

A review on phytochemistry and pharmacological effects of *Trigonella foenum-graecum*

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ABSTRACT

Background and aims: Fenugreek (*Trigonella foenum-graecum*) is a medicinal plant with potential applications in the medicinal purposes. Fenugreek has been used in food as a flavouring agent since ancient times in many countries like Greece, Rome and Egypt. It has a special place in the traditional medical system. The aim of this study was to review phytochemistry and pharmacological effects of *Trigonella foenum-graecum*.

Methods: This research was a review study. Data were collected using articles in various databases and books about pharmacological effects of *Trigonella foenum-graecum*.

Results: The seeds are rich sources of lipids, protein, mucilage, calcium, dietary fiber B vitamins, Iron, protease inhibitors and several steroid saponins, tiny amounts of alkaloid, furostanol glycosides and steroidal peptide. As a medicinal plant, fenugreek recognized as a galactagogue or lactation stimulant in women after child birth as well as for its ability to treat wounds and sore muscles. In addition, it has the ability to be as antibacterial, anti-ulcer, anti-cancer, anthelmintic (antagonistic effect against parasitic worms), and antinociceptive (pain-reducing) properties. In recent years, laboratory studies and clinical trials have focused on the potential activity of fenugreek as a natural medicine.

Conclusion: These studies have shown that fenugreek plants possess immunomodulatory, hypocholesterolaemic, hypoglycaemic, gastro- and hepatoprotective and antioxidative properties. Pharmacological properties of fenugreek have been explored to identify a role for the plant in diabetes management and in cardiovascular health, indicating the presence of bioactive compounds in fenugreek, which may be responsible for its health benefits.

Keywords: Fenugreek, Galactagogue, Antinociceptive, Hepatoprotective, Hypoglycaemic, Antioxidative.

INTRODUCTION

Fenugreek (*Trigonella foenum-graecum* L.) is annual plant from Fabaceae family, which is native to the Indian subcontinent and the Eastern Mediterranean region.¹ Fenugreek,

is known for presence of the distinctive aromatic compounds that gives special flavour and colour to the food.² Fresh fenugreek leaves consider as an ingredient in

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some Indian Currie.³ It is one of the most ancient medicinal herbs. It provides natural food fibre and other nutrients required in human body.⁴

Fenugreek is one of the oldest known medicinal plants which has been documented in ancient herbal history.¹ Seeds of the fenugreek have been used as a holy smoke that Egyptians consumed in their embalming rites during Pharaohs time.⁵ It has been used also to promote labour before delivery during Greek period.⁶ According to Chinese traditional medicine, fenugreek can be used to treat Lymphedema (oedema of the legs).⁷

Fenugreek seed is a good source of calcium, minerals, iron, β -carotene and several vitamins like vitamins A and D. It is rich source of available carbohydrates and dietary fiber.⁸ It is a source of free amino acids; 4-hydroxyisoleucine, lysine, histidine and arginine (25.8%), protein (20-30%), moisture (11.76%), fat (6.53%), crude fibre (6.28%), ash content (3.26%) and energy (394.46 Kcal/100 g seed).⁹ It contains lecithin, choline, minerals, B. Complex, Phosphates, and Para-Amino Benzoic acid (PABA). In addition, the main chemical compounds in fenugreek are saponins, fenugreekine, trigonelline, coumarin, scopoletin, phytic acid and nicotinic acid.¹⁰ The significance of *T. foenum-graecum* seeds is due to the defatted part, with high quality fibre including steroidal saponins and protein comparable to those of soybean.¹¹ The important chemical constituents are saponins, coumarin, fenugreekine, nicotinic acid, phytic acid, scopoletin and trigonelline. The seeds also have the alkaloid trigonelline with mucilage, tannic acid, yellow colour substance, fixed and volatile oils and a bitter extractive, diosgenin and gitogenin a trace of trigogenin.¹² The main bioactive compounds in fenugreek are Galactomannan, Diosgenin, 4-Hydroxyisoleucine.¹³

Fenugreek showed a mild hypoglycemic effect as well as improvement in glucose homeostasis and reduction in low-density lipoprotein (LDL), very-low-density lipoprotein (VLDL), high-density lipoprotein (HDL) and total cholesterol in alloxan diabetic rats.¹⁴⁻¹⁶ It can be used as a control for diabetes mellitus type 2.¹⁷ It has been proven that the soluble dietary fiber of *fenugreek seeds* has antidiabetic effect mediated through enhancement of peripheral insulin action and inhibition of carbohydrate digestion and absorption.¹⁸ The antidiabetic effect of fenugreek has been recorded as same as to glibenclamide treatment which is antidiabetic drug, this shows that fenugreek can be considered as a candidate for future studies on diabetes mellitus.¹⁹

