

ANTIDIABETIC ACTIVITY OF METHI SEEDS (*TRIGONELLA FOENUM GRACEUM*)*¹Kavita, ²Monika Dhaka and ³Om Prakash Sharma¹PG Scholar, PG Department of DravyaGuna, Sri Ganganagar College of Ayurvedic Science & Hospital, Sriganganagar, Rajasthan.²Assistant Professor, PG Department of Dravya Guna, Sri Ganganagar College of Ayurvedic Science & Hospital, Sriganganagar, Rajasthan.³Professor and H.O.D. PG Dept. of DravyaGuna, Sri Ganganagar College of Ayurvedic Science & Hospital, Sriganganagar, Rajasthan.

*Corresponding Author: Kavita

PG Scholar, PG Department of DravyaGuna, Sri Ganganagar College of Ayurvedic Science & Hospital, Sriganganagar, Rajasthan.

Article Received on 23/03/2022

Article Revised on 13/04/2022

Article Accepted on 03/05/2022

ABSTRACT

Fenugreek (*Trigonella Foenum graecum*) is an annual herb having yellowish angular seeds with multiple health benefits. Fenugreek is one of the oldest medicinal plants with exceptional medicinal and nutritional profile. It is considered to be safe for human health in optimal amount. Its nutritional value and biologically active compound profile unquestionably appreciated by medical science. Fenugreek seeds contain a substantial amount of fiber, phospholipids, glycolipids, oleic acid and linoleic acid, choline, Vitamin A,B1,B2,C,nicotinic acid, niacin,minerals like copper, potassium,calcium and many other functional elements. Recent studies and researches have found multiple therapeutic applications like antidiabetic, anticarcinogenic, hypocholesterolemia ,hypoglycemia, gastric stimulant, anti-anorexia agent. Ayurveda has mentioned methi seeds as prmeah nashak (antidiabetic).The review article summarizes the ayurveda literature on *methi* seeds and therapeutic antidiabetic importance in recent studies.

KEYWORDS: Methi, therapeutic, nutritional, biological active compound.

INTRODUCTION

Fenugreek belongs to Fabaceae family it is named *Trigonella* from Latin language that means “little triangle” due to its yellowish white triangular flowers. It is named *Methi* (Hindi,Urdu,Punjabi,Marathi)*Hulba* (Arabic) *Moshoseitaro* (Greek) *Ullwa* (Malayalam) and heyseed in English.^[1-5]

Fenugreek (*Trigonella foenum-graceum*) is one of the oldest medicinal plant from Fabaceae family originated in cultural Asia 4000 B.C. Fenugreek seeds have huge health benefits and a substantial amount of fibers. Seeds of Fenugreek Spice have medicinal properties such as hypochlosterolemic, lactation aid, antibacterial, gastric stimulant for anorexia, antidiabetic agent, galactagogue, hepatoprotective effect and anticancerous .In this review, we have discussed the constituents, pharmacological properties and significance of Fenugreek in ayurveda.^[5-8]

Morphology of Fenugreek Seeds:-Appearance: Solid-rhomboidal seeds, 3 to 5 mm long, 2mm thick hard, pebble like **Colour:** Yellowish brown-light

brownOdour: Characteristic spicy. **Taste:** Bitter and mucilaginous. *Methi* seeds have 45-60% carbohydrates, most of which is 30% soluble and 20% insoluble fiber. It also contain 20-30 % proteins, lysine and tryptophan, volatile oils.^[7,3,19]



Physico-Chemical Constituents Of Fenugreek Seeds^[28]

S. NO.	PARAMETERS	RESULTS
1.	Foreign matter	Not more than 2%
2.	Loss on drying	12.62
3.	Foaming index	259.95
4.	Swelling index	10.5
5.	Ash value	Not more than 4%
	Total ash	3.3
	Acid insoluble ash	0.4
	Water soluble ash	1.6
6.	Extractive values	
	Alcohol soluble extractive value	14.40 {not less than 5% }
	Water soluble extractive value	35.00

Fenugreek Nutritional Value**Amount per 100 grams**

Calories: 323

Total fat: 6gm, Saturated fat: 1.5gm

Cholesterol: 0gm, Sodium: 67mg

Potassium: 770mg, Total carbohydrates: 58gm

Dietary fiber: 25gm, Protein: 23gm

	% Daily value
Vitamin C	5%
Iron	186%
Vitamin B6	30%
Magnesium	47%
Calcium	17%
Vitamin D	0%
Cobalamin	0%

SOURCE: USDA

*Percent values are based on a 2,000 calorie diet.

