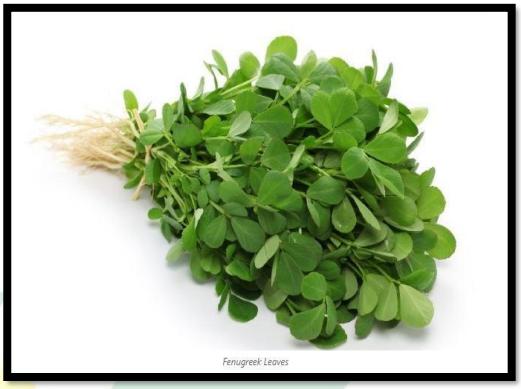
Trigonella foenum-graecum L

TAXONOMICCLASSIFICATION:[1]



- Kingdom:Plantae
- Division:Magnoliophyta
- Class:Magnoliopsida
- Order:Fabales
- Family:Fabaceae
- Genus :Trigonella
- Species:T.foenum graecum

INTRODUCTION:

Fenugreek (Trigonella foenum-graecum L.)is annual plant from Fabaceae family, whichis nativeto the Indiansubcontinent and theEasternMediterraneanregion.Fenugreek,isknown forpresenceofthedistinctivearomaticcompoundsthatgivesspecialflavourandcolour tothefood.Freshfenugreekleavesconsiderasaningredientinsome IndianCurries.Itisone ofthe most ancient medicinal herbs.

It provides naturalfoodfibreandothernutrients requiredinhumanbody.Trigonellafoenum-graecum(Fabaceae)commonly known as metha in local language Hindi.It is a well known herb in the Ayurvedic system of medicine. It is small annual herb found in different part of India. It have two fairly distinct types of plant are recognized : the dwarf type , grown for culinary purposes and the tall growing type, known as Metha in Punjab, grown for fodder use. The herb is nearly smooth erect annual, stipules root toothed, leaflets2-2.5cm.long ,toothed. Flowers, axillary, sessile.

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Corolla much exerted. Pod 5-7.5 cm. long with long persistent beak. Fenugreek seeds are about 4 - 6 mm. long, 2-3 mm wide and 2 mm thick. Seeds are hard, yellowish - brown, irregularly rhomboidal in outline and flattened. Nearly in the center of one of the long, narrow sides is a small depression in which both hilum and micropyle are situated.4The former appearing as a whitish point. This continues in the form of a furrow running diagonally across part of each of the adjoining sides. Thus dividing the radicle pocket from the reminder of seed in which are the two large cotyledons are surrounded by as horny, dark,trance lucent endosperm. The endosperm swells and yields mucilage to the surrounding liquid. The odour of fenugreek specially if powdered, is strong and spicy, the taste is disagreeable.[5

CHEMICAL COMPOSTITION:

Table 1 Chemical constituents of fenugreek.

S. no.	Chemical constituents of fenugreek
Alkaloids	Trimethylamine, Neurin, Trigonelline, Choline, Gentianine, Carpaine and Betain
Amino acids	Isoleucine, 4-Hydroxyisoleucine, Histidine, Leucine, lysine, L-tryptophan, Arginine
Saponins	Graecunins, fenugrin B, fenugreekine, trigofoenosides A–G
Steroidal sapinogens	Yamogenin, diosgenin, smilagenin, sarsasapogenin, tigogenin, neotigogenin, gitogenin, neogitogenin, yuccagenin, saponaretin
Flavonoids	Quercetin, rutin, vitexin, isovitexin
Fibers	Gum, neutral detergent fiber
Lipids	Triacylglycerols, diacylglycerols, monoacylglycerols, phosphatidylcholine phosphatidylethanolamine, phosphatidylinositol, free fatty acids. (Chatterjee et al., 2010)
Other	Coumarin, lipids, vitamins, minerals. 28% mucilage; 22% proteins; 5% of a stronger-swelling, bitter fixed oil.

Yadav et al. (2011), Sowmya and Rajyalakshmi (1999).

