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Amino acid composition of fenugreek (*Trigonella foenum-graecum* L.) seed and galactomannan depleted fenugreek residue

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Abstract

A study was undertaken to evaluate the amino acid composition of fenugreek seed and Galactomannan Depleted Fenugreek Residue (GDFR). A total of six fenugreek seed samples collected from different parts of Tamil Nadu and six GDFR (Fenumax[®]) samples received from E.I.D. Parry (India) limited, Cuddalore, Tamil Nadu were analysed for amino acid composition. The amino acids content (g/100 g sample) of fenugreek seed and GDFR were arginine (0.71 and 0.71), glycine (1.21 and 1.48), histidine (2.08 and 2.41), isoleucine (0.76 and 0.83), leucine (1.53 and 1.89), lysine (1.13 and 1.27), methionine (0.61 and 0.73), phenylalanine (0.79 and 1.04), threonine (0.64 and 0.71), tyrosine (0.50 and 0.84) and valine (0.46 and 0.64).

Keywords: Fenugreek, amino acids, GDFR, composition

Introduction

India, the spice bowl of the world with more than 50 varieties of spices being produced. The total production of spices in India is estimated at 5.8 million tonnes and it accounts for over 45 percent of the world spice trade by volume and value. Fenugreek, an important spice was produced to the tune of 1.279 lakh tones in the year 2010-11. Rajasthan accounts for 74% of the fenugreek seed produced in India^[1].

Fenugreek (*Trigonella foenum-graecum* L.) is known as methi in Hindi and vendayam in Tamil. The largest producer of fenugreek in the world is India. In India, the seeds are used in curries (preparation of pickles, vegetable dishes, dhals and spice mixes such as panch phoron and sambar powder) and for its medicinal properties viz., anti-diabetic and cholesterol lowering properties^[2-5], anti-hyperthyroid effects^[6], against thyroxine-induced hyperglycemia⁷, anti-cancer effects^[8], gastro-protective effects^[9], antioxidant property^[10], antinociceptive property^[11], antimicrobial property^[12], anthelmintic property^[13], anti-sterility and anti-androgenic effects^[14], wound healing property^[15] and also anti-inflammatory and antipyretic actions^[16].

Galactomannan in fenugreek, due to its viscous property, is effective in inhibiting the intestinal glucose uptake and lower blood glucose¹⁷, hence separation of galactomannan are undertaken at industrial levels (eg. M/s. E.I.D. Parry (India) Limited, Bio Products Division, Cuddalore, Tamil Nadu, India) to produce anti-diabetic nutraceutical. The residue is designated as Galactomannan Depleted Fenugreek Residue (GDFR) and marketed as Fenumax[®]. With the increased incidence of diabetes in India and the clamour for using natural drugs for diabetes, the growth of galactomannan separation from fenugreek is likely to increase resulting in more quantity of the GDFR available.

Galactomannan are the major polysaccharide found in fenugreek seed and represent approximately 50% of the seed weight¹⁸. The remaining 50% of the material from fenugreek galactomannan extraction industry is available as galactomannan depleted fenugreek residue (GDFR).

Extractable oil from fenugreek represents about 6 - 8% of the seed weight and contains ω -3(n-3), ω -6(n-6), and ω -9 (n-9) fatty acids along with many saponins, alkaloids, and sterols^[19, 20]. Shahat²¹ studied Egyptian fenugreek oil and reported that it consists of 33.7% linoleic, 35.1% oleic and 13.8% linolenic acids. Baccou *et al.*^[22] studied the fatty acid composition of fenugreek oil from different countries and found that the percentage of linoleic and linolenic acids differ according to place and conditions of cultivation of plant, and the oils had marked drying properties.

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Dietary fatty acids modify the plasma lipoprotein profile and reduce the risk of cardiovascular disease, which has been shown in intervention studies²³⁻²⁵ in particular for polyunsaturated and monounsaturated fatty acids.

