Review article

REVIEW ARTICLE ON FENUGREEK PLANT WITH IT'S MEDICINAL USES.

PRAJAPATI ASHISH D, SANCHETI V.P, SHINDE PUJA M

S.N.D COLLEGE OF PHARMACY, YEOLA

Corresponding Author: PRAJAPATI ASHISH D

ABSTRACT:

Trigonellafoenum-graecum (Family- Fabaeace) plant is eaten in India since long. It is also known as Methi and used in Ayurvedic medicines for the treatment of wounds, abscesses, arthritis, bronchitis, and digestive disorders. In present investigation an attempt has been made for the standardization and Phytochemical evaluation of fenugreek seeds. The standardization evaluation comprises of detailed macroscopy, powder microscopy, and fluorescence analysis, physic-chemical constants such as ash value, extractive values, successive solvent extraction, moisture contents, foaming index and swelling index.^[1]

Trigonellafoenum-graecum (Fenugreek) plant contains a variety of components i.e. alkaloids, glycoside, polyphenols, steroids, amino acids and volatile components etc.In various medicinal applications, works as antidiabetic, anticarcinogenic, remedy for hypocholesterolemia and hypoglycemia, antioxidant, antibacterial agent, gastric stimulant, and anti-anorexia agent. In modern food technology, it is used as food stabilizer, adhesive and emulsifying agent due its fibre, protein and gum content. Its protein is found to be more soluble (91.3%) at alkaline pH of 11. This review article presents the major medicinal and other beneficial uses of fenugreek discovered through last 30 years of research in animal and human subjects as well as in other experimental studies

The present study deals with the pharmacognostic, preliminary phytochemical studies

and anticancer properties of seeds of Trigonellafoenum-graecum. The present paper highlights the macroscopic characters of seeds, physico-chemical evaluation, preliminary phytochemical studies and anticancer properties of the seeds. These observations would be of immense value in the botanical identification and standardization of the drug in crude form and would help distinguish the drug from its other species. Fenugreek (Trigonellafoenum-graecum Linnaeus) is an important herb and spice; its dried seeds have wide application in food and beverages as a flavoring additive as well as in medicines. Pharmacological properties attributed to fenugreek have been reported to be associated with its unique phytochemicals. It is a rich source of calcium, iron, carotene and other vitamins.

KEY WORDS: Trigonellafoenum-graecum ,History, Cultivation,Pharmacognostical studies, Medicinal studies, Mechanism of action, Conclusion

INTRODUCTION

Trigonellafoenum-graecum (Family Fabaeace) is called methika in Ayurveda and used as medicine for the treatment of wounds, abscesses, arthritis, bronchitis and digestive disorders etc since oldest time. It is also eaten in winters as to improve immunity and protects heart, brain and other vital organs of body through its medicinal properties. In traditional Chinese Medicine it is also used for kidney problems and conditions affecting the male reproductive tract. The recent researches have proved it beneficial for

www.earthjournals.org

Atherosclerosis, Constipation, Diabetes, High cholesterol and Hyper-triglyceridemia. The seeds of fenugreek contain alkaloids, flavonoids, saponins, amino acids, tannins and some steroidal glycosides, proteins etc. Standardization of fenugreek seeds is done for the establishment of quality and identity profile of the drug for the purpose of safety monitoring and overall quality assurance of the industrially as well as commercially important drug. Since there is no report in literature regarding the standardization parameters of fenugreek seeds. Therefore, in the present investigation an attempt has been made to standardize fenugreek seeds by using macroscopy and microscopical characters, powder microscopy, fluorescence analysis, physio-chemical values, and phytochemical screening.

Fenugreek, Trigonellafoenum-graecumL.is an annual crop from the familyLeguminosae. The seed of this plant grown in South Asia, has been known to have healthpotential with the ability to lower blood glucose and cholesterol levels, and hence in the prevention and treatment of diabetes and coronary heart diseases. The species name"foenum-graecum" means "Greek hay" indicating its use as a forage crop in the past.Fenugreek is believed to be native to the Mediterranean region^[1], but now is grown as aspice in most parts of the world. It is reported as a cultivated crop in parts of Europe, northern Africa, west and south Asia, Argentina, Canada, United States of America(USA) and Australia ^[1-4]. India is the leading fenugreek producing country in the world. Fenugreek has been used for centuries in folk medicine to heal ailments ranging fromindigestion to baldness. Fenugreek is regarded as the oldest known medicinal plant inrecorded history^[4]. In parts of Asia, the young plants are used as "pot herbs" and the seedas a spice or herbal medicine. Trigonellafoenum-graecumis also employed as anherbalmedicine in many parts of the world. Its leaves are used for their cooling properties andits seeds for their carminative, tonic and approdisiac effects. It is assumed to have astimulating effect on the digestive process. Fenugreek seeds, which are described in theGreek and Latin Pharmacopoeias, are said to have anti-diabetic activity and hypocholesterolaemic effects. In addition, fenugreek has been reported to possess acurative gastric anti-ulcer action, anti-bacterial, anti-helminthic, anti-fertility effects and anti-nociceptive effects. Fenugreek seed contains both saponin and galactomannanpolysaccharides which could be of use as natural antibacterial compounds.Inspite of numerous medicinal uses attributed to this plant, there is very lesspharmacognostical report on the microscopical and other physicochemical standardsrequired for the quality control of the crude drugs. Hence the present investigationincludesmacroscopical evaluation, determination of physicochemical constants, preliminary phytochemical screening and a review on anticancer properties of Trigonellafoenum-graecum.

