows slowly, and leaf development is temperature dependent. Following the seed's germination and the seedling's initial growth, the plant's main growth, which contains the emergence of stems, flowers, pods, and seeds, takes place. Due to its indeterminate growth habit, fenugreek continues to grow from its terminal and axial buds even as it is in the procedure of flowering and developing pods. (Sadeghzadeh *et al.* 2009, Budavari *et al.*, 1996)) Additionally, there are four distinct developmental stages for the fenugreek pod: length development (first stage), width development (second stage), germ development (third stage), and ripening (fourth stage). fenugreek is botanically a short living. (Kozłowski *et al.*, 1982)

Health benefits of fenugreek:

Fenugreek seeds are used as preservatives, they are a good source of the antioxidant vitamin E, fenugreek seeds are used as preservatives. Vitamin E guards against the harm that can be done to body tissue by things called free radicals, which can harm to organs, tissues, and cells. Fresh leaves are used to treat indigestion, flatulence, and a sluggish liver. Additionally, the dried leaves are used as a flavoring, and a leaf infusion is used as a gargle for recurrent mouth ulcers. The fresh leaf paste is used for hair therapy by massaging the scalp with it. It

aids in boosting milk production. Fenugreek seed's gelatinous texture is used to treat skin conditions like eczema, which causes patches of the skin to become rough and inflamed with blisters that bleed and itch. The seeds reduce the amount of calcium oxalate in kidney stone problems. Warm fenugreek cataplasm or a fenugreek poultice is applied to relieve gout pain and muscle aches. Fenugreek seeds aid in lowering kidney stone-causing calcium oxalate levels in the body. (Gopalan et al., 1989, Kirtikar et al., 2009) The steroid diosgenin, one of fenugreek's active components from which other steroids can be produced, is now used as a source.

Therapeutic importance of fenugreek:

1. Fenugreek in antibacterial activity:

Salmonella typhi, Staphylococcus aureus, and Escherichia coli can all be defeated by seed extracts. Seeds are boiled in water to create this aqueous extract. Fenugreek has an antibacterial effect that causes these plants to kill bacteria. Because they excessively inhibit pancreatic enzymes, synthetic -glucosidases inhibitors like acarbose can have negative side effects on the abdomen like abdominal distention, which leads to abnormal bacterial fermentation of undigested carbohydrates in the colon. (McCue et al., 2004) Therefore, it is advantageous to conduct research on the creation and application of antidiabetic plants that only slightly inhibit pancreatic enzymes. The fenugreek extract has alpha-amylase inhibitory components that most likely interact with the enzyme's active sites in a substrate-specific way. Fenugreek is effective at preventing the growth of Salmonella typhi, E. coli, Shigella dysenteriae, and Pseudomonas spp. (Bordia et al., 1997, Thirunavukkarasu et al., 2003)

Fenugreek in obesity:

One of the main risk factors for morbidity and mortality is obesity. It could be characterized as adipose tissue growing abnormally. In a few Research has shown that taking fenugreek seed extract supplements is beneficial. It reduces the weight of the body and adipose tissue. The likely Fenugreek's mechanism for reducing body weight and adiposity It's possible that fenugreek flushes the carbohydrates out of the tissue weight. before they enter the bloodstream, removing them from the body causes. A significant portion (40%) of fenugreek seeds is used for weight loss. These fibers form a gelatinous structure that may slow down food digestion and absorption from the intestines and give the abdomen a feeling of fullness, which in turn curbs appetite and encourages weight loss. Fenugreek is therefore

effective against blood lipids, sugar, and some bacterial strains. Its antioxidant activity protects organs and prevents the entry of diseases into the body, as well as reducing body fat and combating obesity. (Meghwal et al., 2012, Handa et al., 2005)

Fenugreek influence in Digestion:

Dietary spices had an impact on the pancreatic digestive enzymes. By giving rats a spicy diet for eight weeks, fenugreek significantly increased pancreatic lipase activity. Fenugreek's high fiber content aids in treating constipation-related conditions. (Nathiya et al. 2014)

Fenugreek in cancer therapy:

