

**AN OVERVIEW OF FENUGREEK: BACKGROUND, TRADITIONAL USES,
PHARMACOLOGICAL ACTIVITIES, AND MODERN PERSPECTIVES*****Akshy Laxman Mane, Rutuja Shah**

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DOI: <https://doi.org/10.5281/zenodo.18795932>**How to cite this Article:** *Akshy Laxman Mane, Rutuja Shah (2026). An Overview Of Fenugreek: Background, Traditional Uses, Pharmacological Activities, And Modern Perspectives. European Journal of Pharmaceutical and Medical Research, 13(3), 01-06.

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Article Received on 24/01/2026

Article Revised on 13/02/2026

Article Published on 01/03/2026

ABSTRACT

Fenugreek, or *Trigonella foenum-graecum*, is an ancient medicinal herb that is used in many different cultures as a culinary spice and therapeutic agent. Fenugreek has a rich phytochemical profile that includes alkaloids, saponins, flavonoids, polysaccharides, and special amino acids like 4-hydroxyisoleucine. It has long been used in Ayurvedic, Chinese, and Mediterranean medical systems. Its wide pharmacological potential, which includes antidiabetic, antihyperlipidemic, antioxidant, anti-inflammatory, anticancer, antimicrobial, hepatoprotective, and reproductive-modulating properties, is attributed to these bioactive substances. Fenugreek's role in glycemic regulation through improved peripheral insulin sensitivity, increased insulin secretion, and delayed carbohydrate absorption is supported by both experimental and clinical data. Polyphenols, saponins, and steroidal saponins like diosgenin are responsible for its anticancer and antioxidant properties. Its development, genomic enhancement of cultivars, investigation of gut microbiome interactions, and integration into functional foods are further examples.

KEYWORDS: *Trigonella foenum-graecum*, fenugreek, phytochemistry, pharmacological activities, antidiabetic, antioxidant, saponins, diosgenin, 4-hydroxyisoleucine, traditional uses, functional foods, nutraceuticals.**INTRODUCTION**

Trigonella foenum-graecum, also known as fenugreek, is a rainfed, herbaceous, leguminous crop that grows between 30 and 60 cm tall, with leaflets that are between 2 and 2.5 cm long and flowers that are about are axillary, sessile, 1-2 cm long, and grown all over the nation. They have been used as a spice to improve the flavor of food all over the world. Native to the Eastern Mediterranean and Indian subcontinent, fenugreek is a short-lived, self-pollinating crop. It is widely used as a spice, food, herb, and traditional medicine throughout the world and is a member of the Fabaceae family. This annual herb has been used for its nutritional value and medicinal properties since ancient times. It has white flowers and hard, yellowish brown, and sharp seeds. (Kakani et. al 2012).

Anti-diabetic, anti-fertility, anti-cancer, antimicrobial, antiparasitic, lactation-stimulating, hypocholesterolaemia, antioxidant-potent, digestive-

stimulating, and hepatoprotective properties are all attributed to fenugreek. Natural products derived from plants have long been used to treat degenerative diseases. One of the oldest known medicinal plants, fenugreek has been used in traditional Chinese medicine and Ayurveda for its health-promoting properties. Numerous physiological benefits of fenugreek seeds have been observed in recent decades in both human and animal trials. These include the following: hepatoprotective effect, antioxidant potency, hypocholesterolaemia influence, antidiabetic effect, and digestive stimulant action. In recent years, there has been a renewed interest in studying the chemical makeup and pharmacological effects. The pharmacological applications of fenugreek as an antidiabetic, antihyperlipidemic, anticancer, anti-inflammatory, antioxidant, antifungal, and antibacterial have been described by extensive preclinical and clinical research. (Sharma et. al 1986).

Due to its purported antidiabetic, hypolipidemic, anti-inflammatory, antioxidant, and gastroprotective properties, fenugreek has attracted a lot of scientific and commercial attention in recent years. Fenugreek supplementation has shown improvements in glycemic control, insulin sensitivity, and lipid metabolism in metabolic disorders, particularly type 2 diabetes mellitus, according to numerous experimental and clinical studies. Its distinct galactomannan structure and high soluble fiber content also make it pertinent to the development of functional foods and appetite control. (Sharma *et al.* 1990).