History:

For the last few decades, phytochemistry (study of plants) has been making rapidprogress and herbal products are becoming popular. There has been dramatic rise in thesale of herbal products like Allium sativum, Spirulina, Trigonella Foenum Graecum, and

www.earthjournals.org

Volume 4 Issue 4, 2014

40

Silybummarianum. Herbal medicine has produced number of distinguished researchers and due to its accessibility to traditions it is stillpracticed even by lay practitioners. Ayurveda, the ancient healing system of India, flourished in the Vedic era in India. According to historical facts, the classical texts of Ayurveda, CharakaSamhita and SushrutaSamhita were written around 1000 B.C. The Ayurvedic Materia Medica includes 600 medicinal plants along with therapeutics. Herbslike turmeric, fenugreek, ginger, garlic and holy basil are integral part of Ayurvedic formulations. The formulations incorporate single herb or more than two herbs (polyherbal formulations).

Historical accounts indicate that fenugreek leaves and seeds were used for many medicinal purposes, such as treating mouth ulcers and chapped lips, cure of baldness, in alleviation of abdominal and abscesses pain, in alleviation of cardiovascular and hepatic disorders, treating arthritis, dropsy, heart disease, spleen and liver enlargement, kidney ailments among several others, in the subcontinent of India, Greece, Arab and China (Acharya et al. 2010a; Tiran 2003; Weiss 2002).

Background:

Botanical and physiological aspects of fenugreek

Germinated seeds from fenugreek form a seedling, which eventually develops into stems, flowers, pods and seeds (Petropoulos, 2002). Following swelling of the seed, the radicle emerges from the seed coat, penetrates the soil and initiates primary root development.

Origin and centre of diversity of fenugreek

Fenugreek is a diverse species. Authors have widely debated the probable ancestry of Trigonellafoenum-graecum(L.), although the divergent schools of opinion identify three probable centers of origin for the plant (Acharya et al. 2008). Vavilov (1951, 1926) suggested that fenugreek originated from the Mediterranean region. However, according to Fazli and Hardman (1968), and De Candolle (1964) fenugreek has an Asian/Indian center of origin. Dangi et al. (2004) also proposed that the species originated in Turkey. Collections of fenugreek from different countries have been made for the purposes of taxonomic investigation and characterization. Results of these studies have revealed other probable centers of diversity for fenugreek; e.g., Serpukhova (1934) proposed that Yemen and Abyssinia are centers of diversity for fenugreek, while Moschini (1958) suggested that Sicily, Tuscany and Morocco are centers of diversity for fenugreek. In another study, Yemen, the Transcaucasia region of Eurasia, Africa, Afghanistan, the China-Iran region, and India also have been proposed as diversity centers for fenugreek (Furry 1950).

The exact number of species of the genus Trigonellais also unsettled. Petropoulos (2002) indicated that Linneaus suggested that about 260 species of fenugreek exist, while 97 species and 128 species have been described by Fazli (1967) and Vasil'chenko (1953)

www.earthjournals.org Volume 4 Issue 4, 2014

respectively. Hutchinson (1964), and Rouk and Mangesha (1963) placed about 70 species under the Trigonellagenus. This decline in specie's number between the 18th and 20th centuries suggests that many species of Trigonellamay have been lost due to lack of conservation and species domestication. Recently, Acharya et al. (2008) suggested that a total of 18 different currently recognized species of fenugreek may still exist.

Cultivation and Harvesting:

Cultivation:

Fenugreek is best grown as an annual crop from seeds, by the line sowing method. The land should be prepared but related ploughiong and harrowing ^[5]. In India, it is used as green leafy vegetable as well as spice. The plant is cultivated as a semi-arid crop. It is cold season crop and is fairly tolerant to frost and very low temperature. It can also grow on black cotton soils ^[6-7]. Fenugreek requires well-drained, good soil of medium texture. Tolerated pH range is 5.3 to 8.2. Needs full sunlight, and requires watering during dry periods ^[8-9].

Crop becomes ready for harvest in about 120-150 days. At the time of ripening or maturity, leaves and pods become yellowish and leaves start falling. Timely harvesting is very important for this crop as late harvest leads to seed losses due to pod bursting, while in early harvest, the grains remain immature and small. Harvesting should be done early in the morning. After harvest, plants should be dried in threshing yard and threshed by trampling under the feet of bullocks. Seeds should be separated and cleaned by winnowing.

