

A Relative Study on Utilisation of Fenugreek Seeds for Enhancement of the Antioxidant Activities in Various Baked Products

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Abstract

Fenugreek (*Trigonella foenum-graecum* L.) is a widely distributed well-known annual plant and has possessed obvious hypoglycaemic and hypercholesterolemia characteristics. In the present study fenugreek seeds and its extracts are utilized for fortification of low nutritional value baked items so as to enhance its nutraceutical properties. It was found that hot extraction and roasted & grinded fenugreek seed extracts had more polyphenol content than cold extraction and raw & grinded fenugreek seed. So it can be concluded that the amount of soluble polyphenols present in fenugreek seeds are increased after heat treatments. Result shows that, the maximum amount of polyphenols is present in three different types of baked items (bread: 0.304 ± 0.002 , cookies: 0.291 ± 0.003 , muffin: 0.345 ± 0.001 gm GAE/100gm sample) when fortified with hot extraction of fenugreek seeds.

Therefore, for fortification of heat treated baked food items like bread, cookies and muffins, fenugreek seed and its extracts are good sources of polyphenols.

Key words: Fenugreek, polyphenol, heat stable, baked food, nutraceutical

I. INTRODUCTION

Fenugreek (*Trigonella foenum-graecum* L.) is a legume and it has been used as a spice throughout the world to enhance the sensory quality of foods. Fenugreek is well-known for its medicinal properties such as anti-diabetic, anti-carcinogenic, hypocholesterolemic, antioxidant, and immunological activities.

Studies have shown fenugreek seeds to be also a rich source of antioxidants. Polyphenols in fenugreek seeds include apigenin and a number of kaempferol and quercetin glycosides [1] as well as flavonoids; vitexin, tricetin, naringenin quercetin and tricetin-7-O- β -D-glucopyranoside (Shang *et al.*, 1998). The extracts of endosperm husk, and fenugreek seed at about 200mg

concentration exhibited antioxidant activity 72%, 64%, and 56% respectively by free-radical scavenging method [2]. The major bioactive compounds in fenugreek seeds are believed to be polyphenol compounds, such as rhaponticin and isovitexin [3]. Dixit *et al.* (2005) [4] found that fresh leaves of fenugreek contain ascorbic acid of about 220.97 mg per 100 g of leaves and β -carotene is present about 19 mg/100 g. On the other side, it was reported that 84.94% and 83.79% ascorbic acid were reduced in sun and oven-dried fenugreek leaves respectively.

Health benefits of fenugreek seeds include:

- Diabetes Mellitus prevention: Fenugreek powder treatment in patients suffering from mild Non-insulin dependent diabetes mellitus produced marked reduction in blood sugar and serum triglycerides and total cholesterol [5].
- Cancer prevention: The effect of fenugreek seeds observed in induced breast cancer [6]. Further, the ethanolic extract of fenugreek showed antineoplastic effect on the growth of breast cancer cells by reducing cell viability, inducing early apoptotic changes, declining the mitochondrial membrane potential and degrading cellular DNA into fragments [7].
- Antioxidant activity: It has been documented in various studies that fenugreek bears potential of a powerful antioxidant in which the presences of flavonoids and polyphenols have been found to be responsible for the same [4]. The exposure of polyphenol rich extract of fenugreek seeds which showed protective effects against hydrogen peroxide induced oxidation by protecting the erythrocytes from haemolysis and lipid peroxidation in a dose dependent manner [8].

This study was carried out with the objective to enhance the antioxidant properties of various baked products made from soft wheat flour on fortification

with fenugreek seed and extract from it. Bread, Cookies and muffins are prepared using fenugreek seeds/extract.

II. EXPERIMENTAL PROCEDURES

A. Sample preparation (Preparation of Fenugreek seeds for fortification)

Fenugreek seeds were collected from local market (Sodepur, West Bengal, India). Four samples (S1, S2, S3, and S4) were prepared from the fenugreek seeds for fortifications.

