

Review Article

Fenugreek (*Trigonella Foenum-Graecum* L.): Health, Medicine and Chemistry

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Introduction

Morocco, it is a country known by these natural resources, has a singularly rich and varied flora. There are approximately 7000 species of plants, 22% of which are endemic and belong to several botanical families [38].

Among the medicinal plants that make up the plant cover is *Trigonella foenum-graecum* L., it is an annual herb belonging to the Fabaceae family. It is found all over the world, but it is of Mediterranean origin. It is widely known for its very important medicinal and nutritional properties due to the phytochemicals present in the extracts to the seeds of this plant [34]. The pharmaceutical and biological activities of fenugreek are attributed to different constituents such as alkaloids, flavonoids, steroids and coumarins [29]. In the past, fenugreek was mainly used as flavouring agent in foods and as a spice and recently it has been reported as being used in the pharmaceutical industry as a source of steroidal diosgenin [32].

Use of plant derived medicinal compounds has been in practice since antiquity in many cultural systems including India, China, Egypt and Middle Eastern countries. In recent times plant derived medicinal compounds are being widely used and are suggested by doctors to be used in a number of ailments due to their minimal side effects and numerous positive effects

Abstract

Fenugreek (*Trigonella foenum-graecum* L.), is widely distributed throughout the world and belongs to the Fabaceae family. It is an old medicinal plant and has been commonly used as a traditional food and medicine. Fenugreek is known to have hypoglycemic, and hypocholesterolaemic effects. Recent research has identified fenugreek as a valuable medicinal plant with potential for multipurpose uses and also as a source for preparing raw materials of pharmaceutical industry, especially steroidal hormones. This review article summarizes and reviews published experimental studies and scientific literature from the databases including PubMed, Google, Scopus and Local library.

Keywords: *Trigonella foenum-graecum*; Medicine; Pharmaceutical industry et steroidal hormones

on human health. Out of many such medicinal plant, fenugreek recently attracted the attention of scientists from across the globe [46].

Botanical Description

It is an annual herbaceous plant belonging to the Fabaceae family, its foot can reach a height between 30 to 60 cm. Its cultivation requires only calcic soil and a little humidity. There are also many branches on the stem and it has oval-shaped leaves separated into three parts (trifoliolate) [51]. The flowers of *Trigonella foenum-graecum* L., have a yellowish-white color which subsequently gives rise to the fruit in the form of a pod whose length varies around 20 cm and which contains the seeds (10 to 20) [51]. The seeds of *Trigonella foenum-graecum* L., are solid seed with a light brown to yellowish brown color, with a thickness of 2mm and a length of 5mm, they gather at pebbles and have a special spicy smell [49].

The inflorescence shows axillary flowers, grouped in pairs, rarely solitary. The fenugreek flower is sessile, called papilionaceous, quite large, pale yellow to light purple in color, consists of a calyx with five undivided sepals, a corolla with five free triangular petals (hence the name trigonella) and ten stamens and a pluriovulated ovary [30].

Fenugreek is native to North Africa, the Middle East and India, the nit is widely distributed around the Mediterranean basin. Fenugreek proudcers are India, Iran, Nepal, Bangladesh, Pakistan, Argentina, Egypt, France, Spain, Turkey, Morocco and China. However today it grows all over the world [43]. Often eaten as sprouted seeds that can be grown indoors year round, these plants are outdoor, summer-producing annuals. Sow in spring directly in place, in the sun, in well-drained soil, and thinned to 10 cm apart [9].

Phytochemistry

Chemistry data has shown that the seeds contain proteins, an oil rich in unsaturated fatty acids and phytosterols, carbohydrates, steroidal saponins, alkaloids includint tribonellin, mucilage, vitamins (A, B1, B2, B6 and C), phosphorus, magnesium and calcium and as essential oil responsible for the smell of the plant. The average physical and nutritional characteristics for 100 g of fenugreek seed are shown in Table 1.

Traditional Therapeutic Use

- Fenugreek is one of the oldest medicinal and culinary plant. Its seeds, thanks to their chemical compounds, prove to be of great nutritional value and have multiple phytotherapeutic virtues [14], it is used for: Stimulate the appetite, relieve digestive and respiratory disorders, and restore energy to convalescents and depressed people.

- It is also used to promote the production of breast milk.
- Fight against hair loss.
- Treat leg ulcers, gout, muscle pain and eczema.
- Prevent the appearance of certain types of cancer, in particular of the colon, breast and gallbladder.
- Stop constipation
- Eliminate infection and inflammations of the respiratory tract.
- Treat skin wounds and rheumatic pain [49,34].

Table 1: Chemical composition for 100g of fenugreek seed.

