

## Chemical Evaluation of the Nutritive Value of Seeds of African Breadfruit (*Treculia africana*)

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### ABSTRACT

*The chemical composition and nutritive value of the seeds of African breadfruit, Treculia africana, Decne var. Africana, have been investigated.*

*Analysis of the seeds showed that they contained, in terms of dry weight, 13.4% protein, 18.9% lipid, 58.1% carbohydrate, 1.4% crude fibre and 2.1% ash. The moisture content was found to be 7.8% in terms of wet weight.*

*The mineral elements determined were Na, 7.0 mg%; Mg, 184 mg%; Ca, 17.5 mg%; K, 585 mg%; P, 382 mg%; Cu, 3.9 mg%; Fe, 1.6 mg%; Cr, 0.20 mg% and Zn, 7.5 mg%.*

*Vitamins B<sub>1</sub>, 0.5 mg%; B<sub>2</sub>, 0.3 mg% C, 45.1 mg% and β-carotene, 6.0 mg% were found to be present in the seeds. The levels of some toxic substances in the seeds were oxalate (soluble), 2.5 mg% (total), 3.0 mg%; phytate, 2.0 mg%; tannin, 15.0 mg% and HCN, 1.1 mg%. The amino acid composition of the seeds has been studied and the results show that some amino acids are present at high concentrations whilst others are present at only low, or undetectable, levels.*

### INTRODUCTION

The African breadfruit tree (*Treculia africana*) is a native of many parts of West Tropical Africa. It is a representative of the family Moraceae. *Treculia africana* is an unbuttressed large tree, 24-37 m high, with a fluted bole up to 3 m in girth. The bark is smooth and, on slashing, it exudes

abundant latex. On the trunk and larger branches are abundant fruits which usually appear between February and March each year. Within the fruits are small ellipsoidal brown seeds, about 14 cm long. The small brown seeds have a groundnut flavour when roasted and are sold in local markets in the southern states of Nigeria. The seeds are sometimes made into a refreshing drink or added to soup. The seeds can be ground and used as a meal with maize or mixed with oil and eaten as prepared. They may also be processed for making breadfruit flour which serves various purposes in the local communities. It is used for soup thickening and for making breadfruit cakes, snacks and cookies. If well processed, the seeds yield a lot of edible oil which is used locally for food (Hutchison *et al.*, 1958; Irvine, 1961).

A survey of the literature shows only limited and scanty reports on the chemical composition and nutritive value of seeds of *Treculia africana*. These deal mainly with the proximate composition of the seeds (FAO, 1968; Oyenuga, 1968; Okafor & Okolo, 1974; Chidozie, 1979).

The present series of investigations were undertaken to assess, by chemical analysis, the nutritive value of the seeds of *Treculia africana*.

## EXPERIMENTAL

### Collection and treatment of samples for analysis

The ripe fruits of *Treculia africana* were collected between July and August, 1981, from the trees growing at Akpabuyo and Ikot Ekpene in the Cross River State of Nigeria. The fruits were allowed to ferment and the fermented mass was macerated and washed with tap water until the slimy, gelly-like substances covering the seeds were removed. The seeds were then sun dried for 10 h and oven dried in an Asfall-Hearson oven at 70 °C for 24 h. The dry testa was removed and the edible portion ground into flour using an electric mill (National Food Grinder, model MK 308, Japan). The flour was stored in airtight bottles from which samples were taken for chemical analysis.

### Analysis of samples

The methods of treatment of samples and analysis were the standard methods recommended by Joslyn (1970) and the Association of the Official Analytical Chemists (1970, 1975).

The moisture content was determined by drying the wet sample to a constant weight in an air circulating oven at 70–80°C.

The ash was determined by incineration of known weights of the samples in a muffle furnace at 550°C until ash was obtained. The lipid composition was determined by exhaustively extracting a known weight of the samples with petroleum ether (boiling point, 40–60°C) using a Soxhlet apparatus. Protein ( $N \times 6.25$ ) was determined by the macro-Kjeldahl method. The carbohydrate content was obtained by the difference method; that is, by subtracting the total crude protein and crude lipid from the organic matter. Crude fibre was determined by the acid and alkaline digestion methods described by Joslyn (1970) and the AOAC (1975).

The elementary composition was also determined using the methods of the AOAC (1975). Sodium and potassium were determined by flame photometric methods; calcium, magnesium, zinc, iron and copper were determined using an atomic absorption spectrophotometer and phosphorus was determined by a colorimetric method using ammonium molybdate. The amino acid contents of the samples were determined using an automatic amino acid analyzer.

The vitamins were determined by means of the methods of the Association of Official Vitamin Chemists (1966). Carotene was determined colorimetrically at 455 nm. Thiamine was estimated as thiochrome by the fluorometric method; riboflavin was also estimated fluorometrically, using a Locarte fluorimeter. Vitamin C (ascorbic acid) was estimated by the *N*-bromosuccinimide method described by Evered (1960) and total ascorbic acid by the 2,4-dinitrophenyl hydrazine method (Scharffert & Kinglsey, 1955). Oxalate was determined by the method of Dye (1956) and as modified by Oke (1965). The hydrocyanic acid content was determined by the alkaline titration method (AOAC, 1975). Phytic acid was estimated by a photometric method adapted from the methods of McCance & Widdowson (1935). The tannin was determined by the vanillin-HCl reagent method (Burns, 1971; Joslyn, 1970).

