

## Physiological and pharmaceutical effect of fenugreek: a review

Mohsen akbari<sup>\*1</sup>, Hassan Rasouli<sup>2</sup>, Tina Bahdor<sup>3</sup>

<sup>1</sup>Young Researchers Club, Kermanshah Branch, Islamic Azad University, Kermanshah, Iran,

<sup>2</sup>Research Department of Biotechnology of Drought Resistance, Department of Agriculture College in Razi University, Kermanshah, Iran

<sup>3</sup>Student of Pharmacy in Vivekananda College of Pharmacy, Bangalore, India.

### I. SUMMARY

Plants are used medicinally in different countries and are a source of many potent and powerful drugs. Fenugreek is an medicinal plant that use in disease some therapy. Natural products have been a major source of new drugs [1]. Medicinal plants are used by 80% of the world population as the only available medicines especially in developing countries [2]. Fenugreek is one of the oldest medicinal plants, originating in India and Northern Africa. An annual plant, fenugreek grows to an average height of two feet [3]. This plant use for blood lipids and sugar decreasing in diabetic and non diabetic peoples and have antioxidant and antibacterial activity. This plant decrease body fats and effective on obesity. This plant use in therapy atherosclerosis [4], rheumatism [5], sugar lowering [6], blood lipids lowering [7], appetizer [8] and contain antioxidant activity [9].



Fig. 1. Images of fenugreek.

### Active constituents;

Fenugreek contains saponins that are transformed in the gastrointestinal tract into sapogenins. Saponins this plant including; Sarsapogenin, Yuccagenin, Smilagenin and, the most important saponin in this plant is Diosgenin [10]. Fenugreek seeds contain 50-percent fiber (30-per-cent soluble fiber and 20-percent insoluble fiber) that can slow the rate of postprandial glucose absorption [3]. Fenugreek seeds, contain oils, alkaloids, amino acids ( lysine, argenine, tryptophan, threonin, valyn and methionin) and musilages that in this plant is most famous galactomannan, too is contain vitamins A, C, D, B<sub>1</sub> and , minerals calcium, iron and zinc [10].

