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Therapeutic Profile of *Fenugreek (Trigonella foenum-graecum Linn)*: A Culinary Regimen



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ABSTRACT

Introduction: *Trigonella foenum-graecum* commonly known by English name *Fenugreek* or *Greek Hay* and Arabic name *Hulbah* belong to family Fabaceae. Hulbah has been known since time is immemorial for its pleiotropic medicinal value. It is an annual herb indigenous to the countries bordering the Eastern shores of a Mediterranean region extending to Central Asia. In India and South Africa, it has been cultivated as a condiment and a pot herb since centuries. In India, it is popularly known as *Methi*. In ancient Greek and Italy, it was grown purely and mainly for medicinal purpose. Parts of the plant used for medicinal properties are leaves, pods, and seeds. The drug has been popular among scholars of Unani medicine due to its tremendous medicinal properties, such as anti-inflammatory, laxative, concoctive, expectorant, aphrodisiac, emmenagogue, immunomodulatory and nerve tonic to name a few. There is a reference of the use of fenugreek for the treatment of arthritis, diabetes mellitus, cough, metritis, proctitis, general debility, trichological problems and many other diseases. Fenugreek leaves have been found to contain alkaloids, flavonoids, vitamin K and C, Calcium, Iron and nicotinic acid, niacin. Seeds are also known to have a steroidal saponin known as diosgenin (C₂₇ H₄₂O₃) which is known to have properties similar to estrogen. For this reason, fenugreek is used as a source of phytoestrogen. Diosgenin also exhibits anti-inflammatory activity by being the precursor of various steroidal hormones like cortisone. Similarly, seeds have been found to be rich in mucilage, volatile oils, and alkaloids. Seeds have been found to play a role in insulin promotion and glucose regulation. Besides this seeds are also reported to lower the serum cholesterol, improves digestion, cures acid reflux, induce labour and prevents the activation and progression of several serious medical problems. The present paper is aimed at to provide an insight into the therapeutic efficacy of this Unani herb of great merit through extensive literature review and critical analysis of various experimental as well as clinical trials pertinent to the subject.



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INTRODUCTION

Habitat

Annual herb is indigenous to the countries bordering the Eastern shores of Mediterranean region extending to Central Asia. (Wealth of India,1976; Kirtikar,1987). In India and North Africa, it has been cultivated as a condiment (Wealth of India,1976) and a pot herb since centuries. (Wealth of India,1976; CSIR,1986)

It is also grown as fodder and for improving the soil in Mediterranean countries, Southern USSR, India, California, Egypt and some other tropical countries. (Wealth of India,1976; Bentley and Trimen,1990)

In ancient Greek and Italy, it was grown mainly for medicinal purposes. (Wealth of India,1976). In India, it is grown in Punjab, Bihar, Assam, Kashmir, Maharastra, Tamil Nadu, Gujrat, Uttar Pradesh, and Madhya Pradesh. (Wealth of India,1976;Kirtikar, 1987; Sala, 1997)

Common names of *Trigonella foenum* in different languages include:

(Nadkarni,1989; Wealth of India,1976; Ibn Baytar; Chopra,1956;CCRUM, 1987; Hakeem, 1311; Ibn-e-Sina, 1927; Ghani, 1921;Kabiruddin; Kritikar, 1987; Sala, 1996; Lubhaya, 1975; Bentley and Trimen; Multani; Rafiquddin,1985; CSIR,1986; Nagwami)

- *Arabic*: Hulbah
- *English*: Fenugreek, Greek Hayes
- *Afghanistan*: Shamli
- *Greek*: Boukeras
- *Bengal*: Haenugraeb, methi, methika, methishah
- *Ceylon*: mathai,uluvaarisi
- *Chinese*: Hu Lu Pa
- *Dutch*: fenegriek
- *French*: Fenugree
- *German* : Bockshorn, Bockshornklee, siebengeziet
- *Gujrati*: bhaji, methi, methini

