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Phytochemicals Exploration With Formulation And Evaluation Of Fenugreek

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Abstract:

Fenugreek (Trigonella foenum-graecum L.), is widely destributed throughout the world and belongs to the Fabacecae family. It is an old medicinal plant and has been commonly used as a traditional food and medecine. Fenugreek is known to have hypoglycemic, and hypocholesterolaemic effects. Recent research has identified fenugreek as a valuable medicinal plant with potential for multipurpose uses and also as a source for preparing raw materials of pharmaceutical industry, especially steroidal hormone. It is a rich source of calcium, iron and other vitamins. In this study after a general discussion of physio-chemical constituents. This review includes antidiabetic effect, antioxidant activity, antibacterial and antifungal, anti-inflammatory , gastro protective, anti-cancer and to treat cardiovascular diseases. Also, different evaluation test for the Fenugreek plant.

Keywords: Methi, Ayurvedic, Antioxidant, seed.

Introduction:

The importance of food safety is rising in both developed and developing countries. Major contributing factors include ignorance, negligence, and the existence of pathogens, toxins, allergies ,and cross-contamination [1]. Its leaves and seeds are widely employed in the pharmaceutical, nutraceutical, and functional food industries as a vegetable, spice, and medication [2]. Fenugreek seeds have been studied for their medicinal qualities and have been discovered to have many advantages against a variety of Illness such as diabetes and cancer. The symptoms include edema of the legs, hyperlipidemia, inflammation, neurotoxicity, hepatotoxicity, ulcers, wounds, bacterial, and fungal infections [3 4]. Numerous research has not only shown its beneficial effects but also its toxicity profile [5 6 7]. Critical evaluation of scientific research using established criteria is required to guarantee a trustworthy risk assessment based on evidence. [8]. In order to guarantee openness and consistency in risk evaluations, the National Academy of Sciences considers that standard criteria must be applied when evaluating the caliber of toxicological research. [9]. Additionally, experts from REACH (Registration, Evaluation, Authorization, and Restriction of Chemicals) and Society of Toxicology (SOT) suggested rating of the toxicological studies for quality and reliability during regulatory decisions [10,11]. Subsequently, scientists have created the "ToxRTool," an accurate and trustworthy assessment tool..(Reliability Assessment Tool for Toxicological Data) to assess the quality of toxicological research that have been published. This extensively used, standardized, repeatable, and validated technique codes toxicological investigations according to reliability criteria. [12]. A human health hazard assessment can include the studies that ToxRTool was used to

examine because they are regarded as trustworthy. Since no systematic investigation has been done to identify the toxicological profile of fenugreek seed, the current analysis uses the ToxRTool to assess the quality and dependability of previous toxicological studies on the seed.

Table 1: common name of fenugreek

Language	Common Names
Hindi	Methi, Saag methi, Kasuri methi
English	Fenugreek
French	Fenugreec, Trigonelle
Galician	Alforfa
German	Bockshornklee, Griechisch Heu
Georgian	Solinji, Chaman
Japanese	Koruha, Fenu-guriku
Dutch	Fenugriek
Romanian	Molotru, Molotru comun, Schinduf
Assamese	Methi, Mithi
Sanskrit	Methika

Taxanomy:

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Fabales

Family: Fabaceae

Sub-family: Trifoliae

Genus: Trigonella

Sub-genus: Foenumgraecum

Species: Trigonella foenum graecum

Plant Profile:

Fig.1: fenugreek

Morphology :

Appearance: Solid-rhomboid seed, 3 to 5 mm 2mm thick. Hard, pebble-like.

Colour: yellowish brown ,ambar or tann colour.

Odour: Pungent.

Taste: Astringent.

The Fenugreek Plant-

After three days, fenugreek seeds planted in well-prepared soil sprout. After reaching a height of 30 to 60 cm, the seedling grows erect, semi-erect, or branching. The plant has pinnate compound, trifoliate leaves, white to yellow flowers, and 3-15 cm long, thin, po-beaked pods with 10-20 ob greenish-brown seeds with unique hooplike groves [13]. Fenugreek is the sole plant in Fabac that is responsible for pollinating the annual leguminous bean [14]

Stem-

Fenugreek, a plant with several steroidal compounds, has an oily embryo containing trimethylcoumarin, trigonelline, and nicotinic acid found in its stem. Mucilage is the primary component found in seeds [15]. Research indicates that the stem contains approximately mucilage, 5% stronger-smelling proteins, bitter proteins, a volatile oil, two alkaloids, and a coloring substance [16].

Fig.2: stem of T.foenum graceum

Leaves-

Graepes have three leaves that are truncate at the base, measuring 30 mm in length and 5 to 15 mm in width. The margins are shallow and glabrous. Together with being high in sour vitamins including phosphorus, riboflavin, thiamine, and vitamin C, they also contain graecunins and diosgenin [17].

