

# A Review on Multipotential Medicinal Plant: *Trigonella foenum-graecum* (Methi)

## Review Article

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### Abstract

Many of the traditional medicines that have been used for thousands of years in countries like India have their origins in plants. One of the oldest medical systems in the world, Ayurveda, offers leads for several substances with therapeutic potential. All around the world, medicinal plants are a source of significant economic value. The use of therapeutic plants for healing is as old as humanity itself. Combining traditional and modern understanding results are improved in active ingredient sources for illness therapy with fewer side effects. *Trigonella foenum-graecum*, a member of the Fabaceae family, has emerged as one of the most attractive plants with numerous medicinal qualities. *Trigonella foenum-graecum*, often known as "methi," is well-known for its extensive use in the treatment of many ailments in the classical Ayurvedic literature. Due to their expanding usage as a source of raw materials in agronomy production, the pharmaceutical sector, and daily life, spices and medicinal plants have assumed a significant role. This is use as anti-diabetic, antioxidant, anti-inflammatory, hepatoprotective, antimicrobial and various kind of disease. Researchers have worked to confirm the effectiveness of the plant through scientific biological screening in response to numerous claims that it may treat a variety of ailments. The aim of this review is to provide an overview about the main aspects related with pharmacology, photochemistry and pharmacological activities of *Trigonella foenum-graecum* (methi).

**Keywords:** Medicinal plant; Ayurveda; Methi; Traditional medical system; Fenugreek.

## Introduction

Ayurveda, Siddha, and Unani are three of India's traditional medical systems. The ancient Vedas and other writings contain references to medical systems. The Ayurvedic concept appeared and developed between 2500 and 500 BC in India [1]. India has a glorious tradition of health care system based on plants, which dates back to *Vedic Era*. The Rig Veda, the earliest known compendium of human knowledge and wisdom (c. 4500–2500 BC), mentions 100 medicinal plants utilized by the Aryans, while the Charak Samhita makes reference to approximately 340 drugs with botanical roots (1000 BC). Medicinal plants have been used for thousands of years as a traditional medicine in various parts of the world to cure a wide range of human illnesses. Medicinal plants are sources of important

therapeutic aid for alleviating human ailments. It has been in use as a food and flavorings since time immemorial. *Trigonella foenum-graecum* or Methi (fenugreek) is one of the oldest traditional medicinal plants belonging to the Fabaceae family. Methi is used in many forms, such as herb (dried leaves), fresh leaves (vegetables), and spice (seeds) [2]. It is native to the area from the Eastern Mediterranean to Central Asia and Ethiopia, and much cultivated in India and China [3]. Spices are organic food additives that have been used for countless years to improve the sensory appeal of food. Foods are given their distinctive flavor, aroma, and colour by spices. The texture of food can also be changed by some spices, including fenugreek. Leguminous fenugreek (*Trigonella foenum-graecum*) is grown in India and North African nations.

## Description and Distribution of plant

Fenugreek, also known as *Trigonella foenum-graecum* L., is a significant medicinal crop grown primarily in Punjab, Himachal Pradesh, Bihar, and Kashmir in North India. It is grown as a cold-season crop in India. The plant is an annual herb that grows 1-2 feet long and has leaves, blooms, and long, narrow sickle-shaped pods that hold the seed. When the pods reach the ripe stage, the seed are extracted by thrashing.

The leaves of fenugreek are yellowish green, petiolate, ovate, and deeply divided into five or occasionally seven segments, each with a coarsely crenate edge and an obtuse apex. Both surfaces are downy, with the midrib standing out on the lower surface. The flowers are either white or yellowish white in colour, and the leaflets are 2.0 to 2.5 cm long, oblanceolate, and obscurely dentate. The seed is compressed, rhombic-shaped, deep yellow in colour, truncate at both ends, and measures 3.0-7.0 mm in length, 2.8-4.0 mm in breadth, and 2.2-2.5 mm in thickness. The testa is smooth, bitter, spicy, pleasant, and hard to break.