- *Hindi* :methi
- *Italian* : fiengreco, fienogreco
- *Malayalam*: ventayam, venthiam, uvula
- *Morocco*: houlba
- *Persian* :shamlid, shamlit, shamliz
- *Punjab* : methi, methri, methun
- *Russain*: gretskayasochevitsa, pagitnik, treugolka
- *Sanskrit*: Misrapushpa, Munindrika, Methini, Bahuparni, Dipani
- *Sind*: Mathi, Mitha
- *Spanish*: alolva, fenogreco
- *Tamil*: vendayam
- *Telegu*:mentikura, mentula

Taxonomical classification

- Kingdom: *Plantae*- Plants
- Subkingdom: *Viridaeplantae*–Green plant
- Infrakingdom: *Streptophyta*- land plant
- Superdivision: *Spermatophyte* – Seed plants
- Division: *Tracheophyta*–vascular plants
- Subdivision: *Spermatophyta*
- Infradivision : *Angiospermae*
- Class: *Magnoliopsida*– Dicotyledons
- Order: *Fabales*
- Family: *Fabaceae*
- Genus: *Trigonella*Linn.
- Species: *Trigonellafoenum-graceum*L.

Morphology Description (Habit)

An annual herb with 1-2 feet height. (Bentley and Trimen, 1990; Nadkarni, 1989; Multani; Labaya, 1975) It is an erect, slightly branched, cylindrical, hollow smooth stem; root tapering. (Bentley and Trimen, 1990)

Leaves

Leaves are pinnate, 3 foliate, leaflets toothed (Sala,1997). Stipules 1/4th of inch long triangular-acuminate leaflets shortly stalked blunt at the apex. (Bentley and Trimen, 1990)

Flowers

Flowers are white or yellowish white. (Bentley and Trimen, 1990; Sala,1997; Multani; Labaya 1975). They are sessile, solitary in the axils of leave, calyx long and narrow divided half way down into 5 narrowly lanceolate or linear-acuminate teeth, heavy outside, and pale green. Corolla is about twice as long as calyx, pale yellow in colour. Stamens are ten in number, free from the corolla, hypogynous, anthers very small. Ovary downy with numerous ovules, style long, somewhat falcate, stigma capitate. (Bentley and Trimen,1990)

Fruit Pods

Fruit pods are 5-7.5cm long with a long persistent beak. (Bentley and Trimen, 1990; Sala, 1997)

Seeds

Seeds are small hard, angular, somewhat compressed. There are 10-20 seeds per pod. (Multani; Sala,1997). Seeds are yellowish green in colour. (Rafiqudin,1985). Seeds have deep groove across one corner. (Lubhaya, 1975; Multani)

Parts used for medicinal properties and name

Leaves, seeds, pods.

Leaves (Multani; Sala, 1997)

Seeds (Multani; Sala, 1997; Bentley and Trimen, 1990)

Pods (Multani)

Principal Constituents

The principal constituents in the seeds are two flavonoids, glycosides, quercetin, and luteolin. (Rastogi, 1993). Two steroidal saponins from seeds, saponins on hydrolysis yield diosgenin and gitogenin. (Rastogi,1993;Chopra,1956;Nadkarni 1989)

Therapeutic constituents

Phytochemical constituents of different plant parts of *Trigonella foenum-graecum*.

a) Leaves; leaves contain steroidal saponin (diosgenin, yamogenin, tigogenin and neo tigogenin); sapogenins, furostanol saponins, alkaloids, flavonoids, salicylate, graecunin-B,C,D,E and G. Xanthophylls and beta carotene and neo-beta carotene. Vitamin k has also been reported in leaves. Leaves are a good source of choline and nicotinic acid. Besides it is rich in Ca, Fe, and other vitamins. Several volatile constituents such as terpenes and fatty acids have been reported. (Ahmadiani A et al 1984; Wealth of India;1976 and Liu MJ Wang Z. et al ;2005)

b) Seeds; seeds are rich in polysaccharides, Galactomannan. They also contain saponins such as diosgenin, yamogenin, gitogenin, tigogenin, and neoantigens. Other bioactive constituents include mucilage, volatile oils, and alkaloids such as choline and trigonelline. 4-hydroxy isoleucine has been found to play a role in insulin promotion and glucose regulation.(Javan M et al 1997;Wealth of India,1976)