Component	Contents (g/100g)	References
Humidity	7.49 (g)	[44]
Carbohydrates	42.3 (g)	[8]
Proteins	25.4 (g)	[8]
Lipids	7.9 (g)	[8]
Fibers	50.00 (g)	[26]
Ashes	3.38 (g)	[44]
Vitamin A	60-100 (IU)	[20]
Vitamin C	12-43 (mg)	[20]
Vitamin B1	0.41 (mg)	[20]
Vitamin B2	0.36 (mg)	[20]
Vitamin B6	0.60 (mg)	[47]
Niacin	6 (mg)	[26]
Nicotinic Acid	1.1(mg)	[20]
Beta Carotene	96 (µg)	[45]
Thiamine	340 (µg)	[45]
Riboflavin	290 (µg)	[45]
Folic acid	94 (µg)	[45]
Potassium (K)	603(mg)	[2]
Magnesium (Mg)	42 (mg)	[2]
Calcium (Ca)	75 (mg)	[2]
Manganese (Mn)	0.9 (mg)	[2]
Copper (Cu)	0.9 (mg)	[2]
Zinc (Zn)	2.4 (mg)	[2]
Iron (Fe)	25.8 (mg)	[2]

Therapeutic use of *Trigonella foenum-graecum* L.

In herbal medicine, fenugreek seeds are indicated for diabetics, in whom they are said to help control glucose and cholesterol levels. They are also indicated to stimulate the appetite to relieve inflammation, as fortifiers, to facilitate childbirth and as galactogens. Fenugreek seeds would also be used in folk medicine, to strengthen and beautify the hair. Unfortunately, few data based on scientific foundation are offered by the literature to confirm the therapeutic virtues attributed to these seeds.

Antidiabetic effect : Fenugreek powder is a rich ingredient that can be a good alternative for managing high blood sugar and cholesterol levels [41]. Reported that fenugreek seeds contain a free unnatural amino acid, 4-hydroxyisoleucine, which increase glucose-induced insulin release in pancreatic islet cells of humans and rats. The presence of steroid in fenugreek has been studied to minimize blood glucose levels when supplemented to diabetic rats [10,11]. who examined the effect of hydroalcoholic extract of fenugreek seed on type 2 diabetic subjects and found that these seeds have the ability to improve blood sugar and reduce insulin resistance. Fenugreek plays the role of a hypoglycemic also by the presence of soluble fibers slowing down the digestion and absorption of carbohydrates which increases the action of insulin [12,35].

Antioxidant activity: Several studies on *Trigonella foenum-graecum* L., report that the extracts of this plant exhibit antioxidant properties [6]. Supplementation of fenugreek seed powder in the diet leads to a reduction in biomarkers of oxidative damage in alloxan diabetic rats. Furthermore, fenugreek seed polyphenols prevented oxidative hemolysis and H₂O₂-induced lipid peroxidation in vitro in human erythrocytes [16,27].

Antibacterial and antifungal activity: The methanolic and aqueous extracts of fenugreek seeds showed antibacterial activity against Gram-positive and negative bacteria, in particular against *Escherichia coli*, *Serratia marcescens*, *Bacillus cereus*, *Bacillus subtilis*, *Virbio cholerae*, *Salmonella typhi*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* [21,25]. Various investigators have also showed effectiveness of Trigonella extracts against *Helicobacter pylori* [13,36,37] and his group described the activity of different parts of plant fenugreek as the antifungal, such as the seeds leaves, stems and roots by making their aqueous extracts in methanol, petroleum thern ethyl acetate then by using these extract against the strains of fungus as *Botrytis cinerea*, *Fusarium graminearum*, *Alternaria sp*, *Pythium aphanidermatum* and *Rhizoctonia solani* [13].

Anti-inflammatory activity: *Trigonella foenum-graecum* is rich in many anti-inflammatory compounds such as phenolic acids, flavonoids, alkaloids and saponins. These compounds have been shown to reduce oxidative stress and inflammation by reducing Reactive Oxygen Species (ROS) [1,16].

Fenugreek and cardiovascular disease: Because fenugreek contains flavonoids epidemiological studies have shown a reduction in long-term mortality from coronary heart disease in people with a diet rich in flavonoids including quercetin. Thus, researchers evaluated the diet of 805 Danish aged 65 to 84 and followed them for five years. They observed that the men who consumed the highest amounts of flavonoids had just under at 50% risk of having a heart attack during the study [15]. Men with the lowest flavonoids intake were almost four times more likely to have a stroke than those who took the highest amounts. Quercetin fights cardiovascular disease on several fronts. Its an-

ti-thrombotic action helps to prevent the pre-coagulation state with which cardiovascular diseases and major cardiovascular accidents begin [17].

Gastro-protective activity: An aqueous extract of fenugreek seeds showed effective gastric mucosal protective activity, as well as protection against HCL-induced gastric ulcers in rats [31].

Anticancer effect of Trigonella: Cancer is one of the leading causes of mortality worldwide. Many studies have demonstrated the protective effect of fenugreek seeds in experimental models of cancer using cell lines or experimental animals [3-5,7,39].

Other uses: Many studies have shown that fenugreek has other activities such as:

- The fenugreek can be used in the treatment of patients with calcic urolithiasis [19]
- Fenugreek is known to have hypocholesteromic [24,52]
- Fenugreek in asthma treatment [22,28,42]
- Fenugreek against obesity [23,39]
- Effect of Trigonella against pulmonary fibrosis [48]
- Fenugreek against neurological disorders [18,50]

Conclusion

Fenugreek is known as a medicinal plant with multiple therapeutic properties related to its richness in carotenoids, polyphenols, fatty acids, proteins with essential amino acids, iron, ascorbate and folate. Due to its therapeutic interests this plant has attracted the attention of researchers. On the basis of these health benefits, fenugreek can be recommended in our day-to-day diet and considered as functional food when incorporated in foods.

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