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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<sup>®</sup>) 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<sup>[1]</sup>.

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<sup>[2-5]</sup>, anti-hyperthyroid effects<sup>[6]</sup>, against thyroxine-induced hyperglycemia<sup>7</sup>, anti-cancer effects<sup>[8]</sup>, gastro-protective effects<sup>[9]</sup>, antioxidant property<sup>[10]</sup>, antinociceptive property<sup>[11]</sup>, antimicrobial property<sup>[12]</sup>, anthelmintic property<sup>[13]</sup>, anti-sterility and anti-androgenic effects<sup>[14]</sup>, wound healing property<sup>[15]</sup> and also anti-inflammatory and antipyretic actions<sup>[16]</sup>.

Galactomannan in fenugreek, due to its viscous property, is effective in inhibiting the intestinal glucose uptake and lower blood glucose<sup>17</sup>, 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<sup>®</sup>. 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 weight<sup>18</sup>. 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  $\omega$ -3(n-3),  $\omega$ -6(n-6), and  $\omega$ -9 (n-9) fatty acids along with many saponins, alkaloids, and sterols<sup>[19, 20]</sup>. Shahat<sup>21</sup> studied Egyptian fenugreek oil and reported that it consists of 33.7% linoleic, 35.1% oleic and 13.8% linolenic acids. Baccou *et al.*<sup>[22]</sup> 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 studies<sup>23-25</sup> in particular for polyunsaturated and monounsaturated fatty acids.

The active therapeutic constituents of fenugreek seeds are 4-hydroxy isoleucine<sup>26</sup>, 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 level<sup>27</sup>. 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<sup>®</sup>) 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<sup>[28]</sup>.

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<sup>[29-32]</sup>.

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<sup>[33]</sup>.

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<sup>[34]</sup>.

**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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### References

- Anonymous. Spice Board India, Ministry of Commerce and Industry, Government of India, DASD, Calicut, 2010.
- Hannan JMA, Rokeya B, Faruque O, Nahar N, Mosihuzzaman M *et al.*, Effect of soluble dietary fibre fraction of *Trigonella foenum-graecum* on glycemic, insulinemic, lipidemic and platelet aggregation status of Type 2 diabetic model rats, *J Ethnopharmacol* 2003;88:73-77.
- Vats V, Yadav SP, Grover JK. Effect of *Trigonella foenum-graecum* on glycogen content of tissues and the key enzymes of carbohydrate metabolism, *J Ethnopharmacol* 2003;28:1-6.
- Venkatesan N, Devaraj SN, Devraj H. Increased binding of LDL and VLDL to apo B, E receptors of hepatic plasma membrane of rats treated with Fibrinat, *Eur J Nutr* 2003;42:262-271.
- Suboh SM, Bilto YY, Aburjai TA. Protective effects of selected medicinal plants against protein degradation, lipid peroxidation and deformability loss of oxidatively stressed human erythrocytes, *Phytother Res* 2004;18:280-284.
- Tahiliani P, Kar A. The combined effects of *Trigonella* and *Allium* extracts in the regulation of hyperthyroidism in rats, *Phytomedicine* 2003;10:665-668.
- Tahiliani P, Kar A. Mitigation of thyroxine-induced hyperglycaemia by two plant extracts, *Phytother Res* 2003;17:294-296.
- Devasena T, Menon VP. Fenugreek affects the activity of beta-glucuronidase and mucinase in the colon, *Phytother*