Regions of cultivation

Fenugreek is now cultivated in all habitable continents of the world. Some of these continents have a long history of use, while other continents only started cultivating the crop during the past 2-3 decades. Asia is positioned in 1st place among continents in terms of fenugreek production and acreage with India leading in fenugreek seed production, producing about 90% of the world fenugreek grown (Acharya et al. 2008, 2007). Among other Asian countries; Iran, Israel, China and Pakistan also have high levels of production. Asia is followed by the continent of Africa in terms of fenugreek production and acreage as well as richness in genetically distinct fenugreek germplasm.

www.earthjournals.org

MAIN CONTENT OF REVIEW:

PLANT PROFILE:



Fig.TrigonellaFoenumgraecum

Domain	:	Eukarya
Kingdom	:	Plantae
Division	:	Magnoliophyta (or Anthophyta)
Class	:	Magnoliopsida
Order	:	Fabales(or Leguminales)
Family	:	Fabaceae
Sub-family	:	Trifoliae
Genus	:	Trigonella
Sub-genus	:	Foenum- graecum
Species	:	Trigonellafoenu mgraecum
www.earthjournals.org		Volume 4 Issue 4, 2014

Morphology:

- 1. Appearance: Solid- rhomboidal seeds,3 to 5 mm long,2 mm thick. Hard, pebble-like.
- 2. Colour: Yellowish brown-light brown
- 3. Odour: characteristic spicy
- 4. Taste: Bitter and mucilaginous

Common Names:

Latin: Trigonellafoenum-graecum L.; Foenugraeci semen (for the seed) Italian: Fieno Greco Arabic: Hulba Chinese: Hu-lu-ba,Hu-lu-pa, K'u-Tou Norwegian: Bukkehonrkler Dutch: Fenegriek Portuguese: Alforva,Feno-grego Farsi: Sambelil Russian: Pazhitnik,Pazhitnikgrecheskiy, Sambala Finnish: Sarviapila Sanskrit: Methi,Methika, Peetbeeja French: Fenugrec,Trigonelle Spanish: Alholva,Fenogreco German: Bockshornsamen (seed),Bockshorklee. Swedish: Bockshornklee

PHYTOCHEMISTRY

Stem:

Fenugreek contains a number of steroidal sapogenins. The diosgenin were found in the oily embryo. Two furastanol glycosides, F-ring opened precursors of diosgenin have been reported, as also hederagin glycosides. The alkaloid trigonelline, trigocoumarin, trimethylcoumarin and nicotinic acid are present in stem. Mucilage is a prominent constituent of the seeds ^[12]. About 28 % mucilage; 5 % of a stronger-smelling, bitter fixed oil, 22 % proteins; a volatile oil; two alkaloids, Trigonelline and Choline, and a yellow colouringsubstanceare present in stem.

Leaves:

The leaves contain 7 saponins, known as graecunins. These compounds are glycosides of diosgenin. Leaves contain moisture 86.1%, protein 4.4%, fat 0.9%, minerals 1.5%, fiber 1.1%, and carbohydrates 6%. The mineral and vitamins contents are calcium, iron, phosphorous, carotene, thiamine, riboflavin, niacin and vitamine C^[14].

Seed:

Fenugreek Seeds are aromatic, bitter, carminative, galactogouge, antibacterial and may be eaten raw or cooked. Bulk of the seed is dietary fiber (50%) and protein (30%)

www.earthjournals.org

both of which have no taste or flavor. The chemical components of fenugreek seeds include a large carbohydrate fraction (mucilaginous fiber, galactomannan); 20-30% proteins high in tryptophan and lysine; pyridine-type alkaloids; flavonoids; free amino acids (4-hydroxyisoleucine, arginine, lysine, histidine); saponins; glycosides; vitamins, minerals, (28%) mucilage, (22%) proteids, 5% of a stronger-smelling, bitter fixed oil. volatile oils. Bitterness is mainly due to the oil, steroidal saponins and alkaloids. Historically used as a culinary and medicinal herb, recent research studies have shown its effectiveness in reducing blood glucose levels, promoting lean body mass, lowering cholesterol, and treating gastrointestinal disorders. Studies with type 2 diabetics have shown a blood glucose normalizing effect and decreased insulin resistance. Preliminary research with type-1 diabetics suggest that fenugreek may aid insulin secretion and may reduce total cholesterol and LDL cholesterol levels ^[15-18].

Seeds contain 0.1% to 0.9% diosgenin and are extracted on a commercial basis. Plant tissue cultures from seeds grown under optimal conditions have been found to produce as much as 2% diosgenin with smaller amounts of gitongenin and trigogenin. The seeds also contain the saponinfenugrin B. Several coumarin compounds have been identified in fenugreek seeds as well as a number of alkaloids (eg, trigonelline, gentianine, carpaine). A large proportion ofthetrigonelline is degraded to nicotinic acid and related pyridines during roasting. These degradation products are, in part, responsible for the flavor of the seed. The seeds also yield as much as 8% of a fixed, foul-smelling oil. Three minor steroidal sapogenins also have been found in the seeds: smilagenin, sarsapogenin, and yuccagenin.

