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Chemical Studies on the Unripe and Ripe Fruits of *Dennettia tripatela* (Pepper Fruit)

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ABSTRACT

The proximate composition, as well as some mineral, vitamin and anti-nutritional constituents in unripe and ripe fruits of Dennettia tripatela *have been investigated. Moisture in the flesh of the fruit varied narrowly, ranging between 81% in the unripe and 82% in the ripe. The unripe and ripe seeds had about 25% and 71% lower moisture contents when compared with the unripe and ripe flesh, respectively. The crude protein and lipid contents in the unripe flesh were 4% DM and 2% DM, respectively; however, the corresponding values in the unripe seed represented 275% and 200% increases. Protein, lipid, fibre and ascorbic acid contents were generally higher in both the flesh and seed of ripe fruits. Tannin and oxalate contents in the flesh of ripe fruits represented about 100% and 50% increases, respectively, over corresponding values in the unripe fruit. The hydrocyanic acid contents tended to decrease from the flesh to the seeds and also from the unripe to the ripe fruits. The values for mineral contents varied widely, but calcium, magnesium and iron were present in appreciable quantities.*

INTRODUCTION

Dennettia tripatela (English name: Pepper fruit; Nigerian (Efik) name: Nkarika), is a tropical tree common in the mangrove forests of the West Coast of Africa. It flourishes at the beginning of the rainy season, especially during the months of April and May.

The mature unripe and ripe fruits constitute the major edible portions. However, some communities in parts of Southern Nigeria also utilize the fruits, leaves and roots of *Dennettia* for medicinal purposes. The peppery spicy taste of the mature fruits usually serves as a mild stimulant to the consumer. The peppery taste of the fruits also finds application in the prevention of nausea in pregnant women, especially among the low-income group. The fruits are sometimes eaten with cola nuts, garden egg-plant fruits, palm kernel and palm wine in some parts of Nigeria. Despite the availability and wide consumption of the fruits of *Dennettia* among the populations in West Tropical Africa, literature is scarce on the chemical composition and possible nutritional significance of these fruits. This paper reports on the proximate composition, as well as some mineral, vitamin and anti-nutritional constituents, in the flesh and seeds of mature unripe and ripe fruits of *Dennettia tripatela*.

EXPERIMENTAL

Collection and treatment of samples

Both mature unripe and ripe fruits of *Dennettia tripatela* were bought from ten different vendors in the Watt Market in Calabar, Cross River State of Nigeria. They were pooled, washed free of extraneous matter with distilled water, drained and allowed to dry at room temperature. The flesh was then separated from the seed and the samples were allowed to dry to constant weight at 45 °C in a thermostatically controlled air-draught oven (Gallenkamp). The dry samples were then milled in a Waring blender to pass through a 30 mesh sieve. The samples were stored in deep freeze.

Proximate composition analysis

The methods for the determination of moisture, crude protein (Kjeldahl), ether extract (crude lipid), crude fibre, ash and total carbohydrate were

those recommended by the Association of Official Analytical Chemists (AOAC, 1970). The determinations were carried out in triplicate.

Vitamin assay

The vitamin assayed was ascorbic acid. The method of Freebairn (1959), as recommended by the Association of Vitamin Chemists (1966), (utilizing the reducing action of ascorbic acid on 2,6-dichlorophenol indophenol dye) was used. The determinations were carried out in triplicate.

Mineral composition

The atomic absorption spectrophotometric method (wet oxidation) of Walsh (1971) was adopted for the determination of calcium, magnesium, iron, manganese and zinc. The dry-ashing barium sulphate method of Chapman & Pratt (1961) was used for sulphur determination. The determinations were carried out in duplicate.

Anti-nutritional constituents

All determinations were carried out in triplicate. Hydrocyanic acid was by the alkaline titrimetric method (AOAC, 1970); tannin was by the method described by Burns (1971) and oxalate was by the method of Dye (1956).

RESULTS AND DISCUSSION

The results of the proximate analysis of mature unripe and ripe fruits of *Dennettia tripatela* are shown in Table 1. The flesh is shown to contain comparatively higher moisture ranging between 81% and 82%. This is reflected in the more succulent nature of the flesh compared with the more fibrous nature of the seed. The protein content is higher compared with the flesh and this seemingly justifies the preferential consumption of the seeds by most people. Protein content in plants is known to increase with maturity and this probably accounts for the higher protein content in ripe flesh and seed. The values of protein content reported here are relatively high compared with those of some other fruits like apple (24% DM),

TABLE 1
Proximate Composition of Unripe and Ripe Fruits of *Dennettia tripatela*

Constituents	*Per cent dry weight**			
	Flesh		*Seed*	
	Unripe	*Ripe*	*Unripe*	*Ripe*
Moisture†	81	82	62	24
Ether extract (crude lipid)	2	3	6	19
Crude protein	4	12	15	16
Crude fibre	11	17	14	20
Ash	6	4	4	6
Total carbohydrate	88	81	62	83

* Means of three determinations.
† On fresh weight basis.

avocado pear (4% DM), banana (5% DM) and guava (5% DM) (FAO, 1968).

The petroleum ether extract (crude lipid) in the flesh is considerably lower than in the seed, and an apparent preferential accumulation of crude lipid in the seed as the fruit matures is evident. This becomes more apparent when values are expressed in terms of fresh weight of fruits. However, these values fall within the range reported for crude lipid in other fruits (FAO, 1968). The fibre content is also shown to increase with maturity from unripe to ripe fruit in both the flesh and seed. Although the absence of dietary fibre has been associated with a wide range of diseases in man (Eastwood, 1974), it has been reported that the values of plant foods as dietary sources of protein deteriorate at certain critical protein: fibre ratios (Pirie, 1959). The very low protein: fibre ratio (between 3:4 and 1:1) in these fruits does not seem to recommend their value as sources of protein for the consumer.