Research on fenugreek's phytochemistry, mechanisms of action, safety profile, and therapeutic applications has increased due to its growing recognition as a nutraceutical ingredient. However, different plant cultivars, extraction techniques, dosage forms, and research designs have yielded inconsistent results, highlighting the necessity of a thorough synthesis of the available data. The purpose of this review is to provide an overview of fenugreek's traditional applications, phytochemical makeup, pharmacological characteristics, and therapeutic potential while pointing out current gaps and potential future research and application paths. (Zandi *et al.* 2016).

HISTORICAL BACKGROUND

Fenugreek is among the most ancient medicinal plants, referenced in historical religious texts, herbal literature, travel accounts, and narratives throughout human history. During the first century BC, the Romans utilized wine infused with fenugreek. In ancient Rome, it served as a means to induce labor during childbirth, and it was cultivated as a forage crop in the ancient Greek era. The texts of Ayurveda, including Charaka Samhita and Sushruta Samhita, date back to approximately 1000 BC. The incorporation of fenugreek seeds in Chinese medicine was first documented during the Song Dynasty (1057 BC).

In China (1060 BC), fenugreek was utilized to alleviate cold and mitigate pain. It was utilized in Europe to address skin inflammations and transient appetite loss. The entire grass, seeds, and flowers of fenugreek are utilized in traditional Chinese medicine for the management of hyperlipidaemia, hypertension, and immune disorders. Fenugreek leaves were utilized in Egyptian incense Kuphi to generate a sacred smoke employed in fumigation and embalming rituals (Rosengarten 1969).

Different claims about origin of fenugreek:	References
Asia	De Candolle (1964), Fazli (1978)
Turkic	Dangi <i>et al.</i> (2004)
India and north African	Fuller and Stephens (2015)
West African	Rashid <i>et al.</i> (2018)

Fenugreek is presently cultivated in various countries worldwide, including India, China, Egypt, Morocco, Ethiopia, Turkey, Ukraine, Greece, and Canada, primarily for its medicinal properties. Recently, fenugreek has been utilized for its antidiabetic, hypocholesterolemic, antilipidemic, hepatoprotective, antiulcer, antioxidant, anti-inflammatory, antibacterial, antifungal, anticarcinogenic, and neuroprotective

properties. Fenugreek is utilized as a spice in Iran, in Switzerland for flavouring cheese, in Egypt as seed powder combined with flour for flatbread, and in India and Pakistan as a vegetable. Currently, fenugreek bioactive compounds (saponins and sapogenins) have demonstrated efficacy in the treatment of diabetes mellitus.



DRUG PROFILE AND TAXONOMICAL CLASSIFICATION OF FENUGREEK (Borhani et. al 2022)

- **Kingdom;** plantae
- **Division;** Angiospermae
- **Class;** Dicotyledonae
- **Sub-class;** zingiberidae
- **Family;** zingiberaceae
- **Genus;** curcuma
- **Species;** c. longa
- **Biological source;** it is obtained from dried rhizomes of curcuma longa
- **Geographical source;** native to tropical south Asia
- **Chemical constituents;** curcumin, terpene zingiberene, beta-bisabolene
- **Scientific name;** curcuma longa
- **Local name;** haldi, halder, turmeric
- **Useful organ;** underground stem, tubers, rhizomes

SYNONYMS OF FENUGREEK IN VARIOUS LANGUAGES

LANGUAGES	SYNONYMS
English	Fenugreek
Hindi	Methi
Marathi	Methi
Gujarati	Methi
Italian	Fieno greco
German	Bockshornklee
French	Fenugrec
Spanish	Alholva
China	K'u -Tou
Arabian	Hulba
Japanese	Koroha

PHYTOCHEMISTRY OF TRIGONELLA FOENUM-GRAECUM (FENUGREEK)

CLASS	REPRESENTATIVE COMPOUND	KEY ACTIVITIES
Alkaloids	Trigonelline, Gentianine	Antidiabetic, neuroprotective
Saponins	Diosgenin Protodioscin	Hormonal modulation, cholesterol lowering
Flavonoids	Quecetin, Vitexin	Antioxidant, anti-inflammatory
Volatiles	Sotolone	Aroma, flavor
Polysaccharides	Galactomannan	Fiber, glucose control
Lipids	Linoleic acid	Nutritional value
Unique amino acids	4-hydroxyisoleucine	Insulin secretion

UNDESIRABLE EFFECT OF FENUGREEK

Traditionally, fenugreek has been regarded as safe to eat or use as a medicinal plant. However, there is a possibility that using fenugreek will cause allergic reactions in people who already have a chickpea allergy (Patil et al. 1997). Inhaling fenugreek seed powder has been linked to hypersensitivity reactions such as fainting, rhinorrhea, and wheezing (Ohnuma et al. 1998), while using fenugreek paste to treat dandruff has been linked to facial angioedema (Patil et al. 1997). Due to the potential for hypoglycemia, it is strongly advised to monitor blood glucose levels after beginning supplementation (Sharma and Raghuram 1990). Additional adverse effects of fenugreek include an increased risk of fetal death (Arae et al. 2009), a reduction in the intensity of bone marrow cell proliferation, or bleeding risk (Lambert and Cormier 2001).

