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A therapeutic approach of *trigonellafoenumgraceum* – a brief overview

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Abstract
Trigonellafoenumgraceum has a place in the fabaceae family fenugreek. It is composed of a variety of alkaloids, saponins, flavonoids, free fatty acids and lipids, vitamins, minerals mucilage and fibres. *Trigonellafoenumgraceum* have hepatoprotective activity, antioxidant activity, mast cell stabilizing activity, anticancer activity, antibacterial activity, cardioprotective effect and antigenotoxic activity. Traditional medicine in India and other parts of the globe has used *Trigonellafoenumgraceum*as carminative, lactation stimulant, laxative, antidiabetic effect, hypocholesterolemic influence, antioxidant potency, digestive stimulant action and hepatoprotective effect.

Keywords: fenugreek, antigenotoxic activity, laxative, antibacterial activity, hypocholesterolemic influence, hepatoprotective effect.

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Introduction

Medicinal plants constitute animportant natural wealth of a country. They play a significant role in providing primary health care services to the rural population. They serve as therapeutic agents as well as important raw materials for the manufacture of traditional medicines [1].*Trigonellafoenumgraceum* belongs to fabaceae with common names of fenugreek in English, methi in hindi and menthyasopu in kannada[2]. The health benefits and medicinal properties of herbal food products are known since antiquity. Fenugreek plant is an erect annual herb with trifoliate leaves reaching a height of 0.3–0.8 m. The plants bear white or yellow flowers, which give rise to long, slender, yellow to brown pods. At maturity the pods contain hard brown seeds of fenugreek, which is known and utilized for its medicinal use [3]. The plant is rich reservoir of different phytoconstituents attributed to their diverse pharmacological effects [4]. It has been used traditionallyfor numerous indications, such as aid in labor, lactation stimulant, and laxatives [5] . Modern research has also demonstrated that fenugreek seed and leaves are useful in the treatment of number of diseases in animal studies as well as human trials. They include antidiabetic effect, hypocholesterolemic influence, antioxidant potency, digestive stimulant action, and hepatoprotective effect [6].

Morphology

The name of this plant comes from the Greek word *trigonou* meaning triangle, because of the triangular shape of its leaflets. Greek word trigonou, means triangle. Due to its widespread use in ancient Greece, the word foenum-graecum literally translates to "Greek hay" or "Greek grass." The annual herbaceous fenugreek plant grows to a height of 50 cm. This plant only has one stem, which is frequently bent, glabrous, or covered in tomentums. Oval, serrated leaves with three tiny, obovate to oblong leaflets scattered from a central point. Flowers are either light yellow or light purple. 0.8 to 1.8 cm in diameter, and insects are responsible for pollination. Fruits are curved, 3- to 11-cm long pods with 5 to 20 angular, 4- to 6-mm long seeds inside. Seeds have bitter and aromatic taste and their colour varies from fawn yellow to brown [7].

Fig 1: ***Trigonellafoenumgraceum***

Phytochemical Constituents

Fenugreek is one of the most well investigated plants and studies have it to possess alkaloids like trimethylamine, neurin, trigonelline, choline, gentianine, and betaine; the amino acids isoleucine, 4-hydroxyisoleucine, histidine, lysine, l-tryptophan, arginine; saponins like graecunins, fenugrin b, fenugreekine, trigofoenosides a–g; the steroidal sapinogensyamogenin, diosgenin, smilagenin, tigogenin, neotigogenin, gitogenin, neogitogenin, yuccagenin, saponaretin; flavonoids like quercetin, rutin, vitexin, isovitexin; the lipids triacylglycerols, 33diacylglycerols, monoacylglycerols, ethanolamine, phosphatidylinositol, free fatty acids and lipids, vitamins, minerals. 28% mucilage; 22% proteins; 5% of strong smelling, bitter fixed oil. Reports suggest that fresh fenugreek leaves contain ascorbic acid (220.97 mg/100 g) and β-carotene (19 mg/100 g) and are a rich source of calcium, iron and zinc content [8]. The main ingredients of the seed contain steroidal saponins, alkaloids, mucilage, and fibers (50%) [9].