- Res* 2003;17:1088-1091.
9. Pandian RS, Anuradha CV, Viswanathan P. Gastroprotective effect of fenugreek seeds (*Trigonella foenum-graecum*) on experimental gastric ulcers in rats, *J Ethnopharmacol* 2002;81:393-397.
  10. Raskin I, Ribnicky DM, Komarnytsky S, Llic N, Poulev A *et al.*, Plants and human health in twenty-first century, *Trends Biotechnol* 2002;20:522-531.
  11. Javan M, Ahmadiani A, Semnani S, Kamalinejad M. Antinociceptive effects of *Trigonella foenum-graecum* leaves extract, *J Ethnopharmacol* 1997;58:125-129.
  12. Bhatti M, Khan AMTJ, Ahmed M, Jamshaid W, Ahmad W, Antibacterial activity of *Trigonella foenum-graecum* seeds, *Phytotherapeu* 1996;67:372-374.
  13. Ghafgazi T, Farid H, Pourafkari A. *In vitro* study of the action of *Trigonella foenum-graecum* grown in Iran, *Iranian J Pub Health* 1980;9:21-26.
  14. Kamal R, Yadav R, Sharma JD. Efficacy of steroidal fraction of the fenugreek seed extract on the fertility of male albino rats, *Phytother Res* 1993;7:134-138.
  15. Taranalli AD, Kuppast IJ. Study of wound healing activity of seeds of *Trigonella foenum-graecum* in rats, *Indian J Pharm Sci* 1996;58:117-119.
  16. Ahmadiani A, Javan M, Semnani S, Barat E, Kamalinejad M. Anti-inflammatory and antipyretic effects of *Trigonella foenum-graecum* leave extracts in the rat, *J Ethnopharmacol* 2001;75:283-286.
  17. Srichamroen A, Thomson ABR, Field CJ, Basu TK. *In vitro* intestinal glucose uptake is inhibited by galactomannan from Canadian fenugreek seed (*Trigonella foenum graecum* L.) in genetically lean and obese rats, *Nutr Res* 2009;29:49-54.
  18. Raghuram TC, Sharma RD, Sivakumar B, Sahay BK. Effect of fenugreek seeds on intravenous glucose disposition in non-insulin dependent diabetic patients, *Phytother Res* 1994;8:83-86.
  19. Heller L, Fenugreek, A noteworthy hypoglycemic, Pacific College of Oriental Medicine, 2001. From [www.ormed.edu/newsletters/fenugreek.html](http://www.ormed.edu/newsletters/fenugreek.html).
  20. El-Sebaay A, El-Mahdy AR. Lipid changes during germination of fenugreek seeds (*Trigonella foenum-graecum*), *Food Chem* 1983;10:309-319.
  21. Shahat M, The analytical constants and composition of fatty acids of Egyptian fenugreek oil, Proceedings of the 11th Congress in Pure and Applied Chemistry, London, 1947, 569-575.
  22. Baccou JC, Sauvaire Y, Olle M, Petit J, L'huile de Fenugreek: composition, properties, possibilities d'utilisationsans l'industrie des peintures et vernis, *Rerue Francaise des Corps Gars* 1978;25:353-359.
  23. Wolfram G, -3 and -6 Fettsauren: Biochemische Besonderheiten and Biologische Wirkungen, *Fat Science Technology* 1989;12:459-468.
  24. Kinsella JE, Lokesh B, Stone RA. Dietary n-3 poly unsaturated fatty acids and amelioration of cardiovascular disease: possible mechanisms, *American J of Clinical Nutrition* 1990;52:1-28.
  25. Harris WS, n-3 fatty acids and serum lipoproteins, human studies, *American J of Clinical Nutrition* 1997;65(5):S1645-S1654.
  26. Hajimehdipoor H, Sadat-Ebrahim SE, Izaddoost M, Amin GR, Givi E. Identification and quantitative determination of blood lowering sugar amino acid in fenugreek, *Planta Medica* 2008;74:1175-1185.
  27. Bukhari SB, Bhanger MI, Memon S. Antioxidant activity of extracts from fenugreek seeds (*Trigonella foenum graecum*), *Pak. J. Anal. Environ. Chem* 2008; 9:78-83.
  28. Huesgen AG. Sensitive and reliable amino acid analysis in protein hydrolysates using the HP 1100 series HPLC, Hewlett Packard, Technical Note 1988, 1-12.
  29. Nabey AAA, Damir AA. Changes in some nutrients of fenugreek (*Trigonella Foenum graecum* L.) seeds during water boiling, *Plant Foods Hum. Nutrition* 1990;40:267-274.
  30. Leela NK, Shafeekh KM, Fenugreek. 2005. In: *Chemistry of Spices* (Ed) V.A. Parthasarathy, B. Chempakam and T.J. Zachariah, CAB International, Wallingford, UK 2008, 242-259.
  31. Abaza IM. Effects of using fenugreek, chamomile and radish as feed additives on productive performance and digestibility coefficient of laying hens, *Egypt. Poult. Science* 2007;27:199-218.
  32. Mathur P, Choudhry M. Effect of domestic processing on proximate composition of fenugreek seeds. *J. Food Sci. Technology* 2009;46:255-258.
  33. Anonymous, Parry Nutraceuticals, Division of E.I.D Parry (India) Ltd., Chennai 2010.
  34. NRC, Nutrient Requirements of Poultry, 9<sup>th</sup> revised Ed., National Academy Press, Washington, D.C 1994.