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ROLE OF FENUGREEK IN DIABETES TREATMENT

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Abstract:`

Fenugreek is a well known super food as it has some unique medicinal and nutritional vales.Fenugreek seeds are rich in fiber,phospholipids and glycolipids{oleic acid,linolenic acidlinoleic acid,choline}Vitamins-A,B1,B2,nicotinic acid,niacin and other functional elements.In recent years,there are several health benefits of feenugreek seeds are seen on aniaml studies as well ae human trials.These include antidiabetic,anti hypercholestermolic, antioxidant property,diagestive stimulant action, hepatoprotective effect. Fenugreek is widely used herbal medicine as a complimentary therapy for diabetes.Diabetes has become a serious and rapidlly spreading health problem all over the world. Diabetes mellitus has a high prevalence,morbidity and mortality globally.Type 2 Diabetes mellitus (T2DM) is a chronic condition characterized by both high blood sugar levels (hyperglycemia) and glucose intolerance, caused by the body's impaired response to insulin, leading to increased insulin production and eventually an insulin deficiency. High blood sugar, reduced insulin sensitivity, dyslipidemia, hypertension, and obesity, are common features of T2DM which often occur together rather than singly.There is a huge requirement for the production of more effective medication due to increse in number of diabetic patients.Management of type 2 diabetes is difficult with synthetic drugs as they have many side effects and have some limitations.Thus an alternative and immense intreset in medicinal plants with indegenous,inexpensive where these natural medicinal plants are free from the undesirable side effects and esaily available.Fenugreel(Trigonella foenum-graecum) is considered to be potent for treatment and managing type 2 diabetes

Key words : *Fenugreek, Diabetes, Insulin, hypoglycemic*

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INTRODUCTION:

Trigonella foenum-graecum is an annual plant of the family Fabaceae,is known as fenugreek.Fenugreek is commenly known as Methi. Fenugreek seeds are bitter in taste and it is well known for its medicinal properties[1].These seeds are used as spices throughout the world.Fenugreek contains a huge number of active compounds includes complex carbohydrate (galactomannan), saponins (disogenin,tigogenin,yamogenin) flavanoids, alkaloids(fenugreekine) and essential aminoacid(4-hydroxyisoleucine) which posses therapeutic activity for humans as well as for animals.These active compounds of fenugreek have various healyh benefits like Anti inflammatory,Anti-carcinogenic,Anti diabetic, Antihypertensive, immunomodulatory,Anti hypercholestremic, Neuroprotective, Antioxidant, Gastroprotective,Hepatoprotective [2].In Indegenous system of Medicine of India, it is active against Anorexia and as a gastric stimulant.Fenugreek seeds contain several polyphenolic flavanoids such as Trigonelline,quercetin,phytic acid,and saponins.The seeds also contains mucilagenous fiber,lysine,LTR(L-Tryptophan-rich)proteins and some other chemicals like Fenugreekin,coumarin,folicacid,phtic acid,nicotinic acid, sapogenins, trigonelline,scopletin which are having the terapeutic actions [3].

According to International Diabetes Federation(IDF) adults in world wide are currently suffering eith the Diabetes mellitus.Globally over 90% of people are suffering with type 2 diabetes(T2DM). Dabetes mellitus(DM) is an metabolic disorderwhich is diagnosed by elevated blood glucose level.The rise in patients with T2DM is mainly caused by the factors like socio-economic, demographic, Enivironmental,and Genitic factors. Common approches for Diabetes mellitus management are Insulin therapy and anti-diabetic drugs that include sulfonylureas,metformin, sodium-glucose transpoter2(SGLT-2)inhibitors [4].These synthetic druge inculde several side effects like sulfonylureas are associated with hypoglycemia and weightbgain,metformin is associated with gastrointestinal disturbances like Nausea,diarrhoea and dyspepsia,as well as risk of lactic acidosis;and SGLT-2 inhibitors have can result in urigential infections.These synthetic drugs used for antidiabetic activity are having high cost which leads to reduce the use by patients.These are the reasons why there is extensive research is carrying on the natural products used to treat the diabetes.From which on of the natural product used to treat diabetes is Fenugreek.

