

Levels of free essential amino acids in African breadfruit (*Treculia africana*)

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ABSTRACT

African breadfruit (*Treculia africana*), popularly called Ukwa by the Igbos is a wild tropical evergreen tree. African breadfruit is highly regarded as a very nutritive food, hence the essential amino acids were determined using thin layer chromatographic technique. The following essential amino acids: cysteine, tryptophan, phenylalanine, methionine, lysine and histidine were quantified using total and relative pixel mobility. Results show that cysteine concentration was the highest in Ukwa and the least was histidine. The findings indicate that Ukwa contains several essential amino acids. Thus, its consumption could support growth and maintain health.

Key words: Essential amino acids, African breadfruit, *Treculia africana*.

INTRODUCTION

Breadfruit (*Artocarpus altilis*) is species of flowering tree in the mulberry family, moraceae, native to Western Pacific Island. It has been widely planted in the tropical regions elsewhere. Breadfruit is an equatorial lowland species that grows to a height of 20 metres (Zerega, *et al.*, 2004).

Breadfruit is a staple food found in many tropical regions. They were propagated far outside their native range over long ocean distances by Polynesian voyagers. Ukwa consequently came to Africa and its botanical name is *Treculia africana* invariably native to West and Tropical African (Katende, *et al.*, 1995). The seed is an important food item popularly known as Ukwa by the Igbo tribal group of south eastern, Nigeria (Fasasi and Fasasi, 2004).

Treculia africana seeds are rich in protein, oil, carbohydrates and minerals (Nwokolo, 1987). The nutritional composition of Ukwa varies depending on the method of preparation (Zerega, *et al.*, 2004). Keay (1989) reported the proximate analyses of the nutrient contents of *Treculia africana*

as follows: crude protein (12.60%), total carbohydrate (69.08%), dry matter (62.20%), ether extracts (11.32%), ascorbic acid (281.0ml/kg), and carotene (3.9mg/kg). He also reported the antinutritional contents of the seeds as hydrogen cyanide (0.06 ± 0.12), oxalate (3.01 ± 0.11), phytic acid (0.76 ± 0.01), potassium (587 ± 0.02), calcium (165 ± 0.01), magnesium (186 ± 0.01), iron (1.66 ± 0.01), zinc (8.50 ± 0.02), copper (3.67 ± 0.01) expressed as mg/100gDM.

Shittu, *et al.*, (2004) published that when Ukwa was fed to children, no case of kwashiorkor was observed rather weight gain. Thus, Ukwa was suggested as a good locally available and acceptable food of high nutritive value in the nutritional rehabilitation of children with mild to moderate protein energy malnutrition (PEM).

MATERIAL AND METHODS

Mature fruit samples of *Treculia africana* was bought from Eke-oka Market, Awka in South Eastern, Nigeria. These fruits were analyzed at Chukeze Research and Development Laboratories, Awka.

Procedure for extraction

The *Treculia africana* seeds were dried and blended into a powder and about 40grams of the powdered sample were weighed out and mixed with 40ml of petroleum ether. The mixture was squeezed out through the folding of muslin cloth and the filtrate discarded. Then, 40ml of 50% ethanol was used to reblend the residue and again filtered and centrifuged. The supernatant was preserved. The residue obtained from the ethanol extract was reblended with 30ml of 0.1N HCl. This treatment was done to extract the acid soluble amino acids. The filtrate obtained was passed through a muslin cloth, then centrifuged and a clear supernatant was obtained.

This extract was heated slightly over a hot plate to concentrate the sample. The concentrated sample was centrifuged at 13000rpm and the clear supernatant was stored at 0°C until needed. Then, 8.2ml of the analyte was obtained after concentration

Preparation of standard essential amino acids

About 5mg/ml solution of the following essential amino acids: Phenylalanine, lysine, histidine, tryptophan and valine were made with 50% ethanol. Then 1.25mg/ml of leucine was made with 50% ethanol. Then, 10mg/ml solution of methionine was prepared with 0.1N HCl and 4ml solution of cysteine was prepared with 0.1N HCl.

Running the thin layer chromatograph technique as described by Anane *et al.* (2008)

The plate was labelled with the names of each amino acid to be spotted with points of origin indicated. Five (5) mL of the Ukwa extract was spotted on the TLC plate.

The spotting was done at 1.5cm from the edge of the plate. Spots were made between 1.5cm apart from one and another. The diameter of each spotted material was not more than 4mm and this is critical in ensuring the success of the TLC technique. During the running of TLC technique, a small plastic container with flat bottom and tight cover was used. The solvent system of the TLC was composed of n-propanol: ethylacetate: water in the ratio of 2:1:2 for the mobile phase for 30-60 minutes before dipping the plate, and the entire process

lasted for 3 hours in order to move up the plate when the mobile phase got to the premarked solvent front. The plate was removed and air dried. The developing agent was prepared by a mixture of ninhydrin and acetic acid. The plate was then heated over the oven until colour appeared.