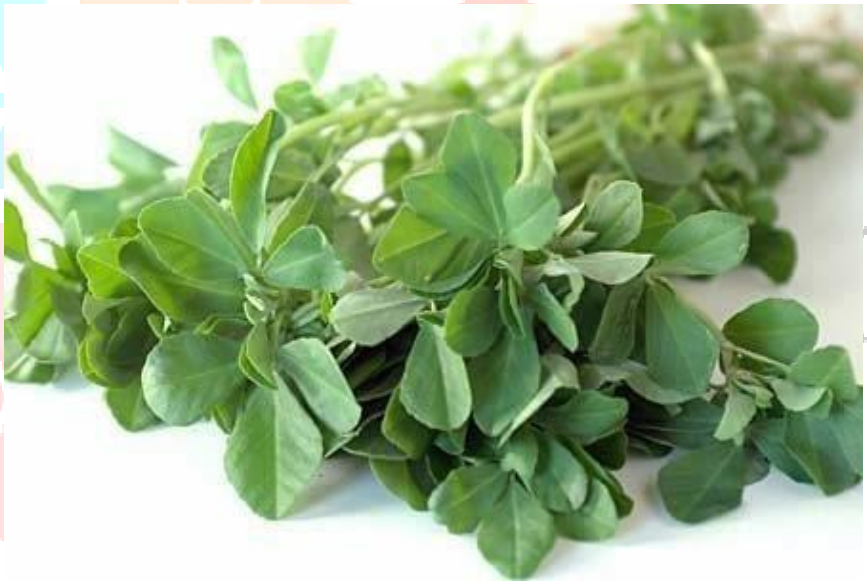

Fig.3: leaves of T.foenum graceum

Seeds-

The seed has a yellow, smooth surface and is shaped like a rhomboidal pebble. It is 3-5 cm long and 2 mm thick. The majority of fenugreek seeds are made up of protein and dietary fiber, neither of which have flavor or taste. [18].

Under optimal cultivation conditions, plant tissue cultures originating from seeds yield diminished quantities of gitongenin and trigogenin. However, a notable 2% of diosgenin is synthesized. Fenugreek seeds primarily consist of substantial amounts of proteins, carbohydrates, flavonoids, alkaloids (including saponin and free amino acids), and various other chemical constituents [19].

Fig.4: seeds of T. Foenum graceum

Therapeutic Use of Fenugreek:

Antidiabetic effect: Effect on blood sugar and cholesterol: Fenugreek powder is a rich component that can be an excellent substitute for high blood sugar and cholesterol [20]. It has been shown that the free unnatural amino acid 4-hydroxysio-leucine found in fenugreek seeds increases the release of insulin in human and rat pancreatic islet cells when glucose is present. When given to diabetic rats as a supplement,[21, 22]. They investigated the impact of fenugreek seed hydroalcoholic extract on individuals with type 2 diabetes and discovered that these seeds could lower insulin resistance and raise blood sugar. The presence of soluble fibers in fenugreek slows down the digestion and absorption of carbs, which heightens the impact of insulin[23].

Antioxidant activity: Trigonella foenum-graecum L. extracts have been shown to possess antioxidant qualities in a number of investigations [24]. When fenugreek seed powder is added to the diet, it lowers the levels of ocidative damage indicators in rats with alloxan diabetes. Moreover, in vitro oxidative hemolysis and H2 O2-induced lipid peroxidation in human erythrocytes were inhibited by fenugreek seed polyphenols. [25,26].

Antibacterial and antifungal activity: Bacillus cereus, Bacillus subtilis, Virbio cholerae, Salmonella typhi, Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli, and Serratia marcescens were among the Gram-positive and negative bacteria that the methanolic and aqueous extracts of fenugreek seeds demonstrated antibacterial activity against. Many researchers have also demonstrated the efficacy of Trigonella extracts against Helicobacter pylori, and his group reported the antifungal activity of various plant parts, including the seeds, leaves, stems, and roots of fenugreek, by preparing their aqueous extracts in methanol, petroleum ether, and ethyl acetate, and then applying these extracts to strains of fungus such as Botrytis cinerea, Fusarium graminearum, Alernaria sp, Pythium aphanidermatum, and Rhizoctonia solani. [27-29].

Anti-inflammatory activity: Trigonella foenum-graecum, commonly known as fenugreek, boasts a diverse range of anti-inflammatory compounds, such as saponins, alkaloids, flavonoids, and phenolic acids. Scientific studies have demonstrated the ability of these substances to mitigate inflammation and oxidative stress by reducing the levels of reactive oxygen species (ROS) [25].

Fenugreek and cardiovascular disease: Epidemiological studies have demonstrated a decrease in long-term mortality from coronary heart disease in individuals with a diet rich in flavoids, such as quercetin, since fenugreek contains flavoids. So, during a five-year period, researchers assessed the diets of 805 Danish individuals ranging in age from 65 to 84. The males who consumed the most flavonoids during the trial had a risk of a heart attack that was somewhat less than 50%, according to their observations [30]. The risk of stroke was nearly four times higher among men who consumed the least flavonoids than in those who consumed the

most. Quercetin combats cardiovascular illness in multiple ways. Because of its anti-thrombotic properties, it helps to avoid the pre-coagulation state that is the precursor to many cardiovascular disorders and serious cardiovascular accidents. [31].