PHARMACOGNOSTICAL STUDIES:

The macroscopy of the seeds were studied bv comparing their macroscopicalcharacters mentioned in the literature. Size was measured using a graduated ruler in millimetres which was used for the measurement of the length, width and thickness of seed samples. Since, the seeds are quite small in size they are measured by aligning 10 of them on a sheet of calibrated paper, with 1mm spacing between lines, and dividing the result by 10. The colour was examined by exposing the untreated seed sample under diffuse daylight, and the colour of the seed sample was studied. For analysing the surface characteristics, texture and fracture characteristics the untreated seed sample were examined using a magnifying lens (6X to 10X), seed surface was touched to determine the texture whether soft or hard; bend or ruptured and to obtain information on brittleness and the appearance of the fracture plane-whether it is fibrous, smooth, rough granular,

etc. The odour was analysed by placing a small portion of the crushed seed sample (25g) in a 100ml beaker and then pouring a small quantity of boiling water onto the crushed seed sample. Determined the strength of the odour (none, weak, distinct, strong) and then the odour sensation (aromatic, fruity, musty, mouldy, rancid, etc.). ^[1-3]

www.earthjournals.org

1.Macroscopic characteristics of fenugreek:

Macroscopical characters

The morphological studies were carried out for shape, size, color, odor and taste and fracture identification of the fenugreek seed.

Macroscopical evaluation

Seeds

The macroscopical characters of seeds are -Solid-rhomboidal, pebble like shape, 3-5cm long, 2mm thick, plain surface, yellow, bitter mucilaginous taste and have characteristic odor.

Leaves

The macroscopical characters of fenugreek leaf are trifoliate, stipules triangular, leaflets obovate to oblong, 10-30 mm long, 5- 15 mm wide, obtuse to truncate at apex, narrowed towards the base; margins shallowly serrate to dentate, glabrous. Infloresences short, axillary racemes, green, pungent in taste and have smooth surface.

Microscopical characters

Transverse section

Transverse section of seed and leaf are present in the Fig: 1 and 2.



Fig. : Transverse section of seedFig. : Transverse section of leaf

Sr.No.	Parameters	Results % w/w
1	Foreign matter	1.16
2	Loss on Drying	12.62
3	Foaming index	259.95
4	Swelling index	10.5
5	Ash Value	
	Total Ash	3.3
	Acid insoluble ash	0.4
		1.6
	Water soluble ash	
6	Extractive values	
	Alcohol soluble extractive value	14.50
	Water soluble extractive value	35.00

Table: Physio- chemical constants of Fenugreek seeds

USES:

1. Ancient use of fenugreek:

Historical uses of fenugreek have been reported by many authors. In the tomb of the Egyptian Pharaoh, Tuthankhamun (1333 BC to 1324 Bc), seeds of fenugreek were found. The Egyptians also used the leaves of fenugreek as one of the components of holy smoke in fumigation and embalming rites (Fazli and Hardman, 1968). Yoshikawa et al. (1997) mentioned that fenugreek was used as an aid to induce labor during childbirth and delivery in ancient Rome.

www.earthjournals.org

2. Fenugreek as a spice:

Fenugreek has long been used as a spice in South Asia, the Mediterranean, and in Africa. Both seed and leaves of fenugreek are widely used as a culinary spice to enhance the taste of many meat, poultry and vegetable dishes (Acharya et al. 2010a b). The fresh or dried leaves are used to flavor dishes in many parts of India. In Egypt and Asia, sprouts of fenugreek and the young leaves are eaten as green vegetables. Fenugreek seed is a natural source of galactomannan gum. This property of fenugreek seed has provided the food industry with an opportunity to use seed extracts as thickening agent in foods or as food emulsifier (Slinkard et al. 2006). In India and China, the seeds are also a source of a food coloring dye and industrial mucilage.

3. Medicinal uses:

The seeds are hot, with a sharp bitter taste; tonic, antipyretic, anthelmentic, increase the apetite, astringent to the bowels, cure leprosy, "vata", vomiting, bronchitis, piles; remove bad taste from the mouth, useful in heart disease (Ayurvedic).1, 3 The plant and seeds are hot and dry, suppurative, aperient, diuretic, emmenagogue, useful in dropsy, chronic cough, enlargement of the liver and the spleen. The leaves are useful in external and internal swellings and burns; prevent the hair falling off (yunani).1, 3 Fenugreek seeds are considered carminative, tonic and aphrodisiac. Several confections made with this the article are recommended for use in dyspepsia with loss of appetite, in the diarrhea of puerperal women, and in rheumatism.1, 3.