Fenugreek contains a number of chemical constituents includ-ing steroidal sapogenins.Diosgenin component has beenfound in the oily embryo of fenugreek. There are two furas-tanol glycosides, F-ring opened precursors of diosgenin thathave been reported in fenugreek also as hederagin glycosides.Alkaloids such as trigocoumarin, nicotinic acid, trimethyl cou-marin and trigonelline are present in stem. The mucilage is astanding out constituent of the seeds (Khare, 2004). There isabout 28% mucilage; a volatile oil; 2 alkaloids such as trigo-nelline and Choline, 5% of a stronger-smelling, bitter fixedoil, 22% proteins and a yellow coloring substance are presentin stem (Grieve, 1984). Fenugreek contains 23–26% protein,6–7% fat and 58% carbohydrates of which about 25% is diet-ary fiber (US Department of Agriculture, 2012). Fenugreek isalso a rich source of iron, containing 33 mg/100 g dry weight(US Department of Agriculture, 2001).[3]

Fenugreekseedisagoodsourceofcalcium,minerals,iron,β-caroteneandseveral vitamins like vitamins Aand D. It isrichsource ofavailablecarbohydratesanddietaryfiber. Itisasourceoffreeaminoacids;4-hydroxyisoleucine,lysine,histidineandarginine

(25.8%), protein (20-30%), moisture (11.76%), fat (6.53%), crude fibre (6.28%), ash content (3.26%) and energy (394.46 Kcal/100 g seed).9 It contains lecithin, choline, minerals, B. Complex,Phosphates,andPara-AminoBenzoicacid(PABA).Inaddition,themainchemical compounds in fenugreek are saponins, fenugreekine, trigonelline, coumarin,scopoletin, phytic acid and nicotinic acid.[4]

PROPERTIES:

Table 2 Nutraceutical properties of fenugreek.

S. no.	Component used	Beneficial effects
1	Seeds	Hypoglycemic effect (Roberts, 2011)
2	Seeds	Hypocholesterolemic effect (Zia et al., 2001; Srivastava et al., 2012)
3	Seed, leaves	Antioxidant (Bukhari et al., 2008; Bhatia et al., 2006; Naidu et al., 2010)
6	Seed	Lactation aid (Snehlata and Payal, 2012; Al-Shaikh et al., 1999)
9	Seed	Immunomodulatory effect (Meghwal and Goswami, 2012)
10	Seed	Digestive effect (Platel and Srinivasan, 2000)
11	Seeds and leaves	Decreases blood pressure (Sowmya and Rajyalakshmi, 1999)
14	Seeds and leaves	Wounds and sore muscles treatment (Mathern et al., 2009)
15	Seeds, leaves	Anti-cancer agent (Sowmya and Rajyalakshmi, 1999; Mathern et al., 2009)
16	Seeds	Asthma, emphysema, pneumonia
17	Seeds leaves	Anti-ulcer agent
19	Seed	Induces growth and reproduction hormones (Blank, 1996)
20	Leaves and seeds	Gastro- and hepatoprotective (Blank, 1996)
21	Seed	For healthy heart (Blank, 1996)
23	Seed	Prevents constipation (Sowmya and Rajyalakshmi, 1999)
24	Seed, leaves	Digestive and appetizer (Sowmya and Rajyalakshmi, 1999)

THERAPEUTI CINDICATIONS:

Fenugreek(Methi) seed are indicated in following health conditions :

- Constipation
- Metabolic disorders
- Diabetes Mellitus
- Rheumatoid Arthritis
- Debility after delivery (characterized by vertigo, loss of appetite ,pain in hands and feet.
- Intestinal gas ,flatulence
- Abdominal heaviness after meal
- Constipation
- Metabolic disorders
- Diabetes Mellitus
- Rheumatoid Arthritis
- Debility after delivery (characterized by vertigo , loss of appetite ,pain in hands and feet,scalp.)
- Hair fall and whitening of hair.