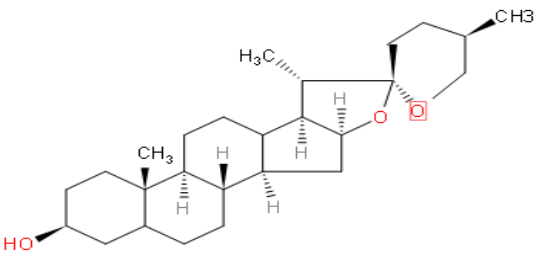

Fig 2: Disogenin

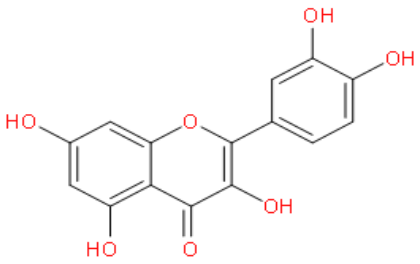

Fig 3: Vitexin

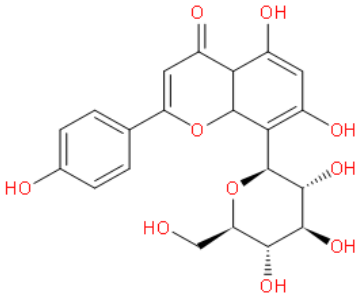

Fig 4: Quercetin

Ethno medical properties and uses

Fenugreek's therapeutic potential is enhanced by the presence of a variety of bioactive substances such as fibres, fatty acids, alkaloids, flavonoids, saponins, and flavonoids. Fenugreek possesses anti-biotic, antioxidant, and anti-carcinogen qualities in relation to its therapeutic competency, and it also lowers hyperglycemia in diabetic patients [10].

Pharmacological Properties

Hepatoprotective activity

The liver of rats treated with methanol extracts of TFG seeds showed a significant attenuation from CCl4 induced liver damage as evident from normal hepatocytes well defined nuclei. Vacuolization and fatty degeneration were remarkably prevented by the treatment with extract. These results suggest that methanol extract of TFG seed has potential clinical applications for treating liver disorders [11].

Antioxidant activity

Dixit P *et al,* carried out Assay out using rat liver, an aqueous fraction of fenugreek exhibited the highest antioxidant activity, the contents from these extracts were measured. To find polyphenols, flavonoids, and other components, HPLC analysis was done. According to this study, fenugreek seeds have significant antioxidant activity when they germinate, which may be partially attributed to the presence of flavonoids and polyphenols [12].

Antiulcer activity

The effect of *Trigonellafoenumgraceum* compared to omeprazole was studied on ethanol induced gastric ulcer. Significant ulcer protection was demonstrated by the seeds' aqueous extract and a gel fraction that was extracted from them. The seeds' cytoprotective properties appeared to be related to their effects on mucosal glycoproteins as well as their anti-secretory properties. Additionally, the fenugreek seeds reduced mucosal damage by preventing the rise in lipid peroxidation brought on by ethanol and by improving the stomach mucosa's antioxidant capacity [13].

Mast cell stabilizing activity

The *Trigonellafoenumgraceum*on the mast cell stabilizing activity was studied on the rat mesenteric mast cells, following active anaphylaxis. Aqueous extract of TFG has marked protection against the mast cell degranulation. Its inhibition of degranulation of mast cells by aqueous extract of *Trigonellafoenumgraceum* may be due to increase in the cyclic AMP levels by decreasing the cAmp phosphodiesterase, this inhibits the fusion of granules. It may be due to flavonoids present in the plant [14].

Anticancer activity

A dry and germinated aqueous extract from fenugreek seeds was prepared. The growth inhibitory effect of both extracts on MCF7 human breast and pancreatic cells were observed. Fenugreek extracts has significant effect on cell viability, increase caspase3 and 6 concentration and LDH activity and caused nucleosomal DNA fragments. Germination increased the phytochemical components such as flavonoids, tannins, steroids, alkaloids, phenolics and trigonelline of the extract which are believed to have antitumor activity [15].

Antibacterial activity

Trigonellafoenumgraceum leaves was soaked in methanol, hexane, chloroform and its extraction were carried out. The antibacterial activity of various extracts was screened by disc diffusion method and ethanol extract was found to be more potent. Minimum inhibitory concentration [MIC] of ethanol extract determined by broth dilution method showed a MIC value of 1mg / ml for staphylococcus aureus and Pseudomonas aeruginosa [16].