4. Fenugreek as animal food:

Although fenugreek is mostly known as a spice crop, the species name foenumgraecumrefers to "Greek hay" supporting its use as a forage crop in early years (Acharya et al. 2008). It is used as green fodder and hay for cattle in India and Turkey (Petropoulos 2002). In Japan, it is used as silage. Petropoulos (2002) reviewed fenugreek as an alternative to alfalfa or forage peas. Fenugreek seeds are also used as feed for lactating cattle as it increases the flow of milk (Duke 1981; Hidvegi et al. 1984).

5. Agricultural and others uses:

As a legume, fenugreek has the ability to fix atmospheric nitrogen in the soil by harboring nitrogen-binding bacteria in its roots. The crop requires a minimal amount of nitrogen fertilizer for its growth, and reduces the need for nitrogen fertilizers for subsequent crops (Acharya et al. 2010b). Fenugreek is considered a dryland crop thus water requirement of this crop is low. Use of fenugreek in arid and semi-arid environments, and in regions with limited water supply can reduce the cost of irrigation, reduce the potential for eutrophication of surface water and limit contamination of groundwater sources (Acharya et al. 2008; Basu 2006).

Here are the few health benefits of FENUGREEK:

- 1} Fenugreek seeds are rich in vitamin E and isone of the earliest spices known to man.as preservative and addes to pickles.
- 2} Fresh fenugreek leaves are beneficial in thetreatment of indigestion, flatulence and asluggish liver.
- 3} The dried leaves of the fenugreek is used as aqualityflavour for meat, fish and vegetable dishes.
- 4} An infusion of the leaves is used as a gargle forrecurrent mouth ulcers. A gargle made from theseeds is best for ordinary sore throat.
- 5} Fresh Fenugreek leaves paste applied over thescalp regularly before bath helps hair grow, preserves natural color, keeps hair silky and also cures dandruff.
- 6} Fenugreek seeds made in gruel, given tonursing mothers increase the flow of milk.
- 7} Topically, the gelatinous texture of fenugreekseed may have some benefit for soothing skinthat is irritated by eczema or other conditions. It also been applied as a warm poultice torelieve muscle aches and gout pain.
- 8} Fenugreek seeds reduces the amounts of calcium oxalate in the kidneys which often contributes to kidney stones. In animal studies, fenugreek appeared to lessen the chance of developing colon cancer by blocking the action of certain enzymes.
- 9} Traditional Chinese herbalists used it for kidneyproblems and conditions affecting the male reproductive tract.
- 10} Fenugreek is currently used as a source of thesteroiddiosgenin , one of its active constituents from which other steroids can be synthesized.

MEDICINAL STUDIES:

Anticancer Activity:

Fenugreek seeds showed potential protective activity against 7, 12-dimethylbenz(a) anthracene (DMBA)-induced breast cancer in rats at 200mg/kg body weight.Fenugreek seeds extract significantly inhibited the DMBA-induced mammaryhyperplasia and decreased its incidence. Epidemiological studies also implicate apoptosisas a mechanism that might mediate the Fenugreek's antibreast cancer protective effects.Theethanolic extract of Trigonellafoenum-graecum, with an ED50 less than10µg/ml in the brine shrimp cytotoxicity assay, was also observed to possess anti-tumouractivity in A-549 male lung carcinoma, MCF-7 female breast cancer and HT-29 colonadenocarcinoma cell lines. The extract gave negative results in the mutagenicity test. The present that Trigonellafoenum-graecumhas appreciable anti-canceractivity. Flavonoids seem to be most likely candidates eliciting study establishes anti-tumorigenic effect.

Anticarcinogenic activities and complementary cancer therapy:

Fenugreek is a promising protective medicinal herb for complementary therapy in cancer patients under chemotherapeutic interventions because fenugreek extract shows a protective effect by modifying the cyclophosphamide induced apoptosis and free radical-

www.earthjournals.org Volume 4 Issue 4, 2014 49

mediated lipid peroxidation in the urinary bladder of mice ^[19]. Diosgenin (C27H42O3) is a crystalline steroid sapogenin found in fenugreek and used as a starting material for the synthesis of steroid hormones such as cortisone and progesterone. It has been found to be potentially important in treatment cancer. It has the ability to prevent invasion, suppress proliferation and osteoclastogenesisthrough inhibition of necrosis factor NF-kappa Bregulated gene expression and enhances apoptosis induced by cytokines and chemotherapeutic agents ^[20]. The seed powder in the diet due to the presence of fibre, flavonoids and saponins decreased the activity of -glucuronidasesignificantly and prevented the free carcinogens from acting on colonocytes whereas mucinase helped in hydrolysing the protective mucin.

Hypocholesterolemic activities:

The abnormal deficiency of cholesterol level in the blood is known as hypocholesterolemic problem and oral administration of methanolic and aqueous extracts of seeds at a dose of one gram per kilogram body weight resulted in hypoglycaemic effect in mice ^[21]. Singhal et al. showed hypocholesterolemic effects of fenugreek seeds and reported that fenugreek seeds have lowered serum cholesterol, triglyceride and low-density lipoprotein in hypercholesterolemia suffering patients and experimental models. Fenugreek consumption in diet reduced triglyceride accumulation in the liver but do not interfered with the plasma insulin or glucose levels obesity suffering rats^[22].