The presence of coumarin constituents, which may intensify the effects of anticoagulant medications, is the cause of adverse effects (Heck et al. 2000). According to Basch et al. (2003), high fiber content is mucilaginous and may cause concurrent oral medication absorption to be delayed or reduced. When combined with other hypokalemic medications, diuretics, or laxatives, fenugreek's reduction of potassium levels (Abdel-Barry et al. 2000) may cause hypokalemia. Additive hypoglycemic action may occur when fenugreek is used with antidiabetic medications (Vijayakumar and Bhat 2008). Due to uterine stimulant effects or maple syrup urine disease, fenugreek should not be used during pregnancy (Korman et al. 2001).

Traditional uses of fenugreek across diverse cuisines worldwide

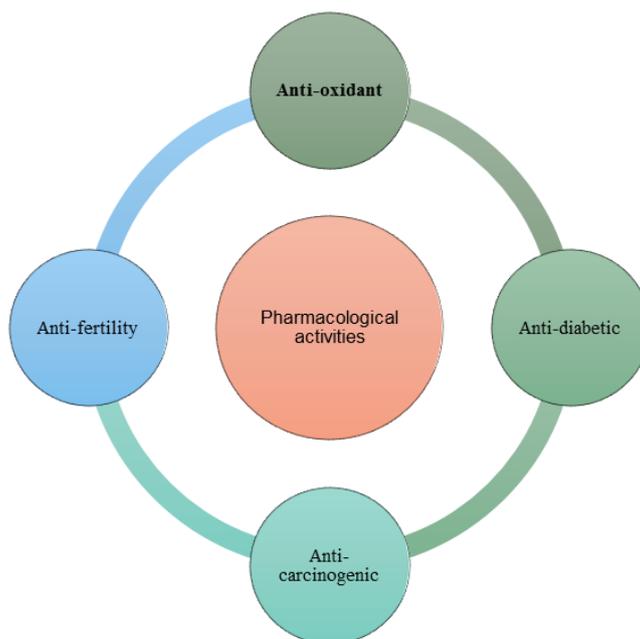
Parts of plant	Dishes or other food uses	Country	References
Fenugreek leaves and stems	Commonly cooked as a winter vegetable (methi ka saag)	India	Passano (1995)
Fenugreek seed	Flavouring agent (spices) in various dishes Eaten raw as vegetable sprouts	India	Passano (1995)
Fenugreek seeds	Flavouring agent in bread baking	Egypt and Ethiopia	Passano (1995)
Fenugreek seed	Flavouring agent in cheese	Switzerland	Passano (1995)
Fenugreek seed	Spice in blends for soups and stews	United states	Passano (1995)
Ground Fenugreek seed	used to prepare çemen, a fenugreek paste used as an edible coating material in the production of pastirma, a	Turkey	Isikli and karababa

	traditional meat product consisting of highly seasoned, air-dried cured beef		(2005)
Fenugreek seed	Desserts (helba metabakha)	Egypt	El-zalaki and basama (2007)
Fenugreek seeds	Desserts (halvah)	Mediterranean area and various other countries	Sarwar et al. (2020)
Fenugreek seed	Spice Once of the ingredient of rfissa (chicken with lentil dish)	Marocco	Sun et al. (2021)

Pharmacological activities

Various evidence suggest that fenugreek may help prevent and manage various health conditions like diabetes, high blood pressure, obesity, brain disorder, painful periods, reproductive issues and cancer. (Das et

al., 2023; Luo et al., 2020; Srinivasa& Naidu, 2021; Syedetal.,2020; Visvanathan et al., 2022). Also, it can show various activities like antioxidant, antidiabetic, antihypertensive, etc.



