Biological Times

Volume No. 4 | Issue No. 10 | Pages 38-39

Nutritional Composition and Therapeutic Potential of Fenugreek (*Trigonella foenum-graecum* L.) Seeds: A Review

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ABSTRACT

The recent change in the lifestyle, diet, stress, the ecological variations, and the extensive use of artificial additives in food manufacturing and farming have contributed largely to rapid development of numerous medical issues. Scholars all over the world have been conducting studies to identify natural medicinal compounds that can be used to treat or prevent the occurrence of some of the lifestyle diseases. Due to the presence of different bioactive chemicals, diverse medicinal plants have been shown to be vastly utilized in treatments. One of them is the fenugreek, an important herb that has been discovered by specialists everywhere in the world as an important therapeutical plant. It has widely been asserted that this plant can treat numerous types of diseases, and they include cancer, hyperlipidemia, hyperglycemia and inflammation. Because of its therapeutic benefits, fenugreek have been effectively used in the food and pharmaceutical industries.

Keywords: Fenugreek, Bioactive chemicals, Therapeutic, Cancer, Inflammation, Lifestyle

To cite this article: Vishal A, F Asim, A Mateen, HA Nisar & S Rustom. Nutritional Composition and Therapeutic Potential of Fenugreek (*Trigonella foenum-graecum* L.) Seeds: A Review. Biological Times. 2025. October 4(10): 38-39.

Introduction

The increasing world population is one of the most pressing problems of the nearest future, and the second one is the biodiversity maintenance. To a significant degree, these issues are targeted at the world of agriculture that is a constantly changing world that sustains the fundamental human requirements. The influence of farming on these global challenges must not be ignored since innovations and long-term approaches in the specified area can make a significant contribution to the quality of lives of the corresponding people. Plant agriculture is of special importance to the reflection of the biodiversity [1]. Fenugreek (*Trigonella foenum-graecum L.)* is an annual leguminous herb of the family Fabaceae, which is consumed in the entire world. It is one of the oldest known medicinal herb and it was originated in the Eastern Mediterranean and Indian subcontinent. The area considers it dietary staple, seasoning and traditional medicine [2]. These seeds contain a variety of minerals and bioactive compounds and research has shown that they have numerous beneficial effects including anti-cancer, anti-inflammatory and antioxidant properties. Fenugreek seeds, leaves and extracts also have a bright future in diabetes treatment [3]. Polyphenols and flavonoids, antioxidants that fight oxidative stress (OS) and prevent the impact of free radicals, are also present in large quantities in the seeds of fenugreek, thus, antioxidant activity (AOA) has a potential to protect the cell against aging and lessen the incidence of chronic diseases [4]. It is possible that the seeds of fenugreek can enhance hormonal regulation, and the study has shown that it can reduce the symptoms of menopause and polycystic ovarian syndrome (PCOS) [5]. Along the path of our journey, we get to know that the seeds of fenugreek are not mere food stuffs; they are the gold-mine of possibilities to human wellness and vitality.

Nutritional Profile of *Trigonella foenum-graecum L.* [4]

Fenugreek contains a range of nutrients and bioactive compounds that boost overall health and biological efficiency.

Dietary Components	Percentage
Protein	22-26%
Carbohydrates	58%
Fats	0.9%
Fiber	25%

Protein

The dietary protein components and amino acid profile influence the quality of the proteins in the fenugreek seeds which was found to be between 260.3 and 295.0 g/kg. One study has established that the fenugreek seeds contain albumins (438g per kg), globulins (272g per kg), glutelins (172g per kg) and prolamins (74g per kg). In a quantitative study, it was shown that the functional differences in the activity of *Triticum durum*, Fenugreek seeds and *Lupinus Albus* could be attributed to the dissimilarity in the abundance of amino acids in these foodstuffs [6].

Lipids and fatty acids

Fenugreek contains 100g/kg of lipid. The lipids consist of diglycerides, glycolipids, phospholipids, and triglycerides with a percentage of approximately 6.3, 5.4, 10.5 and 86.1 respectively. It also contains minor amounts of monoglycerides, sterols and free fatty acids. Another study observed that the percentage of linoleic acid ranged between 34.85 and 42.2 and 0.22 to 30.8 of 0.33, respectively of 0.33. Also, the level of myristic acid ranged from 0.10% 1.38%; the content of palmitic acid C16:0 was in the range of 3.85 to 13.10 percent; and the content of oleic acid was consistently around 13.30% [4].

Fiber and Phytonutrients

Fenugreek seeds are rich in beneficial phytonutrients that support overall health. Notably, their saponin compounds can decrease cholesterol by preventing its absorption in the intestine which might lead to lower total cholesterol throughout body [7].

The dietary fiber is also found in the fenugreek seeds and they comprise 50% of the seeds. The dietary fiber is made up of two components i.e. insoluble fiber (30%) and soluble fiber (20%). The major constituent of the soluble fiber is galactomannan. Fiber is very important in digestive health as it promotes the normal excretion of stool, maintains normal blood sugar levels, and could assist in managing weight [4].