Hypoglycemic activities:

Hypoglycemia is a condition of human body in which there is an abnormal decrease in the sugar level of the blood. Singh and Garg (2006)^[23] reported that fenugreek seeds have hypoglycemic and hypocholesterolemic effect as supported by findings during theexperiment on animals. It improves peripheral glucose utilization, contributing to improvement in glucose tolerance and exerts its hypoglycemic effect by acting at the insulin receptor level as well as at the gastrointestinal level. Raghuram et al. (1994) ^[24]reported increased erythrocyte insulin reception due to fenugreek consumption and they concluded with the help of intravenous glucose tolerance test that fenugreek in the diet reduced the area under the plasma glucose curve significantly and shortened the halflife of plasma glucose by the increased metabolic clearance.

Antioxidant:

Fenugreek contains phenolic and flavonoid compounds which help to enhance its antioxidant capacity. Table 5 shows the major medicinal and general uses and application of the fenugreek.Balch suggested that fenugreek has powerful antioxidant property that has beneficial effect on liver and pancreas; since antioxidant properties have been linked to health benefits of natural products; such properties are studied with germinated fenugreek seeds which are observed to be more beneficial than dried seeds because of the fact that germinated seed increases the bioavailability of different constituents of fenugreek. An aqueous fraction of fenugreek exhibits the highest antioxidant activity compared to other fractions and the quantity of phenolic and

www.earthjournals.org

flavonoid compounds are related to antioxidant activity. These studies reveal significant antioxidant activity in germinated fenugreek seeds which may be due to the presence of flavonoids and polyphenols . Furthermore, Grover et al. (2002) reported that mustard and fenugreek seeds showed hypoglycemic and antihyperglycemic activity in diabetic mice and they have attributed that the health benefits may be due to the presence of antioxidant carotenoids in those spices.^[25]

Influence on enzymatic activities:

Several researchers as mentioned in and have shown in human subject and animal models that fenugreek has the ability to some extent to restore the actions of key enzymes in particular lipids and carbohydrates. Baquer et al. (2011) reported that trigonellaadministration in rats restored the changed enzyme activities and partially normalized hyperglycemia. Concluded from their experiments that the altered levels of superoxide dismutase, antioxidant enzymes catalase and glutathione peroxidase in liver and kidney of diabetic rats were corrected by treating with insulin, vanadate, fenugreek and the combined dose of vanadate and fenugreek. It showed that the activities of glucose-6-phosphatase and fructose-1, 6-biphosphatase in the liver and kidneys of diabetic rats are reduced by administration of fenugreek.^[26]

Immunomodulatory effect:

An agent that intensifies or diminishes the immune responses is known as immunomodulator and such effect is called as immunomodulatory effect. Research work in this effect of fenugreek is scanty but showed stimulatory immunomodulatory effect (as evidenced from body weight, relative thymus weight, cellularity of lymphoid organs, delaved of hypersensitivity response, plaque forming cell type assav. haemagglutinationtitre, quantitative haemolysis assay, phagocytosis, lymph proliferation and a significant increase in phagocytic index and phagocytic capacity of macrophages) of aqueous extract of fenugreek at three doses 50, 100 and 200 mg per kg of body weight for 10 days on the immune system of Swiss albino mice.

Antifertility effect:

Evaluated the potential antifertility activity of feeding diets containing 30% fenugreek seeds to male and female white rabbits of New Zealand and reported the following results: a) an antifertility effect of fenugreek seed in female rabbit; b) toxicity effect in male rabbit; c) testis weight in male reduced with damage to the seminiferous tubules and interstitial tissues; d) in the treated animals, the plasma concentration of the androgen hormone and sperm concentrations were halved; f) in the females rabbits, significant reduction of developing foetuses and g) in the treated animals, the circulation of plasma progesterone concentrations at 10 and 20 days of gestation significantly increased with no significant effect on the pre-breeding estrogen concentrations ^[27].

Diabetes management:

Fenugreek has been well known to be used as antidiabetic remedy for both type I and II diabetes. Sharma et al. studied in non insulin dependent diabetic patients by incorporating 100 g of defatted fenugreek seed powder in their diet for 10 days and found

www.earthjournals.org

fasting food glucose levels to decrease and reported an improvement in theglucose tolerance test, urinary glucose excretion reduction by 64% in 2 h, decrease in serum total cholesterol, low density lipoprotein and very low density lipoprotein cholesterol and triglyceride levels without alteration in the high density lipoprotein cholesterol fraction. In type-I diabetic rats, administration of fenugreek and sodium-orthovanadate orally concluded that sodium-orthovanadate and fenugreek administration to diabetic animals prevent development of hyperglycemia and alteration in lipid profile in plasma and tissues and maintain it near normal but maximum prevention can be observed in the combined treatment with lower dose of sodium-orthovanadate, whereas in another studies, in mild type-2 diabetic patients adjunct use of fenugreek seeds found to improve glycemic control and decrease insulin resistance ^[28].

