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A REVIEW ABOUT BIOACTIVE COMPOUNDS OF FENUGREEK (*Trigonella foenum-graceum*)

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ABSTRACT- Fenugreek (*Trigonella foenum-graceum)* is one of the mostly used medicinal herbs. Fenugreek seeds are rich in source of minerals, vitamins, dietary fibres, carbohydrates and proteins. So it has many potential application. It contains many bioactive compounds which are galactomannan, diosgenin, 4-hydroxyisoleucene, 3-hydroxy-4,5-dimethyl-2(5H) furanone (stolone), etc. Fenugreek have an hypocholesterolemic, hepatoprotective effect, antioxidant potency, digestive stimulant action. It is an anticarcinogenic, antioxidant, antimicrobial agent, gastric stimulant and anti-anorexia agent. These physical properties were evaluated by medicinal and nutritional study. In this review, we will know about the nutritional, nutraceutical, antioxidant and medicinal properties of fenugreek.

Keywords: Fenugreek, bioactive compounds, medicinal and nutraceutical effects.

I. INTRODUCTION

Fenugreek is a good medicinal plant which comes under leguminous crops and its self-pollinating. It has been used as a medicinal plant since more than 4000 years in various parts of the world. It presence of pungent aromatic compounds in their seeds that gives colour, flavour and aroma to food ``Buba.F et.al``. It mostly found in India, North America, certain regions of Africa and in some parts of Australia. Mainly fenugreek herb is harvested in central Asia, Europe, Northern Africa, Northern America and parts of Australia and India having the largest producer in the world. It has wide therapeutic applications including carminative, aphrodisiac, lactation stimulant in women after child birth in traditional Chinese medicine, as well as Indian Ayruvedic medicines "Titran D et.al (2003)". They have many effects Eg: Anthelmintic, antinociceptive anticancer, anti-dicer, antibacterial, gastro and hepatoprotective, immunomodulatory etc "Acharya SN et.al (2007)".

The bioactive compounds of fenugreek include polyphenolic compounds, flavanoids, steroids, sapogenins, alkaloids and many volatile compounds of anethole and stolone. This plant is used as a supplement in maize and wheat flour for bread making in vemen and Persia. It is used for daily meal preparation. It helps in diabetes control and cardiovascular health issues "Tabasum Fatima Maqbool et.al". Trigonelline compound can be present seeds and it based for the manufacture of maple syrup and as an artificial flavour for vanilla, butterscoth etc. The several fenugreek composition was shown in table:4

Table 1: Classification of Fenugreek

DOMAIN	**:**	**EUKARYA**
Kingdom	:	Plantae
Division	:	Magnoliphyta
Class	:	Magnoliopsida
Order	:	Fabales or Leguminales
Family	:	Fabaceae
Sub-family	:	Trifoliae
Genus	:	Trigonella
Sub-genus	:	Foenumgraecum
Species	:	*Trigonella foenum-graecum*

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II. AS A FORAGE CROP

In the presence of fenugreek, the large amount of amino acids, proteins and vitamins has found a high forage value hence it is digestible in cattle. The incorporation of fenugreek in cattle dairy diet resulted in good content of fatty acid in milk and it shows an increases in polyunsaturated fatty acid "Huggins K et.al (1998)". It has the 4% reduction in blood cholesterol as compared to control "Basch et.al (2003)". Due to this reason, it has many health benefits in humans.

III. AS A FOOD STABILIZER, ADHESIVE AND EMULSIFYING AGENT

Only galactomannan presence in fenugreek seeds alone accounts for approximately 15-50% dry weight of seed which is a standard source of dietary fiber in plant which help in many disease combating symptoms "Shrivastava R et.al (2013)". It also enhances the bread quality of wheat flour when incorporated and also reported to increases the nutritional quality of bread "Mulidhar M et.al (2012)". Galactomannan acts as thickener in certain foods like soups and ice-creams "Khorshidian N et.al (2016)". In industries, they produces locust bean gum and guar gum which are used as an emulsifiers, thickeners and stabilizers.

PHYSICAL PROPERTIES:

In physical properties, fenugreek seeds were evaluated by measuring the length, thickness, width, seed mass are measured "Atluntas E et al. (2005)".