- i. S1: 5 gms of raw fenugreek seeds were grinded to powder formed.
- ii. S2: Raw fenugreek seeds are firstly roasted and then 5 gms of roasted seeds are grinded.
- iii. S3: 5 gms of raw fenugreek seeds were cold extracted by soaking in 50 ml of water at refrigerated condition for overnight. The extract was separated and collected by filtration.
- iv. S4: 5 gms of raw fenugreek seeds were hot extracted by boiling them in 50 ml water at 100°C temperature for 5 minutes. After cooling it, the extract was separated and collected by filtration.

B. Preparation of Fenugreek fortified Bread

- **Ingredients:** Four types of bread (B1, B2, B3, and B4) were prepared by fortifying with the four samples of fenugreek seeds. The common ingredients of these four types of breads are 100gm wheat flour, Water (62.5ml), Yeast (2gm), Salt (2gm), Sugar (6gm), Milk powder (4gm), Shortening agent[Butter] (4gm). All the above ingredients were collected from the local market (Sodepur, West Bengal). Fenugreek seed samples were added in 1:25ratio with wheat flour to the four different types of breads viz. 4gms of S1, S2, S3 and S4 in B1, B2, B3 and B4 respectively.
- **Method:** At first all the ingredients were measured properly. Water was boiled in a heater. Milk powder was mixed slowly in Luke warm water. Then the pre-weighed sugar and the rest of water was added and mixed well. Yeast was added to the mixture. The mixture was then kept in a covered beaker. Then the mixture was then kept for fermentation. After the mixture being raised, double to its previous quantity, it was added to the flour, which was taken on a plate with added salt and fenugreek extracts, and then all of these were mixed properly. The dough was then kept for proofing in an incubator after covering it with a moist muslin cloth for 1hour and 30 minutes. After 1 hour and 30 minutes, the dough was separated from the muslin cloth, punched and was placed in moulds according to their sizes and then again kept inside the incubator for 45 minutes. Then after 45 minutes, the dough taken out from the incubator were placed inside the baking oven at

180°C for 45minutes. Baked bread was then taken out from the pans to avoid sweating.

C. Preparation of Fenugreek fortified muffin

- **Ingredients used:** 50gm of Flour, Sugar (50g), Butter (40g), Egg, Vanilla Essence, Baking Powder, Salt, and fenugreek seed samples. All the above ingredients were collected from the local market (Sodepur, West Bengal). Four different types of muffins (50 gms) were fortified with 1% of the four different types of fenugreek seed samples.
- **Method:** The dry ingredients, Flour, Salt and Baking Powder were placed in a bowl. They were mixed until they were fully combined. The wet ingredient, Egg was taken in a separate bowl and whipped. After that, the pulverized Sugar, Butter and Vanilla Essence were added and whipped until the mixture was light and fluffy. All the wet and dry ingredients and also the Fenugreek seed were then mixed with the batter and the dough was prepared. Small amount of dough was then placed inside muffin moulds. The muffin mould was then put inside the oven and was baked at 180°C for 20 minutes until the surface turned slightly golden.

D. Preparation of Fenugreek fortified cookies

- **Ingredients used:** Wheat flour (50g), Sugar (50g), Butter (21g), Egg, Vanilla Essence, Baking Powder, Salt, Fenugreek seed samples. All the above ingredients were collected from the local market (Sodepur, West Bengal). Four different types of cookies (50 gms) were fortified with 1% of the four different types of fenugreek seed samples.
- **Method:** The dry ingredients, Flour, Salt and Baking Powder were placed in a bowl. They were mixed until they were fully combined. The wet ingredient, Egg was taken in a separate bowl and whipped. After that the pulverized Sugar, Butter and Vanilla Essence were added and whipped until the ingredients were incorporated and the mixture was light and fluffy. All the wet and dry ingredients and also the Fenugreek seed extracts were then mixed together very well and the dough was prepared. Small amount of dough was taken and placed them onto a baking sheet forming a cookie like structure. The baking sheet was then put into an oven and was baked for 30minutes at 140-160°C until the surface turned slightly golden.