Fenugreek is a therapeutic herb used to treat cancer patients receiving chemotherapeutic treatments. By reducing the cyclophosphamide-induced apoptosis and free radical-mediated lipid peroxidation in the mouse urinary bladder, fenugreek extract exhibits a protective effect. It has been found to have potential importance in the treatment of cancer. In human carcinoma cells, flavonoids and catechins were first demonstrated to induce apoptosis. Fenugreek contains diosgenin, which inhibits cell growth and causes apoptosis in the H-29 human colon cancer cell line. It was discovered that fenugreek seed had hepatoprotective qualities. Fenugreek seed polyphenolic extract protects the liver from abnormalities brought on by ethanol. (Ahmadiani et al., 2001, Raju et al., 2006, Kaviarasan et al., 2007)

Fenugreek in the Treatment of Diabetes:

Fenugreek seeds have been shown to lower fasting serum glucose levels in both animal and human studies. Both type I and type II diabetes can be treated with fenugreek as an anti-diabetic. Fenugreek's saponins and diosgenin are what give it its hypolipidemic and anti-diabetic effects. According to reports, fenugreek has hypoglycemic-lowering properties in both humans and lab animals. (Kaviarasan et al., 2007)

Fenugreek in anthelmintic activity:

Fenugreek seeds exhibited strong and noticeable anthelmintic activity. Alcoholic extracts in this case demonstrated positive anthelmintic activity. Additionally, water extract exhibits less activity. (Rao et al., 2005)

Fenugreek effect in cholesterol lowering:

Hypocholesterolemia problem refers to the abnormally low level of cholesterol in the

blood. The faecal excretion of bile acid and cholesterol was increased by fenugreek. It might be secondary to the formation of micelles that are too big for the digestive tract to absorb because of a reaction between saponins and bile acids. Another effect is that the gum portion of the seed, which is high in fiber, slows the liver's production of cholesterol. Both mechanisms help lower cholesterol. (Dash et al., 2011) The seeds of fenugreek have hypocholesterolemia properties. Fenugreek seeds have therefore reduced serum cholesterol and triglyceride levels. (Stark et al. 1993)

Fenugreek in antibacterial activity:

Salmonella typhi, Staphylococcus aureus, and Escherichia coli can all be defeated by seed extracts. Seeds are boiled in water to create this aqueous extract. According to reports fenugreek has an antibacterial effect that causes these plants to kill bacteria. Because they excessively inhibit pancreatic enzymes, synthetic -glucosidases inhibitors like acarbose can have negative side effects on the abdomen like abdominal distention, which leads to abnormal bacterial fermentation of undigested carbohydrates in the colon. Therefore, it is advantageous to conduct research on the creation and application of anti-diabetic plants that only mildly inhibit pancreatic enzymes. As has been suggested for other inhibitors, the glycolytic activity of -amylase may be caused by the direct blockage of the active center at several subsites of the enzyme. (McCue et al., 2004, Bordia et al., 1997, Thirunavukkarasu et al., 2003)

Fenugreek in Gastro protection:

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Fenugreek seeds work well for gastric ulcers. Both the aqueous extract and the gel fraction isolated from fenugreek seeds demonstrated notable ulcer-protective properties. The seeds' anti-secretory properties and effects on mucosal glycoproteins are what give them their cytoprotective properties. Fenugreek seeds also inhibit ethanol's ability to increase lipid peroxidation. Additionally, it increases the gastric mucosa's antioxidant potential, which can lessen mucosal injury. Numerous studies have shown that soluble gel fraction from the seeds was superior to omeprazole at preventing lesion formation. (Mahmood et al., 2005, Meghwal et al., 2012)

Conclusion:

This overview presents the various therapeutic uses of fenugreek. This review article described the main health-enhancing properties of fenugreek that may offer promising therapeutic applications. It is the main medicinal ingredient of fenugreek that has been proven in numerous studies. Its high fiber content, gum-like properties, and the compounds it contains make it a natural health-promoting herb. By studying these observations, it is recommended that fenugreek is safe and can be used in the daily diet.

Conflict of Interest: We would like to confirm that there are no known conflicts of interest related to this publication and that we have no material financial support that might affect the results of this work. The authors declare no conflicts of interest.

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