Table (A): PHYTOCHEMICAL CONSTITUENTS

Phytochemical Constituents	REFERENCE
Glycosides Quercetin And Luteolin	Rastogi,1993
Saponins Diosgenin and Gitogenin	Rastogi,1993 Chopra,1956 Nadkarni,1989
Alkaloids Trigonelline	Kirtikar Chopra,1956 Nadkarni,1989 Rafiquddin ,1985
Choline	Chopra, 1956 Nadkarni ,1989 Lubhaya,1975
Methylamine, dimethylamine, trimethylamine	Nadkarni, 1989
Essential oils	Chopra ,1956

Prolamin	Chopra ,1956
Nicotinic acid	Chopra,1956
Globulins and albumins High content of histidine	Nadkarni ,1989 Bentley and trimen,1990
Neurin Betain	Nadkarni ,1989
Inorganic substances-Fe	Nadkarni ,1989; Rafiquddin 1985
Polyphenolic compounds flavones, flavonones, flavonols, flavanols (flavan-3-ols), isoflavones, proanthocyanidins and anthocyanins. flavonoids such as quercetin, luteolin, vitexin, isovitexin, saponaretin, homoorientin, vicenin-1 and vicenin-2 .Some phenolic compounds i.e. coumarin, scopoletin, chlorogenic, caffeic and P-coumaric acid.	Rayyan S et al 2010

Table (B): Pharmacological actions (*Afaal -o-Khawas*)

Pharmacological action (<i>Afaal-o-Khawas</i>)	Unani reference	Ethnobotanica I reference
Muhallil orally (Anti-inflammatory)	IbnBaytar, Lubhaya,1984;Iftikhar,1987;Kabiruddin,1951.;Ghan i; Multani N.A	Kirtikar 1987;
<i>MuhallilMuqami</i> (topical anti-inflammatory)	Multani N.A; Lubhaya,1984; Ibn-e-sina,1927;Ibn Baytar.	Sala 1997
<i>Mulain-e-ama</i> (Laxative)	Ibn-e-sina,1927;Ibn Baytar; Rafiqudin ,1985	Kirtikar 1987
<i>Munzij</i> (concoctive)	Hakeem,1311 A.H; Lubhaya 1984;Kabirudin,1951 ;Ibn-e-Sina 1927;Rafiqudin ,1985;Nagwami	Chopra 1956
<i>Munaffis</i> (expectorant)	Rafiqudin,1985	Chopra 1956

<i>Mudir-e-baul</i> (Diuretic)	Multani; Iftikhar ,1987	Kirtikar 1987
<i>Mudir-e-haiz</i> (Emmenagogue)	Ghani ; Lubhaya1984;Ibn-e-sina,1927;Ibn-e-baytar;kabirudin,1951;Nagwami.,N.A.	Kirtikar 1987
<i>Muqawwi-bah</i> (Aphrodisiac)	Kabirudin,N.A; Lubhaya,1984; Rafiqudin ,1985; Ibn-e-baytar; Hakeem 1311 A.H	Kirtikar 1987 Chopra 1956 Sala 1997
<i>Jali</i> (Cleanser)	Kabiruddin. (1951).Nagwami, N.A; Rafiqudin,1985;Iftikhar,1987.Ibn-e-baytar;ibn-e-sina,1927	
<i>Muqawwi-asaab</i> (nervine tonic)	Kabiruddin ,1951; Nagwami ,N.A;Hakeem,1311A.H.	
<i>Musaff-e-khoon</i> (Blood Purifier)	Ibn-e-Baytar	
<i>Defehumma</i> (Antipyretic)		Kirtikar 1987
<i>Kasir-e-riyah</i> Carminative		Kirtikar 1987; Chopra 1956; Sala 1997
<i>Qabiz</i> (Astringent)		Sala 1997
<i>Murakhkhi</i> (Emollient)		Sala 1997

