A Review on Pharmacognostical and Pharmacological Activities of *Trigonella Foenum-Graecium*


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**ABSTRACT**

Fenugreek (*Trigonella foenum-graecum*) is a medicinal plant with potential applications in the medicinal purposes. Fenugreek has been used in food as a flavouring agent since ancient times in many countries like Greece, Rome and Egypt. It has a special place in the traditional medical system. The seeds are rich sources of lipids, protein, mucilage, calcium, dietary fiber B vitamins, Iron, protease inhibitors and several steroid saponins, tiny amounts of alkaloid, furostanol glycosides and steroidal peptide. It has the ability to act as anti obesity, antibacterial, anti-ulcer, anti-cancer, anthelmintic (agonistic effect against parasitic worms), and antinociceptive (pain-reducing) properties. In recent years, laboratory studies and clinical trials have focused on the potential activity of fenugreek as a natural medicine. The aim of the present review is to provide detailed information about pharmacognostical and pharmacological activities of fenugreek.

**Keywords:** Fenugreek, pharmacognostical and pharmacological activities, hypolipidemic

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**1. Introduction**

Fenugreek (*Trigonella foenum-graecum L.*) is an annual plant from Fabaceae family, which is native to the Indian subcontinent and the Eastern Mediterranean region1. Fenugreek, is known for the presence of distinctive aromatic compounds that gives special a flavour and colour to the food2. Fresh fenugreek leaves are considered as an ingredient in some Indian Curry3. It is one of the most ancient medicinal herbs. It provides natural food fibre and other nutrients required in human body4. Fenugreek is one of the oldest known medicinal plants
which has been documented in ancient herbal history. Seeds of the fenugreek have been used as a holy smoke that Egyptians consumed in their embalming rites during Pharaohs time. It has been used also to promote labour before delivery during Greek period. According to Chinese traditional medicine, fenugreek can be used to treat Lymphedema (oedema of the legs). Fenugreek seed is a good source of calcium, minerals, iron, β-carotene and several vitamins like A and D. It is rich source of available carbohydrates and dietary fiber. It is a source of free amino acids; 4-hydroxyisoleucine, lysine, histidine and arginine (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). It contains lecithin, choline, minerals, B. Complex, Phosphates, and Para-Amino Benzoic acid (PABA). Apart from main chemical compounds present in fenugreek, there are other constituents such as saponins, fenugreekine, trigonelline, coumarin, scopoletin, phytic acid and nicotinic acid. The significance of T. foenum-graecum seeds is due to the defatted part, with high quality fibre including steroidal saponins and protein comparable to those of soybean. The seeds also have the alkaloid trigonelline with mucilage, tannic acid, a yellow colour substance, fixed and volatile oils and a bitter extractive, diosgenin and gitogenin. A trace of trigogenin. The main bioactive compounds in fenugreek are Galactomannan, Diosgenin, 4-Hydroxyisoleucine.

### Pharmacognostical Activities:

Earlier workers have reported that seeds possess, antidiabetic and wound healing activities. Chauhan et al. 2010, Shah and Seth 2010. The key obstacles which has hindered the acceptance of the alternative medicines in the developing countries is the lack of documentation and stringent quality control. There is a need for documentation of research work carried out on traditional medicines, hence it becomes extremely important to make an effort towards standardization of the plant material to be used as medicine. Hence this work attempts to bring out the pharmacognostic features of leaves and stem of Trigonella foenum-graecum.

### 2. Materials and Methods

#### Microscopic Characters:

For microscopic studies, the leaves were cut and removed from the plant and fixed in FAA. After 24 hours of fixation, the epidermal peel and transverse sections of leaf were taken by free hand. The section were stained in safrain (1%) and mounted in glycerol.

#### Quantitative Microscopic:

The total number of stomata was calculated by stomatal index = No. of stomata X 100/ total no. of epidermal cells. The type of the stomata, vein islet and vein termination was recorded in the epidermal peeling. Quantitative microscopy was studied as per the procedure given by Wallis 1958 and Lala 1981. The total no of stomata in the epidermal peelings, vein islet no, vein termination no. were recorded. Trigonella foenum-graecum showed 39.82% of stomatal index, No of stomata-92, vein islet no 19-30/ sqmm, vein termination no 16-22/-sqmm. The stomata was observed to be anisocytic with 3 subsidiary cells surrounding the guard cell.

#### Organoleptic Characters and Anatomical Study:

**Organoleptic:**

Characterization of dried leaf powder was carried out. The texture, smell, colour and taste was observed. Free hand section of Leaves and Stems of Trigonella foenum-graecum were taken, stained with Safranin and mounted in glycerol and observed under light microscope and photographed at 40x. The study showed that Trigonella foenum-graecum dried leaves were dull green, brittle, aromatic, bitter, and astringent.