SIDEEFFECTS[6]

Themostcommonsideeffectis loosestoolswhenitisusedforthefirsttime.Anexcessive consumption of fenugreek (Methi) can cause a few unpleasant side effects

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- Unusual sweating (common)
- Aheadache (only with higher dosage i.e. more than5 grams twice daily)
- Nervousness
- Fast heartbeat
- Shakiness
- Stomach upset

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ALLERGICREACTION:[6]

Some people may develop an allergic reaction to Fenugreek resulting in:-

- Skin rash
- Itching
- Swelling of the face, tongue, or the throat
- Dizziness

DOSAGE:
As mentioned AyurvedicPharmacology,2gm to6 gm of Bark powder is safe for consumption[8]

PRECAUTIONS&WARNINGS:[6][7]

Pregnancy: Fenugreek seeds can increase the risk of premature childbirth and miscarriage in the first and second trimester. It also has emmenagogue action, which likely to promote uterine bleeding. However, these effects only appear with a high dosage of fenugreek (i.e. more than 6 grams per day). The effect of fenugreek can be different in each individual, so its occasional use is also discouraged.

Lactation: Fenugreek seeds and leaves both are likely to be safe during lactation and likely to promote breast milk production. Fenugreek is **POSSIBLY SAFE** when taken by mouth to increase breast-milk flow in the short-term. Some research shows that taking 1725 mg of fenugreek three times daily for 21 days does not cause any side effects in infants.

Children: Fenugreek is **POSSIBLY UNSAFE** when taken by mouth in children. Some reports havelinked fenugreek teato loss of consciousness in children. An unusual body odor resembling maple syrup may also occur in children drinking fenugreek tea.

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- **Medications for diabetes (Antidiabetes drugs) interacts with FENUGREEK**

Fenugreek might decrease blood sugar. Diabetes medications are also used to lower blood sugar. Taking fenugreek along with diabetes medications might cause your blood sugar to go too low. Monitoryourbloodsugarclosely.Thedoseofyourdiabetesmedicationmightneedtobe changed.

- **Medications that slow blood clotting (Anticoagulant / Antiplatelet drugs) interactswith FENUGREEK**

Fenugreek might slow blood clotting. Taking fenugreek along with medications that also slow clotting might increase the chances of bruising and bleedingSome medications that slow blood clotting include aspirin, clopidogrel (Plavix), diclofenac (Voltaren, Cataflam, others), ibuprofen (Advil,Motrin,others),naproxen (Anaprox, Naprosyn, others), dalteparin (Fragmin), enoxaparin (Lovenox), heparin, warfarin (Coumadin), andothers.

Warfarin (Coumadin) interacts with FENUGREEK

Warfarin (Coumadin) is used to slow blood clotting. Fenugreek might also slow blood clotting .Taking fenugreek along with warfarin (Coumadin)might increase the chances of bruisingand bleeding. The dose of your warfarin (Coumadin) might need to be changed.

RESEARCH:

1. Eighteen healthy obese subjects participated in a single blind, randomized, crossover study of three test breakfasts, containing 0 g (control), 4 g or 8 g of isolated fenugreek fiber. Subjects recorded ratings of hunger, satiety, fullness and prospective food consumption usingvisual analogscales (VAS)every30 min for3.5 h. Postprandial blood glucose and insulin responses were measured. Energy intake from an ad libitum lunch buffet and for the remainder of the day was assessed. The 8 g dose of fenugreek fiber significantlyincreased mean ratings ofsatietyand fullness, and reduced ratings of hunger and prospective food consumption ($P < 0.05$). Palatability was significantly reduced with increasing doses of fenugreek fiber ($P < 0.05$). No differences were observed for area under the curve (AUC) for blood glucose among treatments. An increase in insulin AUC was found with 8 g fenugreek fiber. Energy intake at an ad libitum lunch buffet was significantly lower for 8 g than 4 g fenugreek fiber, but not significantly different from control, although there was a trend towards a lower intake ($p = 0.11$). No differenceswere observed for energy intake for the remainder of the day. Fenugreek fiber (8 g) significantlyincreased satietyand reduced energy intake at lunch, suggesting it mayhave short-term beneficial effects in obese subjects. Satiety results were not related to postprandial blood glucose.[2]