The active therapeutic constituents of fenugreek seeds are 4-hydroxy isoleucine²⁶, lysine and L-tryptophan rich proteins, mucilaginous fibre (galactomannan) and other rare chemical constituents such as saponins, coumarin, fenugreekine, nicotinic acid, saponin, phytic acid, scopoletin and trigonelline, which are thought to account for many of its presumed therapeutic effects like, inhibition of cholesterol absorption and lowering blood sugar level²⁷. In this study, amino acid composition of fenugreek seeds and GDFR was investigated.

Methodology

A total of six fenugreek seed samples were collected from different areas of Tamil Nadu. The samples were ground and used for analyses. The six samples of GDFR (Fenumax[®]) were received from E.I.D. Parry (India) limited, Bio Products Division, Cuddalore, Tamil Nadu. These six samples in each of fenugreek seed and GDFR were analysed for amino acid composition.

Amino acid composition

The protein in fenugreek seed and GDFR was hydrolysed with 6 ml of 6N HCl in sealed tube. The tube was maintained in boiling water bath for a period of 24 hours. The tubes were cyclomixed at every one hour. At the end of 24 hours, the tubes were centrifuged at 3500 rpm for 15 minutes. The supernatant was filtered and neutralized with 1N NaOH. The filtrate was diluted to 100 times its volume with triple distilled water and was proceeded for estimation of amino acids using Florescence detector in HPLC^[28].

The analytical conditions were as follows

The column used was Shim-pack ISC-07/S 1504 Na, mobile phase used in the study was sodium-type, prepared with sodium citrate and sodium hydroxide. The flow rate of the mobile phase was regulated to 0.3 ml/minute. The reaction solution was prepared with sodium hypochlorite solution, O-phthalaldehyde, polyoxyethylene lauryl ether (Briz-35) and N-acetyl cysteine in alkaline buffer. The flow rate of the reaction solution was 0.4 ml/minute. The column was maintained at 55°C and the amino acid was detected at excitation of 348 nm and at emission of 450 nm.

The area and time of elution of individual amino acid was compared with the respected area and time of elution of standard amino acids.

Results and Discussion

Amino acid composition

The amino acids content of fenugreek seed and GDFR are presented in Table 1. In fenugreek seed, the arginine, glycine, isoleucine, leucine, lysine, phenylalanine, threonine, tyrosine and valine contents were similar, histidine and methionine contents were higher than the reported values of earlier workers^[29-32].

In GDFR, the isoleucine content was similar, glycine, histidine, leucine, lysine, methionine, phenylalanine, threonine, tyrosine and valine contents were higher and arginine content was lower than the earlier report^[33].

The amino acids contents of GDFR were more than fenugreek seed except for arginine which was comparable. The amino acids contents of fenugreek seed and GDFR were higher than

maize^[34].

Table 1: Amino acid profile of fenugreek seed and GDFR (on DM)

Amino acid (g/100g sample)	Fenugreek Seed	GDFR
Arginine	0.71 ± 0.03	0.71 ± 0.06
Glycine	1.21 ± 0.12	1.48 ± 0.18
Histidine	2.08 ± 0.14	2.41 ± 0.23
Isoleucine	0.76 ± 0.07	0.83 ± 0.03
Leucine	1.53 ± 0.14	1.89 ± 0.12
Lysine	1.13 ± 0.09	1.27 ± 0.06
Methionine	0.61 ± 0.07	0.73 ± 0.05
Phenylalanine	0.79 ± 0.08	1.04 ± 0.13
Threonine	0.64 ± 0.07	0.71 ± 0.12
Tyrosine	0.50 ± 0.08	0.84 ± 0.12
Valine	0.46 ± 0.04	0.64 ± 0.07

Each value is a mean of six observations.

Conclusions

This study revealed that the amino acids content (g/100 g sample) of fenugreek seed and GDFR were arginine (0.71 and 0.71), glycine (1.21 and 1.48), histidine (2.08 and 2.41), isoleucine (0.76 and 0.83), leucine (1.53 and 1.89), lysine (1.13 and 1.27), methionine (0.61 and 0.73), phenylalanine (0.79 and 1.04), threonine (0.64 and 0.71), tyrosine (0.50 and 0.84) and valine (0.46 and 0.64).

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