It has been reported that fenugreek has antioxidant activity.^{20,21} It also can be considered as a potent antioxidant.²² Due to normalize the disruption in free radical metabolism in diabetic rats, and the presence of flavonoids; especially malondialdehyde, nonprotein thiol, protein, and cysteine contents in the plant, it has been shown that fenugreek seeds contain antioxidants which protect cellular structures from oxidative damage and alterations in antioxidant enzymes.²³⁻²⁸ Fenugreek exerts its chemopreventive effect by decreasing circulatory lipoproteins and enhancing antioxidant levels.²⁹

It has been shown the hypolipidaemic effects of fenugreek seeds due to the fraction rich in fibres (hypocholesterolaemic and hypotriglyceridaemic effects), and to the fraction rich in saponins.^{30,31} It has been proven that fenugreek increases the plasma insulin, decreases the total cholesterol, very low-density lipoprotein (VLDL) and low-density lipoprotein (LDL).^{32,33} Also, some other various medicinal and pharmacologic properties of fenugreek which have been stated but received less attention including anti-bacterial,

anti-cholinergic, anthelmintic, wound healing activities.³⁴

In recent years, various dietary components that can potentially be used for the prevention and treatment of cancer have been identified.³⁵ It has been proved that diosgenin induced apoptosis in HT-29 cells at least in part by inhibition of bcl-2 and by induction of caspase-3 protein expression. On the basis of these findings, the fenugreek constituent diosgenin seems to have potential as a novel colon cancer preventive agent.³⁶

Greek showed cytotoxic activity against various cancer cell lines.³⁷ It killed MCF-7 human breast cancer cells via an apoptotic pathway.^{38,39} Protodioscin (PD) was purified from fenugreek (*Trigonella foenum-graecum* L.) and identified by Mass, and 1H- and 13C-NMR. The effects of PD on cell viability in human leukemia HL-60 and human stomach cancer KATO III cells were investigated. PD displayed strong growth inhibitory effect against HL-60 cells, these findings suggest that growth inhibition by PD of HL-60 cells results from the induction of apoptosis by this compound in HL-60 cells Fenugreek has anti-Leukemic potential activity.^{40,41}

It has been demonstrated that fenugreek has anti-inflammatory and antipyretic properties.⁴² As it can protect against skin damage because it is strongly suppressed the production of inflammatory cytokines.⁴³ Treated arthritic rats with fenugreek showed an increase in ESR and total WBC, a decrease in RBC count and hemoglobin and aberrant changes to the C-reactive protein levels.⁴⁴ The outgoing results of phytochemical tests confirmed the presence of flavonoids in fenugreek seeds which is the responsible for anti-inflammatory activity of the plant.⁴⁵ Fenugreek seeds have antioxidant, anti-inflammatory, and antineoplastic activities.⁴⁶⁻⁴⁸ The recent studies support the traditional uses of fenugreek for inflammations. However, more researches are needed for its use in clinical studies.⁴⁹

It has been reported that fenugreek has antiandrogenic and antifertility potential activities.^{50,51} It has been documented that fenugreek seeds have antifertility effect in the female rabbits and more of a toxicity effect in the male rabbits.⁵² The antifertility activity of fenugreek exists because of the presence of saponins.⁵³ It has been showed that fenugreek seeds are effective almost three times more than combined oral contraceptive pills at higher dose.⁵⁴

A 30% of fenugreek powder for 20 days lead to reduction in the fetal and placental weights.⁵⁵ A 3.2 g/kg dosage of fenugreek affects on the bone marrow proliferation; bone marrow cells have not been clearly demonstrated.⁵⁶ A 0.11 g/kg of fenugreek for 15 days to male rats could lead to the changes in the level of thyroid hormones.⁵⁷ Fenugreek aqueous extract affects the fertility by promoting anti-implantation, or through embryonic loss or re-absorption.^{58,59} At the 2 doses (500 and 1000 mg/kg/day) of fenugreek lyophilized aqueous extract increased pup mortality and reduced body weights.⁶⁰

CONCLUSION

Fenugreek is an annual plant in the family Fabaceae. Fenugreek has a long history as medicinal herb in the ancient world. The largest producer of fenugreek seeds is India. Its seeds are a common ingredient in dishes from the Indian subcontinent. The most three bioactive compounds that were examined in experiments are: Galactomannan, diosgenin and 4-hydroxyisoleucine. Fenugreek has potential therapeutic activities in so many treatments such as diabetes, atherosclerosis, digestive problems, chronic coughs, inflammation, milk flow in Breastfeeding, tuberculosis, baldness, Parkinson's disease, cancer, and exercise performance.

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