## RESULTS AND DISCUSSION

The results of the analysis are shown in Tables 1 to 5. Table 1 shows the results of the proximate composition of seeds of *Treculia africana*. The results of the proximate analysis compare favourably with earlier studies

**TABLE 1**  
Proximate Composition of the Seeds of the African Breadfruit Tree (*Treculia africana*) in Per Cent Dry Weight (Mean  $\pm$  standard error)<sup>a</sup>

Food energy (kcal)	456.4
Moisture (wet weight)	7.8 $\pm$ 0.02
Crude protein	13.4 $\pm$ 1.7
Crude fat	18.9 $\pm$ 0.3
Crude fibre	1.4 $\pm$ 0.1
Ash	2.1 $\pm$ 0.03
Carbohydrate	58.1 $\pm$ 1.2

<sup>a</sup> Mean of six determinations.

**TABLE 2**  
Mineral Composition of the Seeds of the African Breadfruit Tree (mg/100 g dry weight)<sup>a</sup>

Sodium	7.0
Magnesium	183.5
Calcium	17.5
Potassium	585.0
Phosphorus	381.8
Copper	3.9
Iron	1.6
Chromium	0.2
Zinc	7.5

<sup>a</sup> Average of two determinations.

**TABLE 3**  
Levels of Some Vitamins in the Seeds of the African Breadfruit Tree (mg % dry weight) (Mean  $\pm$  standard error)<sup>a</sup>

	(mg %) Dry weight
$\beta$ -Carotene	6.0 $\pm$ 0.5
Thiamine	0.5 $\pm$ 0.02
Riboflavin	0.3 $\pm$ 0.01
Ascorbic acid	
Total	45.1 $\pm$ 1.1
Reduced	0

<sup>a</sup> Mean of four determinations.

**TABLE 4**  
 The Levels of Some Toxic Substances in the Seeds of the  
 African Breadfruit Tree (*Treculia africana*)  
 (Mean  $\pm$  standard error)<sup>a</sup>

Oxalate	Total	3.0 $\pm$ 0.8 %
	Soluble	2.5 $\pm$ 0.5 %
Phytate	Phytic acid P	2.0 $\pm$ 0.3 mg %
Tannin		15.0 $\pm$ 0.1 mg %
HCN		1.1 $\pm$ 0.1 mg %

<sup>a</sup> Mean of four determinations.

(FAO, 1968; Oyenuga, 1968). The level of protein in the seeds of *Treculia africana* is such that about 400 g of the seeds need to be consumed each day to supply the recommended daily requirement of 44–56 % protein (National Research Council, 1973). The mineral composition of the seeds of *Treculia africana* is shown in Table 2. The seeds had high levels of magnesium, potassium and phosphorus.

The levels of other minerals, such as sodium (7.0 mg %) and calcium (17.5 mg %), were low. The levels of magnesium, potassium, phosphorus and zinc were such that about 100 to 200 g of the seed samples could supply the human daily requirement.

Table 3 shows the vitamin content of the seeds of *Treculia africana*. The seeds of *Treculia africana* can be regarded as a rich source of thiamin, carotene and vitamin C, but they are not rich in riboflavin. Losses of some of the vitamins may occur during further processing of the seeds for consumption as food. Table 4 shows the levels of some toxicants found in the seeds of *Treculia africana*. The phytic acid phosphorus was 2.0 mg % and thus constituted about 0.5 % of the phosphorus in the seeds. The levels of the toxic substances were not high enough to cause concern. It is, however, worth noting that some of these toxicants, such as phytic acid, oxalic acid and tannin, can interact with other nutrients and thus render them unusable by the consumer of the food (Axtel, 1972; Osaniyi & Eka, 1978; Goldstein & Swain, 1965).

Table 5 shows the amino acid content of the seeds of *Treculia africana*. The essential amino acids, lysine, phenylalanine, threonine and valine, were present but some only at low concentrations (FAO/WHO Expert Group, 1965). A number of essential amino acids, such as isoleucine, leucine, methionine and tryptophan, were not determined. Efforts are being made to establish the levels of these. There is a need for animal

**TABLE 5**  
Amino Acid Content of Seeds of the African  
Breadfruit Tree (g/16 gN)<sup>a</sup>

Alanine	10.1
Arginine	12.2
Aspartic acid	2.7
Cysteine	4.7
Glutamic acid	20.1
Glycine	14.5
Histidine	3.7
Isoleucine	—
Leucine	—
Lysine	10.9
Methionine	—
Phenylalanine	12.1
Proline	0
Serine	18.1
Threonine	17.3
Tryptophan	—
Tyrosine	—
Valine	2.7

<sup>a</sup> Mean of two determinations.

—, Not determined.

feeding experiments to assess, biologically, the nutritive value of the seeds.

On the whole, it appears that the seeds of *Treculia africana* can serve as a good source of some nutrients and hence may be used to supplement foods deficient in some vitamins and minerals. With a fat content of 18.9%, the seeds may be considered as an oil seed. It will be of interest to characterize the oil obtained from the seeds of *Treculia africana*. Some investigations are being carried out in this direction.

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