RESULTS

The results showed that *Treculia africana* (Ukwa) contains essential amino acids in different concentrations. The total and relative pixel mobility of the standard amino acids and various bands of Ukwa were recorded as showed in Table 1

The result also showed that the readings of the relative mobility of the various bands of Ukwa were matched with the closest reading of the relative mobility of the standard amino acids. The relative mobility of leucine and valine were out of the closeness with the bands 5 and 6, respectively (Table 2).

The results also indicated the various concentrations of the free essential amino acids in *Treculia africana* (Ukwa). From such results, cysteine was the highest concentration in Ukwa and other amino acids followed one another according to their concentration as shown (Table 3).

DISCUSSION

African Breadfruit otherwise known as *Treculia africana* is a very good source of essential amino acids which the body needs for catalytic and structural activities. The findings agree with the work of Lukong, *et al.* (2007). The research revealed that various concentrations of essential amino acids are present in African breadfruit with cysteine having the highest concentrations (8.7mg/ml) among them. Methionine: 0.67mg/ml, lysine: 0.17mg/ml, phenylalanine 0.13mg/ml and tryptophan: 0.053mg/ml. This is in agreement with the findings of Nwokolo, (1987) who observed that *Treculia africana* seeds are rich in protein, oil, carbohydrate and minerals. Keay, (1989) also published the proximate analysis of the seeds.

The present study revealed that cysteine, a sulphur containing, essential amino acid is

Table 1: Total and relative pixel mobility of standard amino acids and various bands of Ukwa

Segment	Segment Description	Total Pixel Mobility	Relative Pixel Mobility
2.1	Leucine	347164.1	0.6527
3.1	Histidine	265878.1	0.0560
4.1	Cysteine	3934.93	0.0560
5.1	Phenylalanine	178047.6	0.722
6.1	Cysine	244382.4	0.1582
7.1	Methionine	264490.3	0.2879
8.1	Valine	246419.2	0.5967
9.1	Tryptophan	315546.6	0.7681
10.1	Band 1 of Ukwa	21319.36	0.0703
10.2	Band 2 of Ukwa	13665.62	0.1088
10.3	Band 3 of Ukwa	44270.82	0.2758
10.4	Band 4 of Ukwa	-2974.21	0.2923
10.5	Band 5 of Ukwa	25151.82	0.4143
10.6	Band 6 of Ukwa	20725.34	0.4956
10.7	Band 7 of Ukwa	118993.32	0.6714
10.8	Band 8 of Ukwa	5544.69	0.7758

Table 2: Relative mobility of various bands of Ukwa and the standard amino acids

Segment Description	Relative Mobility	Segment Description	Relative Mobility
Tryptophan	0.7681	Band 8 of Ukwa	0.7766
Phenylalanine	0.7220	Band 7 of Ukwa	0.6714
Leucine	0.6527	Band 6 of Ukwa	0.4956
Valine	0.5967	Band 5 of Ukwa	0.4145
Histidine	0.2901	Band 4 of Ukwa	0.2923
Methionine	0.2879	Band 3 of Ukwa	0.2758
Lysine	0.1582	Band 2 of Ukwa	0.1088
Cysteine	0.056	Band 1 of Ukwa	0.0703

required by infants and growing children. Hittu, *et al.* (2004) reported that when Ukwa was fed to children, there was no case of kwashiorkor but rather weight gain was observed. Thus, Ukwa was suggested as a good locally available and acceptable food of high nutritive value in the nutritional rehabilitation of children with mild to moderate protein energy malnutrition (PEM). The research findings show that Ukwa contains essential amino acids such as phenylalanine and tryptophan which are in concentrated quantity, and these amino

Table 3: Concentrations of amino acids in Ukwa

Amino acids	Concentration of Amino acids in 40mg/ml of Ukwa
Cysteine	8.668
Methionine	0.6694
Lysine	0.16774
Phenylalanine	0.13358
Tryptophan	0.0527
Histidine	-0.3354

acids are precursors of neurotransmitters. These neurotransmitters play unique roles in synaptic transmission (Garrett and Grishman, 2002). Therefore, it may be suggested that *Treculia africana* should be formulated into different food packages such as alcoholic beverages as breadfruit drinks, breadfruit cakes, soup thickening, snacks and other cookies. Katende (1995) noted that the seeds could

be dried, fried or roasted and eaten. He also observed that edible oil can be extracted from the seeds.

Conclusively, *Treculia africana* seeds may be beneficial to both young and old in different dimensions such that it serves as food and also as a source of income for the people of Southern Eastern Nigeria.

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