E. Physico-chemical analysis of the Fenugreek Seed samples and fenugreek seeds fortified bakery products

The polyphenol contents of all the fenugreek seed samples (S1, S2, S3 and S4) and fenugreek seeds fortified baked products (breads, muffins and cookies) were determined by using spectrophotometer method and expressed in terms of Gallic acid equivalent [9].

Moisture, ash, carbohydrate, protein and fat content of the fortified bakery products were done by standard AOAC (1990) [10] methods.

F. Sensory analysis of the fortified bakery products

Sensory analysis was done for the fenugreek seed fortified bakery products by ten trained panel members of food technology department by using 9 point hedonic scale [11].

III. RESULT

A. Estimation of Total Phenolic Compounds

Total polyphenol content of fenugreek seed samples (S1, S2, S3 and S4) obtained from the different extraction methods were estimated (Table I) as well as total polyphenol content of bakery products prepared from different extracts obtained from fenugreek seeds were also estimated (Table II).

Table I: Polyphenol Content of Fenugreek in Different Extraction Method

Hot Extraction from Fenugreek (gm GAE/100gm) (Avg±s.d.)	Cold Extraction from Fenugreek (gm GAE/100gm) (Avg±s.d.)	Roasted & Grinded Fenugreek (gm GAE/100gm) (Avg±s.d.)	Raw & Grinded Fenugreek (gm GAE/100gm) (Avg±s.d.)
0.762±0.005	0.281±0.001	0.549±0.005	0.444±0.002

(Avg±s.d.)= Average± standard deviation, n=3

Table II: Polyphenol Content Table for Bakery Products after Fortification

Fortified Food Sample	Control (gm GAE/100gm) (Avg±s.d.)	Fortified with Hot Extraction from Fenugreek (gm GAE/100gm) (Avg±s.d.)	Fortified with Cold Extraction from Fenugreek (gm GAE/100gm) (Avg±s.d.)	Fortified with Roasted & Grinded Fenugreek (gm GAE/100gm) (Avg±s.d.)	Fortified with Raw & Grinded Fenugreek (gm GAE/100gm) (Avg±s.d.)
Bread	0.0055±0.003	0.3047±0.002	0.1157± 0.002	0.1265±0.002	0.1531±0.002
Cookie	0.0046±0.002	0.2913 ±0.003	0.1235 ±0.002	0.1527±0.002	0.1708±0.002
Muffin	0.0059±0.005	0.3456±0.001	0.1527±0.002	0.1552±0.002	0.1707±0.002

(Avg±s.d.)= Average± standard deviation, n=3

B. Chemical analysis

Chemical tests such as moisture, ash, carbohydrate, protein and fat content of the fenugreek fortified bakery products were also estimated. The results obtained are shown in (Table III).

Table III: Chemical Analysis of the Fenugreek Fortified Bakery Products:

Fortified Food Sample	Moisture Content (%) (Avg±s.d.)	Ash Content (%) (Avg±s.d.)	Fat Content (%) (Avg±s.d.)	Protein Content (%) (Avg±s.d.)	Carbohydrate Content (%) (Avg±s.d.)
Bread	35.19±0.026	1.78±0.02	6.11±0.025	12.052±0.017	62.58±0.017
Cookie	3.2±0.012	1.21±0.04	25.64±0.026	9.365±0.034	60.21±0.027
Muffin	26.72±0.35	1.41±0.48	12.98±0.026	7.10±0.025	52.36±0.028

(Avg±s.d.)= Average± standard deviation, n=5

C. Sensory Evaluation

The organoleptic characteristics of the fenugreek fortified bread; cookie and muffin were evaluated by

using a taste panel, consisting of 10 judges. The panellists were asked to evaluate colour, appearance, taste, flavour, texture and overall acceptability. The ratings were on a 9-point hedonic scale, ranging from 9 as like extremely to 1 as dislike extremely. An average of the ratings obtained from the sensory evaluation of the products prepared is given below (Table IV).