Anti-oxidant action

Extracts, plant fractions, and some fenugreek-enriched foods have all been shown to exhibit fenugreek's antioxidant activity. Flavonoid and phenolic compounds, terpenes, alkaloids, saponins, and other secondary metabolites are frequently found in fenugreek extracts. Two aqueous extracts from fenugreek seeds with different phytochemical compositions demonstrated comparable high antioxidant capacity, according to Benziane et al. (2019). By probing various levels of antioxidant protection, such as ferric reducing antioxidant power, free radical scavenging, and inhibition of lipid peroxidation in mitochondrial preparations, an aqueous fraction rich in flavonoids and other phenolics demonstrated the highest antioxidant capacity in germinated seeds (Dixit et al., 2005). The seeds husk fraction, which is highest in TPS, has the highest antioxidant capacity at 72%, while the endosperm has 56% and the seeds have 64%. (Naidu et al.,2011). The antioxidant capacity of fenugreek seeds oil was associated with the presence of other antioxidant molecules including α -terpenes and pinene. α - tocopherol

is another important antioxidant associated with the liquid fraction of fenugreek. (Akbari et al., 2019).

Enzymes found in the liver, such as alanine aminotransferase, aspartate aminotransferase, lactate dehydrogenase, bilirubin, gamma glutamyl transferase, and alkaline phosphatase, reduce hepatic glycogen levels. Additionally, its medication improves lipid levels while reducing peroxidation levels, aldehyde, and collagen. (kaviarasan et al. 2011).

Anti-diabetic action

Fenugreek has been extensively studied for its potential benefits in glycemic control, largely due to its high soluble fiber content and bioactive compounds. The seed's galactomannan significantly slows gastric emptying and carbohydrate absorption, leading to reduced post-prandial glucose excursions (Madar, 1984). This mechanical effect is complemented by **4-hydroxyisoleucine**, an amino acid unique to fenugreek, which has been shown to stimulate insulin secretion in a glucose-dependent manner (Sauvaire et al., 1998). By

enhancing insulin release only when blood glucose is elevated, fenugreek may help improve glycemic control without increasing the risk of hypoglycemia.

In addition to effects on insulin secretion, fenugreek appears to improve peripheral insulin sensitivity and glucose uptake. Its polyphenols and saponins have been associated with improved insulin action at the cellular level and reduced hepatic glucose output, contributing to overall antihyperglycemic activity (Sharma *et al.*, 1990).

Anti-carcinogenic action

By altering cyclophosphamide-induced apoptosis and free radical-mediated lipid peroxidation, fenugreek is a potentially useful medicinal herb for cancer patients' complementary therapy (Bhatia *et al.* 2006). Many bioactive substances, such as diosgenin, which is used to make the steroid hormones cortisone and progesterone, can be used to treat cancer (Aggarwal and Shishodia 2006). Diosgenin was used to inhibit cell growth and induce apoptosis in the H-29 human colon cancer cell line (Thirunavukkarasu *et al.* 2003). Because seed powder contains saponins, flavonoids, and fiber, it helps reduce β -glucuronidase activity and stops free carcinogens from acting on colonocytes. Studies have also indicated that leukemic cells are strongly inhibited (Devasena and Menon 2003).

Anti-fertility effects

Due to its saponin content, fenugreek has been used as a spermicidal agent for human semen and rats, and its potential use in contraception has been studied.

While fenugreek seed consumption is prohibited during pregnancy, it is strongly advised during lactation. According to reports, the oil extract of seeds contains a lactation-promoting factor, but it also has a mild antifertility effect because it contains diosgenin, which is used to synthesize sex hormones and oral contraceptives and may have estrogenic activity. (Rana, P. 2022).

FUTURE PERSPECTIVES OF FENUGREEK

1) Standardized Procedures (Yao *et al.*, 2020)

The creation of standardized fenugreek extracts will be a top priority in the future. Results are difficult to compare because different studies frequently use different varieties of the seed. The reliability of subsequent studies could be significantly increased by developing preparations with constant concentrations of essential elements, such as diosgenin and 4-hydroxyisoleucine.

2) Potential for Phyto pharmaceuticals (Basu *et al.*, 2019)

Compounds isolated from fenugreek may be used as a starting point for new drug candidates as interest in plant-based therapeutic agents grows. Eventually, targeted drugs may be created from purified molecules with particular metabolic effects.

1) Genetic and agricultural advancements (Kumar, M. A. N. O. J., *et al.* 2013)

Enhancing the plant itself is becoming more and more popular. Future cultivars could be optimized for increased yield, improved resistance to environmental stresses, and a higher phytochemical content using biotechnological techniques or selective breeding.