Anti- inflammatory activity

According to Khan F*et. al,* the chemical constituents responsible for the anti-inflammatory activity of Trigonella& the constituents present were alkaloids, saponin and flavonoids. Inflammatory cytokines such as IL-1, IL6, and TNF–α was produced. Inhibitory action of fenugreek extract with methanol as a solvent system was observed with suppression in TNF-α production. Not only seeds but also antipyretic and anti-inflammatory activity of the leaves of *Trigonellafoenumgraceum*[17].

Neuroprotective effect

Khalil WK *et al,* reported that the bioactive compounds present in the fenugreek extracts have the potential to reduce the risk of several neurological disorders such as depression, Alzheimer disease and Parkinson disease. Dietary administration of fenugreek saponins resulted in the inhibition of apoptosis and acetylcholinesterase (AChE) activity thus induced neuroprotective effects [18].

Cardioprotective effect

Diabetes mellitus (DM) leads to cardiovascular implications like diabetic cardiomyopathy. *Trigonellafoenum-graecum* has been long used as a traditional medicine and has many therapeutic effects. 42 male rats were given an injection of streptozotocin (60 mg/kg) to cause diabetes. For six weeks through gavage, diabetic mice were given three different doses of fenugreek seed extract (50, 100, and 200 mg/kg) or metformin (300 mg/kg). By reducing oxidative stress and apoptosis, fenugreek seed may protect the heart structure in STZ-induced diabetic rats [19].

Antigenotoxic activity

Root tip meristem cells of onion were treated with toxic chromium trioxide. Methanolic extract of the sprouts of fenugreek showed dose-dependent decrease in chromosomal aberration in Allium cepa roots. Studies have been done in microbial systems to observe the antimutagenic effect of fenugreek. Aqueous extract of fenugreek seeds inhibited the mutagenic activity of the direct acting mutagens against Salmonella typhimurium [20].

Antirheumatic effect

Ethanol extract of fenugreek was tested against Freund's complete adjuvant-induced arthritis in rats. It was found that the activities of cyclooxygenase-2 and myeloperoxidase and concentration of thiobarbituric acid reactive substance were decreased and the activities of antioxidant enzymes, vitamins C and reduced glutathione level were increased on treatment with fenugreek mucilage [21].

Antidiabetic activity

The study used male and female albino Wistar rats. The TFG powdered seeds were soxhelated (100 g) for 3–4 days with 90% ethanol. After 72 hours of alloxan induction in rats, the diabetes was evaluated, and blood glucose levels (BGL) were measured after 0 days, 7 days, 14 days, and 21 days. At 400 mg/kg, T. foenum-graecum lowered blood sugar at the conclusion of the 21-day treatment period. Fenugreek prevents the rise in blood sugar levels after a meal by slowing down the rate of glucose absorption and perhaps delaying stomach emptying. The amino acid 4-hydroxy isoleucine found in seed fibre also strongly promotes insulin secretion in the cells, increasing cellular glucose glycolysis [22].

Antidiarrheal activity

RevathiBoyina*et al,*.evaluated the anti-diarrheal activity of aqueous extract of whole plant of Trigonellafoenum-

graecum by using castor induced diarrheal model. The animals were challenged with 1ml of castor oil orally for inducing diarrhoea, aqueous extract of TFG when tested at 100mg/kg, 200 mg/kg, showed reduction in the weight of stool when compared to untreated control rats. The liberation of ricinoleic acid from castor oil results in inflammation of the intestinal mucosa leading to release of prostaglandin biosynthesis which stimulates motility and secretions. Extract at a dose of 200mg/kg reduced diarrhoea by inhibiting PGE2 induced intestinal accumulation of fluid [23].

Conclusion

According to the literature research and experimental data analysis TFG is a traditional treatment for labor induction, aiding digestion, and as a general tonic to improve metabolism and health. Fenugreek is known to have several pharmacological effects such as gastroprotective effect, antimicrobial activities, anticancer effect, used in treatment of arthritis, reducing weight, increasing milk production, may regulate hyperthyroidism and hypocholestrolemic effect. It is a suitable plant candidate with a high prospect of being used as a credible medicinal plant to derive new drugs.

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