FENUGREEK: PHARMACOLOGICAL ACTIONS

Dr. Ragni Sinha1*, Prof. Dr. G. P. Rauniar2, Dr. Dipesh Raj Panday3 and Dr. Sunil Adhikari4

1*Post-Graduate Resident, Department of Clinical Pharmacology & Therapeutics, BPKIHS (B.P. Koirala Institute of Health Sciences), Nepal.
2HOD and Professor Department of Clinical Pharmacology & Therapeutics, BPKIHS, Nepal.
3Assistant Professor, BPKIHS.
4Post-Graduate Student, Jilin University.

ABSTRACT

Background: Fenugreek’s leaves and seeds are used as daily spices in our recipes. It is also used as an ingredient in traditional medicine. Preliminary animal and human trails suggest possible hypoglycemic and antihyperlipidemic properties of oral fenugreek seed powder.


Results: Phytochemically it contains trigonelline, sapogenins, 4-hydroxyisoleucine, diosgenin, aponins, etc. possessing hypolipidemic, antihyperlipidemic and many other properties. Conclusion: Lack of adequate better controlled human trials has limited use of fenugreek and still far from recommending it as an antihypercholesteric and antidiabetic agent.

KEYWORDS: Fenugreek, Trigonella foenum-graecum, Antihyperlipidemic, Hypoglycemic.

INTRODUCTION

• Botanical name: Trigonella foenum-graecum
• Family: Fabaceae
• Common Names: Bird’s Foot, Bockshornklee, Greek Hayseed, Goat’s Horn, Methi, Methulu.
• Major fenugreek-producing countries are: Afghanistan, Pakistan, India, Iran, Nepal, Bangladesh, Egypt, France, Spain, Turkey and Morocco.

• The largest producer is India, where the major producing states are Rajasthan, Gujarat, Uttarakhand, Uttar Pradesh, Madhya Pradesh, Maharashtra, Haryana and Punjab.

• Rajasthan accounts for over 80% of India’s output.\[33\]

• Fenugreek is used as a herbs (dried or fresh leaves), spice (seeds) and vegetable (fresh leaves, sprouts and microgreens).

• An erect annual herb with white flowers and hard, yellowish brown and angular seeds.

• Fenugreek seeds and leaves are strongly aromatic and flavorful.

• Seeds are bitter in taste but lose their bitterness if roasted slightly.\[34\]

• Ribofavin in vitamins such as thiamin, folic acid, riboflavin, niacin, vitamins A, B6 and C.

• Storehouse of minerals such as copper, potassium, calcium, iron, selenium, zinc, manganese and magnesium.

• Fenugreek leaves are a rich source of vitamin K as well.

• Fenugreek seeds are rich source of trigonelline, lysine and l-tryptophan.

• The seeds also contain a large amount of saponins and fibers that could account for many health benefits.

• Sotolon is the chemical responsible for fenugreek’s distinctive sweet smell.

• Used both whole and powdered in the preparation of pickles, vegetable dishes, daals.

• Fresh fenugreek leaves are an ingredient in some Indian curries.

• Sprouted seeds and microgreens are used in salads.

**NUTRITIONAL PROFILE**

• Fenugreek leaves contain these nutrients per 100 g of edible portion.\[8,9\]

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>6.0g</td>
</tr>
<tr>
<td>Protein</td>
<td>4.4g</td>
</tr>
<tr>
<td>Fat</td>
<td>0.9g</td>
</tr>
<tr>
<td>Calcium</td>
<td>395mg</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>51mg</td>
</tr>
<tr>
<td>Iron</td>
<td>1.93mg</td>
</tr>
<tr>
<td>Total energy</td>
<td>49Kcal</td>
</tr>
</tbody>
</table>
HYPOLIPIDEMIC EFFECTS OF FENUGREEK

- Fenugreek seed lower serum triglycerides, total cholesterol and low-density lipoprotein cholesterol which may be due to sapogenins, which increase biliary cholesterol excretion and lower serum cholesterol levels.\cite{4,5,6,7}
- Dietary fibers (galactomannan) in fenugreek seeds are polysaccharides consisting of a mannose backbone with galactose side chains, galactomannan form a viscous gel in the intestine\cite{20} and inhibit glucose and lipid absorption.

MECHANISMS OF LOWERING BLOOD GLUCOSE

- Fenugreek stimulates the tyrosine phosphorylation of the insulin receptor and enhances glucose uptake into cells.\cite{10}
- In rodents, it has been shown to inhibit the intestinal disaccharidases as well as normalize the deranged levels of Pyruvate Kinase and phosphoenol pyruvate carboxykinase enzymes.\cite{11}
- The amino acid 4-hydroxyisoleucine in fenugreek seeds increased glucose-induced insulin release in human and rat pancreatic islet cells.\cite{1}
- In humans, fenugreek seeds exert hypoglycemic effects by stimulating glucose-dependent insulin secretion from pancreatic beta cells as well as by inhibiting the activities of alpha-amylase and sucrase, two intestinal enzymes involved in carbohydrate metabolism.\cite{2,3}
- The antihyperglycemic effect has been correlated with decline in somatostatin and high plasma glucagon levels.\cite{12}
- The steroids present in fenugreek have been reported to reduce blood glucose level when supplemented to diabetic rats.\cite{13}
- A study on intestinal and renal disaccharidases activity in STZ-induced diabetic rats proved the beneficial effects of fenugreek seed mucilage by enhancing the reduction in maltase activity during diabetes.\cite{14}