## Phytochemical constituents [4]

<b>Alkaloids</b>	trimethylamine, neurin, trigonelline, choline, gentianine, carpaine betain
<b>Amino acids</b>	isoleucine, 4-hydroxyisoleucine, histidine, leucine, lysine, L-tryptophan, argentine
<b>Saponins</b>	graecunins, fenugrin B, fenugreekine, trigofenosides A-G
<b>Steroidal sapinogens</b>	yamogenin, diosgenin, smilagenin, sarsasapogenin, tigogenin, neotigogenin, gitogenin, yuccagenin, saponaretin
<b>Flavonoids</b>	quercetin, rutin, vitexin, isovitexin
<b>Fibres</b>	gum, neutral detergent fibre
<b>Lipids</b>	triacylglycerols, diacylglycerols, monoacylglycerols, phosphatidylcholine, phosphatidylethanoamine, free fatty acids
<b>Others</b>	coumarin, lipids, vitamins, minerals. 28% mucilage; 22% proteins; 5% of a stronger-swelling, bitter fixed oil

## Pharmacological activities

### Antidiabetic activity

*Trigonella foenum-graecum* (fenugreek) seeds have previously been shown to have hypoglycemic and hypocholesterolemic effects on type 1 and type 2 diabetes mellitus patients and experimental diabetic animals [5].

Administrations of the ethanolic extract of *Trigonella foenum-graecum* seed powder decreased blood glucose, serum cholesterol, serum glutamate oxaloacetate transaminase (SGOT) and serum glutamate pyruvate transaminase (SGPT) levels [6].

The aqueous extract of *Trigonella foenum-graecum* leaves given both orally and intraperitoneally possesses a hypoglycaemic effect in normoglycaemic and alloxan induced hyperglycaemic rats [7].

A rat animal model was recently used to compare the pharmacokinetics of metformin, a first-line anti-diabetic drug, with and without the concomitant administration of fenugreek extract.

According to the findings, taking fenugreek and metformin at the same time boosted the metformin bioavailability and reduced the drug distribution volume by 70% [8].

### Anti oxidant activity

An aqueous fraction of fenugreek exhibits the highest antioxidant activity compared to other fractions and the quantity of phenolic and flavonoid compounds are related to antioxidant activity. Studies have revealed significant antioxidant activity in germinated fenugreek seeds which may be due to the presence of flavonoids and polyphenols. Furthermore, mustard and fenugreek seeds showed hypoglycemic and antihyperglycemic activity in diabetic mice and this may be due to the presence of antioxidant carotenoids in those spices [9].

Fenugreek has powerful antioxidant property that has beneficial effect on liver and pancreas; since antioxidant properties have been linked to health benefits of natural products; such properties are studied with germinated fenugreek seeds which are observed to be more beneficial than dried seeds because of the fact that germinated seed increases the bioavailability of different constituents of fenugreek [10].

A freeze-dried extract of fenugreek was reported to be antioxidant in a carotene and linoleic acid emulsion, with an activity comparable to standard commercial antioxidants. The fenugreek extracts (methanol, ethanol, dichloromethane, acetone, hexane and ethyl acetate) act as potent source of antioxidants [11]. Flavonoids of fenugreek extract have been observed to possess anti-oxidant activity [12]. Fenugreek seeds have been reported to raise the antioxidant levels and lower the lipid peroxidation in liver of ethanol intoxicated and diabetic rats [13].

Chemopreventive active *Trigonella foenum-graecum* (Fenugreek) seeds showed potential protective effect against 7, 12-dimethylbenz (a) anthracene (DMBA)-induced breast cancer in rats at 200 mg/kg body wt. [14].

### Anti-cancer activity

The *Trigonella foenum-graecum* (fenugreek) seed powder in the diet due to the presence of fiber, flavonoids and saponins decreased the activity of  $\beta$ -glucuronidase significantly and prevented the free carcinogens from acting on colonocytes whereas mucinase helped in hydrolysing the protective mucin. Intra-peritoneal administration of the alcohol seed extract before and after inoculation of Ehrlich ascites carcinoma cell in mice prevented tumor cell growth and this treatment enhanced peritoneal exudates and macrophage cell counts [15].