Alkaloids, Saponin And Flavanoids In Fenugreek^[8-12,29,30,31]

There are multiple alkaloids, saponins and flavonoids which are responsible for different therapeutic actions of *methi*. Saponin are in high concentration in Fenugreek seeds. 100gram of fenugreek seeds have 4.63gm saponins.

The constituents shows Hypolipidemic, hypoglycemic and cholagogic activity which can be used to manage diabetes mellitus and hypercholesterolemia.

COMPONENTS	
Diosgenin	Hypolipidemic, Anti diabetic
Saponins	Hypocholesterolemic activity
Flavenoids	Antioxidant activity
Galactomannan	Anti-Diabetic activity
Polyphenols	Antioxidant activity

Vitamins in Fenugreek

Fenugreek seeds have vitamins-A, B1, B2, C, niacin, nicotinic acid and germinated seeds contains pyridoxine, calcium pantothenate, biotin and Ascorbic acid.

Fenugreek seeds have 43mg of B-carotene, 96µg beta carotene, 340µg of thiamine, 290µg riboflavin.

Proteins in Fenugreek

Fenugreek seed is highly rich in protein such as globulin, albumin, histidine and lecithin. Fenugreek has high proportion of protein ranging from 20 to 30% as well as amino acid, 4-hydroxyisoleucine, which contains high potential for insulin-stimulating activity.

Minerals in Fenugreek

Fenugreek does not have so much of minerals, but it has good amount of phosphorus and sulphur. It is also known for its higher occurrence of calcium, iron and zinc.

Volatile Content

Fenugreek aroma detection by the help of gas chromatography: acetic acid, linalool, isovaleric acid, butanoic acid, 3-isopropyl-2-methoxypyrazine, olfactometry diacet yl eugenol, caproic acid, 3-Amino-4,5-dimethyl-3,3-isobutyl-2-methoxypyrazine.

Fenugreek Gum

The fenugreek gum can be utilized for thickening, stabilizing and emulsifying food agents.

Fenugreek gum is originated from the endosperm of the seeds and it consists of mannose and galactose. Whenever making bread with wheat flour with combination of fenugreek, the prepared dough showed more water absorption in spite to the dough made without fenugreek gum. In 1997, this scientific study concluded that purified fenugreek gum, containing 0.8% residual protein, could reduce the surface tension and form stable emulsions with small oil droplets approximately 2-3µm.

Fenugreek Fiber

The fiber content of fenugreek seed extract plays a role in its ability to moderate metabolism of glucose in the digestive tract. The 100g of seeds gives more than 65% of dietary fibers. Fiber binds to toxins in the food and helps to prevention of the colon mucus membrane from cancer causing toxins. The higher concentration of fiber in fenugreek influences its strength for glucose level

tolerance. Galactomannan is an important soluble fiber of the fenugreek seeds; it diminishes the bile salts uptake in intestine and also decreases the digestion and absorption of starch in body.^[8,18-21]

LITERATURE REVIEW^[1,3,5,28]

Methi is popular drug for *vata vyadhi* mentioned by *Bhavprakash* but not mentioned by *acharya Charaka* and *acharya Sushruta* and *acharya Vagbhata*.^[2] BHAVPRAKASH has described "*Methi*" in *Haritkyadi varg* and included it as one of the ingredients of *chaturbija*. Adarash Nighantu mentioned it in "*Palashadi varg*". RAJ NIGHANTU quoted it in "*Pipplyadi varg*".