OTHER MECHANISMS OF ACTION OF FENUGREEK

- Trigonelline has neuroprotective, antimigraine, sedative, memory-improving, antibacterial, antiviral and anti-tumor activities and it has been shown to reduce diabetic auditory neuropathy and platelet aggregation.\cite{24}
- Fenugreek acts by affecting β cell regeneration, insulin secretion, activities of enzymes related to glucose metabolism, reactive oxygen species, axonal extension and neuron excitability.\cite{24}
USES OF FENUGREEK

• Reduces Cholesterol- Fenugreek contains saponins that help reduce the body’s absorption of cholesterol from fatty foods.\[25\]

• Increases Breast Milk - used as galactagogue by nursing mothers to increase inadequate breast milk supply.\[29\]

• Prevents Diabetes
An unusual amino acid 4-Hydroxyisoleucine found only in fenugreek has possible antidiabetic properties such as enhancing insulin secretion under hyperglycemic conditions and increasing insulin sensitivity.\[25\]

• Maintains healthy Testosterone Levels
A study reported significant positive effect of fenugreek on physiological aspects of male libido and also found that it may assist to maintain normal healthy testosterone levels.\[31\]

• Aids Digestion
Effective heartburn or acid reflux remedy because the mucilage in fenugreek seeds assists in soothing gastrointestinal inflammation and coating the stomach and intestinal lining.\[30\]

• Helps with Weight Loss
Fenugreek complements diet for weight loss.

Aids weight loss by suppressing appetite\[21\], increasing energy in the short term and potentially modulating carbohydrate metabolism.

FENUGREEK: NATURAL REMEDIES

• Fenugreek seeds are rich in vitamin E and are added as preservatives in pickles.\[30\]
• Dried leaves of the fenugreek are used for flavoring meat, fish and vegetable dishes.\[30\]
• Herbal tea made with fenugreek, lemon and honey is traditionally used as remedy for fever.\[29\]
• A paste made from fresh fenugreek leaves applied regularly to scalp before bath helps hair growth, improves hair complexion and reduces dandruff.\[30\]
• Fenugreek is used traditionally as remedy for eczema, burns, abscesses and gout.\[30\]
• Stimulates uterine contractions and induces childbirth.\[29\]
SIDE EFFECTS

- Hypoglycemia.\textsuperscript{[30]}
- Diarrhea.\textsuperscript{[30]}
- Stomach upset.\textsuperscript{[30]}
- Bloating.\textsuperscript{[30]}
- Maple syrup odour in urine.\textsuperscript{[27]}
- In large doses, fenugreek may cause birth defects because of its teratogenic potential. It would be prudent to avoid fenugreek supplementation during pregnancy.\textsuperscript{[29]}
- Skin irritation and allergy.\textsuperscript{[30]}
- Severe allergy symptoms include chest pain, facial swelling and difficulty breathing or swallowing.\textsuperscript{[30]}

INTERACTIONS

- Antidiabetic drugs interacts with Fenugreek might decrease blood sugar.\textsuperscript{[32]}
- Medications that slow blood clotting (Anticoagulant/Antiplatelet drugs) interacts with fenugreek.\textsuperscript{[28]}

Taking fenugreek along with medications that also slow clotting might increase the chances of bruising and bleeding.

- Some medications that slow blood clotting include aspirin, clopidogrel, heparin, warfarin, etc.\textsuperscript{[32]}

DOSES

- Studies investigating the use of fenugreek in diabetes and cholesterol lowering have used 5 g/day of seeds or 1 g of a hydroalcoholic extract.\textsuperscript{[26]}
- To increase testosterone-500-600mg/day for 6-8 wks.\textsuperscript{[31]}

### SUMMARY OF FENUGREEK STUDIES

<table>
<thead>
<tr>
<th>Condition treated</th>
<th>Study type</th>
<th>Author, Year</th>
<th>N</th>
<th>Statistically significant results</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 2DM</td>
<td>Randomised controlled double blind study</td>
<td>Gupta et al, 2001\textsuperscript{[15]}</td>
<td>25</td>
<td>Yes</td>
<td>Improved fasting Glucose and GTT with fenugreek</td>
</tr>
<tr>
<td>Type 2 DM</td>
<td>Randomised crossover study</td>
<td>Raghuram et al, 1994\textsuperscript{[22]}</td>
<td>10</td>
<td>Yes</td>
<td>Improved peripheral utilization with</td>
</tr>
</tbody>
</table>
CONCLUSION

The incidence of type 2 diabetes is increasing dramatically worldwide, resulting in large measure from the increasing prevalence of obesity. Since fenugreek has versatile properties and several studies have shown its beneficial effects, it contains vitamins such as thiamin, folic acid, ribofavin, niacin, vit A,C and minerals as Potassium, Magnesium, Calcium, Zinc, Iron, etc. has shown its use in diabetes, hypercholesteremia. It contains 4-hydroxyisoleucine which can induce insulin secretion from beta pancreatic cells under conditions of high glucose concentrations. Several studies have shown to exert hypoglycemic effects by inhibiting the activities of an $\alpha$-amylase and sucrase and saponins lower serum triglycerides, total cholesterol and LDL. Thus, dietary supplements that can modulate glucose homeostasis and potentially improve lipid parameters would be desirable, is true for diabetes prevention in patients with metabolic syndrome. Fenugreek is a dietary supplement that may hold promise in this regard. Fenugreek might have hypoglycemic actions but data isn’t sufficient to recommend its use in diabetes in the absence of careful supervision.
REFERENCE


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34. Fenugreek seeds. BBC News.