FENUSTEROLS®: PRODUCT WRITE-UP

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PRODUCT WRITEUP

INTRODUCTION

Fenusterols® is the saponin rich fraction obtained from Fenugreek seeds. Saponins are complex glycosidic compounds present in a diverse array of edible and inedible plants[1]. Each saponin consists of a sapogenin which constitutes the aglycon moiety of the molecule, and a sugar. The sapogenin may be a steroid or a triterpene and the sugar moiety may be glucose, galactose, pentose or a methylpentose[2] (Figure 1).

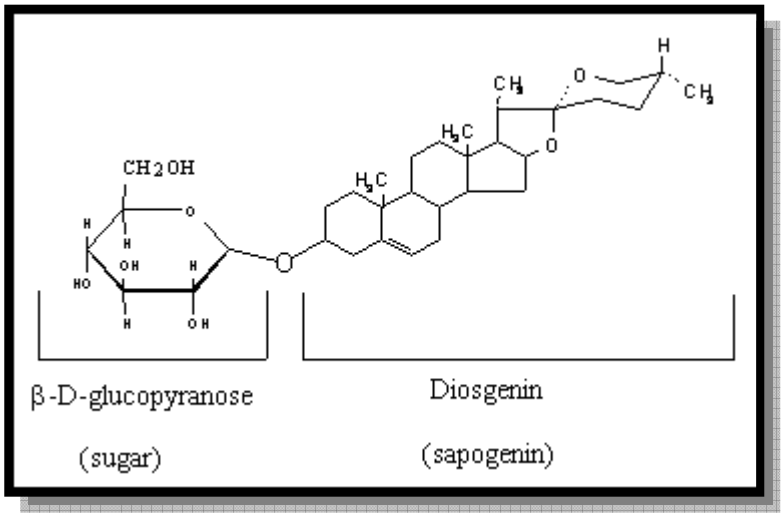

Figure 1: Structure of a saponin[2a]

Fenugreek seeds are a rich source of saponins (5-6%)[3].

Fenugreek (*Trigonella foenum-graecum*, Family: Leguminosae) is an annual herbaceous plant, 30 to 60 cm in height. The herb is native to North Africa, as well as the countries bordering the eastern Mediterranean, and is widely cultivated in India. Traditionally, the seeds of Fenugreek have been used as a condiment in Indian homes[4]. Fenugreek is an important cash crop in various parts of the world, with the herb being used as food, spice and medicine[5].

The medicinal uses of Fenugreek seeds have been known since ancient times. Fenugreek seeds have nutritive and restorative properties and they also stimulate the digestive process[3].

STEROIDAL SAPONINS FROM FENUGREEK

The presence of special steroidal substances in Fenugreek seeds was first reported in 1919 by Wunschendorff[6], a French research scientist working in Algeria. This discovery was confirmed in various follow-up studies notably by Marker et al[7], who detected the presence of diosgenin, gitogenin and traces of tigogenin after hydrolysis of the plant material.

Fenugreek seeds contain saponins in the form of furostanol saponins. Furostanol saponins may be defined as bidesmosidic saponins which have two sugar chains, with one bonded at C3 and one attached through an ether linkage at C26 with a D-glucose[3]. The general structure of a furostanol saponin is given below in Figure 2.

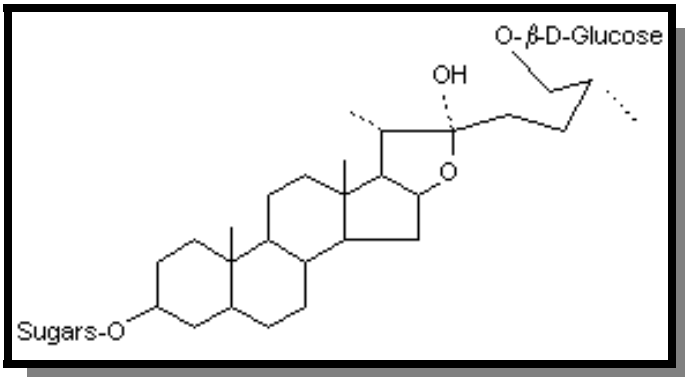

Figure 2: Chemical Structure of Furostanol Saponins[3]

Fenugreek seeds have been found to contain at least a dozen different saponins[3]. The main saponin is diosgenin and its isomers yamogenin, gitogenin and tigogenin. The other furostanols include smilagenin, sarsasapogenin, neotigenin, yuccagenin, lilagenin and neogitogenin[8]. The structures of some of these compounds are as shown in Figure 3.

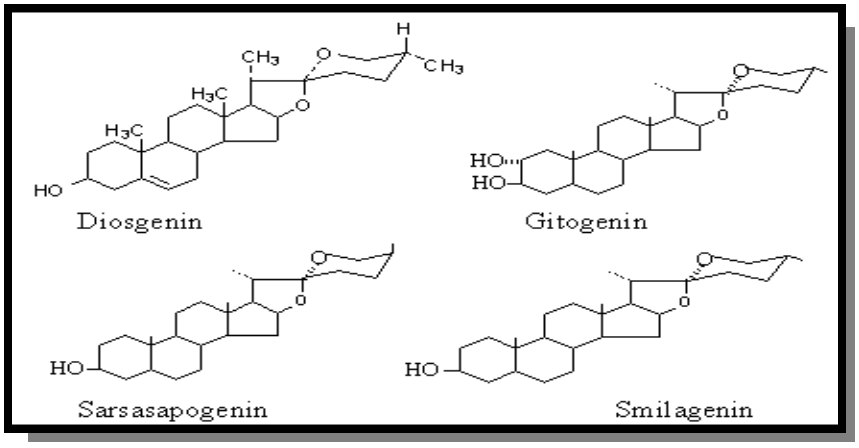

Figure 3: Chemical Structure of some Fenugreek Saponins[9]