Bio-availability of active compounds of fenugreek

The seeds have several useful compounds and therefore the bioavailability of these compounds is very important. Furastanol glycoside extracted using fenugreek seed extract was tested in rats with respect to its bioavailability. The investigators analyzed the pharmacokinetics, tissue distribution and clearance of 200mg/kg of furastanol glycoside extract given orally. They observed an area under the curve was 0.177 g/mL h after a single dose, a time to maximum concentration time interval (T_{max}) of 72 hours and a half-life ($t_{1/2}$) of 40.10 hours. The seed extract was slowly taken up by the intestines and diffused. Fenugreek also had antibacterial and antifungal activities [8].

Therapeutic effect of Fenugreek Seeds

The medicinal effect of fenugreek seeds determined by the bioactive constituents. These are amino acids, coumarin, steroidal saponins, flavonoids, lipids, vitamins, minerals, galactomannan fiber and alkaloids such as trigonelline. The medicinal and clinical evidence has emphasized the therapeutic value of fenugreek seeds in the different diseases [9].

Antidiabetic potential

Diabetes has been described as a long-term metabolic disorder marked by high blood glucose levels. The condition is caused by a reduced insulin activity or secretion in the course of fasting and postprandial periods [4]. Fenugreek has gained popularity in the use of the herb as an anti-diabetic agent in individuals with diabetes type II and type I. It has also had extensive application as a source of antidiabetic compounds in its seeds, leaves, and extracts in numerous experimental applications [10].

Anti-obesity potential

Fenugreek seeds contain dietary fibers which include galactomannan which has shown notable weight-reducing properties. This is because they have the tendency to create some kind of gel in the intestines that hinder the absorption of fats and glucose. The extract of fenugreek seeds was identified to be useful in preventing lipid accumulation caused by high intake of fat in diet and dyslipidemia, in rats. These benefits are believed to be associated with its ability to inhibit the digestion and absorption of fat, increase the metabolism of glucose, fats, insulin sensitivity, stimulate antioxidant activity, and reduce the level of lipase [11].

Hypocholesterolemic potential

Fenugreek galactomannan is also a complex carbohydrate which lowers the sugar levels and influence surface activity in the small intestine. It recognized for providing health benefits especially in hypercholesterolemic people. Also, galactomannan was reported to have positive effects on lipids profile, arterial pressure and thrombolysis [12].

Anticancer potential

Phytoestrogens and saponins are phytoestrogens and saponins of fenugreek that cause the desirable anticancer effects. Saponins possess special anti-proliferative effects in tumor cells and are capable of triggering apoptotic events, which may cause orderly cell apoptosis. There have been several studies designed to evaluate the anticancer properties of chemical compounds present in it and they have provided promising results. Indicatively, the research has found that alkaloid family compounds referred to as trigonelline have possible therapeutic application in cancer treatment [13].

Safe use and adverse effects of fenugreek

The research study on fenugreek available does not mention any side effects that can be considered clinically significant and harmful. Although the commonly held belief about fenugreek is that it is a safe and tolerable substance, it has been associated with many side effects. Allergic patients to fenugreek or chickpeas need to be cautious with the use of fenugreek as they may develop cross-reactivity. The other side effects of fenugreek are temporary diarrhea, drowsiness and flatulence. The level of glucose in the blood should be monitored after supplementation because fenugreek may lead to hypoglycemia. In case of its use as a treatment method, fenugreek must be administered in a limited amount or a certain dose. Overdose may be detrimental to health. People need to be conscious of any sign of allergic reaction or significant drops in blood glucose levels and should consult the doctor as soon as possible [8].

Fenugreek interaction with drugs

Fenugreek fiber possesses structural properties that may compromise the orally administered medications and intestinal absorption. Consequently, its preparations ought to be ingested between dose of recommended medicine. When the hypoglycemic drugs are used together with fenugreek, the level of blood sugar should be checked as fenugreek may decrease serum glucose levels unexpectedly. Potassium level of a small group of healthy participants was reduced by 14% when an aqueous extract of fenugreek was given. Therefore, the use of fenugreek can lead to the precipitation of drugs that lower potassium in blood [8].

Conclusion

Fenugreek seeds are multipurpose and versatile in their applications in a variety of fields because they find numerous applications in health, nutrition, food, and nanotechnology. Their future medicinal use is premised on the brilliant nutritional composition that is characterized by high levels of significant bioactive elements. There is intensive research showing that the fenugreek seeds possess specific components, which make it antidiabetic, anti-oxidant, anti-obesity, hyperlipidemia, anti-cancer, and myocardial protector. Fenugreek seeds have significantly contributed to the food industry by enhancing the various products with their exceptional qualities. The paper highlighted the extensive use of the fenugreek seeds, which will stimulate further research and development in the fields of healthcare, food and technological progress. The current research paper tries to explain the nutritional and pharmacological alleged application of fenugreek. Its therapeutic components such as alkaloid, amino acid and flavonoid make it an effective anti-inflammatory and anti-oxidant agent. Moreover, the compound nature of fenugreek has also given credence to the medicinal uses of the plant as it is an effective aid to stopping total dependence on numerous artificial drugs in treating illnesses. Nonetheless, the research is still at an early stage and more research is needed to explore modern methods of separation of bioactive components to produce new functional foods and medicines.

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