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Review Article

Hulba (*Trigonella foenum-graecum* L.): A Comprehensive Unani Drug Review Integrating Classical Literature, Phytochemistry, Pharmacological Activities, Therapeutic Applications, and Contemporary Scientific Evidence

Mohd Mushfiq ^{1*}, Tabassum Latafat ², Mursaleen Naseer ³, Jamal Azmat ³¹ PG scholar, Department of Moalajat (Medicine), Ajmal Khan Tibbiya College, Aligarh Muslim University, Aligarh, India² Professor, Department of Moalajat (Medicine), Ajmal Khan Tibbiya College, Aligarh Muslim University, Aligarh, India³ Assistant Professor, Department of Moalajat (Medicine), Ajmal Khan Tibbiya College, Aligarh Muslim University, Aligarh, India

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For Correspondence:

Mohd Mushfiq, PG Scholar, Department of Moalajat (Medicine), Ajmal Khan Tibbiya College, Aligarh Muslim University, Aligarh, India

Abstract

Objective(s): To critically review Hulba (Fenugreek; *Trigonella foenum-graecum* L.) in the light of classical Unani literature and contemporary scientific evidence, with emphasis on its temperament (*mizāj*), vernacular names, parts used, doses, correctives, substitutes, compound formulations, pharmacological actions, therapeutic applications, phytochemical constituents, and experimentally validated pharmacological activities.

Data Sources: Classical Unani texts, including *Al Jāmi' li-Mufradāt al-Adwiya wa al-Aghdhiya*, *Muḥīṭ-i-A'zam*, *Khazā'in al-Adwiya*, *Al-Qānūn fī al-Tibb*, and standard CCRUM publications, were consulted. Contemporary literature was retrieved from PubMed, Google Scholar, ScienceDirect, and Scopus.

Study Selection: Relevant English, Arabic, Persian, and Urdu sources describing the traditional uses, phytochemistry, pharmacology, toxicology, and clinical studies of *Trigonella foenum-graecum*, published up to February 2026, were critically screened and synthesized.

Summary of Contents: Hulba is classified in Unani medicine as predominantly hot and dry and is widely used as a carminative, tonic, aphrodisiac, galactagogue, anti-inflammatory, expectorant, laxative, and antidiabetic drug. Classical indications include diabetes, dyspepsia, flatulence, arthritis, asthma, amenorrhoea, leucorrhoea, anemia, wounds, and skin disorders. Phytochemical investigations reveal galactomannan, 4-hydroxyisoleucine, trigonelline, diosgenin, steroidal saponins, flavonoids, and alkaloids as principal bioactive constituents. Experimental and clinical studies confirm significant hypoglycemic, hypolipidemic, antioxidant, gastroprotective, hepatoprotective, antimicrobial, neuroprotective, and immunomodulatory effects.

Conclusion: The convergence of classical Unani descriptions and contemporary scientific findings supports Hulba as a scientifically validated medicinal and functional food with considerable potential in evidence-based and integrative healthcare. Further standardized clinical trials and mechanistic studies are warranted.

Keywords: Hulba; *Trigonella foenum-graecum*; Fenugreek; Unani Medicine; Phytochemistry; Pharmacological Activities; Therapeutic Uses; Herbal Medicine.

INTRODUCTION

Trigonella foenum-graecum Linn. is a smooth, erect, aromatic annual plant growing up to 30–60 cm in height.^{1–18} It is native to regions such as Punjab, Kashmir, and the Upper Gangetic plains,^{1,6–7,11,13–14} and is widely cultivated across many parts of India.^{1–2,5–7,12–15,17,19} Additionally, the plant is native to North Africa and countries along the eastern Mediterranean,³ and it spread through Persia and Abyssinia to the Mediterranean region.^{3–4,13}

The seeds of the plant are typically 10–20 in number, rhomboidal to oblong in shape, with a deep groove across one corner. They are greenish-brown in color, measuring approximately 2.5–5.0 mm by 2.0–3.5 mm, and have a

sharp, bitter taste.^{14–15,17} Sowing is typically done in the winter season, with flowering and fruiting occurring from February to March.^{14–15,17} One of its well-known forms is dried fenugreek leaves, popularly known as Kasoori Methi, which originated in Pakistan's Kasur region.¹⁰

According to ESCOP and WHO monographs, fenugreek seeds are recommended as adjuvant therapy for conditions such as diabetes mellitus, anorexia, and hypercholesterolemia.⁵ The therapeutic significance of fenugreek is also emphasized in traditional Islamic teachings, as the Prophet Muhammad (PBUH) reportedly said, "If his community knew the benefits of fenugreek, they would pay its weight in gold."¹⁰

METHODOLOGY

Hulba (*Trigonella foenum-graecum* L.) was reviewed through classical Unani literature to evaluate its *mizāj* (temperament), *asmā' al-mufrada* (vernacular names), parts used, *miqdār-i-khurāk* (dose), *muḍirr* (adverse effects), *muṣliḥ* (correctives), *badal* (substitutes), *murakkabāt* (compound formulations), *af'āl* (pharmacological actions), and *maḥal-i-ista'māl* (therapeutic applications). Major authoritative Unani texts consulted included *Al Jāmi' li-Mufradāt al-Adwiya wa al-Aghdhiya* by Ibn al-Baitar, *Muḥīt-i-A'zam* by Hakim Mohammad Azam Khan, *Khazā'in al-Adwiya* by Najmul Ghani, *Al-Mukhtārāt fī al-Ṭibb* by Ibn Hubal al-Baghdadi, *Tadhkirah Ulul Albab* by Dawud al-Antaki, and other standard Arabic, Persian, and Urdu references available in institutional libraries.

Contemporary scientific data on phytochemistry, pharmacological activities, therapeutic applications, and toxicological studies were retrieved from electronic databases, including PubMed, ScienceDirect, Google Scholar, Scopus, and journals such as the Journal of Drug

Delivery and Therapeutics (JDDT), using keywords including "*Trigonella foenum-graecum*," "Fenugreek," "Hulba," "Tukhme Hulba," "Unani medicine," "phytochemistry," "pharmacology," "clinical studies," and "toxicity." Standard Unani terminology and transliteration were adopted from publications of the Central Council for Research in Unani Medicine (CCRUM) in collaboration with the World Health Organization (WHO).

Relevant literature published up to February 2026 was included in the review. In addition, print resources and offline journals, including the Hippocratic Journal of Unani Medicine and Indian Journal of Unani Medicine, were consulted through the library of Aligarh Muslim University. The retrieved information was critically analyzed, cross-referenced, and synthesized to integrate classical Unani concepts with contemporary pharmacological and clinical evidence.

RESULTS

Description of Hulba (*Trigonella foenum-graecum* Linn.) in Unani and other ancient literature.