#### Maceration:

The stems of Trigonella foenum-graecum were cut into small piece, boiled in water and cooled. The cooled material was repeatedly boiled to expel air and repeated for 3-5 times until the pieces settled down. Treated pieces of the plants was soaked in jeffreys fluid (equal volume of 10% of nitric acid and 10 % chromic acid) for 24 hours at 30-40°C, decanted washed and then stored in 50% alcohol. Pieces of macerated stem was treated with aqueous safrainin overnight, dehydrated through alcohol series (50%,60%,70%,80%,90%,100%) for five minutes and passed through alcohol: xyrol (1:1 ration) series for five minutes. Then each material was macerated and observed. The macerated stem of the plant showed various structures. In Trigonella foenum-graecum xylem fibers, tracheids with scalariform thickening was commonly observed.

#### Histochemical Test:

The plant section treated with various reagent such as Wagner's reagent (Potassium iodide and Iodine) for detection of alkaloid, Toluidine blue 0 for lignin, Ferric chloride in IN Hydrochloric acid for Tannin, Sulphuric acid for detection of calcium oxalate Crystals and Methylene blue for phenols. The histochemical studies showed the presence, alkaloids, protein, starch, lignin, mucilage and phenol; tannin and lipids were absent.

#### Phytochemical Screening:

The leaves and stem were washed thoroughly, blotted dry and completely dried. The dried leaves were extracted with aqueous, petroleum ether and Dichloromethane. The
extracts were used for the following phytochemical tests. Chemical tests for various extracts were also carried out according to the standard procedures described by Harborne 1998; Kokate 1986.

The preliminary analysis of leaf and stem aqueous, petroleum ether and dichloromethane extract showed the presence of Alkaloids, flavonoids, tannin, saponin, resin and steroid was recorded. Alkaloids were present in all the three extract, while tannin was present only in dichloromethane extract. Summaya et al., 2012 reported that absence of phenol in the leaf and stem extracts. It was reported that phenol are abundantly present in seeds only. Aqueous extracts showed presence of saponins. Singh et al.,2010 Presence of high ascorbic acid and total phenol was reported by. Phenolic acids like caffic acid, ferulic acid, vanillic acid and flavonoid are responsible for the antioxidant activity. Protein and carbohydrate content was reported to increase in mature leaf and stem. In present study presence of protein and carbohydrates was not observed in aqueous extract

3. Powder Analysis
The dried leaves and stems were powderized and sieved to obtain coarse powder. The powder thus obtained was placed on to a clean slide and observed under microscope. Resins, Bradycerlide, Macrocisteride, Tracheids with scalariform thickening, calcium oxalate crystal, anisocytic stomata with subsidiary cells, epidermal cell were present. 

Fluorescence Analysis:
The dry powder was placed on a slide and treating with several drops of specified reagent like Hydrochloric acid, Sodium hydroxide, Nitric acid, Sulphuric acid, Ferric chloride, Iodine Acetic acid, HNO3+ Ammonia, Methanol, Sodium Hydroxide, Methanol. The slides were observed under UV 265 nm and 365 nm and the emitted fluorescence was observed that helps in identifying the drug in powdered sample. Fluorescence analysis has been carried out according to the method of Kokoshi et al.,1958. Under white light, leaf powder with Hydrochloric acid, sodium hydroxide, nitric acid, sulphuric acid, ferric chloride, Iodine,Acetic acid, HN03 , Ammonia, methanol,sodium hydroxide + Methanol showed brownish green, green, yellowish red, blackish brown, black, reddish brown respectively. Under UV light 265 nm it exhibited yellowish with NaOH, reddish with NaOH+Methanol. Fluorescence was observed in 365nm and it appeared bluish green with HNO3+ ammonia, and NaOH+ Methanol

Physical Parameters: Determination of total ash, acid Insoluble ash, water soluble ash and moisture content was done according to Indian Pharmacopoeia 1985; 1996; 1998; Kokate 1986.

Qualitative Analysis:
Analysis of physical parameters of leaf and stem powder, the moisture content was 5.3%, water insoluble ash 10.9%, acid insoluble ash 0.61% and total ash 22.77%. It was reported that analysis of seed powder revealed moisture content was 1.5% whereas acid insoluble ash was 0.44% and the soluble extract 35 %w/w.
omepazole was studied on ethanol-induced gastric ulcer. The aqueous extract and a gel fraction isolated from the seeds showed significant ulcer protective effects. 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. Histological 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.

