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Amino Acid Composition of Tamarind Fruit Growing Wild in Oyo Town

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Abstract

Tamarind (*Tamarindus indica* L.) fruit grows wild in some parts of the savannah region of Nigeria. The fruit is grossly underutilised in Nigeria, despite its invaluable contribution to the food security and economy of some Asian countries. The amino acid composition of tamarind pulp was determined using amino acid analyser. Tamarind pulp was found to contain both essential and non-essential amino acids. Tamarind pulp could supply 53.8 %, 52.8 %, and 87.6 % of total essential, total sulphur and total aromatic amino acids respectively (FAO/WHO/UNU standard).

Keywords: *Tamarind fruit, aromatic amino acid, protein.*

Introduction

Tamarind (*Tamarindus indica* L.) is found in majority of the Tropics where it grows wild in backyards, roadsides or wastelands (Gunasena and Hughes, 2000). It is mostly found in the savannah region of Nigeria. The indigenous people utilise various parts of the plant as medicine and food. Tamarind, though has a great wide range of domestic and industrial uses, is still underexploited (Gunasena and Hughes, 2000). The most valuable and commonly used part of tamarind tree is the fruit, which is reputed to have one of the highest levels of protein and carbohydrate when compared with other of types of fruits (Gunasena and Hughes, 2000; BAIF, 2002; De Caluwe *et al.*, 2010). Tamarind fruits could therefore serve as a reasonable source of protein and thereby help to alleviate the perennial problem of malnutrition in many developing nations. Limited data on nutritional composition of tamarind pulp found in Nigeria exist in the literature. Available information on Nigerian tamarind is mainly on the proximate, sugar and

phytochemical, antimicrobial and physico-chemical properties of the fruits and their utilisation in traditional beverages (Isholaet *al.*, 1990; Akoma, 2002; Onuorah *et al.*, 2002; Adeola and Aworh, 2010a,b; Adeola *et al.*, 2010; Adeola and Aworh 2012; Adeola *et al.*, 2012). In the light of the aforementioned, this study was carried out to analyse the profiles of amino acids in *Tamarindus indica* L. pulp found in south western Nigeria, with particular reference to Oyo town.

Materials and Methods

Materials

Mature tamarind fruits were obtained from three randomly selected plants that are growing wild in Oyo town. The pulp of the fruits was hand-scraped

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from the seeds, and was thereafter stored in an industrial freezer at -20°C prior to analysis.

Method

The amino acid content of tamarind fruit samples was determined by the method of Spackman *et al.* (1958). About 50 g of tamarind pulp sample was dried at 105°C to constant weight in an oven. About 5 g of the dried sample was defatted with chloroform/methanol (2:1) mixture for 15 hours, using Soxhlet extractor (A.O.A.C., 1995). About 1 g of the defatted sample was weighed into glass ampoule and 7 mL of 6 N HCl added. In order to prevent possible oxidation of some amino acids during hydrolysis, oxygen was expelled by passing nitrogen into the ampoule. The glass ampoule was then sealed with Bunsen burner flame and put in an oven preset at $105 \pm 5^{\circ}\text{C}$ for 22 h. The ampoule was broken at the tip after cooling, and the content filtered. The filtrate was then evaporated to dryness at 40°C under vacuum in a rotary evaporator and the residue obtained was dissolved with 5 mL of acetate buffer (pH 2.0). This was stored in plastic specimen bottles and kept in the freezer. The Technicon Sequential Multi-Sample Amino Acid Analyser was thereafter loaded with about $5\mu\text{l}$ of the dissolved residue for analysis of acidic (aspartic and glutamic acids), neutral (glycine, alanine, valine, leucine, isoleucine, phenylalanine, tyrosine, serine, threonine, cysteine, methionine) and basic (arginine, lysine, histidine) amino acids of the hydrolysate.

Results

Data presented in Table 1 show the amino acid composition of the tamarind pulp samples. The essential amino acid (EAA) identified in tamarind pulp included cysteine, histidine, isoleucine, leucine, methionine, phenylalanine, threonine and valine. The identified non-essential amino acids (NEAA) were alanine, arginine, aspartic and glutamic acids, glycine, proline, serine and tyrosine. The most abundant EAA and NEAA were respectively leucine (6.71 g/100 g protein) and glutamic acid (6.72 g/100 g protein). Cysteine (0.62 g/100 g protein) and glycine (1.73 g/100 g protein) were the least EAA and NEAA, respectively.