2) Investigation of Interactions with the Gut Microbiome (Jones, K. A., *et al.*, 2022)

It is still unclear how fenugreek and the gut microbiota interact. Fenugreek's fiber and polyphenols may be investigated for their possible prebiotic effects and their impact on metabolic health as microbiome research grows.

3) Novel Types of Functional Foods (Yao *et al.*, 2020)

Fenugreek may be used more frequently in functional foods due to the growing demand for natural products that promote health. Including it in commonplace objects.

4) Function in the Health of Women (Akhtari *et al.*, 2024)

Although there is still little clinical evidence, fenugreek has long been used in traditional medicine to improve the health of women. Future studies may shed light on its possible function in promoting lactation, controlling PCOS, or reducing menopausal symptoms.

REFERENCES

1. Abdel-Barry JA, Abdel-Hassan IA, Al-Hakiem MHH. Hypoglycaemic effect of aqueous extract of the leaves of *Trigonella foenum-graecum* in healthy volunteers. *East Mediterr Health J*, 2000; 6: 83-8.
2. Acem MN, Aggad H, Abdali M. Phytochemistry, HPLC profile and antioxidant activity of algerian fenugreek seed extracts. *Acta Sci Nat*, 2019; 6(2): 71-87.
3. Aggarwal BB, Shishodia S. Molecular targets of dietary agents for prevention and therapy of cancer. *Biochem Pharmacol*, 2006; 71: 1397-421.
4. Akbari S, Abdurahman NH, Yunus RM, Alara OR, Abayomi OO. Extraction, characterization and antioxidant activity of fenugreek (*Trigonella foenum-graecum*) seed oil. *Mater Sci Energy Technol*, 2019; 2(2): 349-55.
5. Akhtari E, Ram M, Zaidi SMA, Marques AM, Rahimi R, Bahramsoltani R. Fenugreek (*Trigonella foenum-graecum* L.) in women's health: A review of clinical evidence and traditional use. *J Herb Med*, 2024; 43: 100816.
6. Araee M, Norouzi M, Habibi G, Sheikhvatan M. Toxicity of *Trigonella foenum-graecum* (Fenugreek) in bone marrow cell proliferation in rat. *Pak J Pharm Sci*, 2009; 22: 126-30.
7. Basch E, Ulbricht C, Kuo G, Szapary P, Smith M. Therapeutic applications of fenugreek. *Altern Med Rev*, 2003; 8: 20-7.