Antiulcer:

The aqueous extract and a gel fraction, isolated from the seeds showed significant ulcer protective effects. It has soothing effect on gastric and gastritis ulcer.

MECHANISM OF ACTION:

The hypoglycemic effects of fenugreekhave been attributed to several mechanisms.Sauvaireet. Al. demonstrated in vitro the amino acid4-hydroxyisoleucine in fenugreek seeds increased glucose-induced insulin release in human and ratpancreatic islet cells.6 This amino acid appeared act only on pancreatic beta cells, since the levelsofsomatostatin and glucagon were not altered.In human studies, fenugreek reduced the area underthe plasma glucose curve and increased thenumber of insulin receptors, although the mechanismfor this effect is unclear.7 In humans,fenugreek seeds exert hypoglycemic effects bystimulating glucose-dependent insulin secretionfrom pancreatic beta cells,8 as well as by inhibitingthe activities of alpha-amylase and sucrase,9two intestinal enzymes involved in carbohydratemetabolism.Fenugreek seeds also lower serum triglycerides,total cholesterol (TC), and low-densitylipoprotein cholesterol (LDL-C).10-14 These effectsmay be due to sapogenins, which increase biliarycholesterol excretion, in turn leading to loweredserum cholesterol levels.10,15-17 The lipid-loweringeffect of fenugreek might also be attributed to itsestrogenic constituent, indirectly increasing thyroidhormone T4.^[29]

CONCLUSION:

To ensure reproducible quality of herbal products, proper control of starting material is utmost essential. Thus in recent years there has been an emphasis on standardization of medicinal plants of therapeutic Potential. According to World Health Organization (WHO) the macroscopic and microscopic description of a medicinal plant is the first step towards establishing its identity and purity and should be carried out before any tests are undertaken. Morphological evaluation is a technique of qualitative evaluation based on the study of morphological and sensory profiles of whole drugs. Evaluation of foreign matter was done for determination of contaminant and adulterative matters in drug.

www.earthjournals.org

Evaluation of ash value helps to determine the quality and purity of crude drug. Evaluations of extractive values are useful for the qualitative and quantitative evaluation of crude drug. It shows the presence of specific constituents and their solubility in different solvents. In this study hot extractive value were found to be more in comparison to cold extractive values and in the successive solvent extraction polar solvents were have more extractive value in comparison to non- polar solvents. Phytochemical screening was useful for the determination of the presence of significant chemical classes of constituents. The results indicated the presence of alkaloid, flavonoids, amino acid, tannins, protein, starch, mucilage and saponins. Swelling index is useful for the determination of the presence of saponins contents in the drug. Fluorescence evaluation is the type of luminescence in which the molecule emits visible radiation passing from a higher to lower electronic state. This evaluation indicates the presence of constituents. All evaluation of Trigonellafoenumgraecum seeds was successfully performed.

The major health beneficial properties of fenugreek, which can give promising therapeutic application, found in various studies in last three decades has been discussed in this review article. Antidiabetic, antioxidant, anticarcinogenic, anthelmintic, antiulcer, antifertility, immunomodulatory effect, enzymatic pathway modifier, hypoglycemic activity, hypocholesterolemic activity are the major medicinal properties of the fenugreek demonstrated in various studies. High fibre content, protein content, gummy nature and other bioactive compounds make it a naturally several health promoting herb. Based on the these several medicinal usefulness as discussed based on various past reported scientific findings, fenugreek can be recommended and can be made a part of our daily diet as its liberal use is safe and various health benefit can be drawn from this natural herb but in some extreme cases like patient suffering from chronic asthma etc., it should be avoided or its consumption should be minimized.

ACKNOWLEDGEMENT

It is said that 'accomplishment must be created to those who had put up the foundation of the particular chore. Here, I pay tribute to **my parents** for lifting up till this phase of life. I thank them for their love, trust, patience and support of course for bearing all kind of stresses, they could, to make me what I am .I owe everything to them and for being my constant companion the strongest source of motivation and inspiration.

I wish to express my deep sense of gratitude and indebtness to my esteemed guide **Mrs. Sancheti** .V.P. and also thankful to **Mr. KashidG.A.Sir** for their continuous perseverance, motivation, untiring efforts and encouragement throughout the course.

I am grateful to **Mr.Pawar S.C.** for providing necessary guidance to carry out this work.

www.earthjournals.org

I am very thankful to my colleagues Ashish, Sagar, & Vaibhav for their contribution and support for my work.

REFERENCES:

1. Anonymous. Quality Control Methods for Medicinal Plant Materials.WHO, Pharma, 1992; 4thedn, 492-559.

2. Ansari SH. Essentials of Pharmacognosy, Birla Publication Pvt. Ltd, 2005; 1th edn, 357-384.

3. Ayurvedic Pharmacopoeia. Ministry of Health and Family Welfare, Govt. of India, New Delhi, 1996; 1, 43.

4. Farnsworth NR. Biological and Phytochemical Screening of Plants, J. Pharm Science, 1966; 55, 225-276.

5. Harborne JB. Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis. Chapman and Hall, London, 1998; 3th edn, 32-38.

6. Indian Herbal Pharmacopoeia. Indian Drugs Manufacturing Association Mumbai, Regional Research Laboratory Jammu Tavi, 1999; 1, 33.