Priya Nighantu described it in "*Shatpushpadi varg*". Madan pal Nighantu mentioned it in "*Shunthyadi varg*".

Physical properties

Ras (Taste): *Katu*(pungent), *Tikta*(Bitter)

Virya (Potency): *Ushna* (Hot potency)

Gun a(Qualities): *Laghu* (light to digest), *Snigdha* (Unctuos, oily).

Vipaka (Taste conversion after digestion): *Katu* (Pungent)

Effects on *Tridosha*: *Vata Ghana*, *Kaphaghona*

Part used: Seeds, Whole plant

Dosage: Seed powder: 1-3gm^[1,2,3,5,28]

Medicinal use of fenugreek according to Ayurveda^[3,21]

1. *DEEPANI*: the herb improves the digestive fire.
2. *VATAHARA*: it balances vata dosha disorders like paralysis, constipation, neuralgia, and bloating.
3. *KAPHAHARA*: It balances kapha disorders like asthma, bronchitis, chest congestion, and cough.
4. *PRAMEHA NASHAK*: It is effective in type 2 diabetes mellitus and urinary tract disorders.
5. *ARUCHI NASHAK*: Beneficial in anorexia.

Antidiabetic Activity

Fenugreek seeds have antidiabetic effect by increasing gastric emptying time and glucose absorption rate. Fenugreek seeds have greater quantity of fiber which reduces glucose uptake in small intestine also increase serum insulin level.

Galactomannan, reduces postprandial blood glucose level. When fenugreek seed powder treatment for 21 days to diabetic rats brought down the high fasting blood glucose levels to control levels. The enzyme activities were restored to control values in both the kidney and liver. Fenugreek seeds have saponins and fiber content which are responsible for its antidiabetic property. The effect of oral administration [5% in the diet] of powder of fenugreek seeds in alloxan-induced diabetic rats for 21 days were investigated, the glycolytic, NADP linked lipogenic and gluconeogenic enzymes were determined in the kidney and liver tissues of rats. The *T. foenum graecum* saponin fraction significantly modulated the

glycogen enzyme and disaccharidase activities in the intestine, it suppressed the increase of blood sugar level, increased the hepatic glycogen content and improved results in the oral glucose tolerance test.^[22-24]

According to the recent study oral administration of *diosgenin* to diabetic rats for forty five days shows a reduction in hyperglycemic condition and also an increase in insulin levels.^[33]

Hydroalcoholic extracts of fenugreek seeds at different doses was shown to produce increased body weight and glucose uptake, reduced plasma glucose, glycosylated hemoglobin (HbA1C).^[34]

Clinical trial has shown fenugreek reduced high fasting blood glucose levels in diabetic rats. The enzyme activities were restored to control value. These effects are due to the activity of saponins, diosgenin, galactomannan, flavenoids.^[6]

DISCUSSION

Ayurveda is the core science of herbal medicine, which in very early times described the use of methi seeds which are today proven as in its pharmacological properties. Fenugreek seeds have valuable medicinal properties. Many ethanobotanical surveys suggested fenugreek seeds can be used in various health ailments. Several human intervention trials and animal experiments demonstrated that the antidiabetic effect of *Trigonella foenum graecum*. Fenugreek seed extract can lower blood glucose, blood lipids. Diabetes mellitus is a common metabolic disorder, leading to hyperglycemia. WHO estimates a prevalence of 347 million people with diabetes. Recently, many medicinal plants have shown potential for the cure of type 2 diabetes.

The antidiabetic properties of fenugreek seeds are attributed due to saponins, 4-hydroxyisoleucin [4-OH-Ile], galactomannan and trigonelline fenugreek seed have 50 saponins. Which reduce the rate of glucose absorption in digestive tract. 4-hydroxyisoleucin stimulates insulin.^[6,7,8] Clinical trials suggests potential of fenugreek seeds to become source of new anti-diabetic medication.