2. Trigonella foenum-graecum (fenugreek) seeds have been documented as a traditional plant treatment for diabetes. In the present study, the antidiabetic properties of a soluble dietary fibre (SDF) fraction of T. foenum-graecum were evaluated. Administration of SDF fraction (0 x 5 g/kg body weight) to normal, type 1 or type 2 diabetic rats significantly improved oral glucose tolerance. Total remaining unabsorbed sucrose in the gastrointestinal tract of non-diabetic and type 2 diabetic rats, following oral sucrose loading (2 x 5 g/kg body weight) was significantly increased by T. foenum-graecum (0 x 5 g/kg body weight). The SDF fraction suppressed the elevation of blood glucose after oral sucrose ingestion in both non-diabetic and type 2 diabetic rats. Intestinal disaccharidase activity and glucose absorption were decreased and gastrointestinal motility increased by the SDF fraction. Daily oral administration of SDF to type 2 diabetic rats for 28 d decreased serum glucose, increased liver glycogen content and enhanced total antioxidant status. Serum insulin and insulin secretion were not affectedby the SDF fraction. Glucose transport in 3T3-L1 adipocytes and insulin action were increasedby T.foenum-graecum.The presentfindingsindicatethattheSDF fractionof

   T. foenum-graecum seeds exerts antidiabetic effects mediated through inhibition of carbohydrate digestion and absorption, and enhancement of peripheral insulin action.[9]

3. Fenugreek seeds contain a good amount of non-starch polysaccharides (NSP) including mucilaginous fiber. The mucilaginous fiber content in it helps in easier bowel movement by increasing bulk formation.[6]According to Ayurveda, fenugreek gives strength to the intestinal

wall and increases its peristaltic movement.

4. Fenugreek seeds reduce sticky mucus content in the stool by increasing bile secretion from the liver into the intestine, which helps to improve fat metabolism and acts as a digestive for oily substances.

5. **Gastroesophageal Reflux Disease (GERD):** Fenugreek is an effective remedy for treating acid reflux and heartburn. Although fenugreek seeds have hot potency, but the high amount of mucilage in fenugreek seeds helps in relieving heartburn by coating the inner mucosal lining of the stomach and intestine. It soothes the irritated gastrointestinal tissues and provides relief from sour eructation, burning in the throat, pain in the abdomen,nausea, and vomitingcausedbythereflux oftheacidiccontents ofthestomach into the esophagus in the patients with GERD.[6]

6. Products derived from botanicals have a time-honored history of use in the treatment of metabolic diseases including type 2 diabetes. Trigonella foenum-graecum, commonly known as fenugreek, is an annual herbaceous plant that has been a staple of traditional herbal medicine in many cultures. \Diosgenin, 4-hydroxyisoleucine, and the fiber component of the plant are the most intensively studied bioactive constituents present in fenugreek. These compounds have been demonstrated to exert beneficial effects on several physiologic markers including glucose tolerance, inflammation, insulin action, liver function, blood lipids, and cardiovascular health. Although insights into the molecular mechanisms underlying the favorable effects of fenugreek have been gained, we still do not have definitive evidence establishing its role as a therapeutic agent in metabolicdisease. This reviewaims to summarize thecurrentlyavailable evidenceon the physiologic effects of the 3 best-characterized bioactive compounds of fenugreek, with particularemphasisonbiologicmechanismsofactionrelevantinthecontextofmetabolic syndrome.[10]

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7. Antioxidant activity of fenugreek; Antioxidants decrease cardiac disease, and increase immunity,thereforeneed thatsupplybybodyorsupportof externalresources.Fenugreek (Trigonella foenum-graecum) is an important spice; its dried seeds have wide application