Taxonomical Classification

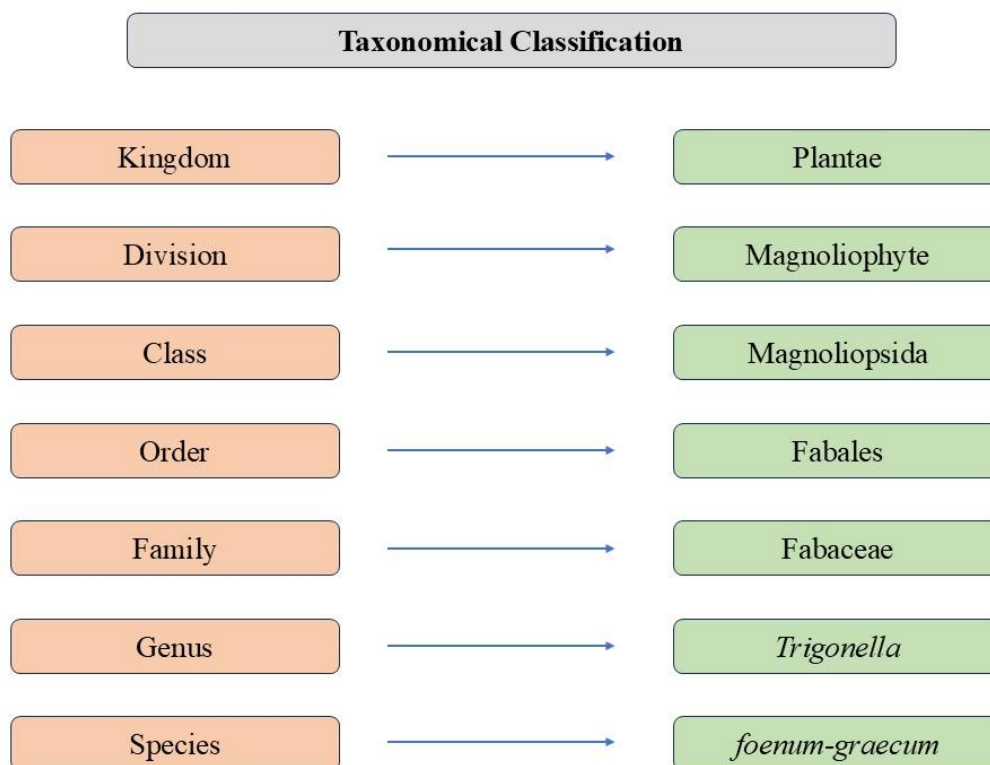


Figure 1: Taxonomical classification of Hulba (*Trigonella foenum-graecum* Linn.)²⁰

Botanical name: *Trigonella foenum-graecum* Linn.^{10-13,16-19,21}

Trigonella Faenum Graecum.(W.)²²

Foenograecum, *Foenumgraecum* Fuchs.^{18,23}

Foenumgraecum sativum Bauhin.^{18,23}

Family: Papilionaceae.^{1-2,4-5,9,16,19,24}, Fabaceae.^{1-2,4-5,9,16,19,24}, Leguminosae.^{3,12,17}

Table 1: *Mutrādifāt* (Vernacular Names) of Hulba (*Trigonella foenum-graecum* Linn.)

Language/ System	Vernacular Names	References
Arabic	<i>Hulbah; Hulabaha; Shimleet; Qarn-us-Saur; Fareeqa; Qarn-ul-Unar; Bazr ul Hulba</i>	10–13,15–16,19,21,25–32
Persian	<i>Shamlid; Shamlit; Shamliz; Shanbalid; Shamlita; Shamleez; Shamiled; Shamleet</i>	10–13,15,19,21,26–27,29,33–34
English	Fenugreek; Greek Hayes	1–2,3,5,9–15,17–18,21,24,26–27
Hindi	<i>Methi; Muthi; Peet Machja</i>	2,6–7,9,12–15,17,19,22,34–35,39
Urdu	<i>Methi</i>	9,13,15,17,28,38
Unani	<i>Hulbaa; Methi; Talis; Tals; Shaleen; Fareeqa; Teelas</i>	1,5,12,17,21
Ayurvedic	<i>Methikaa (Bhaavaprakaasha); Vastikaa; Selu (Ayurveda Saukhyam); Methini; Dipani; Bahupatrikaa; Bodhaini; Gandhaphala</i>	1
Siddha	<i>Vendhayam</i>	1

Parts usedSeeds^{1–4,6,11–12,14,17}Leaves^{6,11,14}Pods¹¹**Figure 2:** Morphological characteristics and botanical features of *Trigonella foenum-graecum* L. (Fenugreek). Reproduced from Ved et al., FRLHT's ENVIS Centre on Medicinal Plants.³⁶**Table 2:** *Mizāj* (Temperament) of Hulba (*Trigonella foenum-graecum* Linn.)

<i>Mizāj</i> (Temperament)	References
Hot 2°, Dry 2°	10–12,15,17,31–32,37
Hot 2°, Dry 2° <i>ma'a Ruṭūbat Fuḍliyya</i>	26–27,29–30,34
Hot 1°, Dry 1°	12,16,39,47
Hot 1°, Dry 1° (<i>Hārr daraja ūlā ākhir, Yābis daraja ūlā wa laysa khāliyan min Ruṭūbat Fuḍliyya</i> — Hot in the final phase of the first degree, Dry in the first degree, and not devoid of surplus moisture)	25
Hot ½, Dry 1°	33
Hot 2°, Dry 1°	21,28
Hot 1°, Dry 3°	19,37
Hot 1°, Wet 1° (Lu'āb)	37

Miqdār-i-Khurak (Doses)Seed 3-5 g powder. (CCRAS.)^{1,5,19,26-38}3-6 g *Safūf* powder^{2,9}4-6 g¹⁷3.5 -7 g¹⁵*Ṭilā'* 7 g³⁷*Ḥuqna* 6 tola³⁷**Muḍirr (Adverse Effects):**

Fenugreek is reported to exhibit certain adverse effects in certain individuals and organ systems. It may be unsuitable for persons with *mizāj ḥārr* (hot temperament).^{29,32,37} It is also described as having adverse effects on the *unthayayn* (testes).^{12,19,26,29-34} Additionally, some classical texts note that it may affect the *khuṣyatayn* (testicles).^{10,37}

Badal (Substitutes):

The substitutes for Fenugreek include seeds in place of leaves^{26,29}, Tukhm Ālsī (*Linum usitatissimum* Linn.)^{17,37}, Iklīl al-Malik / Nakhūnā (*Trigonella uncata* Boiss.)^{17,37}, and Tukhm Khurfah Siyāh (*Portulaca oleracea* Linn.).³¹⁻³²

Muṣliḥ (Correctives):

Correctives used to moderate the effects of Fenugreek include Sikanjabīn^{29-30,33}, Sikanjabīn Tursh (vinegar-lemon preparation)^{17,37}, and sard ashyā' (cold substances).³⁷ Other important correctives mentioned in classical texts are Anīsūn (*Pimpinella anisum* Linn.)^{17,29,33,37}, Anār mey Khush (sweet pomegranate)²⁹⁻³⁰, Barg Kasnī (*Cichorium intybus* Linn.)^{17,29}, and Roghan Quṣṭ.³⁴

Murakkabāt (Compound Formulations):

Fenugreek is an ingredient in several Unani compound formulations, including Dawā' al-Luk^{15,40}, Dawā' al-Misk^{12,15,26}, La'ūq Hulba^{15,17,40}, La'ūq Dīq al-Nafas^{15,40}, La'ūq Ḥabb us Sanobar¹⁷, La'ūq Mu'tadil⁴¹, Ḥabb Khabath al-Ḥadīd^{15,17,40}, Qayrūtī Ārd Karsanah^{12,15,17,26,40}, Qayrūtī Ārd Bāqlā⁴², Ḍimād Kibrīt^{15,40}, Ḍimād Khanāzīr¹⁵, Ḍimād Waram Kulliyya Qawī⁴², Marham Dakhelyoon^{12,15,26,40,43}, Marham-e-Dakhelyoon Murakkab⁴⁴, Ma'jūn Murawweh ul Arwāḥ⁴³, Tiryāq-e-Dīq al-Nafas¹², Roghan Shifā¹², Safūf Gesu Daraaz⁴⁴, and Shiyāf Kundur⁴².