The mineral and vitamin contents in the fruits of *Dennettia* are shown in Table 2. These results show that the fruits are comparatively rich in calcium (210–527 mg% DM), magnesium (238–420 mg% DM) and iron (12–77 mg% DM). The contents of manganese and zinc are also relatively high. The high content of sulphur probably indicates a high content of sulphur amino acids. The contents of most of these mineral elements are comparable with values reported for other fruits (FAO, 1968).

The ascorbic acid content is shown to increase from flesh to seed of

TABLE 2
Mineral and Vitamin Composition of Unripe and Ripe Fruits of *Dennettia tripatela*

Constituents	*mg% dry weight**			
	Flesh		*Seed*	
	Unripe	*Ripe*	*Unripe*	*Ripe*
Calcium	210	265	527	315
Magnesium	238	340	420	240
Manganese	11	10	13	12
Iron	77	12	57	75
Zinc	7	3	5	5
Sulphur (g%)	4	4	4	3
Ascorbic acid	2	2	3	3

* Mean of two determinations.

Dennettia although these values (2–3 mg% DM) appear low compared with the range of values reported for other fruits (9 mg% in Tamarind to 1831 mg% in guava) (FAO, 1968).

The contents of some anti-nutritional constituents are shown in Table 3. Tannin is comparatively higher in the flesh of the fruits of *Dennettia*, and is also shown to increase from unripe to ripe fruit (31–61 mg% DM). The presence of tannin is reported to have an adverse effect on the protein value of plant foods (Ford & Hewitt, 1979). However, the tannin content in *Dennettia* is low compared with values reported for some other foodstuffs (260–2370 mg% DM in sorghum) by the same authors. Some therapeutic effects of tannin have also been reported (Ekabua & Eka, 1978). The total oxalate content is shown to range between 236 and

TABLE 3
Composition of Some Anti-nutritional Substances in the Unripe and Ripe Fruits of *Dennettia tripatela*

Constituents	*mg% dry weight**			
	Flesh		*Seed*	
	Unripe	*Ripe*	*Unripe*	*Ripe*
Tannin	31	61	8	13
Total oxalate	237	355	404	242
Hydrocyanic acid	355	48	22	14

* Mean of three determinations.

404 mg% DM. Oxalate, especially the soluble fraction, is known to precipitate calcium salts.

However, the total oxalate values reported here are low compared with the lethal dose of 2–5 g reported for soluble oxalate (Oke, 1966). The hydrocyanic acid content in the flesh of the fruit is shown to decrease from unripe to ripe. Chakraborty & Eka (1978) also reported some reduction in hydrocyanic acid content in the back of ripe plantain fruit compared with that of the unripe fruit. These studies also show a higher hydrocyanic acid content in the ripe seed compared with the flesh, on a fresh weight basis. It is possible that the hydrocyanic acid is hydrolysed during ripening and is easily lost from the flesh into the atmosphere.

However, the hydrocyanic acid contents in the flesh and seed of ripe fruits of *Dennettia* compare quite favourably with values reported for some other fruits (Chakraborty & Eka, 1978).

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REFERENCES

AOAC (1970). *Official methods of analysis* (12th edn). Association of Official Analytical Chemists, Washington, DC.

Association of Vitamin Chemists (1966). *Methods of vitamin assay* (3rd edn). Interscience, New York, 127–47.

Burns, R. E. (1971). Method of estimation of tannin in grain sorghum. *Agron. J.*, **63**, 511.

Chakraborty, K. & Eka, O. U. (1978). Studies on hydrocyanic, oxalic and phytic acid content of foodstuffs. *W. Afr. J. Biol. Appl. Chem.* **21**(1–4), 50–55.

Chapman, H. D. & Pratt, P. F. (1961). In: *Methods of analysis for soil, plants and waters*, Agric. Publ. Univ. of Calif. Riverside, 195–6.

Dye, W. B. (1956). Studies on *Halogeton glomerulus*, *Weed*, **4**, 55–60.

Eastwood, M. A. (1974). Dietary fibre in human nutrition. *J. Sci. Fd. Agric.*, **25**, 1523–7.

Ekabua, C. & Eka, O. U. (1978). Studies on tannic acid produced by *Psidium guajova*. *J. Pharm. Med. Sci.* **2**, 47–50.

FAO (1968). *Food and Agricultural Organisation of the United Nations. Food Composition Table for use in Africa*, Rome.

Ford, J. E. & Hewitt, D. (1979). Protein quality in cereals and pulses. 1 Application of microbiological and other *in vitro* methods in the evaluation of rice, sorghum, barley and field beans. *Br. J. Nutr.* **41**, 341–52.

Freebairn, H. T. (1959). Determination and stabilization of reduced ascorbic acid in extracts from plant material. *Anal. Chem.* **31**, 1850–1.

Oke, O. L. (1966). Chemical studies on the more commonly used leaf vegetables in Nigeria. *J. West Afr. Sci. Assoc.* **II**(1 & 2), 42–8.

Pirie, N. W. (1959). Leaf proteins. *Ann. Rev. Plt. Physiol.* **10**, 33–52.

Walsh, L. M. (1971). In: *Instrumental methods for analysis of soils and plant tissues*, Soil Science Society of America Inc., Madison, Wisconsin, USA, 17–37.