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PATENTS

A solvent free process of obtaining an insoluble fiber rich fraction from *Trigonella Foenum-graceum*seeds is disclosed. The multifunctional fiber rich fraction (FRF) and highly purified FRF are useful as excipients for pharmaceutical dosage forms for various routes of administration. These excipients can be used as binder, disintegrant, filler, dispersing agent, coating agent, film forming agent, thickener and the like, forpreparation of variety of dosage forms. FRF and highly purified FRF can also be used ina controlled release, targeted release and other specialized delivery systems, as well as in food and cosmetics formulation.[12]

1. The present invention discloses compositions comprising fenugreek hydrocolloids comprising soluble and insoluble dietary fibers. The present invention further relates to theuseofthese compositionscomprisingfenugreekhydrocolloidsas healthcare, personal care, food, household care and industrial products.[13]
2. The present invention relates to a synergistic composition for the treatment of diabetes in a subject in need thereof, said composition-comprising Trigonelline of concentration ranging between 20 to 30%, amino acids of concentration ranging between 20 to 60%, and soluble fiber of concentration ranging between 10 to 60%, optionally along with pharmaceutically acceptable additives, a process thereof and also, a method of treating diabetes.[14]

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REFERENCES:

1. http://www.spicesmedicinalherbs.com/fenugreek-seeds-trigonella-foenum-graecum.html
2. Mathern,JocelynR.,etal."Effectoffenugreekfiberonsatiety,bloodglucoseandinsulin response and energy intake in obese subjects."*Phytotherapy research* 23.11 (2009):1543-1548
3. Wani, Sajad Ahmad, and Pradyuman Kumar. "Fenugreek: A review on its nutraceutical properties and utilization in various food products."*Journal of the Saudi Society of Agricultural Sciences* 17.2 (2018): 97-106.
4. Hilles, Ayah & Mahmood, Syed. (2018). A review on phytochemistry and pharmacological effects of Trigonella foenum-graecum.
5. Gupta, Shyam, Piyush Gupta, and Surendra Patsariya. "Phytochemical and Pharmacological review on Fenugreek (Trigonella foenum-graecum)."*Current Research in Pharmaceutical Sciences* (2012): 11-13.
6. https://www.ayurtimes.com/fenugreek-methi-trigonella-foenum-graecum/
7. https://www.webmd.com/vitamins/ai/ingredientmono-733/fenugreek
8. Gogte, Vishnu Mahadev.*Ayurvedic pharmacology and therapeutic uses of medicinal plants*. Dravyaganvigyan), I Edn. Mumbai: Bhartiya Vidya Bhavan, 2000.
9. Hannan, J. M. A., et al. "Soluble dietary fibre fraction of Trigonella foenum-graecum (fenugreek) seed improves glucose homeostasis in animal models of type 1 and type 2 diabetes by delaying carbohydrate digestion and absorption, and enhancing insulin action."*British Journal of Nutrition* 97.3 (2007): 514-521.
10. Fuller, Scott, and Jacqueline M. Stephens. "Diosgenin, 4-hydroxyisoleucine, and fiber fromfenugreek:mechanismsofactionsandpotentialeffectsonmetabolicsyndrome."*Advances in Nutrition* 6.2 (2015): 189-197.
11. Akbari, M., H. Rasouli, and T. Bahdor. "Physiological and pharmaceutical effect of fenugreek: a review."*IOSR Journal of Pharmacy (IOSRPHR)* 2.4 (2012): 49-53.
12. Pilgaonkar,PratibhaSudhir,etal."Compositionscomprisingfenugreekhydrocolloids." U.S.Patent ApplicationNo. 13/122,337.
13. Pilgaonkar, Pratibha S., et al. "Fiber rich fraction of Trigonella Foenum-graceum seeds and its use as a pharmaceutical excipient." U.S. Patent No. 9,295,643. 29 Mar. 2016.

Bhaskaran, Sunil, and Vishwaraman Mohan. "Synergistic composition for the treatment of diabetes mellitus." U.S. Patent No. 7,674,485. 9 Mar. 2010

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SINCE 1998