



TRADITIONAL HERBAL MEDICINAL PLANT TRIGONELLA FOENUM-GRAECUM; PHARMACOLOGICAL SIGNIFICANCE: A REVIEW

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Abstract

Fenugreek is the traditional herbal medicinal plant which is most widely used in many pharmaceutical medicinal preparation as well as food supplements. Herbal preparation and plants play an important role for human health. Fenugreek plant, seeds and its leaf contain a wide variety of flavonoids like Quercetin, rutin, vetexin, saponins like gracunculins, fenugrin B, fenugreekine, amino acids like isoleucine, 4-hydroxyisoleucine, histidine, leucine, lysine, Alkaloid like trigonellin, Fenugreek also contain mucilage. Fenugreek variety *Trigonella foenum-graecum* show many pharmacological and therapeutic action like anti-inflammatory, stomachic, Diuretic, Carminative, Anaesthetic, Stimulant, Anti-diabetic Analgesic, Nephroprotective, Neuroprotective, Hair Tonic, Expectorant, Demulcent, Blood purifier, General body tonic, Aphrodisiac, Anti-bacterial, Anti-oxidant, Anti-fungal, Anti-hyperlipidemic, anti-cancerous activity.

Keywords: *Trigonella foenum-graecum*, Medicinal use, Alkaloid

INTRODUCTION

Trigonella foenum-graecum belongs to family Leguminaceae⁵. It is also known as Fenugreek. The Indian traditional name of fenugreek is Methi and in Arabic it is known as Hulbah. The name of *Foenum-graecum* derived from Greek word meaning is hay and the name of genus *Trigonella* is derived from the Greek name meaning Three angled from the form of its corolla. It is 30-55 cm in length, annual herb, cultivated throughout in India. Its leaflets is 2-2.5 cm long, oblong, toothed, flowers 1-2, axillary, calyx teeth linear.

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Fabales

Family: Fabaceae

Genus: Trigonella

Species: Trigonella Foenum-graecum



Morphology: *Trigonella foenum-graecum*

Appearance: It is solid rhomboidal seeds 3 to 6 mm long hard pebble like

Order: Characteristic spicy

Colour: Light brown- Yellowish brown

Test: Bitter and mucilaginous

Chemical constituent:

Alkaloids: *Trigonella foenum-graecum* contain many alkaloids trimethylamine, neurin, trigonelline, choline, gentianine, betain and carpaine

Amino Acid: It contains isoleucine, leucine, histidine, lysine, valine, 4-Hydroxy isoleucine, tryptophan, yamogenin, argenins, tyrosine, cystine, threonin, diosgenin, smilagenin, sarsasapogenin, tigogenin and gitogenin.

Steroidal saponin: Neogitogenin, yuccagenin and saponaretin.

Fibers: Gum, neutral detergent and fibers

Flavonoids: Quercetin, rutin, isovetixin and vrtixin.

Saponins: Graecunins, fenugreekine, trigofenosides and fenugrin B

Others: Vitamins, coumarin, lipids, minerals 28 %, Mucilage 22 %, proteins, bitter fixed oil, 5 % stronger swelling.

Pharmacological and therapeutic activity

As fenugreek is widely used as herbal medicines of many disease in past many decades. Now it's very important to know that what kind of pharmacological and therapeutical activity it has.

Antioxidant Activity

The alcoholic extract of fenugreek seeds give antioxidant activity due to the presence of the polyphenolic compounds in it. This activity is analysed by using the free radical scavenging and the ferric reducing antioxidant power method.²¹

Urotoxicity Activity

Cyclophosphamide is generally used as anticancer drug which produce some toxic metabolites like cyclophosphamide mustard and acrolein. In the study modulation of toxicity caused by concomitant exposure to cyclophosphamide and L-buthionine-SR-sulfoximine by fenugreek extract was evaluated by measuring lipid peroxidation and anti-oxidant in urinary bladder in mice. Fenugreek is common dietary and medicinal herb which show protective effect not only on LOP but also on the enzymatic anti-oxidants. Cyclophosphamide treated animals exhibited a significant decrease in the activity of glutathione S-transferase, glutathione reductase, glutathione peroxidase and catalase when compared to the controls. Pre treatment of herbal drug extract restored activities of all the enzymes and thus showed an overall protective effect on additive effect of cyclophosphamide and L-buthionine-SR-sulfoximine. Restoration of GSH by extract treatment may play an important role in reversing cyclophosphamide induced apoptosis and free radical mediated LPO in urinary bladder.