Gastro-protective activity: Rats protected against HCL-induced stomach ulcers and shown good gastric mucosal protective action when exposed to an aqueous extract of fenugreek seeds. [32].

Anticancer effect of Trigonella: Cancer stands out as a leading global cause of mortality. Multiple studies have employed cell lines or experimental animals to illustrate the preventive impact of fenugreek seeds in cancer models [33].

Formualtion:

Gel Prepration: Harvesting Leaf Material and Creating Extracts: Following collection, fenugreek leaves underwent a thorough cleaning process, followed by shade drying and subsequent milling into a fine powder. Portions of 200 grams of this powder were immersed for seven days with occasional stirring in a solution consisting of 1,100 milliliters of ethanol and 1,100 milliliters of purified water with a 10% ethanol content. The extraction process, conducted at temperatures not exceeding 70°C, involved filtration and concentration using a rotary evaporator (Evator, EV-11; Equitron Medica, Mumbai, India). The concentration of extracts per milliliter was determined, and the pH of the aqueous extract was assessed using an Equitronics EQ-614 pH meter based in Mumbai, India. The concentrated extracts were securely stored between 2°C and 8°C in tightly sealed containers [34].

Preparation of Fenugreek Seed Powder: I bought fenugreek (Trigonella foenum-graecum L.) from the neighborhood store. The fenugreek seeds were allowed to soak for 12 hours at room temperature in a 1:5 (w/v) tap water solution. After being soaked, the seeds were dried at 55–60 °C and then thrice rinsed in distilled water. Hegazy claims that the dried seeds were processed into a powder using an electric grinder and then kept in plastic containers for later usage [35].

Preparation of Capsule- We purchased 25 kg of fresh and dried fenugreek seeds from a commercial source. After being cleaned in distilled water, the seeds were ground into a fine powder in a mixer that was kept cold. The obtained powder was extracted using 70% w/w percolated white ethanol. The extract of ethanol underwent lyophilization. There were 2600 g of lyophilized extract. The dried extract received a 25 percent addition of tricalcium phosphate. The powder combination was put through a 20-mesh sieve after being crushed in a blinder. The capsules containing powder were prepared using a capsule-filling machine. Each capsule weighed an average of 525 milligrams (500 mg of pure extract). A dosage of 525 mg of lactose powder tinted with 1% tartrazin was placed within placebo capsules.

Evaluation Test-

a) PH: With a pH meter, one can determine the pH of herbal hair gel. The pH was measured at 1, 30, 60, and 90 days following preparation in order to identify any gradual changes over time.

b) VISCOSITY: The viscosity of the herbal hair gel that was made was measured using an RVTDV II Brookfield viscometer. The spindle number six was used to take the reading at 100 rpm.

c) APPEARANCE AND HOMOGENECITY: The produced gels were examined visually to ensure they were homogeneous and of a herbal hair gel formulation. [36]

d) SPREADABILITY: A popular approach for estimating and measuring the spreadability of semisolid preparations, the parallel plate method was employed to determine the spreadability. Two 20 × 20 cm horizontal plates, the highest weighing 125 g, were pressed with different formulations (1 g). Following one minute, the spread diameter was measured. The following formula was used to determine spreadability: S equals M × L / T. where T is the time (in seconds) needed to fully separate the slides from one another, L is the length moved by the glass slide, M is the weight in the pan (attached to the higher slide), and S is the spreadability. [36]

e) DIFFUSION STUDY: To ascertain the medication release of the developed herbal hair gel formulation, the diffusion investigation was crucial. It was done in this manner using a Franz tube, with 1 gram of herbal hair gel sealed with a cellophane membrane at the bottom. Membranes act as the skin. In the solution, the tube's surface is quite deep. Remove the 5 ml sample from the media every time after 1, 2, 3, 5, 6, 7, and 8 hours and replace it with stock solution. Then, calculate the drug release at 234 max of herbal hair gel. 250 ml of phosphate buffer solution is used to absorb media of drug and maintain the PH 7.4 of solution. [37]

f) STABILITY STUDY: According to ICH recommendations, the optimized formulation was submitted to stability under the following conditions (ICH, 2003). The properties of the improved formulation and drug release did not exhibit any significant changes. A stable container containing an adequate amount of the herbal hair gel formulation was stored in a stability chamber at For three months, samples were maintained in a stability chamber at the following temperatures: 1. 40 ± 2°C and 75 ± 5% relative humidity.2. The temperature in the room At one, two, and three months, formulations were examined for the following tests: i) visual appearance ii) drug diffusion study. [38]

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