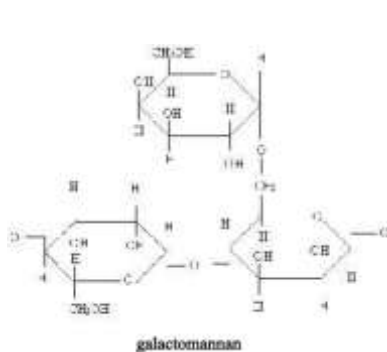


Fig. 2. Galactomannan

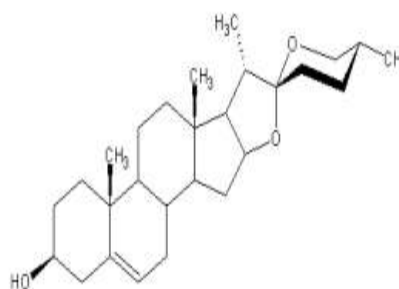


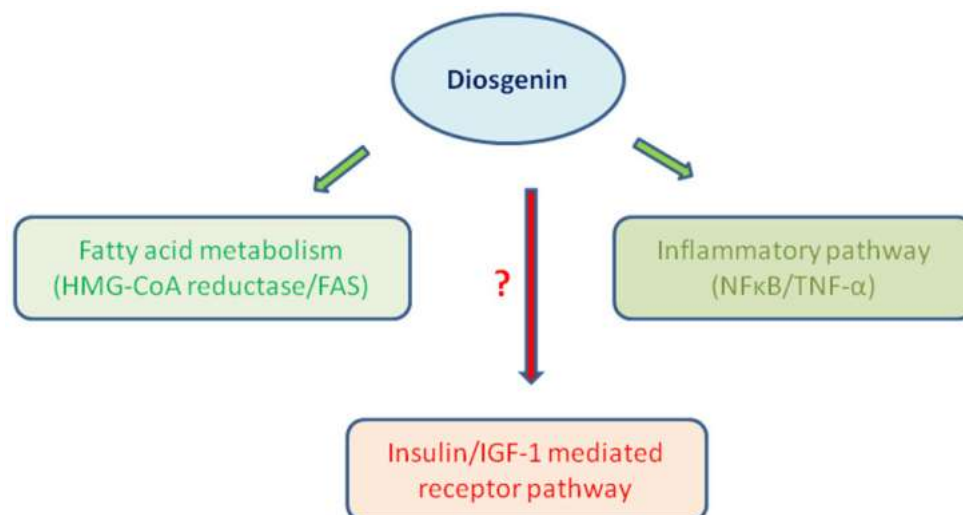
Fig. 3. Diosgenin

### **Effects fenugreek on sugar decreasing and diabetes;**

Fenugreek seed powder in the diet reduces blood sugar and urine sugar with concomitant improvement in glucose tolerance and diabetic symptoms in type 2 diabetic patients [15]. Too studies [17,18,19], showed hypoglycemic effects of fenugreek seeds type 2 diabetics and [20] conducted a randomized, controlled, crossover trial in 10 patients with type1 diabetes. The hypoglycemic effects of fenugreek have been attributed to several mechanisms. [11] demonstrated in vitro the amino acid 4-hydroxyisoleucine in fenugreek seeds increased glucose-induced insulin release in human and rat pancreatic islet cells, It was observed that 4-hydroxyisoleucine extracted from fenugreek seeds has insulin tropic activity [16]. [11] show This amino acid appeared to act only on pancreatic beta cells, since the levels of somatostatin and glucagon were not altered. In human studies, fenugreek reduced the area under the plasma glucose curve and increased the number of insulin receptors, although the mechanism for this effect is unclear. [13] In humans, fenugreek seeds exert hypoglycemic effects by stimulating glucose-dependent insulin secretion from pancreatic beta cells, [12] as well as by inhibiting the activities of alpha-amylase and 50ignali, two intestinal enzymes involved in carbohydrate metabolism. According report [14] The hypoglycemic effect of fenugreek is thought to be largely due to its high content of soluble fiber, which acts to decrease the rate of gastric emptying thereby delaying the absorption of glucose from the small intestine. The cases suggest fenugreek reduced post-prandial hyperglycemia primarily in subjects with diabetes, but less so in subjects without diabetes. This effect might be more pronounced if raw seeds rather than boiled seeds had been used. Fenugreek may aid with insulin secretion, as suggested by animal studies, since typically these patients have little or no endogenous insulin production [3]. Animal tests have proved that galactomannan blocks intestinal absorption of glucose. Water soluble fiber increases the viscosity inside the intestine and then inhibit absorption of glucose.

### **Effects fenugreek on blood lipids decreasing ;**

According report [21,7], supplementation of these medicinal plants mixture (fenugreek), decreased in serum triglycerides, total cholesterol, LDL-C, VLDL-C in both raw and cooked form but increased in HDL-C with the increase in supplementation of medicinal plants. Studies reported that diabetic state, resulting from an impaired secretion and sensitivity of insulin may be responsible for high triglycerides level in serum than normal individuals, as the insulin stimulated the synthesis of adipose tissue by agency of lipoprotein lipase [22]. Similar decrease in triglycerides and total cholesterol level of the diabetics were observed by feeding fenugreek seeds by various workers [19]. Because fenugreek is contain fiber and fiber have effect of dietary fiber on lipoprotein cholesterol is due to its association with absorption and transport of lipids [23]. Too, according reports, Fenugreek seeds also lower serum triglycerides, total cholesterol (TC), and low-density lipoprotein cholesterol (LDL-C) [24, 25]. These effects may be due to saponin, which increase biliary cholesterol excretion, in turn leading to lowered serum cholesterol levels. The lipid-lowering effect of fenugreek might also be attributed to its estrogenic constituent, indirectly increasing thyroid hormone [26]. The quality and quantity of protein in the diets have a direct effect on the levels of cholesterol. Generally plant protein appears to lower cholesterol level [28]. The plant protein in fenugreek is 26%, so it might exert a lipid lowering effect [27]. A study on the extent of degradation of the saponin and/or diosgenin another steroid saponins in the alimentary tract of alloxan diabetic dogs suggested that steroid saponinand saponin might have a role in lowering cholesterol [29]. The lipid-lowering potential of diosgenin has been demonstrated by several experimental studies [30]. Diosgenin decreased the elevated cholesterol in serum LDL and HDL fractions in cholesterol-fed rats, and had no effect on serum cholesterol in normo cholesterolemic rats. In addition, diosgenin inhibited cholesterol absorption, and suppressed its uptake in serum and liver, and its accumulation in the liver [31]. Galactomannan influences intestine walls to generate hormones and enzymes and they influence biosynthesis of cholesterol in liver.