Discussion

Amino acids (AAs) are biologically important compounds made from amine ($-\text{NH}_2$) and carboxylic acid ($-\text{COOH}$) functional groups, along with a side-chain specific to each amino acid. According to Wagner and Musso (1983), about 500 AAs are known and only 23 are proteinogenic (protein-building). Twenty out of the 23 proteinogenic AAs are encoded directly by triplet codons in the genetics code and are known as standard AAs. Nine of the 20 AAs are regarded as essential for humans because the human body is unable to synthesise them from other compounds. Comparing the findings of this study with that of Gunasena and Hughes (2000), amino acids of tamarind fruits could be said to be more concentrated in the seeds than pulp. Majority of the amino acids in tamarind pulp are lower than FAO/WHO/UNU (1985) reference pattern. However, tamarind pulp could supply 53.8%, 52.8% and 87.6% respectively of the reference values suggested by FAO/WHO/UNU (1985) for total essential amino acids, total sulphur amino acids and total aromatic amino acids. Cysteine and methionine, as sulphur-containing amino acids, are known to possess antioxidant property (Atmaca, 2004). However, the ability of thiols (sulphur-containing compounds) to function as anti- or pro-oxidants is partly determined by the type of oxidant stress and the physiological circumstances (Atmaca, 2004). Aromatic amino acids, apart from their structural function in proteins, are precursors of many important biological compounds such as neurotransmitters and hormones in the human body (Krzyściak, 2011).

The observation that leucine was the most abundant EAA corroborates the reports of Aremu *et al.* (2006), Olaofe *et al.* (2008), Aremu *et al.* (2010) and Aremu *et al.* (2011) that leucine is the most abundant EAA in Nigerian plant foods. Leucine is the only dietary amino acid that has the capability to stimulate muscle protein synthesis and is the most important amino acid for muscle building (Etzel, 2004). Combaret *et al.* (2005) reported that leucine slowed the degradation of muscle protein by increasing the synthesis of muscle proteins in aged rats. The leucine:

Table 1: Amino acid composition (g/100g protein) of tamarind (*Tamarindus indica* L.) pulp

Amino Acid	Tamarind pulp	FAO/WHO/ UNU (1985)	EAA Scores
Essential Amino acids (EAA)			
Cysteine	0.62±0.33	-	-
Histidine	1.61±0.24	1.90	0.85
Isoleucine	2.30±0.41	2.80	0.82
Leucine	6.71±0.16	6.60	1.02
Lysine	N.D.	5.8	-
Methionine	0.70±0.16	-	-
Phenylalanine	3.50±0.33	-	-
Threonine	1.70±0.57	3.40	0.50
Valine	2.22±0.49	3.50	0.63
Total essential amino acids	19.35±0.35	36.00	0.54
Non-essential amino acids			
Alanine	3.10±0.24	-	-
Arginine	4.00±0.65	-	-
Aspartic acid	5.30±0.82	-	-
Glutamic acid	6.72±0.59	-	-
Glycine	1.73±0.51	-	-
Proline	1.80±0.41	-	-
Serine	2.36±0.16	-	-
Tyrosine	2.02±0.25	-	-
Total non-essential amino acids	27.04±1.53	-	-
Total sulphur amino acids (cysteine + Methionine)	1.32±0.28	2.50	0.53
Total aromatic amino acids (Phenylalanine + Tyrosine)	5.52±0.57	6.30	0.88
Leucine/isoleucine ratio	2.9:1	1.8:1	-
Limiting amino acids	I		Threonine
	II		Total sulphur amino acids

ND, Not determined; Each result expresses the mean of three determinations ± SD

isoleucine ratio of tamarind pulp was higher than the ideal ratio of 1.8:1 that is suggested by FAO/WHO/UNU (1985). Deosthale *et al.* (1970) showed that excess leucine in foods interfered with the utilisation of isoleucine and lysine. The EAA score of proteins from tamarind pulp was evaluated taking into account the suggested pattern of amino acid requirements by FAO/WHO/UNU (1985). The EAA scores of the amino acids in tamarind pulp were not less than 0.50, with the total EAA score being 0.54. De Caluwe *et al.* (2010) reported that the essential

amino acids of tamarind fruit pulp exceed those of the 'ideal' protein standard established by the WHO, except for tryptophan. Threonine and total sulphur amino acids were the first and second limiting EAA, with EAA scores of 0.50 and 0.53, respectively.

Conclusion

In conclusion, tamarind fruits could make significant contribution to the protein intake of an average Nigerian. Hence, its consumption both as a fruit and ingredients in food formulations should

be encouraged among Nigerians and researchers.

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