**Antioxidant Activity**

CCart et al.,2001 studied the anti oxidant effect in comparative study of antioxidant potential for previously identified optimum levels along with fenugreek (FGK) were evaluated in raw and cooked patties manufactured from frozen pork. The FGK (0.01%) showed most effective antioxidant effect with significant reduction with third position in descending order on 9th day.35,36

**Fibrinogen and Fibrinolytic Activity**

Bordia A et al.,1997 studied the fibrinolytic activity in a placebo-controlled study the effect of ginger and fenugreek was examined on blood lipids, blood sugar, platelet aggregation, fibrinogen and fibrinolytic activity. Fenugreek in dose of 2.5 gm twice daily for 3 month administration did not affect platelet aggregation, fibrinolytic activity and fibrinogen.

**Antifungal Activity**

Montagner demonstrated that coumarin, a constituent of *T. foenum-graecum*, has antifungal activity.24 Again,Yang CR et al.,2006 proved another in-vivo study the antifungal activity of saponin35. Dharajaya D et al.,2016 showed that methanol extraction of *T. foenum-graecum* leaves powder had been shown to provide maximum antifungal activity against trichoderma viridae (ZOI = 14.5 ± 0.5mm) at the dose of 100 mg/ml. Again,Einour MEM et al.,2015 *T.foenum-graecum* seeds had been proved to possess the antifungal activity against *Aspergillus niger* (ZOI = 20 ± 0.88 mm) and *Candida albicans* (ZOI = 17 ± 0.57 mm) while treated with petroleum ether extract and here the concentration was 250 mg/ml. Again,Haouala proved that methanol extraction of not ground seeds of *T. foenum-graecum* showed the strongest antifungal inhibition (71.44%) at the dose of 3g/100 ml.

**Antibacterial Activity**

Priya et al., stated that *Trigonella foenum-graecum* have many essential phytochemicals such as Aziridine, 1, 2,3-trimethyl-, trans-, that may show antimicrobial activity.39 Again, some alkaloid components like jentianine and scopoletin are isolated from *T. foenum-graecum* seeds which have antibacterial activity. Patil S and Jain G demonstrated that scopoletin has bacteriostatic activity against *Escherichia coli*, *Staphylococcus aureus*, *Streptococcus sp.*, Klebsiella pneumoniae and *Pseudomonas aeruginosa*.40 However, *T.foenum-graecum* seeds have been shown to decrease the activity against E.coli (ZOI = 17 ± 0.33 mm) and *Staphylococcus aureus* (ZOI = 15 ± 0.57 mm) while treated with petroleum ether extract and here the concentration was 250 mg/ml. Again, at the dose of 100 mg/ml the aqueous extraction of *T. foenum-graecum* leaves showed antibacterial activity against *Serratia Marcescens* (ZOI = 12.33 ± 0.57 mm) and *Bacillus cereus* (ZOI = 11.50 ± 0.50 mm).

**Antalgic and Anti-Inflammatory Activities**

Vyas S et al.,2008 examined the Analgesic and anti-inflammatory effects in a partially purified fraction (MTH) of the *Trigonella foenum-graecum* seed extract. MTH at the dose of 40 mg/kg has shown significant analgesic activity (p<0.001) as compared to diclofenac sodium and pentazocine at the doses employed. In comparison to control, MTH at the employed doses

4. Conclusion

Natural products show a valuable and significant role in the health of the human being with or without marginally producing any undesirable effects likes side effects and adverse effects. They are usually the combination of the primary and secondary plant metabolites like alkaloids, flavonoids, glycosides, saponins etc.,and deliver the health protective and disease curing action. *T.foenum-graecum* is one of the natural gifts for us due to their phytochemical constituents which take part in different health related activities. It contains some significant alkaloids like trigonelline, gentianine; amino acids ; saponins like dioxygenin, fenugreekine; and flavonoids like quercetin, vitexin, luteolin, homoerietin, isovitexin, saponarin, vicenin-1 and vicenin-2. *T. foenum-graecum* is used for the treatment of diabetes, oxidative stress, cancer, ulcer, allergy, bacterial, viral infection, fungal, malaria and inflammation etc. It is also used as antioxidant,hypolipidemic agent, breast enlarging agent,immunomodulator, anti-fertility agent, anti-inflammatory, analgesic and antipyretic agent. Clinical application of fenugreek is useful for present in addition to future but because of loss of focusing on research and clinical trials, all actions are not reported for human complications. Research on these seeds is going to give an explanation of its use in different types of cancer and other diseases/disorders. The present review shows that the plant possesses a wide variety of uses in preventing and curing various diseases.

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