Table IV: Sensory Evaluation

Fortified Food Sample	Fortified with Hot Extraction from Fenugreek	Fortified with Cold Extraction from Fenugreek	Fortified with Roasted & Grinded Fenugreek	Fortified with Raw & Grinded Fenugreek
Bread	9	9	8	9
Cookie	8	9	8	8
Muffin	8	9	7	8

IV. DISCUSSION

By studying the values obtained we may conclude that, hot extraction and roasted & grinded fenugreek seed extracts had more polyphenol content than cold extraction and raw & grinded fenugreek seed extracts

(Fig 1). So it can be concluded that the polyphenols present in fenugreek seeds are heat soluble.

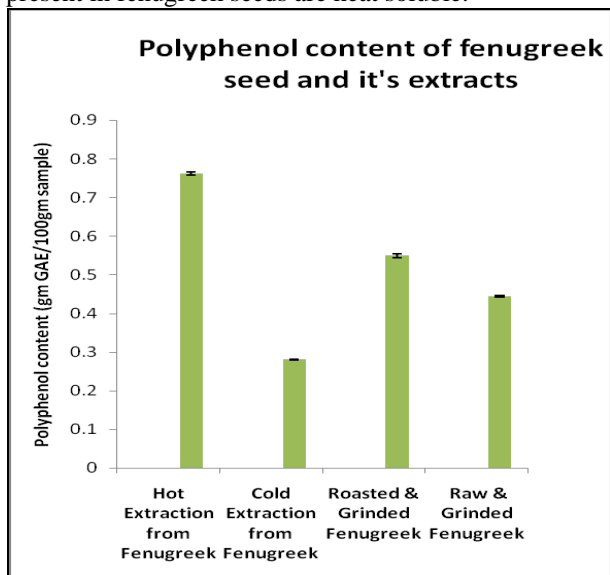


Fig 1: Polyphenol content of fenugreek seeds and its extract

But after fortification in bakery products it was found that the polyphenol content in hot extraction of fenugreek fortified product had lowest polyphenol content than cold extraction and roasted & grinded fenugreek fortified product (Fig 2). Again, it was found that raw and grinded fenugreek fortified product had the highest polyphenol content.

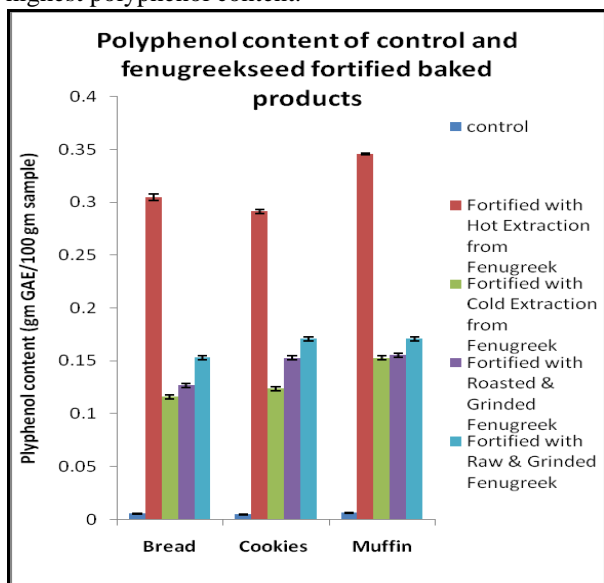


Fig 2: Polyphenol content of bakery products

V. CONCLUSION

On the basis of above experimental data it could be concluded that *Trigonella foenum graecum* (fenugreek) seed can be utilized as great source of antioxidant based

plant species. Nutritional deficiency being the most common disorder in the world, through our study, we found that fenugreek seeds possess highly heat stable polyphenols, which when incorporated in low nutritional value possessing, heat processed bakery products, a high nutrition-rich product can be obtained. Due to its medicinal properties, the consumption of these fenugreek fortified bakery product may also be proved beneficial for the patients suffering from Diabetes and Cancer. Fenugreek fortification within bakery items did not readily affect the desirable flavour and colour properties of the bakery items. Along with enhancing its antioxidant as well as medicinal properties it also increases the volume & bulk density of the bakery items. This study also suggests that natural antioxidant can be utilized for food safety and for increasing the shelf life of the food and securing the health aspects.

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