Pathophysiology of Diabetes mellitus:

T2DM is characterised by the Insulin insensitivity as a result of Insulin resistance,decreased insulin production, and elevated beta cells failure.This leads to decreased glucose transport into liver,muscle cells and fat cells.There is an incline in the breakdown of fat with hyperglycemia.As a result of the dysfunction the hepatic glucose and glucagon levels that rise durind the fasting and not suppressed with a meal.The inadequate levels of the insulin and insulin hypersensitivity;hyperglycemia is resulted.A majority of the people suffering with T2DM are obese,the adiposity is the reason.Therefore the adipose tissue plays an improtant role in the pathogenisis of T2DM.These hypothesis says that the reasons for the T2DM is increased insulin insensitivity,beta cells dysfunction and the pateints being obese are the risk factors [5].

Taxonomy of Fenugreek:

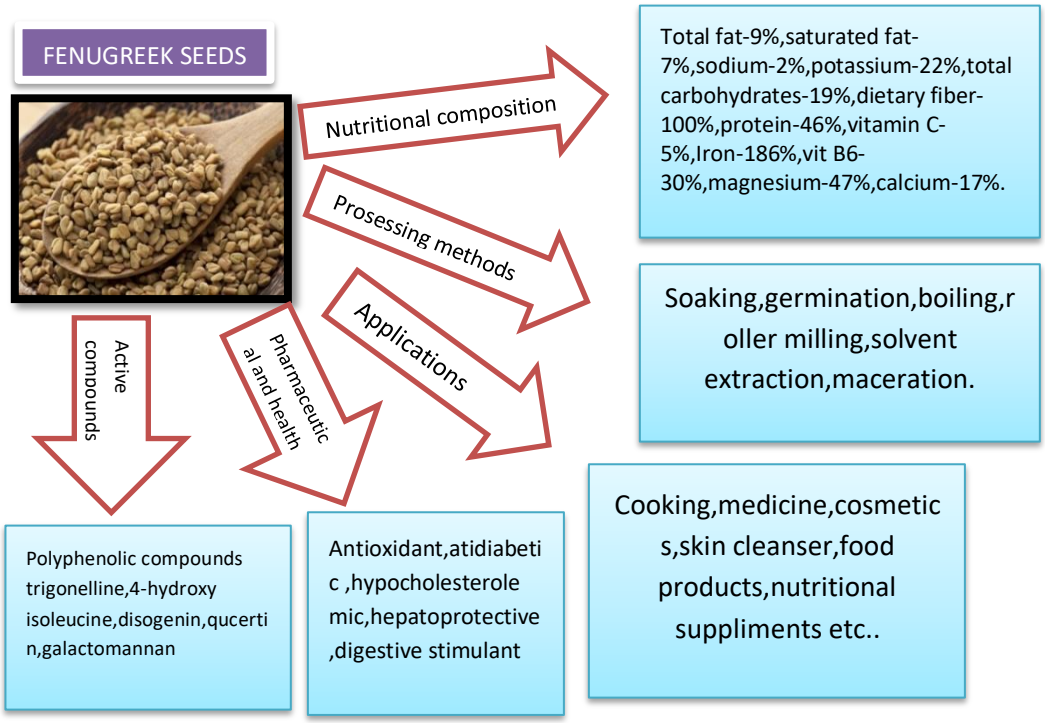
Kingdom	**Plantae**
Division	Mangnoliophyta
Class	Mangnoliopsida
Order	Fabales
Family	Fabaceae
Sub family	Papilionanceae
Genus	Trigonella
Species	Foenum-graecum

Phytochemistry of the Fenugreek seeds:

Fenugreek seeds contain 45-60% of carbohydrates,which is mainly mucilagenous fiber that is galactomannas;20-30% of proteins that are lysine and tryptophan;5-10% of fixed oils/lipids,0.2-0.36% of alkaloids that is trigonelline;0.5% of choline;gentianine and carpaine;flavanoids like apigenin,leuteolin,orientin,quercetin,vitexin, and isovitexin;0.09% of free aminoacids that are 4-hydroxyisoleucine,arginine,histidine,anlysine;calciu m and iron;0.6-0.7% of saponins;on hydolysis of glycosides forms sapogenins that are disogenin,yamogenin,tigogenin,neotigogenin:cholestr ol and sitosterol;Coumarin;fenugreekine,nicotinic acid,phytic acid,sco[oletin,vitamin A,B1,C ;0.015% of volatile oils that are n-alkanes and sesqierpines [6].

List of Biologically active components of Fenugreek seeds:

Chemical group	Compounds
Alkaloids	Trigonelline,choline,carpaine
Aminoacids	Lysine,histidine,4-hydroxyisoleucine, tryptophan,tyrosine,cystine,arginine.
Coumarins	Methyl couymarin,trigocoumarin, trimethyl coumarin
Flavanoids	Nargenine,lilyn,kaempferol,vecenin-1tricin,7-o-Dglucopyranoside, saponarein,isovitexin,isoorientin,Orientin,vitexin,luteolin,quercetin.
Saponins	Fenugrin,foenugracin,glyoside,yamogenin,trigonoesides,smilagenin,gitogenin,sarsasapogenin,yuccagenin,hedergin,disogenin,tigogenin,neotigenin.
Others	VitaminA,folicacid,ascorbicacid,thiamin,riboflavin,biotin,nicotinic acid,gum



Formulations of Fenugreek seeds: There are different formulations are available from the fenugreek seeds.Some of the are given below.

GEL: The gel form of fenugreek seeds extract is used for **Anti Inflammatory activity**.The components of seeds that show anti oxidant activity are flavanoids and polyphenols.Fenugreek is reported to posses anti inflammatory activity due to presence of flavanoids which shows the antioxidant activity.These flavanoids are potential inhitors of cycloxygenase, lipooxygenase and nitric acid synthase [7].

METHOD OF PREPARATION: The gels are prepared by cold mechanical method.

Polymer(carbopol-934,HPMC k4m)was weighed individually.

Sufficient amount of distilled water were mixed in separate beaker,after which continuously mixed by mechanical stirrer til the polymer is soaked in water.kept at room temperature for 24 hours.

With continuous stirring,appropriate quantity of methyl paraben and propyl paraben are added which acts as preservtive. Triethanolamine is added to maintain neutal ph.

Finally fenugreek extract was added to gel with continuous stirring till the drug is dispersed completely.

The prepared gel is sealed in a aluminium collapible tube.

CREAMS: Fenugreek seeds posses **antioxidant properties** and contain a mucilage which has emollient properties.It can also produce skin healing,whitening,moisturing,skin soothing,antiwrinkle effects.by using the fenugreek extract in the cream along with paraffin oil shows reduced **skin melanin** content and increase the **skin moisture** contents with out causing skin irritation [8].

METHOD OF PREPARATION:

Oily phase (paraffin oil)and surfactant ABIL-EM90was taken and heated upto75+/-1 c

At the same time aueous pahse consisting of water is heated to same temperature and fenugreek seed(4%)were added.

Aqueous phase is added to the oilphase drop by drop.

Stirring is continued at 2000rpm by the mechanical mixer for 15min until complete aqueous phase is added.

2-3 drps of oflemon oil is added during stirringtime to give fragrance to the emulsion

After the complete addition of aqueosus phase speed the mixer is reduced to 1000rpm for homogenization for a period of 5min.

Then the speed of the mixer is reduced to 500rpm for further 5min for complete homogenization,until the emulsion is cool to room temoerature.