CONCLUSION

Methi seeds have valuable health benefits, used in many health conditions as mentioned in ayurveda which can be co-related with the pharmacological properties of fenugreek proving its importance as a potent herbal drug. Fenugreek is one of the supplements used to support non-insulin dependent diabetes mellitus. Fenugreek seed helps by not only reducing blood sugar levels due to its high concentrations of phytochemicals, but it has also reduced low density cholesterol. Herbal drugs should be more focused to explore the numerous health benefits and mechanism of action, properties.

The review article shows the multiple studies data on antidiabetic potential of fenugreek seeds. As mentioned in ayurveda *methi* is primarily *prameh nashak* [anti – diabetic] Diabetes melitus have high prevalence in present era and the synthetic drugs are more toxic have wide range of side effects and expensive so moving towards the herbal alternative is a great initiative as the medicinal plant drugs are generally cheap less harmful and are safe .for more adequate confirmation . Multiple researches needs to be conducted to conclude mechanism of action of every specific bio active compounds.

REFERENCE

1. Dr. J.L.N. Sastry, Dravyaguna Vijnana vol 2, Chaukhamba orientalia Varanasi, Reprint, 2015; 728-729.
2. Prof K. C. Chunekar, Bhavaprakasa Nighantu, Chaukhamba bharti Academy Varanasi, edited by Dr G.S Pandey, Reprint, 2015; 39.
3. Acharya priyavrat Sharma, Dravyaguna Vijnana Vol 2, Chaukhamba Bharati Academy, Varanasi, Reprint, 2006; 825.
4. Bapalal G. Vaidhya, Nighantu Adarsavol 1, Chaukhamba Bharti Academy Varanasi, Third edition, Palashadivarg, 2002; 411-412.
5. Pandit Narahari, Raj Nighantu, Edited by Dr Indradeva Tripathi, Chaukhamba krishna Das Academy, 4th Edition. Pippalyadivarg, 2006; 148.
6. Pandey Meenakshi; Singh DC; Kumar Naveen; Kandpal Asheesh, Therapeutic significance of Feenugreek W.S.R. to its Hypolipidemic activity , International Journal of Ayurveda and Pharma Research, 2017; 5/7.
7. Srinivasan K., Feenugreek (*Trigonella foenum graecum*): A review of health beneficial physiological effects, food-reviews International, 2006, 203-224.
8. Asha jhajharia, krishan kumar, Feenugreek with its medical application, Int. J. Pharm. Sci. Rev, Res, 41 (1) November-December 2016; 37: 194-201.
9. Leela NK, Shafeekh KM, Fenugreek. Chemistry of Spices. CAB International, Pondicherry, India, 2008.
10. Blank I, Lin J, Devaud S, Fumeaux R, Fay LB. The principal flavour components of fenugreek (*Trigonella foenum graecum*). In: Risch, SJ and Chi, TH (eds) Spices: Flavour Chemistry and Antioxidant Properties. ACS, Washington, DC., 1997.
11. Brummer Y, Cui W, Wang Q. Extraction, purification and physicochemical characterization of fenugreek gum, Food hydrocoll, 2003; 17: 229-236.
12. Raju J, Gupta D, Rao AR, Yadava PK, Baquer NZ. *Trigonella foenum graecum* (fenugreek) seed powder improves glucose homeostasis in alloxan diabetic rat tissues by reversing the altered glycolytic, gluconeogenic and lipogenic enzymes, Mol Cell Biochem, 2001; 224: 45- 51.
13. Madar Z, Shomer IJ. Polysaccharide composition of a gel fraction derived from fenugreek and its effect on starch digestion and bile acid absorption in rats, J Agric Food Chem, 1990; 38: 1535-1539.