Table 3: Pharmacological Actions (*Af'āl*) of Hulba (*Trigonella foenum-graecum* Linn.)

Pharmacological Action (<i>Af'āl</i>)	References
Kāsir-i-Riyāḥ (Carminative)	1,6-7,10-12,14-15,19,26-27,29,37,39
Mundij (Concoctive)	10,12,16,19,25-27,30,33-34,47
Jālī (Detergent)	10,12,15,19,26-27
Muqawwī (Tonic)	1,4,6-7,11,14,26,39
Muqawwī-i-A'sāb (Nervine tonic)	10,12,15,19,26-27
Muqawwī-i-Mi'da (Stomachic)	10,12,19
Muqawwī-i-Am'a' (Intestinal tonic)	12
Muqawwī-i-Badan (Body tonic)	10,12,26
Muqawwī-i-Bāh (Aphrodisiac)	1,6-7,10-12,14-15,21,26,29
Muqawwī-i-Nifāsiyya (Puerperal tonic)	5
Mufarriḥ-i-Qalb (Cardiac exhilarant)	39
Mushtahī (Appetizer)	12,33,39
Muqī (Emetic)	37
Qātil-i-Dīdān-i-Am'a' (Anthelmintic)	4,39
Mudirr-i-Laban (Galactagogue, internally)	1,3,5-6,12,27,37
Muqallil-i-Laban (Antigalactic, externally)	10,27,30
Muwallid-i-Manī (Spermatogenic)	1
Muḥarrik-i-Bāh / Mubhī (Libido stimulant)	19
Dāfi'-i-Dhayābītus (Antidiabetic)	1-4
Muḥammir (Rubefacient)	1-5
Dāfi'-i-Ta'affun / Māni'-i-'Ufūnat / Dāfi'-i-'Ufūnat (Antiseptic)	1,5

Mulaṭṭif (Attenuant)	1,5,11–12,14–15,17,33
Dawā' Lu'ābī (Mucilaginous drug)	11,14
Mugharrī (Glueing drug)	12
Mudirr-i-Bawl (Diuretic)	11,12,14–15,17,21,27,29–32,37
Mudirr-i-Ḥayḍ (Emmenagogue)	10–12,14–15,17,26–27,29–33,37
Munaqqī-i-Ṣadr (Chest cleanser)	21,29–30
Mu'ajjil al-Wilāda / Musahhil al-Wilāda (Labour facilitator)	3
Qābiḍ (Astringent)	4,11,14,39
Mumallis (Emollient)	11,14
Dāfi'-i-Ḥudār (Antirheumatic)	1,11,26
Muḥallil-i-Waram (Anti-inflammatory)	2,10,12,15,17,19,26–27,29–30,33,37–38
Hypolipidaemic	2–4
Hypoglycaemic	1,3–5,46
Hypocholesterolemic	4,46
Dāfi'-i-Nazla (Anticatarrhal)	1
Musakkin-i-Ḥarārat (Febrifuge)	1
Mulayyin (Laxative)	10–12,15,17,19,25–26,30,33–34,21,38,47
Mulayyin al-Ṣadr (Softener of morbid matter from chest)	30,47
Mulayyin al-Ḥalq (Softener of morbid matter from throat)	47
Munaffith-i-Balgham (Expectorant)	1,5,10,12,15,17,19,21,26,30,34
Musakkin (Soothing agent / Calming agent)	11,12

Table 4: Therapeutic Uses (*Maḥal-i-Ista'māl*) of Hulba (*Trigonella foenum-graecum* Linn.)

Therapeutic Uses (<i>Maḥal-i-Ista'māl</i>)	References
Amrād Bārīda (Cold diseases)	10,12,19,26–27,29–32,37
Ṣar' (Epilepsy)	10,12,15,19,26–27,29–32,37
Laqwa (Facial palsy)	10,12,19,26–27,29–32,37
Fālij (Paralysis)	10,12,19,26–27,29–32,37
Waja' al-Mafāṣil (Arthritis)	10,12,15,19,26–27,29–32,37
Istirkhā' (Flaccidity)	15
Istisqā' Ziqqī (Ascites)	15,29–30,37
Ramad Ḥaqīqī (Conjunctivitis)	10,12,15,26
Waram al-Raḥim (Metritis)	15
Waram Ṣulb	21
Al-Ghathayān (Nausea)	39
Ḥummā Judariyya (Smallpox)	6–7
Buṭlān al-Shahwa / Suqūṭ al-Shahwa (Anorexia)	4–5,11–12,14
Nafkh-i-Mi'da (Flatulence)	5,11–12,14,25,27,29–30
Fasād al-Ḥaḍm / Sū' al-Ḥaḍm (Dyspepsia)	4–5,11

Ṭūl Zamān al-Intihā' (Increase in convalescence stage of disease)	4
Waram al-Mi'da (Gastritis)	3-4
Qurūḥ al-Mi'da (Gastric ulcers)	3
Magḥṣ / Maror (Intestinal colic)	5,11,14
Ishāl (Diarrhoea)	10-12,14,25,27
Ishāl Nifāsiyya (Diarrhoea in puerperal women)	11
Zaḥīr (Dysentery)	5-7,10-12,14,25,27,48
Ziyādatī-i-Miqdār Maqāmī al-Kabid (Hepatomegaly)	1,5,11,14,37
Ziyādatī-i-Miqdār Maqāmī al-Ṭihāl (Splenomegaly)	1,5,10-11,14-15,27,30,37,48
Waja' al-Kabid (Hepatalgia)	21,29-30
Waja' al-Zahr (Backache)	10,21,26-27,29-30
Waja' al-Ṣadr (Chest pain)	39
Waja' al-Udhun / Dard-i-Gosh (Otalgia)	37
Iltihāb al-Shu'ab (Bronchitis)	1,11,30
Bawāsīr (Haemorrhoids)	11,15,21,29,37
Su'āl Muzmina (Chronic cough)	10-12,14-15,21,29-30,37
Ḍiq al-Nafas (Dyspnoea)	15
Rabw (Asthma)	10,12,21,26,30,33
Ṭarfa (Subconjunctival haemorrhage)	10,26,38
Istisqā' (Dropsy)	11,14
Awrām al-Maghābin (Lymphadenitis)	4
Khanāzīr (Cervical lymphadenopathy / diphtheric lymphadenitis)	12
Faqr al-Dam (Anaemia)	11,12,14,21,30
Niqris (Gout)	4,11-12,15,37
Dhayābiṭus (Diabetes)	1-2,4,11,14
Intithār al-Sha'r (Hair fall)	10-11,25,27,30,48
Sayalān al-Raḥim (Leucorrhoea)	3,11
Iḥtibās al-Ṭamth (Amenorrhoea)	12,15,21,30
Al-Waja' fi'l Ayn (Pain in eyeball)	33,47
Al-Waja' fi'l Raḥim (Pelvic pain)	38
Ḍu'f al-Bāh (Sexual debility)	10,15,21,26,27
Ḍu'f al-A'ṣāb (Weakness of nerves)	10,15
Ḍu'f al-Mi'da (Gastric debility)	12,25,33
Qurūḥ-i-Mi'da (Gastric ulcers)	25
Qurūḥ al-Raḥim (Uterine ulcers)	25
Waram-i-Ṭihāl (Splenitis)	21,25,29-30,33
Waram al-Raḥim (Metritis)	21,25,29-30
Waram al-Maq'ad (Proctitis)	25
Awrām Buthūr-i-Balghamī	25
Awrām-i-Sawdāwī	25