TABLETS: Fenugrrek is widely used for its **antidiabetic** activity which is attributed to mainly to the presence of trigonellie. For this tablet preparation sodium starch glycolate is used as super disintegrant and mucilage present in the fenugreek seed extract retards the disintegration which slos the drug release.Tablets are prepared by wet granulation method [9].

METHOD OF PREPARATION:

500mg of dired extract of fenugreek is mixed with lactose til produce coherent mass.

The required quantity of starch powder(5%) is added.

Then powder blend is passed through #12 to produce granules.Granules are gently spread and dried at temperature below 60 c

Dry granules are weighed and their weight is recorded.

Further dry granules are regranulated by passing through #16 place on oversize #44 to get uniform sized granules.

Granules retained on the #44 are also weighed.Fines which passed through #44ae also weighed.

Fines equivalent to 15%of the weight of granules are mixed wih granulesand other ingredients like starch powder,talc,magnesium sterate are added in required quantities.

Tablets are prepare by compressing the granules in rotary tablet machine.

CAPSULES: Fenugreek seeds are reported to contain multiple antidiabetic constituents and hence widely used for the treatment of diabetes mellitus.Capsules are prepared by encapsulation of the granules prepared from fenugreek seeds extract using sodium starch glycolate as super disintegrant.These capsules are used to treat **diabetes [10].**

METHOD OF PREPARATION:

Viscous sticky extract is mixed with lactose till it produces the coherent mass.(no binding agents are added externally since mucilagenous constituents are present in fenugreekwhich act as binding agent)

The required quantity of starch powder(5%) is added.

Then powder blend is passed through #12 to produce granules.Granules are gently spread and dried at temperature below 60 c

Dry granules are weighed and their weight is recorded.

Further dry granules are regranulated by passing through #16 place on oversize #44 to get uniform sized granules.

Granules retained on the #44 are also weighed.Fines which passed through #44ae also weighed.

Fines equivalent to 15%of the weight of granules are mixed wih granulesand other ingredients like starch powder,talc,magnesium sterate are added in required quantities.

Prepared granules are packed in hard gelatin capsules using hand operated capsule filling machine such that each capsule contains 1000mg of granules.

ANTI DIABETIC EFFECTS OF FENUGREEK WITH POSSIBLE WAYS [11]:

Fenugreek seed extract have been reported to exhibit antidiabetic activity by producing

Delay in gastric emptying time and delay in glucose absorption rate.

Reduce in glucose uptake in small intestine by its high fiber content and slows the carbohydreate metabolism and lower the blood glucose.

Restoring the function of pancreatic tissues and Protecting the beta cells.

Elevating serum insulin level possibly through beta cell regeneration or stimulation of insulin release from existing beta cells of islets.

Stimulating the activity of glycogen synthase and promote the fprmation of liver and muscle glycogen.
Correcting the imsulin sensitive carbohydrate metabolic enzyme activities.

Correcting serum lipid profiles.
Preventing lipid peroxidation and restoring glutathione and superoxide dismutase.

Promoting insulin sensitivity and improving insulin action at cellular level.

Recovering the level of HbA1c by utilization of glucose in oeripheral tissues there by maintain the blood glucose.

Many studies reported that oxidative stress,decresed level of antioxidants along with the free radicals plays a role in pathogenisis of DM.Where fenugreek has been proved to have antioxidant activity that might prevent the pathogenisis of Diabetes.