7. Kokate CK. Purohit AP. and Gokhale SB. A Text Book of Pharmacognosy, 2005; 31, 130-132.

8. Mukherjee PK. Evaluation of Indian Traditional Medicines, Journal of Drug Information, 1996; 35, 631-640.

9. Madhav, N.V. Satheesh, KumurUpadhyaya. Phytochemical screening and standardization of poly herbal formulation of dyslipidema. International Journal of Pharmacy and Pharmaceutical Sciences, 2011; 3, 235-238.

10. Mathur, Jaya, Khatri, Pankaj, Samanta, Kartick Chandra. Pharmacognostic and phytochemical investigations of AMARANTHUS SPINOSUS (LINN.)Leaves. International Journal of Pharmacy and Pharmaceutical Sciences, 2010; 2, 121-124.

11. Thomas JE, Bandara M, Lee EL, Driedger D, Acharya S (2011) Biochemical monitoring in fenugreek to develop functional food and medicinal plant variants. N Biotechnol 28: 110-117.

- 12. Blank I (1996) The flavor principle of fenugreek. Nestlé research center.211th ACS Symposium. New Orleans 24-28.
- 13. Sowmya P, Rajyalakshmi P (1999) Hypocholesterolemic effect of germinated fenugreek seeds in human subjects. Plant Foods Hum Nutr 53: 359-365.
- 14. Brar JK, Rai DR, Singh A, Kaur N (2011) Biochemical and physiological changes in fenugreek (Trigonellafoenum-graceum L.) leaves during storage under modified atmosphere packaging. Journal food science and technology.
- Senthil A, Mamatha BS, Vishwanath P, Bhat KK, Ravishankar GA (2010) Studies on development and storage stability of instant spice adjunct mix from seaweed. Journal of food science and technology 48: 6.
- 16. Srinivasan K (2006) Fenugreek (Trigonellafoenum-graecum): A Review of Health Beneficial Physiological Effects. Food Reviews International 22: 203-224.
- 17. Balch PA (2003) Prescription for dietary wellness (2ndedn). Penguin group, New York.
- 18. Thomas JE, Bandara M, Lee EL, Driedger D, Acharya S (2011) Biochemical monitoring in fenugreek to develop functional food and medicinal plant variants. N Biotechnol 28: 110-117.
- 19. Lee EEL (2006) Genotype X environment impact on selected bioactive compound content of Fenugreek (Trigonellafoenum-graecum). Department of biological sciences, University of Lethbridge, Canada 1-150.
- 20. Montgomery J (2009) The potential of fenugreek (Trigonellafoenum-graecum) as a forage for dairy herds in central Alberta. University of Alberta, USA 4-15.

www.earthjournals.org

- 21. Yadav S, Sehgal S (1997) Effect of home processing and storage on ascorbic acid and, β-carotene content of bathua(Chenopodium album) and fenugreek (Trigonellafoenumgraecum) leaves. Plant Foods for Human Nutrition 50: 239- 247.
- 22. Sharma RD (1986) Effect of fenugreek seeds and leaves on blood glucose and serum insulin responses in human subjects. Nutrition Research 6: 1353-1364.
- 23. Muralidhara, Narasimhamurthy K, Viswanatha S, Ramesh BS (1999) Acute and subchronic toxicity assessment of debitterized fenugreek powder in the mouse and rat. Food ChemToxicol 37: 831-838.
- 24. Jani R, Udipi SA, Ghugre PS (2009) Mineral content of complementary foods. Indian J Pediatr 76: 37-44.
- 25. Altuntas E, Ozgoz E, Taser OF (2005) Some physical properties of fenugreek (Trigonellafoenumgraceum L.) seeds. J Food Eng 71: 37-43.

26. Kakani RK, Anwer MM, Meena SS, Saxena SN (2009) Advance production technology of fenugreek. NRCSS Tech. Release 1-24

27. Raghuram TC, Sharma RD, Pasricha S, Menon KK, Radhaiah G (1992) Glycaemic index of fenugreek recipes and its relation to dietary fiber. International journal of diabetes in developing countries 12: 1-4.

28. Sowmya P, Rajyalakshmi P (1999) Hypocholesterolemic effect of germinated fenugreek seeds in human subjects. Plant Foods Hum Nutr 53: 359-365.

29. Blank I, Lin J, Devaud S, Fumeaux R, Fay LB (1997) The principal flavour components of fenugreek (Trigonellafoenumgraecum). In: Risch, SJ and Chi, TH (eds) Spices: Flavour Chemistry and Antioxidant Properties. ACS, Washington, DC.