Taqṭir al-Bawl (Dribbling of urine)	12,21,29–30,33,37
Mathāna ki Burūda	21,29–30
Muqallil-i-Manī (Semen-reducing agent)	39
Waram Ṣulb (Internal and external swellings)	11,34,48
Ḥudār (Rheumatic disorder)	1,12,14,26
Siman Mufriṭ (Obesity)	1–2
Dubayla (Abscess)	3,21,33
Dummal (Boil/Furuncle)	3–4,21
Qurūḥ (Ulcers)	3–4
Jurūḥ (Wounds)	4
Ḥarq (Burn)	3,14,21,25
Ḥarq al-Shams (Sunburn)	18
Barash (Freckle)	18
Dawālī (Varicose veins)	18
Kalaf (Melasma)	21,25,30
Ḥazāz / Bafā (Dandruff)	21,25,30,38,47–48
Ghāza (Face powder)	12,21,25,30,37
Ḥumra (Bilious inflammation)	33
‘Araq Muntin (Bromhidrosis)	21,25
Saraṭān al-Raḥim (Cervical cancer)	3
Nār Fārsī (Eczema)	4
Myalgia	4
Spondylosis	1
Lymphatism	11,12,14
Rickets	11,12,14
Scrofula	11
Neurasthenia	11
Closure of vulva	48
Evacuation of retained blood after delivery or menstruation	8,21,37

History:

The Egyptian *Ebers Papyrus* (c. 1500 BC) documents a prescription for treating burns that includes fenugreek. In ancient Egypt, fenugreek was also employed to induce childbirth. By the 5th century BC, the renowned Greek physician *Hippocrates* regarded fenugreek as a valuable soothing herb. Later, in the 1st century AD, the Greek pharmacologist *Dioscorides* recommended it as a remedy for various gynecological conditions, including infections of the uterus and inflammation of the vagina and vulva. In the Middle East, fenugreek, commonly known as *Hulba*, is one of the most frequently used medicinal plants.³ However, caution is advised: fenugreek seeds should not be consumed during pregnancy.³

CHEMICAL CONSTITUENTS

Fenugreek contains a rich and diverse profile of chemical constituents, both organic and inorganic. Among the organic compounds identified are alkaloids, flavonoids, glycosides, proteins, amino acids, reducing sugars, saponins, steroids/triterpenes, tannins, and fixed oils.¹⁷ The inorganic elements found in the plant include sodium, potassium, magnesium, iron, phosphate, sulphate, and chloride.¹⁷

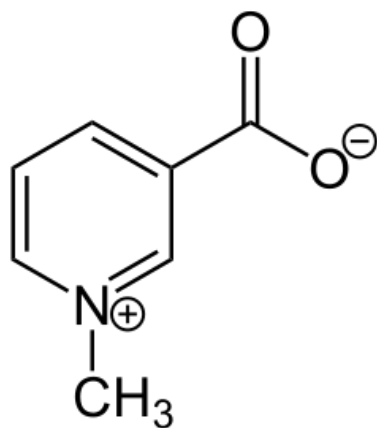


Figure 3: Chemical structure of Trigonelline, a major alkaloid found in *Trigonella foenum-graecum*. Adapted from PubChem database (CID 5570).⁵¹

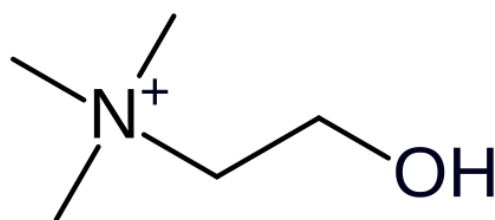


Figure 4: Chemical structure of Choline, a key precursor for neurotransmitters and a major constituent of dietary phospholipids. Adapted from PubChem database (CID 305).⁵²

The seeds of fenugreek are particularly notable for their biochemical richness. They contain the alkaloids trigonelline and choline, as well as essential oil, saponins, prolamin, mucilage, a bitter extractive, and a yellow coloring substance.^{6-7,9} Mucilage is a prominent constituent, accounting for 25–40% of the seed content, and is primarily composed of mannogalactans.¹ Another source notes the mucilage content at 25–30%, primarily in the form of galactomannan.⁵

The seeds yield a variety of alkaloids, including trigonelline, gentianine, and carpaine. Saponins are also present, mainly derived from sapogenins such as diosgenin and its isomer yamogenin, along with gitogenin and tigogenin. The flavonoids found include vitexin and its glycosides and esters, luteolin, and others. A small quantity of volatile oil is also present.⁵

Nutritionally, the seeds consist of 45–60% carbohydrates, predominantly mucilaginous fiber (galactomannans); 20–30% proteins that are rich in lysine and tryptophan; and 5–10% fixed oils (lipids). They also contain pyridine-type alkaloids such as trigonelline, choline, gentianine, and carpaine. Flavonoids like apigenin, luteolin, orientin, quercetin, vitexin, and isovitexin are present, alongside free amino acids, calcium, iron, glycosides that yield steroidal sapogenins on hydrolysis (including diosgenin, yamogenin, tigogenin, neotigogenin), cholesterol, sitosterol, Vitamins A, B1, C, and nicotinic acid, and a small amount (0.015%) of volatile oil consisting of n-alkanes and sesquiterpenes.^{1,3} Air-dried seeds contain

approximately 0.38% trigonelline (N-methyl-nicotinic acid) and 3 mg% nicotinic acid.^{3,6}

A unique steroidal sapogenin peptide ester known as fenugreekine has been identified for its hypoglycemic activity.⁵ Notably, about 80% of the total free amino acid content in the seeds is comprised of 4-hydroxyisoleucine, which has been shown to directly stimulate insulin secretion.⁵ Saponin-rich extracts from fenugreek have also been shown to reduce blood cholesterol levels.⁵

Several specific compounds have been isolated from fenugreek seeds, including tigogenin, neotigogenin, diosgenin, yamogenin, gitogenin, 4-hydroxyisoleucine, vitexin, isovitexin, saponaretin, homoorientin, vicianin-1, vicianin-2, and various graecunins (H, I, J, K, L, M, N), as well as fenugrin B.^{2,45,49-50} Additionally, the leaves of the fenugreek plant are known to function as an effective insect repellent.⁷ Interestingly, fenugreek has also been explored as a potential replacement for cod liver oil.^{12,33}

PHARMACOLOGICAL STUDIES

Aqueous Extract Studies

The aqueous extract is demulcent, promotes healing of gastric ulcers produced experimentally in rats, and exhibits a smooth muscle relaxing effect in rabbits without affecting either the heart or blood pressure.⁵

Alkaloidal constituents of fenugreek seeds have been reported to stimulate appetite and may exert mild diuretic and ureopoeitic effects.¹¹

Fenugreek (*Trigonella foenum-graecum*) exhibits a wide range of pharmacological activities, as outlined in the provided document.