Immunomodulatory Effect

Fenugreek seed extract has demonstrated immunomodulatory effect in mice. Number of herbal extracts and their isolated constituents have also shown protective effects against cyclophosphamide induced urotoxicity. Thiols containing compound such as mesna and cysteine have shown protective effects against cyclophosphamide induced urotoxicity. These include its anti-inflammatory, antipyretic, hypoglycemic and immunomodulatory activities. Modulatory effect of *Trigonella foenum-graecum* extract on deltamethrin-induced low dose immunosuppression in mice has shown to possess several pharmacological properties. In clinical studies, it has shown hypoglycemic and anti-

diabetic properties. Immunomodulatory effect of fenugreek extract has also been demonstrated in mice. Modulatory effect of fenugreek seed extract on the immunotoxic effects of deltamethrin in mice. Swiss albino male mice were treated per os with the aqueous extract (100 mg/kg, body weight daily for 15 days). Deltamethrin was given orally in a single dose of 18 mg/kg body weight in corn oil. Body weight, relative organ weight, lymphoid organ cellularity, hemagglutination titre, plaque forming cell assay and quantitative hemolysis of SRBC (QHS) assay were studied in the treated animals. Deltamethrin showed significant suppressive effect on lymphoid organ weight and cellularity and humoral immune functions. Plant extract itself produced no immunotoxicity at the above dose whereas it resulted in restoration of humeral responses in deltamethrin-treated animals as shown by a significant ($p < 0.01$) increase in PFC response as well as QHS in deltamethrin-treated animals. The results show that exposure to deltamethrin causes immunosuppression in mice and fenugreek extract has modulatory effects on these parameters. The antioxidant property of fenugreek seeds somewhat contributing to modulatory property resulting in its protective effect in immunosuppressed mice.

Chemopreventive Activity

Cancer is the most leading cause of death in the world. Conventional therapies cause serious side effects and they increase the patient life only for few years. Cancer control may therefore benefit from the potential that resides in alternative therapies. There is thus an inherent demand to utilize other and alternative concepts or approaches to the prevention of cancer. It showed potential protective effect of Fenugreek seeds against 7, 12-dimethylbenz anthracene (DMBA)-induced breast cancer in rats at 200 mg/kg body weight. Fenugreek seeds extract significantly inhibited the DMBA-induced mammary hyperplasia and decreased its incidence. Epidemiological studies also implicate apoptosis as a mechanism that might mediate the Fenugreek's anti breast cancer protective effects.

Anticancer Activity

Apoptosis is a type of programmed cell death and agents with the ability to induce apoptosis in tumors have the potential to be used for antitumor therapy. Flavonoids produce many biological effects and the apoptosis inducing activities of flavonoids have been identified in several previous studies. Flavonoids and catechins were first shown to be apoptotic in human carcinoma cells. Similar observations have since been extended to lung tumor cell lines colon cancer cells, breast cancer cells, prostate cancer cells stomach cancer cells brain tumor cells, head and neck squamous carcinoma and cervical cancer cells quercetin, rutin, and other food flavonoids have been shown to inhibit carcinogenesis in animal models. They all induce apoptosis in tumor cells. It appears that these flavonoids

can also differentially induce apoptosis in cancer cells, but not in their normal counterparts. The ultrastructure of mammary acini from protected rats showed dying cells with large numbers of cytoplasmic vacuoles; some of these vacuoles appear autophagic. Recently, alternative cell death processes have been recognized in epithelial cells, including autophagy and para-apoptosis. These pathways can be activated in parallel with apoptosis, and significant crosstalk between apoptotic and alternative death pathways may exist. Thus, herbal induced autophagic cell death may also contribute to the cell death and hence inhibiting the DMBA-induced tumour progression. *T. foenum-graecum* has also been shown to have stimulatory effects on macrophages. Phagocytosis and killing of invading microorganisms by macrophages constitute body's primary line of defense against infections. The present study establishes that *T. foenum-graecum* has appreciable anti-cancer activity. It is not possible to identify the most effective anticancer constituent of *T. foenum-graecum* at this point. However, based on the published studies, flavonoids seem to be most likely candidates eliciting anti-tumorigenic effect.