Table (C) Therapeutic uses

S.No.	Uses	Unani reference	Ethnobotanical reference
1.	<i>WAjaulMafasil</i> (Rheumatism)	Kabirudin, 1951	
2.	<i>Suaal</i> (Cough)	Ghani, 1921; Ibn-e- Baytar; Iftikhar,1987;Kabirudin, 1951;Ibn-e-Sina, 1927	Sala, 1997

3.	<i>Kirmshikam</i> (intestinal infestation)	Multani,N.A;	Kirtikar, 1987;
4.	<i>Indemalqurooh</i> (Cicatrizant)	Ibn-e- sina, 1927	
5.	<i>Bahat -e-saut</i> (Hoarseness of voice)	Ibn-e- Baytar.	
7.	<i>Warm raham</i> (metritis)	Multani,N.A; Kabiruddin, 1951; Ibn-e-Sina 1927: Hakeem,1311 A.H;	
9.	<i>Warm Miqad</i> (proctitis)	Ibn-e-Sina, 1927	
10.	<i>Nafakh e- shikam</i> (Flatulence)	Multani,N.A; Hakeem, 1311 A.H;Rafiqudin,1985;Iftikhar, 1987 Ghani, 1921.	
11.	<i>Bawasir</i> (Haemmoroids)	Multani,N.A;	Kirtikar 1987
13.	<i>Qooba –e- azfar</i> (Tineaungium)	Rafiqudin,1985; IbnBaytar; Hakeem, 1311 A.H.	
14.	<i>Niqris</i> (Gout)	Multani, N.A. ; Ghani,1921	
15.	<i>Warm-e- tihal</i> (Splenitis)	Ghani, 1921; Ibn-e-Sina, 1927; Hakeem,1311 A.H; Rafiqudin,1985	
16.	<i>Warm-e-reham</i> (Metritis)	Ghani,1921; Hakeem,1311 A.H; Ibn-e-Baytar; Ibn-e-Sina, 1927; Rafiqudin ,1985	

17.	Fasad-e-laun (pigmentation disorders)	Ibn-e-Sina,1927; Ibn-e-Baytar;Multana,N.A; Ghani, 1921;Kabirudin ,1951.	Kirtikar, 1996;
18.	<i>Amraz-e- naffas</i> (diseases of perpurium)	Multani, N.A.;	Ghani,1921
19.	<i>Ziabetusshakri</i> (Diabetes)	Multani, N.A.	
20.	<i>Muqqawiaam</i> (General tonic)	Lubhaya,1984;	Kirtikar, 1987 Chopra, 1956
21.	<i>Dard-e-rahem</i>	Ibn-e-Sina,1927; Ibn-e-Baytar;Kabirudin,1951.	
22.	<i>Qoolanjwalshal</i> (Intestinal colic) and diarrhoea)	Ibn-e-sina, 1927	
23.	<i>Jaoodatshaar</i> (Curling of hair)	Ibn-e-Baytar.	
24.	<i>Muqawwi-shar</i> (hair tonic)	Hakeem,1311 A.H	
25.	<i>Wajaulqatn</i> (Lumbago)	Hakeem, 1311 A.H; Ibn-e-baytar	
26.	<i>Zofwalaghari</i> (cachexia)	Hakeem, 1311 A.H	
27.	<i>Dama</i> (Asthma)	Lubaya, 1984; Ibn-e-sina 1927; IbnBaytar; Kabirudin, 1951	
28.	<i>Masqat-e- janeen</i> (Abortifient)	Hakeem, 1311 A.H.	
29.	<i>Qai</i> (Emesis)	Ibn-e-sina,1927;Ghani, 1921	
30.	Mudir-e- laban (Galactogogue)	Ghani,1921	Chopra,1969;Wealth Of India, 1976; Sala, 1997
31.	Huzaz (dandruff)	Ghani, 1921; Ibn-e-sina 1927; Ibn-e-baytar.	
32.	<i>Safa</i> (Alopecia)	Ghani, 1921.	
33.	<i>Harq</i> (Burns)	IbnBaytar	Kirtikar, 1987