Hypoglycemic Activity

Fenugreek seeds demonstrate a mild hypoglycemic effect, improving glucose homeostasis in alloxan-induced diabetic rats. The soluble dietary fiber enhances peripheral insulin action and inhibits carbohydrate digestion and absorption, making it a potential candidate for managing type 2 diabetes mellitus, comparable to glibenclamide.⁵³

Fenugreek reduces blood sugar in type 1 and type 2 diabetes by improving peripheral glucose utilization and tolerance, and increasing liver glycogen. Its galactomannan-rich soluble fiber slows gastric emptying, delaying glucose uptake, while seed extracts mimic insulin effects and enhance metformin bioavailability.⁵⁴

Fenugreek seeds exert mild to significant hypoglycemic effects by improving glucose homeostasis, enhancing peripheral insulin action, and delaying carbohydrate absorption. The galactomannan-rich soluble fiber slows gastric emptying, while seed extracts mimic insulin activity and enhance metformin bioavailability. Experimental studies show increased GLUT4 translocation, enhanced hexokinase activity, decreased glucose-6-phosphatase and fructose-1,6-bisphosphatase activities, and inhibition of α -amylase and maltase.⁵⁵ These actions protect pancreatic β -cells, stimulate insulin release, and modulate GLP-1, AMPK, and DPP-IV pathways. Clinical studies confirm improved blood

glucose control, insulin resistance, and lipid profiles in type 2 diabetes patients.⁵⁴

Fenugreek also exhibits renoprotective effects in diabetic nephropathy models by improving glucose regulation, renal function, oxidative stress, and lipid metabolism. Mechanistic insights reveal modulation of the PI3K–Akt–ERK signaling pathway, with upregulation of MAPK1, MAPK3, AKT1, and PI3K, indicating its nephroprotective role.⁵⁷

Preclinical Antidiabetic Effects

Fenugreek seeds and isolated compounds reduce hyperglycemia in type 1 and type 2 diabetes models by enhancing glucose transporter type-4 (GLUT4) translocation and hexokinase activity, decreasing glucose-6-phosphatase and fructose-1,6-bisphosphatase activities, and inhibiting α -amylase and maltase activities.⁵⁵

They protect pancreatic β -cells, increase insulin release, and act as a glucagon-like peptide-1 (GLP-1) modulator, 5'-AMP-activated kinase (AMPK) activator, and dipeptidyl peptidase-IV (DPP-IV) inhibitor.⁵⁵

According to Shaikh *et al.*, 2024, Bioactive compounds like galactomannan, 4-hydroxyisoleucine, saponins, diosgenin, trigonelline, quercetin, orientin, vitexin, and isovitexin contribute to these effects by improving insulin signaling and glucose metabolism.⁵⁵

Clinical Antidiabetic Effects:

Fenugreek seed supplementation improves blood glucose levels, insulin resistance, insulin sensitivity, and lipid profiles in patients with type 2 diabetes, demonstrating its potential as a therapeutic agent for diabetes management.⁵⁵

Phytochemistry

Fenugreek (*Trigonella foenum-graecum* L.) seeds are rich in bioactive compounds that underpin their diverse pharmacological activities. They contain lipids, proteins, mucilage, calcium, dietary fiber, B vitamins, iron, protease inhibitors, steroidal saponins, alkaloids, furostanol glycosides, and steroidal peptides.⁵³ Essential oil extracted from the seeds (yield 4.35%) contains diverse phytochemicals, with dibutyl phthalate identified as a major constituent through GC–MS analysis.⁵⁶ Phytochemical analyses further confirm the presence of alkaloids, saponins, tannins, phenols, and flavonoids in both seeds and leaves, contributing to their therapeutic potential.⁵⁴

Traditional and Nutraceutical Uses

Fenugreek has been traditionally employed as a lactation stimulant, labor inducer, laxative, and galactagogue owing to its phytoestrogen and saponin content.^{53–54} It is widely consumed as a functional food due to its high fiber, protein, and gum content, and is also used as a food stabilizer and emulsifying agent. Topical applications have been used to promote wound healing and relieve sore muscles, while seed preparations are consumed for digestive and metabolic benefits.

Hypolipidemic and Hypcholesterolemic Effects

Fenugreek reduces total cholesterol, LDL, VLDL, and triglycerides while increasing HDL. These effects are attributed to soluble fiber, which reduces bile acid reabsorption and enhances cholesterol excretion, as well as diosgenin and saponins, which inhibit cholesterol absorption and modulate hepatic cholesterol metabolism.^{53–54}

Antioxidant Properties

According to Neetu Singh *et al.*, 2024, Fenugreek seeds and oils exhibit strong antioxidant activity due to flavonoids and polyphenols such as vitexin and isovitexin. They scavenge free radicals, inhibit lipid peroxidation, and enhance endogenous antioxidant enzymes (SOD, GPx, GR), protecting against oxidative stress in diabetic and aging models.⁵⁶

Anti-inflammatory, Antipyretic, and Analgesic Activities

Flavonoid-rich fractions of fenugreek suppress pro-inflammatory cytokines, reduce arthritis-associated inflammation, and exhibit antipyretic activity in animal studies. Analgesic effects are mediated through modulation of inflammatory mediators and central pain pathways.⁵³

Gastroprotective and Antiulcer Effects

Fenugreek aqueous extract promotes healing of experimentally induced gastric ulcers, protects gastric mucosa due to its mucilage content, and demonstrates smooth muscle-relaxing effects without altering heart rate or blood pressure.⁵³

Hepatoprotective Effects

According to Visuvanathan *et al.*, 2022, Fenugreek exerts hepatoprotective action in toxin-induced hepatic injury models, normalizing enzyme levels, protecting hepatocytes, and promoting tissue regeneration.⁵⁴

Anticancer and Antineoplastic Potential

Steroidal saponins (e.g., diosgenin) and flavonoids induce apoptosis, inhibit proliferation, and reduce migration of cancer cells including colon, prostate, breast, pancreatic, and leukemia cell lines, with minimal toxicity to normal cells. Mechanisms involve inhibition of bcl-2, upregulation of p53, and activation of caspase-3 pathways.⁵⁴

Antimicrobial and Anthelmintic Activities

Fenugreek extracts show antimicrobial activity against bacterial pathogens (*E. coli*, *P. aeruginosa*, *B. cereus*) and antifungal strains. Seed oil and ATTEB formulations enhance this effect and demonstrate safety at therapeutic doses.^{56,58} Anthelmintic properties disrupt helminth life cycles, indicating potential against parasitic infections.