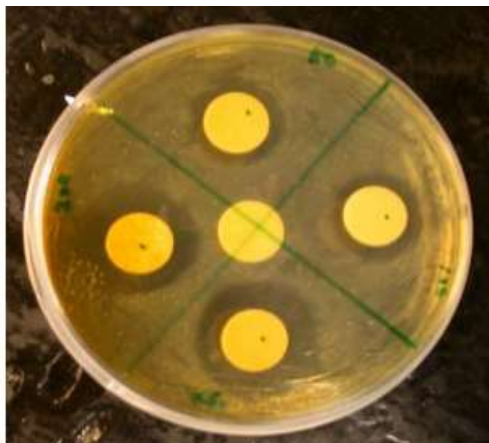
**Fig. 4.** Schematic representation depicting the molecular mode of action of diosgenin in the control of metabolic pathway. Diosgenin plausibly regulates signaling molecules in fatty acid metabolism and inflammatory pathway. Insulin and IGF-1 mediated signaling pathways may also be regulated by diosgenin.

#### **Antioxidant activity of fenugreek;**

Antioxidants decrease cardiac disease [34], and increase immunity[35], therefore need that supply by body or support of external resources. Spices and herbs possess antioxidant activity and can be applied for preservation of lipid peroxidation in biological systems. Fenugreek (*Trigonella foenum-graecum*) is an important spice; its dried seeds have wide application in food and beverages as a flavoring additive as well as in medicines[9]. The antioxidant property of the plant material is due to the presence of many active phytochemicals including vitamins, flavonoids, terpenoids, carotenoids, coumarins, curcumins, lignin, saponin, plant sterols and etc[9]. Free radicals are implicated for more than 80 diseases including diabetes mellitus, atherosclerosis, cataract, rheumatism, and other autoimmune disease like aging. Etc. in treatment of these diseases antioxidant therapy has gained an utmost importance. Current research is now directed towards finding naturally occurring antioxidant of plant origin. In Indian system of medicine *Trigonella foenum-graecum* is an important medicinal. Antioxidants exert their mode of action by suppressing the formation of reactive oxygen species either by inhibition of enzymes or by chelating trace elements [34]. Antioxidant benefits fenugreek related with existing phenol and saponins, therefore use for liver therapy [35].

#### **Antibacterial activity of fenugreek;**

Screening of medicinal plants for antimicrobial activities is important for finding potential new compounds for therapeutic use. Fenugreek has antibacterial activity, according to reports [36,37], this plant kills bacteria. The use of synthetic  $\alpha$ -glucosidase inhibitors such as acarbose, causes adverse side effects such as abdominal distention due to the excessive inhibition of pancreatic enzymes, resulting in abnormal bacterial fermentation undigested carbohydrates in the colon. Hence, research on the development and utilization of anti-diabetic plants with mild inhibition of pancreatic enzymes is beneficial [37,38]. The mechanism of inhibition of the glycolytic activity of  $\alpha$ -amylase may occur through the direct blockage of the active center at several subsites of the enzyme as also suggested for other inhibitors [39]. The  $\alpha$ -amylase inhibitory factors present in the fenugreek extract probably interact with the active sites of the enzyme in a substrate specific manner. Fenugreek is effective in inhibiting the growth of *Pseudomonas* spp., *E. coli*, *Shigella* dysenteriae, and *Salmonella typhi* [40].



**Fig 5.** *Helicobacter pylori* inhibition disk assay. (Center disk represents control; Disk along periphery has increasing concentrations of fenugreek extract 50, 100, 150, 200  $\mu$ Ls starting from top disk in clockwise direction).

#### **Anti-arthritic and vascular protective effects of fenugreek;**

Rheumatoid arthritis is a systemic inflammatory disease associated with generation of oxidative stress that produced vascular dysfunction. Is an autoimmune disorder characterized by synovial proliferation and inflammation, and subsequent destruction and deformity of joints [41]. Not exist much findings related with this activity fenugreek, and not clear mechanism this fenugreek activity, only [42] reported this activity.

#### **Effect of fenugreek on total body and organ weights;**

Obesity is one of the major risk factor for morbidity and mortality. Obesity may be defined as abnormal growth of adipose tissue [43]. Some researchers indicated that fenugreek seed extract supplementation in reducing the body and adipose tissue weight [44, 45]. The probable mechanism of fenugreek decreasing the total body and adipose tissue weight may be that 1) fenugreek flushes out the carbohydrates from the body before they enter the blood stream resulting in weight loss 2) Fenugreek seeds contain a high proportion (40%) of soluble fiber. This fiber forms a gelatinous structure (similar to gaur gum) which may have effects on slowing the digestion and absorption of food from the intestine and create a sense of fullness in the abdomen, thus suppresses appetite and promotes weight loss [45]. In conclusion this plant is effective on blood lipids and sugar and on some bacterial strains, antioxidant activity of fenugreek causing protective of organs and inhibition of entrance diseases to body, too decrease body fats and is effective on obesity.

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