			Sala, 1997
34.	<i>Dumbal, quroohwakhuraj</i> (Boils, ulcers and abscess)		Sala, 1997
35.	Cracks And Wrinkles	Ghani,1921;Ibn-e-sina 1927; Ibn-e-baytar.	
43.	<i>Kalf</i> (Melasma)	Ghani,1921	
36.	<i>Ashoub-e-chasm</i> (conjunctivitis)	Kabirudin,1951; Ibn-e-Baytar	
37.	<i>Arq-e-mantan</i> (Bad odour of urine and sweet)	Ibn-e-baytar; Ibn-e-sina 1927; Ghani 1921	
38.	<i>Warm-e-shob</i> (Bronchitis)		Kirtikar,1987 Sala, 1997
39.	<i>Izam-e-kabidwatihal</i> (Hepato-spleenomegaly)		Kirtikar, 1987
40.	Juzam (Leprosy)		Kirtikar, 1987
41.	Zaheer-e- muzmin (Chronic dysentery)		Kirtikar, 1987
42.	Uzeema (Dropsy)		Kirtikar,1987
43.	Soo-e-hazm (Dyspepsia)		Kirtikar, 1987
44.	Inteqshararat (hypothermia)		Sala, 1997
45.	Suqootishteha (Anorexia)		Sala, 1997
46.	Veterinary medicine		Sala, 1997 Kirtikar, 1987 Bentley and Trimen, 1990

Pharmacological Evidences

Analgesic, neuropharmacological and cytotoxic activity

Analgesic, neuropharmacological and cytotoxic activity of *trigonella foenum-graecum* was investigated in mice by obtaining a methanolic extract from leaves by Akter *et al.*, 2011.

Anti-Inflammatory

Anti-inflammatory activity and the effect of *Trigonella foenum-graecum* some biochemical parameters in experimental rats was seen by Kareem AA *et al.*, 2013. Fenugreek at a dose of 100mg and 200 mg/kg reduced carrageenan-induced paw oedema in rats. Shariffara F. *et al.*, 2009. The saponins and flavonoids present in fenugreek exhibits anti-inflammatory activity as these are antioxidants and potential inhibitors of cyclo-oxygenase and lipo-oxygenase pathway of arachidonic acid metabolism. Shariffara F. *et al.*, 2009; Rao YK, *et al.*, 2007; . Shariffara F. *et al.*, 2005.

Effect on Oxidative Stress

Flavonoids of fenugreek extract have been observed to possess anti-oxidant activity by Moskaug J.O. *et al.*, 2005 and Mohammad Asim. *et al.*, 2005,

Moreover, in a recent study fenugreek seed extract has been reported to prevent both LPO and hemolysis in RBC by Kaviarasan S. *et al.* 2004. Fenugreek seeds have also been reported to raise the antioxidant levels and lower the LPO in the liver of ethanol intoxicated (Thirunavukkarasu V. *et al.*, 2003) and diabetic rats. (Anuradha, C.V. *et Al.*, 2001)

Analgesic Property

Injections of fenugreek (500-2,000 μ g intrathecally or 1g intraperitoneally) were given in rats it appeared to have analgesic properties mediated via the spinal serotonergic system.

Morani A.S. *et al.*, 2012 gave a seed extract of fenugreek orally to rats at 50-200mg/kg for one month following spinal nerve damage (either a partial sciatic nerve ligation (PSNL) or a sciatic nerve crush injury (SNCI) injury). It was seen to reduce the hyperalgesia induced by the injuries

following two weeks of supplementation. The magnitude of analgesia with 200mg/kg of seed extract was comparable to the reference of 100mg/kg pyridoxine HCl.