Immunomodulatory Effects

Fenugreek modulates immunity by enhancing phagocytic activity, increasing CD4+ and CD8+ T-cells, regulating macrophage polarization (M1/M2), and improving

cytokine profiles. ATTEB formulations further potentiate immunomodulation synergistically.⁵⁸

Endocrine and Hormonal Effects

According to Skrzypiec-Spring *et al.*, 2025 Fenugreek phytoestrogens relieve dysmenorrhea, improve menopausal bone health, and enhance lactation. Diosgenin acts as a precursor for steroid hormone synthesis, and clinical evidence suggests fenugreek seed extracts improve testosterone levels, libido, and male reproductive health, with synergistic benefits when combined with *Withania somnifera*.⁵⁹

Neuroprotective Effects

Fenugreek saponins inhibit acetylcholinesterase and apoptosis, offering neuroprotection in models of aluminum-induced toxicity and Parkinson's disease by restoring dopaminergic neurons and reducing oxidative stress markers.⁵⁴

Safety and Toxicological Profile

According to Maru Saurabh *et al.*, 2025, Fenugreek seed extracts are generally considered safe. OECD 423 acute toxicity studies reported no mortality at 2000 mg/kg, and subacute studies (OECD 407) found no adverse effects up to 1000 mg/kg. Hematological, biochemical, and histopathological parameters remained within normal ranges, and micronucleus assays confirmed absence of genotoxicity. The estimated LD50 >2000 mg/kg places fenugreek extracts in toxicity Category 4.⁵⁸

DISCUSSION

In India and many other parts of the world, medicinal plants continue to play a significant role in both traditional and integrative healthcare systems. This has renewed interest in evidence-based evaluation of drugs described in classical Unani literature. Hulba (*Trigonella foenum-graecum* L.), commonly known as fenugreek, is one of the most extensively used medicinal and dietary plants and has been valued since ancient Egyptian, Greek, and Arab medical traditions. The present review demonstrates that Hulba occupies an important place in Unani medicine, where it is characterized by a predominantly ḥarr yābis (hot and dry) temperament and described as possessing numerous pharmacological actions and therapeutic applications. The scope and structure of your review are reflected in the compiled manuscript.

Classical Unani texts attribute to Hulba a wide range of *af'āl*, including *kāsir-i-riyāḥ* (carminative), *mundij* (concoctive), *muqawwī* (tonic), *muqawwī-i-bāḥ* (aphrodisiac), *mudirr-i-bawl* (diuretic), *mudirr-i-ḥayḍ* (emmenagogue), *muḥallil-i-waram* (anti-inflammatory), *mulayyin* (laxative), *munaffith-i-balgham* (expectorant), and *mudirr-i-laban* (galactagogue). These traditional descriptions closely correspond with contemporary findings demonstrating hypoglycemic, hypolipidemic, anti-inflammatory, antioxidant, gastroprotective, hepatoprotective, antimicrobial, neuroprotective, and immunomodulatory activities. Such concordance highlights the enduring relevance of classical Unani

pharmacology and supports the scientific basis of many traditional indications.

The broad therapeutic spectrum of Hulba in Unani medicine includes disorders of the digestive, respiratory, musculoskeletal, genitourinary, gynecological, dermatological, and metabolic systems. Its longstanding use in conditions such as dyspepsia, flatulence, diabetes, obesity, arthritis, asthma, leucorrhoea, amenorrhoea, anemia, wounds, burns, and skin disorders aligns well with modern clinical and experimental research. In particular, substantial evidence supports its use in diabetes mellitus and dyslipidemia, areas in which compounds such as galactomannan, 4-hydroxyisoleucine, trigonelline, diosgenin, and steroidal saponins play important mechanistic roles.

Phytochemical analysis reveals that fenugreek seeds are exceptionally rich in soluble fiber, alkaloids, flavonoids, saponins, steroidal sapogenins, amino acids, and essential micronutrients. These constituents contribute synergistically to its pharmacological effects. Galactomannan delays glucose absorption, 4-hydroxyisoleucine stimulates insulin secretion, trigonelline exhibits antidiabetic and neuroprotective properties, and diosgenin demonstrates hypocholesterolemic, anti-inflammatory, and endocrine-modulating activities. The presence of these bioactive compounds provides a strong biochemical foundation for the diverse actions attributed to Hulba in classical medicine.

Despite the abundance of preclinical evidence and encouraging clinical findings, several limitations remain. Many studies differ considerably in plant source, extraction methods, standardization, dosage forms, and treatment duration, making direct comparison difficult. Clinical trials are often limited by small sample sizes and variable methodological quality. Furthermore, traditional Unani formulations containing Hulba, such as La'ūq Hulba and Dawā' al-Misk, have not been extensively investigated using modern research methods.

Toxicological studies indicate that fenugreek is generally safe when used in recommended doses. Nevertheless, classical texts caution against its use in individuals with hot temperament and note possible adverse effects on the reproductive organs. Modern literature also advises caution during pregnancy because of its uterotonic and labor-inducing effects. These observations underscore the importance of individualized prescribing and adherence to classical principles such as *muṣliḥ* (correctives) and *badal* (substitutes).

Overall, the available evidence demonstrates a substantial convergence between traditional Unani descriptions and contemporary scientific research. Hulba represents a notable example of a medicinal plant whose historical reputation is increasingly supported by modern pharmacological and clinical data, reinforcing its value in evidence-based herbal therapeutics.

CONCLUSION

This review critically evaluates Hulba (*Trigonella foenum-graecum* L.) in the light of classical Unani

literature and contemporary scientific evidence. Classical physicians described it as an important medicinal drug with a predominantly hot and dry temperament and extensive applications in digestive, respiratory, gynecological, musculoskeletal, dermatological, and metabolic disorders. The documented *mizāj*, *af'āl*, and *maḥal-i-ista'māl* are remarkably consistent with findings from modern experimental and clinical studies.

Contemporary research confirms that Hulba possesses significant hypoglycemic, hypolipidemic, antioxidant, anti-inflammatory, gastroprotective, hepatoprotective, antimicrobial, immunomodulatory, neuroprotective, and endocrine-modulating activities. These effects are largely attributed to bioactive constituents such as galactomannan, 4-hydroxyisoleucine, trigonelline, diosgenin, and other steroidal saponins and flavonoids. Among its many therapeutic applications, the strongest current evidence supports its role in the management of diabetes mellitus, dyslipidemia, obesity, and lactation support.

Although the scientific evidence is substantial, much of it remains preclinical, and available clinical studies vary in quality and methodology. Further research is needed to standardize extracts and formulations, elucidate mechanisms of action, conduct robust randomized controlled trials, and evaluate classical Unani compound formulations containing Hulba.

The integration of traditional Unani knowledge with contemporary biomedical research highlights the therapeutic significance of Hulba and supports its rational use in evidence-based and integrative healthcare systems.

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Author Contribution:

Conceptualization and Study Design: Mohd Mushfiq, Tabassum Latafat, Mursaleen Naseer, and Jamal Azmat.

Literature Search and Data Collection: Mohd Mushfiq.

Data Analysis and Interpretation: Mohd Mushfiq, Tabassum Latafat, Mursaleen Naseer, and Jamal Azmat.