Antidiabetic Activity

Vanadate treatment to diabetic rats has been reported to correct the altered carbohydrate metabolism and antioxidant status. However, vanadate exerts these effects at relatively high doses and several toxic effects are produced. Low doses of vanadate in combination with *Trigonella foenum-graecum* seed powder (TSP) effect on the enzyme changes in diabetic rats. Alloxan-diabetic rats were treated separately with insulin, vanadate (0.6 mg/ml), TSP and a combined dose of Vanadate (0.2 mg/ml) and TSP for 21 days. At the end of the experimental period, blood glucose levels and activities of pyruvate kinase (PK), phosphoenolpyruvate carboxykinase (PEPCK), glutathione peroxidase (GPx), glutathione reductase (GR), superoxide dismutase (SOD) and catalase (CAT) were measured in cytosolic fraction in the liver and kidney. Blood glucose levels increased markedly in diabetic rats. Treatment with antidiabetic compounds resulted in the reduction of glucose levels. Rats treated with combined dose of vanadate and *Trigonella* had glucose levels comparable to control ones. Similar results were obtained with the activities of PK, PEPCK, SOD, GPx, GR, and CAT in liver and kidney of diabetic rats. Combined dose of vanadate and *Trigonella* was found to be most effective in correcting these alterations. ⁴² Fenugreek has primarily been described as an antihyperglycemic herb in humans as well as in laboratory animals. ^{43, 44} Its cholesterol-reducing effect is also well established. ⁴⁵ In the present study, fenugreek showed an overall stimulatory effect on the specific as well as nonspecific immune functions in mice. Stimulatory effects were observed at 100 mg/kg body

weight dose and in some cases at 250 mg/kg. Though there was an increase in liver weight,

Gastroprotective Effect

The effect of fenugreek seeds (*Trigonella foenum-graecum*) compared to omeprazole was studied on ethanol-induced gastric ulcer. The aqueous extract and a gel fraction isolated from the seeds showed significant ulcer protective effects. The cytoprotective effect of the seeds seemed to be not only due to the anti-secretory action but also to the effects on mucosal glycoproteins. The fenugreek seeds also prevented the rise in lipid peroxidation induced by ethanol presumably by enhancing antioxidant potential of the gastric mucosa thereby lowering mucosal injury. Studies revealed that the soluble gel fraction derived from the seeds was more effective than omeprazole in preventing lesion formation. These observations show that fenugreek seeds possess antiulcer potential.

Anti-inflammatory and Antipyretic Effect

Anti-inflammatory and antipyretic effects of the *Trigonella foenum-graecum* (TFG) leaves extract, an Iranian medicinal plant, were examined. For anti-inflammatory activity, the formalin-induced edema model was used. Hyperthermia was induced by intraperitoneal injection of 20% (w/v) aqueous suspension of brewer's yeast. Sodium salicylate (SS) was used as a positive control. Both TFG and SS significantly reduced formalin-induced edema in single dose (TFG 1000 and 2000 mg/kg, SS 300 mg/kg) and chronic administration (TFG 1000 mg/kg and SS 300 mg/kg). TFG and SS also significantly reduced hyperthermia induced by brewer's yeast in 1 and 2 h after their administration. Phytochemical studies indicate that alkaloids, cardiac glycosides, and phenols are the major component in the extract. Although existence of three anti-inflammatory, analgesic and antipyretic effects in this extract suggest a NSAID-like mechanism for it, but the presence of alkaloids, the absence of other effective compounds such as flavonoids, saponins, steroids, etc., and also its analgesic effect on tail-flick test that usually is not produced by NSAIDs, suggest another mechanism for the extract. So the possibility of alkaloids as effective compounds, in this extracts increases.

Antibacterial activity

The seed extracts of fenugreek is show antimicrobial activity against salmonella typhi, E. Coli and *Staphylococcus aureus*.

Analgesic activity

Analgesic activity of fenugreek seeds show in rat by using tail flick method in comparison to diclofenic potassium.

In this method the extracted fenugreek seeds were administered 1 hours prior to pain induction in dose range of 50, 100 and 200 mg per kg in orally.

Hypoglycemic activity

The hypoglycemic effect was detected by fenugreek seeds in alloxan induce diabetic rabbit. The hypoglycemic activity of isolated trigonelline was compared with standard trigonelline, ethanol extract and insulin. Isolated trigonelline at a dose of 10mg/12 hrs show hypoglycemic effect in diabetic rabbits.

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