14. AE Slinkard, R Mc Vicar, C Brenzil, P Pearse, K Panchuk, and S Hartley. Fenugreek in Saskatchewan, Saskatchewan Agriculture and Food, 2006.
15. E Basch, C Ulbricht, G Kuo, P Szapary, and M Smith, Alt Med Rev., 2003; 8: 20-27.
16. Tori Hudson, Nd, Fenugreek (*Trigonella foenum Graecum*) An Overview Of The Research And Clinical Indications, Sponsored by: Gaia Herbs 90ltt081, 1626.
17. Vani Pasricha, Rajinder K Gupta, Nutraceutical potential of Methi (*Trigonella foenum graecum* L.) and Kasurimethi (*Trigonella corniculata* L.), Journal of Pharmacognosy and Phytochemistry, 2014.
18. Nathiya S, Durga M, Devasena T, Therapeutic role of *Trigonella foenum-graecum* [Fenugreek] – A Review Int. J. Pharm. Sci. Rev. Res., July August 2014; 27(2).
19. Dilkash Bano, Heena Tabassum, Asad Ahamad, Abdul Mabood, Etc., The Medicinal Significance OfThe Bioactive Compounds of *Trigonella foenum graecum*, Int. J. Res. Ayurveda Pharma, Jul-Aug 2016; 7(4).
20. Megh Shyam Sharma And Prema Ram Choudhary, Hypolipidemic Effect Of Fenugreek Seeds And Its Comparison With Atorvastatin On Experimentally Induced Hyperlipidemia, Journal Of The College Of Physicians And Surgeons Pakistan, 2014; 24(8): 539-54.
21. Prof. PriyaVrat Sharma, Priyanighantu, Chaukhamba Subharti Prakashan, edition, satpushpadivarg, 2004; 78: 79.
22. *Shri Nrip Madanpalrachit Madan Vinod, Madanpal Nighantu, Chaukhamba Orientalia Varanasi, First edition, Sunthyadivarg, 2012; 272.*
23. *K.R. Kritikar B.D. Basu, Indian Medicinal Plants, International Book Distributors Dehradun, 2005; 1: 700.*
24. *Shrindra Sharma, Medicinal Plants of India; An Encyclopaedia, Daya Publishing House, 2003; 248.*
25. Fenugreek [<https://en.wikipedia.org/wiki/Fenugreek>], cited, 2021; 29.
26. Vaidya Vishnu Mahadev Gogte, Ayurvedic Pharmacology And Therapeutic Uses of Medicinal Plants (Dravyaguna Vignyan), Chaukhamba Publications, New Delhi, Edition- Reprint, 2012; 700- 701.
27. Mullaicharam AR, Geetali Deori, and Uma Maheswari R, Medicinal Values of Fenugreek – A Review, JanuaryMarch RJPBCS Volume 4 Issue 1 Page No. 1304, Research Journal of Pharmaceutical, Biological and Chemical Sciences, 2013.
28. The Ayurvedic Pharmacopoeia of India, Part-1, vol-2.
29. Indian horticulture database 13, National Horticulture board, Government of India, 2012.
30. Dash BK, *Sultana S, Sultana N* Antibacterial activity of methanol and acetone extracts of feenugeek (*Trigonella foenum*) and coriander (*Coriandrum*

- sativum*), life science and medicine research, 2011; 1: 27.
31. Rohini RM, Nayeem M, Das A K Diuretic effects of *Trigonella foenum graecum* seed extracts. Intern J Altern Medi, 2009; 6: 2.
 32. Mooventhan A, Nivethitha L. A Narrative review on evidence based antidiabetic effect of fenugreek (*Trigonella foenum-graecum*). Int J Nutr Pharmacol Neurol Dis, 2017; 7: 84-7.
 33. Saravanan G, Ponmurugan P, Deepa MA, Senthilkumar B. Modulatory effects of diosgenin on attenuating the key enzymes activities of carbohydrate metabolism and glycogen content in streptozotocin induced diabetic rats. Can J Diabetes, 2014; 38: 409-14.
 34. Joshi DV, Patil RR, Naik SR. Hydroalcohol extract of *Trigonella foenum graecum* seeds attenuates markers of inflammation and oxidative stress while improving exocrine function in diabetic rats. Pharm Biol, 2015; 53: 201-11.