8. Basu SK, Zandi P, Cetzal-Ix W. Fenugreek: distribution, genetic diversity, and industrial potential. In: The role of functional food security in global health, 2019. p. 471-97.
9. Bhatia K, Kaur M, Atif F, Ali M, Rehman H. Aqueous extract of *T. foenum-graecum* ameliorates additive urotoxicity of buthionine sulfoximine and cyclophosphamide in mice. *Chem Toxicol*, 2006; 44: 1744-50.
10. Borhani B, Khodakaramian G, Velázquez E. Diversity and phylogeny of bacterial strains isolated from nodules of fenugreek (*T. foenum-graecum*) in Iran. *FEMS Microbiol Lett*, 2022; 369(1): fnac045.
11. Chaudhary S, Chaudhary PS, Chikara SK, Sharma MC, Iriti M. Review on fenugreek and its important secondary metabolite diosgenin. *Not Bot Horti Agrobo*, 2018; 46(1): 22-31.
12. Dangi RS, Lagu MD, Choudhary LB, Ranjekar PK, Gupta VS. Assessment of genetic diversity in *T. foenum-graecum* and *T. caerulea* using ISSR and RAPD markers. *BMC Plant Biol*, 2004; 4(1): 1-11.
13. DeCandolle A. Origin of cultivated plants. New York: Hafner; 1964. Vavilov NI. Studies in the origin of cultivated plants. Leningrad: Inst Appl Bot Plant Breed, 1926.
14. Devasena T, Menon VP. Fenugreek affects beta-glucuronidase and mucinase activity in colon. *Phytother Res*, 2003; 17: 1088-91.
15. Dixit P, Ghaskadbi S, Mohan H, Devasagayam TP. Antioxidant properties of germinated fenugreek seeds. *Phytother Res*, 2005; 19(11): 977-83.
16. El-Zalaki LM, Basma MN. Chemical, nutritional and sensory evaluation of two Egyptian sweet products. *Alexandria J Food Sci Technol*, 2007; 4(2): 41-51.
17. Fuller S, Stephens JM. Diosgenin, 4-hydroxyisoleucine, and fiber from fenugreek: mechanisms and metabolic effects. *Adv Nutr*, 2015; 6(2): 189-97.
18. Heck AM, DeWitt BA, Lukes AL. Potential interactions between alternative therapies and warfarin. *Am J Health Syst Pharm*, 2000; 57: 1221-7.
19. Isikli ND, Karababa E. Rheological characterization of fenugreek paste (çemen). *J Food Eng*, 2005; 69(2): 185-90.
20. Jones KA, Richard AJ, Salbaum JM, et al. Cross-omics analysis of fenugreek supplementation indicates benefits due to gut microbiome changes. *Int J Mol Sci*, 2022; 23(7): 3654.
21. Kakani RK, Anwer MM. Fenugreek. In: Handbook of herbs and spices. Woodhead Publishing, 2012; p. 286-98.
22. Kaviarasan S, Naik GH, Gangabhairathi R, Anuradha CV, Priyadarsini KI. In vitro antiradical and antioxidant activities of fenugreek seeds. *Food Chem*, 2007; 103: 31-7.
23. Korman SH, Cohen E, Preminger A. Pseudo-maple syrup urine disease due to maternal fenugreek ingestion. *J Paediatr Child Health*, 2001; 37: 403-4.
24. Kumar MANOJ, Prasad M, Arya R. Grain yield and quality improvement in fenugreek: a review. *Forage Res*, 2013; 39: 1-9.
25. Lambert JP, Cormier A. Potential interaction between warfarin and boldo-fenugreek. *Pharmacotherapy*, 2001; 21: 509-12.
26. Madar Z. Fenugreek as a means of reducing postprandial glucose in diabetic rats, 1984.
27. Naidu MM, Shyamala BN, Naik JP, Sulochanamma G, Srinivas P. Chemical composition and antioxidant activity of fenugreek husk and endosperm. *LWT Food Sci Technol*, 2011; 44(2): 451-6.
28. Ohnuma N, Yamaguchi E, Kawakami Y. Anaphylaxis to curry powder. 1998
29. Patil SP, Niphadkar PV, Bapat MM. Allergy to fenugreek. *Ann Allergy Asthma Immunol*. 1997; 78: 297-300
30. Passano PJM. The many uses of methi. *Nutrition*. 1995; 2(1): 31-4.
31. Rashid F, Hussain S, Ahmed Z. Extraction, purification and characterization of galactomannan from fenugreek. *Carbohydr Polym*, 2018; 180: 88-95.
32. Rana P. A study on antifertility effect of fenugreek on house rat. Doctoral dissertation: Punjab Agricultural University; 2022.
33. Sarwar S, Hanif MA, Ayub MA, Boakye YD, Agyare C. Fenugreek. In: Medicinal plants of South Asia, 2020. p. 257-71.
34. Sauvaire Y, Petit P, Broca C, et al. 4-Hydroxyisoleucine: a potentiator of insulin secretion. *Diabetes*, 1998; 47(2): 206-10
35. Sharma RD. Effect of fenugreek seeds and leaves on blood glucose and insulin in humans. *Nutr Res*, 1986; 6(12): 1353-64.
36. Sharma RD, Raghuram TC. Hypoglycaemic effect of fenugreek seeds in NIDDM subjects. *Nutr Res*. 1990; 10(7): 731-9.
37. Singh U, Chamoli M, Singh KP, et al. Amazing health benefits of fenugreek. *Int J Environ Health Sci*, 2022; 4: 19-27.
38. Sun W, Shah Rajabian MH, Cheng Q. Fenugreek cultivation: historical aspects and uses. *Mini Rev Med Chem*, 2021; 21: 724-30.
39. Thirunavukkarasu V, Anuradha CV, Viswanathan P. Protective effect of fenugreek seeds in ethanol toxicity. *Phytother Res*, 2003; 17: 737-43.
40. Vijayakumar MV, Bhat MK. Hypoglycemic effect of a dialysed fenugreek extract mediated by hepatic enzymes. *Phytother Res*, 2008; 22: 500-5.
41. Yao D, Zhang B, Zhu J, et al. Applications of fenugreek seeds as functional foods. *Crit Rev Food Sci Nutr*, 2020; 60(14): 2342-52.
42. Zandi P, Basu SK, Cetzal-Ix W, et al. Fenugreek: an important medicinal and aromatic crop. In: Active ingredients from aromatic and medicinal plants. IntechOpen, 2017.