BIOLOGICAL EFFECTS OF THE FUROSTANOL SAPONINS

1. Steroidal Saponins and Sports Medicine

In sports nutrition, the anabolic effects of the furostanol saponins could be potentially used to induce increase muscle mass and strength, with the consequent improvement in athletic performance. In a clinical study, a preparation rich in furostanol saponins was shown to possess immunostimulating and leutinizing hormone releasing properties. The furostanols preparation also increased testosterone levels and spermatogenesis[10]. Testosterone is known to play a key role in sperm cell production and immune functions and is often used to increase fertility and recovery. From a sports nutrition point of view, furostanol saponins are particularly promising since increased testosterone levels increase the deposition of protein in the muscles, leading to increased muscle mass and strength[11].

2. Hypocholesterolemic effects

The seeds of fenugreek are known to exert hypocholesterolemic effects. In experiments conducted over the last decade, several groups of researchers demonstrated that the hypocholesterolemic effects of fenugreek resided in the fat-free fraction, more precisely, in the saponin-rich sub-fraction. Diosgenin, the primary furostanol saponin in fenugreek has been proven to have various effects on cholesterol metabolism, the most important being its capacity to lower plasma cholesterol concentration. This hypocholesterolemic effect appears to be dependent upon the capacity of diosgenin to inhibit cholesterol absorption, to decrease liver cholesterol concentration and to increase biliary cholesterol secretion and the fecal excretion of neutral sterols[12].

In a detailed study to elucidate the mechanism of hypocholesterolemic action of fenugreek, one group of researchers administered fractionated extracts from fenugreek seeds to alloxan diabetic dogs[13].

Defatted fenugreek seeds were fractionated into two parts:

- a fraction containing the testa and endosperm (Subfraction A)
- a fraction containing cotyledons plus axis (Subfraction B)

Subfraction B was extracted with isopropanol/water (70:30, v/v), and lyophilized. The lyophilized extract contained practically all the saponins (Subfraction S), but not the sapogenins (aglycone part of the saponins). The insoluble portion contained protein without saponin (Subfraction P).

Dogs made diabetic by injection of alloxan and four sets of experiments were performed using various combinations of the fractions. In each case, the levels of saponins and cholesterol in the fecal matter excreted by the dogs before and after treatment were determined. The authors concluded that ingested fenugreek saponins are partially hydrolyzed to diosgenin and related sapogenins in the gastrointestinal tract. In view of the proven capacity of diosgenin to inhibit cholesterol absorption, it was surmised that the hypocholesterolemic effects of fenugreek could be attributed to the saponin-rich fraction which underwent enzymatic hydrolysis in the gastrointestinal tract.

Subsequent research work on rats confirmed the hypocholesterolemic effects of the chronic administration of purified saponins from fenugreek. Steroid saponins from fenugreek decreased total plasma cholesterol without any changes in the triglyceride levels[14].

3. Restorative properties

The restorative and appetite/digestion stimulating properties of fenugreek have been known for centuries. In recent years, researchers proved that these properties could be attributed to the biological effects of the furostanol saponins in fenugreek seeds. The effects of the steroidal saponins on the feeding behavior and metabolic endocrine changes in diabetic rats, were studied in these experiments[14].

Pharmacological experiments were performed *in vivo* in normal and streptozotocin diabetic rats. The saponins were extracted from fenugreek seeds, purified and administered sub-chronically mixed with the food (12.5 mg/day, per 300 g body weight). The results revealed that the treatment with steroidal saponins significantly increased food intake and the motivation to eat in normal rats. The circardian rhythm of feeding behavior was modified in normal rats. In diabetic rats, food consumption was stabilized, resulting in a progressive weight gain in these animals, in contrast to untreated diabetic controls[14]. Simultaneously, the total plasma cholesterol levels decreased in both normal and diabetic treated animals, without changes in plasma triglyceride levels, as described earlier. These results validate the restorative effects of fenugreek furostanol saponins.

TOXICOLOGICAL STUDIES

Fenugreek has been consumed in traditional diets for centuries, with no apparent ill effects. However, in view of the high therapeutic doses of fenugreek seed powder used in the management of diabetes, a toxicological evaluation of fenugreek seeds was performed in 60 subjects suffering from non insulin dependent diabetes. Ingestion of an experimental diet containing 25g fenugreek seed powder (corresponding to about 1.5 g of furostanol saponins) resulted in no renal or hepatic toxicity in a 24 week study, but blood urea levels were seen to decrease after week 12. The authors of this study concluded that fenugreek seeds exhibited no clinical, hepatic or renal toxicity and no hematological abnormalities in diabetic subjects. Earlier studies have reported that the saponins present in traditional foods are generally non-toxic to humans, even if ingested after isolation from their natural sources[15].

In light of the effects which furostanol saponins exert on appetite stimulation and hormone release, Fenusterols® may be potentially useful in strength and muscle building. The anabolic effects combined with control of cholesterol levels would be particularly helpful to athletes and others undergoing strength training. Additionally, anyone involved in strenuous sports activities would benefit greatly from the restorative properties of fenugreek saponins. Fenusterols® is thus a safe and effective phytonutrient for potential use in sports nutritional formulations.

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"The vision of a research scientist takes on social and commercial expressions." This in short explains the genesis and growth of the Sabinsa – Sami Labs Group of Companies.

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