Aqueous extract of *Trigonella foenum-graecum* is a promising protective medicinal herb for complementary therapy in cancer patients under chemotherapeutic interventions because fenugreek extract shows a protective effect by modifying the cyclophosphamide induced apoptosis and free radical-mediated lipid peroxidation in the urinary bladder of mice [16]. Apoptosis is a type of cell death, and agents with the ability to induce apoptosis in tumors have the potential to be used for antitumor therapy. Flavonoids produce several biological effects, and the apoptosis inducing activities of

flavonoids have been identified in several previous studies [17]. Flavonoids and catechins were first shown to be apoptotic in human carcinoma cells [18].

The preventive effectiveness of fenugreek seed and its major constituent, diosgenin, on azoxymethane- induced rat colon carcinogenesis during initiation and promotion stages was investigated. Dietary FSP at 1% and diosgenin at 0.1% fed only during the promotional stage also inhibited total ACF up to 33%. Additionally, diosgenin induced apoptosis in HT-29 cells at least in part by inhibition of bcl-2 and via induction of caspase-3 protein expression [19].

#### Anti-inflammatory and analgesic activity

The anti-inflammatory activity was exhibited by all three (ether, alcohol and aqueous) extracts but the ether extract was the most potent and comparable to sodium salicylate. The methanolic extract obtained from *Trigonella foenum-graecum* seeds produced marked acute anti inflammatory activity in rats [20].

*Trigonella foenum-graecum* inflammation have been proposed as the critical process of initiation of the symptoms of metabolic syndrome and the pro-inflammatory state of obesity and metabolic syndrome is probably initiated by an excessive caloric intake in a high carbohydrate diet [21].

Fenugreek seed extract exhibit anti-inflammatory and analgesic activities due to presence of glycoside and steroidal compound saponins. Moreover fenugreek seed powder reported to reduce the severity of dysmenorrhea and this effect is attributed to the presence of phytosterols alkaloids, glycosides and phenols [22].

#### Neuropharmacological activity

The *Trigonella foenum-graecum* seeds of total alcoholic extract, total aqueous extract, total alkaloidal extract, petroleum ether extract, total glycosidal extract, fenugreek oil, diosgenin and trigonelline were assessed for their neuropharmacological activity. All the extracts and active principles except total aqueous extract showed significant central nervous system (CNS) stimulant activity, while total aqueous extract alone showed significant CNS depressant activity [23].

It has also been reported that trigonella (100mg/kg) plays an important role in reducing the incidence of Parkinson disease by preventing the rotational behavior and by restoring SNC (substantia nigra compact) neuron and MDA (malondialdehyde) levels [25].

#### Anthelmintic activity

The alcoholic extracts of seeds of *Trigonella foenum-graecum* has shown a potent anthelmintic activity, which was compared with albendazole as reference drug [25]. Seeds of *Trigonella foenum graecum* Linn. Showed mark and potent anthelmintic activity [26].

#### Cardio protective activity

The cardioprotective effect of a combination of fenugreek seeds and garlic was assessed in hypercholesterolemic rats administered isoproterenol. Myocardial infarction was induced with isoproterenol injection. Moreover, increased circulatory troponin, changed

activities of cardiac ATases, increased serum iron and decreased ceruloplasmin established myocardial infarction. Elevated lipid peroxides accompanied with reduced antioxidant molecules caused by isoproterenol and change activities of antioxidant enzymes in serum and heart in induced myocardial necrosis were countered by dietary fenugreek, garlic and fenugreek plus garlic [27].

#### Antilipidemic activity

Fenugreek seeds have been shown to exhibit hypocholesterolemic effects, lowered serum cholesterol, triglyceride and low-density lipoprotein in hypercholesterolemia suffering patients and experimental models [28].