Drafting of Manuscript: Mohd Mushfiq.

Critical Revision and Supervision: Tabassum Latafat, Mursaleen Naseer, and Jamal Azmat.

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Abbreviations

AMPK, 5'-adenosine monophosphate-activated protein kinase; CCRUM, Central Council for Research in Unani Medicine; DPP-IV, Dipeptidyl Peptidase-IV; ESCOP, European Scientific Cooperative on Phytotherapy; GC-MS, Gas Chromatography-Mass Spectrometry; GLP-1, Glucagon-Like Peptide-1; GLUT4, Glucose Transporter Type 4; HDL, High-Density Lipoprotein; JDDT, Journal of Drug Delivery and Therapeutics; LDL, Low-Density Lipoprotein; OECD, Organisation for Economic Co-operation and Development; PI3K, Phosphoinositide 3-Kinase; WHO, World Health Organization.

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REFERENCES

1. Khare CP, editor. Indian Herbal Remedies: Rational Western Therapy, Ayurvedic and Other Traditional Usage, Botany. New York : Springer-Verlag ; 2004. 453-455, 459-460 p. <https://doi.org/10.1007/978-3-642-18659-2>
2. Tandon N, editor. Quality Standards of Indian Medicinal Plants. Vol. 4. New Delhi : Indian Council of Medical Research ; 2006. 232-241 p.
3. Chevallier A. The Encyclopedia of Medicinal Plants. New York : DK Publishing Book ; 1996. 11, 19, 51-52, 195, 206, 276 p.
4. Singh VK, Govil JN, Bhardwaj R, editors. Recent Progress in Medicinal Plants. Vol. 19: Phytopharmacology and Therapeutic Values I. Houston (TX) : Studium Press LLC ; 2008. 73, 153, 178-179, 205-206, 260, 416 p.
5. Khare CP. Indian Medicinal Plants: An Illustrated Dictionary. New York : Springer Science+Business Media, LLC ; 2007. 662-663, 674-675, 766 p.
6. Chopra RN, Chopra IC, Verma BS. Supplements to Glossary of Indian Medicinal Plants. New Delhi : National Institute of Science Communication and Information Resources (NISCAIR), CSIR ; 2009. 97-98, 244-245, 248-249 p.
7. Chopra RN, Chopra IC, Handa KL, Kapur LD. Indigenous Drugs of India: Their Medical and Economic Aspects. 1st ed. Calcutta : The Art Press ; 1933. 426-428, 528-529, 572, 582 p.
8. Singh VK, Khan AM. Medicinal Plants and Folklores: A Strategy Towards the Conquest of Human Arealments. New Delhi : Today and Tomorrow's Printers and Publishers ; 1990. 48-49, 123, 140, 151, 172, 217 p.
9. Ministry of Health and Family Welfare. The Ayurvedic Pharmacopoeia of India. Part 1, Vol. 1. New Delhi : Government of India, Ministry of Health and Family Welfare ; 1999. 70-72, 162-164 p.
10. Naṣir, H. T. Tāj al-Mufradāt (Khawāṣ al-Adviyah). 1st ed. New Delhi : Idara Kitab-us-Shifa ; 2010. 617-618, 716-717 p.