Antiulcer Activity

Evaluation of antiulcer activity of *Trigonella foenum-graecum* leaves methanolic extract against water immersion restraint stress-induced ulcers in rats was carried out by Anand S.C. et al. 2012. The antiulcer effect was compared with that of Omeprazole 10mg/kg-1p.o. It showed a significant reduction in ulcer formation and increase in inhibition of gastric lesions. It is also reported to accelerate wound healing, the defence for gastric mucosa and regress gastric ulcer. Pandiana RS, et al., 2002. Mahmood AA. et al., 2005. Studies have shown fenugreek to increase the secretion of gastric mucin. Al-Dalain. et al., 2008. Fenugreek extract derived through bioconversion using *Rhizopus oligosporus* has shown its defensive effect on gastric mucosa by acting against *Helicobacter pylori*. Randhir, et al., 2007. Jagdeep Kaur. et al; 2011.

Antifungal Activity

Antifungal activity of aqueous extracts of various parts of *Trigonella foenum-graecum* (3%) against harmful pathogenic fungi like *Botrytis cinerea*, *Fusarium graminearum*, *Alternaria sp.*, *Pythium aphanidermatum*, and *Rhizoctonia solani*. (Haouala et al. 2008,)

Galactagogue Activity

A few trials have been conducted on the matter, and fenugreek seems to be able to enhance milk production in recent mothers more than placebo. In one of the preliminary clinical trials, ten women kept diaries of their breast milk production for two weeks. The first week established baseline milk production. During the second week, three capsules of fenugreek seed were taken three times daily. This observational study used each patient as her own control in comparing breast milk production with and without the fenugreek. Results for average daily pump volumes for week 1 and week 2 were compared. The average daily milk volume for week 1 was 207 ml compared to 464 for week 2. This increase was statistically significant (P=0.004). Thus, use of fenugreek significantly increased the volume of breastmilk produced. Swafford et al., 2000.

Effect on Pregnancy

Trigonella foenum-graecum, at dosages of 800mg/kg bodyweight or above in rats (128mg/kg human estimated dose), is potentially a teratogenic substance and cause birth defects when consumed by a pregnant woman; the mechanism behind this teratogenesis is hypothesized to be through inhibiting stem cell differentiation. (Araee M, *et al.*)

Immunomodulatory Activity

Bin-Hafeez B. et al used Fenugreek extract to show immunomodulatory effects on the specific as well as non-specific immune functions, it was found significant.

Anti-Diabetic Activity

Soluble dietary fiber fraction of *Trigonella foenum-graecum* (fenugreek) seed improves glucose homeostasis in animal models of type 1 and type 2 Diabetes by delaying carbohydrate digestion and absorption, and enhancing insulin action. Serum insulin and insulin secretion were not affected. It was established by J. M. A. Hannan et al.

Effect on Libido

Fenugreek may also enhance male libido when ingested at 600mg a day (Testofen brand name, 50% Fenusides) in two divided doses for 6 weeks.

Anti-Plasmodial Activity

In vitro antiplasmodial activity of TFG was established by Palaniswamy et al. The ethanol extract (50%) possess profound antiplasmodial activity against chloroquine sensitive and resistant *P.falciparum* isolates, respectively.

CONCLUSION

Fenugreek is a remedy of merit used in *Unani* medicine since ancient times and is one of the oldest herb used medicinally across cultures. There are historical references of its use in Egypt for embalming mummies. Among its pleiotropic medical benefits, its usefulness in metabolic syndrome is most coveted. The incidence of metabolic and lifestyle disorders is on the rise

throughout the world. The decision of WHO to put the theme of world health day for 2016 as diabetes further underscores the gravity of the issue. Moreover, the adverse effects of drugs further add up to the problem particularly in cases of long-term therapy. In this backdrop, the practice of dietotherapy becomes even more appreciable. Dietary supplements that can either be used singly or as an adjuvant to promote health and immunity would be desirable. Use of fenugreek can prove to be low risk ,economical dietary supplement for diseases including inflammation, general debility, difficult labour, hormonal disorders as well as a metabolic syndrome to name a few. Fenugreek as a dietary supplement may hold promise for numerous and serious medical problems. Results from clinical trials have proved beneficial effects of fenugreek beyond anecdotal evidence on different diseased conditions. However, well-designed trials with high methodology quality as well as characterised fenugreek preparations of sufficient dose with safety studies are required to provide more conclusive evidence.

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