Table 2: Physical properties of fenugreek seeds

1000 seed Mass, g	Bulk density, g/ml	Kernel density, g/ml	Porosity, %	Angle of Response, °
14,40g	6.51g	1.190g	42.51%	13.53°

CHEMICAL PROPERTIES:

The chemical properties of raw and germinated fenugreek seeds (%d/b) were analysed as moisture, fat, protein, ash content and carbohydrate content "Ms. Syed Ayesha Rasheed et.al".

Table 3: Chemical properties of fenugreek

Name of sample	**Moisture (%)**	**Fat (%)**	**Protein (%)**	**Ash (%)**	**Carbohydrate (%)**
Raw fenugreek Seeds	11.21	7	23.30	3	55.49
Germinated fenugreek seeds	13.50	6.24	24.12	3.14	53

Table 4: Chemical constituents of fenugreek:

Classes of chemical constituents	**Chemical constituents**
Proteins	Globulin, Albumin and Lecithin
Lipid fatty acids	Linoleic acid, A-Linolenic, Oleic, Stearic acids, Palmitic and Sterols: B-Sitosterol, Campesterol, Cycloartenol, Triacyl glycerides.
Carbohydrates	Mucilage or gum: Galactomannan
Saponins	Fenugrin B, Fenugreekine, Trigofoenosides A-G, graecunins
Steroidal Saponins	Diosgenin, Yamogenin, Gitogenin, Tigogenin, Neogitogenin, Smilagenin, Sarsasapogenin.
Flavanoids	Apeginin, Luteolin, Vitexin, Isovitexin, Irilone, Tricine, Calycosin, Daidezin,Orientin.
Alkaloids	Trigonelline, Choline, Carpaine, Gentianine.
Fibers	Gum, neutral detergent fiber lipids triacylglycerols, phosphatidylcholine.
Amino acids	Isoleucine, Leucine, lysine, Arginine, Histidine.

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IV. BIOACTIVE COMPOUNDS OF FENUGREEK

Steroid saponins:

Fenugreek seeds does not contain free saponins but they occur as a complex glycosides. Sapogenins are derived from the glycone portion of the plant. They have the medicinal property to reduce the level of serum cholesterol "Sauvaire Y et.al".

Alkaloids:

In fenugreek seeds trigonelline is a methy betaine derivative of nicotinic acid is the major alkaloid. They can treat diabetes and central nervous system diseases. It shows an antibacterial, antiviral and memory improving activities "NIN report et.al".

Galactomann:

It is an compound of cell wall and it also an major polysaccharide found in fenugreek. It can reduce the plasma glucose level and also has anti-diabetic effect "Borida et.al".

Volatile compounds:

Stolone – furanone is the principle of volatile compound in fenugreek. Carbonyles and sesquiterpene is also an other volatile compounds. It shows an antimicrobial properties against bacteria, yeast and fungi "Mulidhar M et.al (2012)".

4-Hydroxyisoleucine:

It most commonly found in free amino acids in fenugreek seeds. It occurs in two isomeric forms. It has an anti-diabetic agent "Shalini Hooda et.al (2003)".

V. MEDICINAL PROPERTIES

Fenugreek plant contain many medicinal properties. They can be tried and experimented by using both humans and animals "Sowmya P et.al". They have been reported that the antidiabetic and blood lipid lowering effect "anuradha CV et.al (2001)". In the presence of nutritional compounds are mostly taken in diet. Fenugreek seeds helps to beneficial influence on digestion and also has the ability to modify food texture "Suileman Y et.al (1991)". Fenugreek contains saponins, hemicelluloses, mucilage, tannins and pectin compounds helps to decrease the level of low density lipoprotein cholesterol (LDL) in blood "Borida A et.al".

VI. CONCLUSION

Present review focuses on nutritional and health benefits of fenugreek. The bioactive components of fenugreek giving it promising the nutritional and health beneficial properties. It can be used as therapeutic drug for curing many types of diseases as well as its extracted compounds can be used individually in drug designing and discovery. Major health beneficial properties of fenugreek are antioxidant, antifungal, antidiabetic, anticarcinogenic, hypoglycaemic activity and hypocholesterolemic activity. The consumption of fenugreek has safe and secure for humans and it may be implemented for health benefit as dietary component, through its rich full of fiber packaged and other bioactive components are present. Future research on this plant could lead to the medicine and pharmaceutical industries due to herbal nature and low side effects. So in scientific research areas fengrueek plays a major role.

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