11. Nadkarni AK. Dr. K.M. Nadkarni's Indian Materia Medica. 3rd ed. Vol. 1. Bombay : Popular Prakashan Private Ltd. ; 1982. 1220-1224, 1240-1243 p.
12. Ali, S. S. Yūnānī Advīyah Mufradah. 7th ed. New Delhi : National Council for Promotion of Urdu Language ; 2013. 139-140, 243, 427-428, 453-454 p.
13. Kirtikar KR, Basu BD. Indian Medicinal Plants. 2nd ed. Vol. 2. Blatter E, Caius JF, Mhaskar KS, editors. Allahabad : Lalit Mohan Basu ; 2012. 700-701 p.
14. Chatterjee A, Pakrashi SC, editors. The Treatise on Indian Medicinal Plants. Vol. 2. New Delhi : Publication & Information Directorate, CSIR ; 2005. 125 p.
15. Ministry of Health and Family Welfare. The Unani Pharmacopoeia of India. Part I, Vol. II. New Delhi : Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy (AYUSH) ; 2007. 53-54 p.
16. Ministry of Health and Family Welfare. The Unani Pharmacopoeia of India. Part I, Vol. IV. New Delhi : Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy (AYUSH) ; 2007. 51-52 p.
17. Ministry of Health and Family Welfare. Standardisation of Single Drugs of Unani Medicine. Part I. New Delhi : Central Council for Research in Unani Medicine (CCRUM) ; 1987. 220-225 p.
18. Dioscorides P. The Greek Herbal of Dioscorides. Book I, Aromatics. Goodyer J, translator. Gunther RT, editor. Oxford : Oxford University Press ; 1934. 55 p.
19. Rafiq, H. M. Kanz al-Adviyah Mufradah. Aligarh : Aligarh Muslim University Press ; 1985. 305-307, 594-596 p.
20. U.S. Department of Agriculture, Natural Resources Conservation Service. *Trigonella foenum-graecum* L. classification. USDA PLANTS Database. Available from: <https://plants.sc.egov.usda.gov/classification/83221>. Accessed 2026 Jan 13
21. Ibn al-Bayṭār, Diyā' al-Dīn Abū Muḥammad 'Abd Allāh ibn Aḥmad. al-Jāmi' li-Mufradāt al-Adviyah wa-al-Aghdhiyah (Urdu Translation by CCRUM). Vol. 2. New Delhi : Central Council for Research in Unani Medicine (CCRUM) ; n.d. 52-54 p.
22. Fleming J. A catalogue of Indian medicinal plants and drugs, with their names in the Hindustani and Sanscrit languages. Calcutta : Hindustani Press ; 1810. 42 p.
23. Dioscorides P. The Greek Herbal of Dioscorides. Book II. Goodyer J, translator. Gunther RT, editor. Oxford : Oxford University Press ; 1934. 243 p.
24. Aronson JK, editor. Meyler's Side Effects of Herbal Medicines. Amsterdam : Elsevier ; 2009. 122, 165 p.
25. Ibn Sīnā. al-Qānūn fī al-Tibb (Urdu translation by Kantūrī, G. H.). Vol. 3 (Pt. 2). New Delhi: Idara Kitab-us-Shifa; 2010. pp. 346-347, 353-354, 1031-1038.
26. Kabīruddīn, H. Makhzan al-Mufradāt al-Ma'rūf Khawāṣ al-Adviyah. Delhi : Eijaz Publishing House ; n.d. 495-496, 562-564 p.
27. A'wān, H. M. Kitāb al-Mufradāt. 3rd ed. Lahore, Karachi : Sheikh Ghulam Ali and Sons ; 1960. 414-415, 419 p.
28. Kabīruddīn, H. Lughāt al-Adviyah (al-Ma'rūf Lughāt-i Kabīr). 2nd ed. New Delhi : Idara Kitab-us-Shifa ; 2014. 133, 318 p.
29. Ḥakīm, M. A. Bustān al-Mufradāt. New Delhi : Idara Kitab-us-Shifa ; 2002. 489-490, 572-573 p.
30. Shīrāzī, M. H. Makhzan al-Adviyah (Urdu translation by Karīm, N.). Vol. 2. Kanpur : Munshi Nawal Kishore ; n.d. 251-253, 456-457 p.
31. Ḥakīm, M. A. Mufradāt-i 'Azīzī (Urdu Translation by CCRUM). New Delhi : Central Council for Research in Unani Medicine ; 2009. 49, 60, 101, 103 p.
32. Aḥmad, J. Ta'lim al-Adviyah. 1st ed. Lucknow : Yusuf Publication ; 1930. 44, 98 p.
33. Mu'min, K. H. Tuhfah-yi Ḥakīm Mu'min. Kanpur / Lucknow : Munshi Naval Kishore ; 1853. 93 p.
34. Anṣārī, 'A. B. H. Ikhtiyārāt-i Badī'ī (Urdu Translation). Kanpur : Munshi Nawal Kishore ; n.d. 135-136 p.
35. Nabī, M. G. Makhzan al-Mufradāt wa-al-Murakkabāt. 3rd ed. New Delhi : Central Council for Research in Unani Medicine (CCRUM) ; 2007. 235 p.
36. Ved DK, Suma TS, Barve V, Srinivas V, Sangeetha S, Ravikumar K, et al. *Trigonella foenum-graecum* L. [Internet]. Bengaluru : FRLHT's ENVIS Centre on Medicinal Plants ; 2016 [cited 2026 Feb 11]. Available from: envis.frlht.org
37. Ghānī, N. H. Khazā'in al-Adviyah. New Delhi: Idara Kitab-us-Shifa; 2011. pp. 1138-1139.
38. Kabīruddīn, H. M. 'Ilm al-Adviyah Nafīsī. Delhi : Daftar al-Maseeh ; 1938. 124, 327-328 p.
39. Khān, M. A. Muḥīṭ-i A'zam (Urdu Translation). Vol. 4. New Delhi : Central Council for Research in Unani Medicine ; 2018. 264-266, 705-706 p.
40. Ministry of Health and Family Welfare. National Formulary of Unani Medicine. Part 1. New Delhi : Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy (AYUSH) ; 2006. 13, 22, 35, 46, 88-89, 116-117, 162-167, 170, 242, 244, 247 p.
41. Ministry of Health and Family Welfare. National Formulary of Unani Medicine. Part 3. New Delhi : Central Council for Research in Unani Medicine ; 2001. 85 p.
42. Ministry of Health and Family Welfare. National Formulary of Unani Medicine. Vol. 1, Part 2. New Delhi : Central Council for Research in Unani Medicine ; 2007. 26, 60, 136, 139-140 p.
43. Ministry of Health and Family Welfare. National Formulary of Unani Medicine. Part 5. New Delhi : Central Council for Research in Unani Medicine ; 2008. 21-23, 95-96, 116, 137 p.
44. Ministry of Health and Family Welfare. National Formulary of Unani Medicine. Part 6. New Delhi : Central Council for Research in Unani Medicine ; 2011. 15, 31, 77, 103, 122-123, 135 p
45. Rastogi RP, Mehrotra BN, editors. Compendium of Indian medicinal plants. Vol. 3. New Delhi : Central Drug Research Institute, Lucknow and National Institute of Science Communication and Information Resources ; 2007. 646-648, 659-660 p.
46. Rastogi RP, Mehrotra BN, editors. Compendium of Indian medicinal plants. Vol. 5. New Delhi : Central Drug Research Institute, Lucknow and National Institute of Science Communication and Information Resources ; 2005. 851-854, 864-865 p.
47. Sa'īd, I. A. Kitāb al-Faṭḥ fī al-Tadāwī (Urdu translation by Bārī, A.). 1st ed. New Delhi : NCPC Printers ; 2007. 116 p.
48. Dioscorides P. The Greek Herbal of Dioscorides. Book IV, Other herbs and roots. Goodyer J, translator. Gunther RT, editor. Oxford : Oxford University Press ; 1934. 733 p.
49. Rastogi RP, Mehrotra BN, editors. Compendium of Indian Medicinal Plants. Vol. 2. New Delhi : Central Drug Research Institute, Lucknow and National Institute of Science Communication and Information Resources ; 2006. 679-680, 688 p.
50. Rastogi RP, Mehrotra BN, editors. Compendium of Indian medicinal plants. Vol. 4. New Delhi : Central Drug Research Institute, Lucknow and National Institute of Science Communication and Information Resources ; 2008. 733-736, 740-741 p.
51. National Center for Biotechnology Information (NCBI). PubChem compound summary for CID 5570, Trigonelline [Internet]. Bethesda (MD): National Library of Medicine; cited 2026 Feb 11.
52. National Center for Biotechnology Information (NCBI). PubChem compound summary for CID 305, Choline [Internet]. Bethesda (MD): National Library of Medicine; cited 2026 Feb 11.
53. Hilles AR, Mahmood S. A review on phytochemistry and pharmacological effects of *Trigonella foenum-graecum*. Adv Herb Med. 2016 ; 2(3) : 61-67.

54. Visuvanathan T, Than LTL, Stanslas J, Chew SY, Vellasamy S. Revisiting *Trigonella foenum-graecum* L.: pharmacology and therapeutic potentialities. *Plants (Basel)*. 2022 ; 11(11) : 1450. <https://doi.org/10.3390/plants11111450> PMID:35684222 PMCID:PMC9182856
55. Sarker DK, Ray P, Dutta AK, Rouf R, Uddin SJ. Antidiabetic potential of fenugreek (*Trigonella foenum-graecum*): a magic herb for diabetes mellitus. *Food Sci Nutr*. 2024 ; 12 : 7108-7136. <https://doi.org/10.1002/fsn3.4440> PMID:39479631 PMCID:PMC11521722
56. Singh N, Yadav SS, Narasihman B. Antimicrobial and antioxidant assessment of *Trigonella foenum-graecum*. *Legume Res*. 2024 ; 47(7) : 1113-1119. <https://doi.org/10.18805/LR-5348>
57. Niu Y, Niu H, Chi L, Li P, Du J, Wang X, et al. *Trigonella foenum-graecum* L. protects against renal function decline in a mouse model of type 2 diabetic nephropathy by modulating the PI3K-Akt-ERK signaling pathway. *Front Pharmacol*. 2025 ; 16 : 1566723. <https://doi.org/10.3389/fphar.2025.1566723> PMID:40170727 PMCID:PMC11959092
58. Maru S, Belemkar S. Acute and subacute oral toxicity study of a herbal formulation containing *Asparagus racemosus*, *Tinospora cordifolia*, and *Trigonella foenum-graecum* in mice. *J Toxicol*. 2025 ; 2025 : 8221552. <https://doi.org/10.1155/jt/8221552> PMID:39974656 PMCID:PMC11839261
59. Skrzypiec-Spring M, Pokrywka A, Kuliczowska-Płaksej J, Szeląg A, Bolanowski M. *Withania somnifera* and *Trigonella foenum-graecum* as ingredients of testosterone-boosting supplements: possible clinical implications. *Adv Clin Exp Med*. 2025 ; 34(1) : 1-9. <https://doi.org/10.17219/acem/185743> PMID:38628109