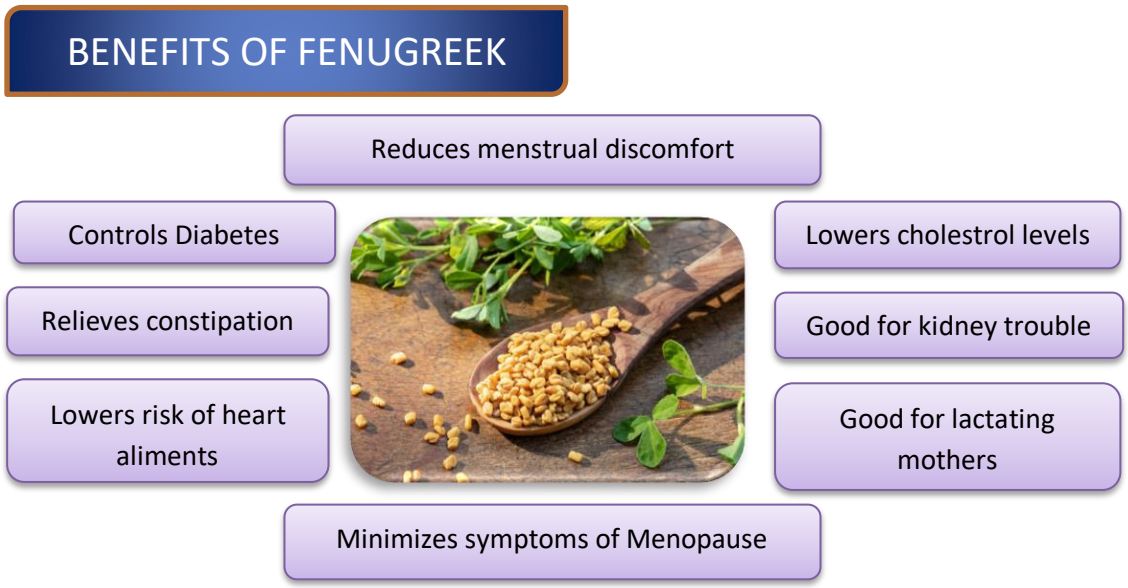
4-hydoxyisoleucin is an aminoacid present in fenugreek seed is reported to have the effect of increase glucose stimulated insulin release and enhance insulin sensitivity and glucose uptakein peripheral tissues.

SYNERGISTIC EFFECT OF FENUGREEK WITH ANTIDIABETIC DRUGS [12]:
In uncontrolled T2DM,18 pills of fenugreek dialy along with oral sulfonylureas have shown significantly decrease In FBS,PPBS,and HbA1c levels and the associated clinical symptoms.It suggest that the sulfonylureas along with fenugreek supplementation is effective therapy to manage diabetic patients with uncontrolled blood glucose

Hydroalcoholic extract os fenugreek seeds along with Glimepiride has been reported to potentiate the hypoglycemic effect of glimepiride.

Fenugreek seeds along with metformin in T2DM patients have beneficial effect on the lipid profile.

USES OF FENUGREEK SEEDS [13]:
Spice in cooking,Herbal tea,Digestive aid,Blood sugar management,Lactation support,Herbal remedies-such as relieving sore throat,reducing fever and esaing menstrual discomfort,Hair care,Skin care.



Doses of fenugreek [13]:

- 500mg of fenugreek once/twice daily either alone or in combination with antidiabetic drugs such as metformin,glipizide,shows controlled plasma glucose levels.
- 15g of fenugreek soaked in water will significantly reduced the post prandial blood glucose.

- ❖ Dietary supplementation of 25g and 100g of fenugreek seed powder daily for 15 and 10 days respectively,significantly reduce fasting blood sugar and improved the glucose tolerence test.

CONCLUSION:

Based on these several health usefulness as discussed in review,fenugreek can be recommended and must be taken as a part of our daily diet as its liberal use is safe and various health benefits can be drawn from the natural herb.The above mentioned studies on fenugreek suggest that the functional,nutritional and therapeutic characteristics of fenugreek can be exploited further in the development of healthy products.From this review it was observed that fenugreek have many bioactive compounds which are used to treat various diseases.This review states that the fenugreek could improvre the over all glycemic control parameters by different mechanisms.The review states that adeverse effects of fenugreek are mild gastrointestinal side effects,with no reports of renal toxicity or hepatic toxicity.The review states that fenugreek may be an effective and safe therapeutic options for the individuals with T2DM.

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