In high fat diet-induced obese rats, fenugreek seed extract inhibits fat formation and improves dyslipidemia. This investigation showed that fenugreek seeds were what caused the hypolipidemic effects [29].

#### Immunomodulatory activity

The effect of fenugreek is scanty but stimulatory immunomodulatory effect has been shown (as evidenced from body weight, relative thymus weight, cellularity of lymphoid organs, delayed type of hypersensitivity response, plaque forming cell assay, haemagglutination titre, quantitative haemolysis assay, phagocytosis, lymph proliferation and a significant increase in phagocytic index and phagocytic capacity of macrophages) of aqueous extract of fenugreek at three doses 50, 100 and 200 mg per kg of body weight for 10 days on the immune system of Swiss albino mice [30].

#### Antimicrobial activity

Recently, Sudan and his colleagues explored the antifungal activity of fenugreek seed extracts against *Microsporum gypseum*. The reported results depicted that the ethanolic extract of fenugreek seeds at 100 µmL concentration developed highest inhibitory zone (16.5 mm exhibiting 38.4% inhibition [31].

#### Gastroprotective activity

The aqueous extract and a gel fraction isolate from the seeds showed significant ulcer protective effects [32].

#### Hepatoprotective and nephroprotective activity

The protective effect of aqueous extract of germinated fenugreek seeds against Cypermethrin induced hepatic and renal toxicity [33]. Extract of dried seed of *Trigonella foenum-graecum* on an animal model exhibits hepatoprotective activity revealed the presence of flavonoids [34].

#### Wound healing activity

The aqueous suspension and extract of the seed of *Trigonella foenum -graecum* was investigated for wound healing properties in excision, incision and dead space wound models in rats. Results indicate that the suspension and extract promoted significant wound healing activity [35].

#### Antifertility activity

The *Trigonella foenum-graecum* seeds extract exerts antiestrogenic

and anti fertility activity in female rats [37]. Fenugreek oil has stimulating effect on the ovarian activity of mice. Administration of fenugreek oil showed that the total number and quality of cumulus-oocyte complexes increased and the oil stimulated the oocytes to progress in meiosis, but the levels of nucleic acid contents were unaffected [36].

A randomized clinical trial on efficacy of hydroalcoholic extract of fenugreek on PCOS patients showed significant decreased in polycystic appearing ovaries on ultrasound and regularization of menstrual cycle due to presence of furostanolic saponins [37].

### Anti-cataract activity

The anti-cataract potential of *Trigonella foenum-graecum* L seeds [fenugreek] in selenite-induced in vitro and in vivo cataract was evaluated. In vitro enucleated rat lenses were maintained in organ culture containing Dulbecco's modified Eagles medium [DMEM] alone or in addition with 100 µM selenite and served as standard and control groups, respectively. For the test group, the medium was supplemented with selenite and *Trigonella foenum-graecum* aqueous extract. The lenses were incubated for 24 h at 37°C. After incubation, the lenses were processed for the estimation of reduced glutathione [GSH], lipid peroxidation product [malondialdehyde], and the antioxidant enzymes. A fall in GSH and a rise in malondialdehyde levels were seen in control as compared to standard lenses [38]

### Haemopoietic study

This clinical trial proved that the fenugreek seeds rich in proteins with essential amino acids, iron and ascorbate. Folate content has restorative and nutritive properties. Thus, it was evidenced for haemopoietic activity of fenugreek seed [39].

### Conclusion

*Trigonella foenum-graecum* is a significant medicinal herb, as is seen from this review. It contains a number of phytoconstituents, which are the main components of this plant's medicinal usefulness. Various ailments can be treated with this plant's leaves and seeds, for example. The key *Trigonella foenum-graecum* pharmacological studies, phytochemical research, and identified principles from these studies are summarized in the current review. A thorough review of the literature on *Trigonella foenum-graecum* revealed that it is a well-liked treatment for a number of diseases among different ethnic groups, Vaidyas, Hakims, and Ayurvedic practitioners. For the creation of items for better commercial and therapeutic use, a comprehensive research and development effort should be made.

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