

Mineral and nutritive value of *Dennettia tripetala* fruits

Donatus Ebere Okwu^{a*}, Frank N.I. MORAH^b

^a Department of Chemical Sciences, Michael Okpara University of Agriculture, Umudike, PMB 7267, Umuahia, Abia State, Nigeria
ebereokwu@fastemail.com

^b Department of Chemistry, University of Calabar, Calabar, Cross River State, Nigeria

Mineral and nutritive value of *Dennettia tripetala* fruits.

Abstract — Introduction. *Dennettia tripetala* G. Baker (Annonaceae), or pepper fruit tree, is a well-known Nigerian spicy medicinal plant. The mineral, vitamin and nutrient composition of the fruit of *Dennettia tripetala* were determined. **Materials and methods.** Ripe fruits of *Dennettia tripetala* were analysed for proximate composition, and mineral and vitamin contents. **Results and discussion.** Our work showed that *Dennettia tripetala* contained crude protein (15.31%), total carbohydrate (62%), crude fibres (9.84%), crude lipids (3.47%) and moisture (8.0%). It had a calorific value of 480.24 g cal·100 g⁻¹ of fresh fruit, and mineral content comprised: calcium (1.80%), phosphorus (0.33%), potassium (2.50%) and magnesium (0.42%). Trace elements included iron, copper, zinc and cadmium, but chromium was not detected. The water-soluble vitamins include ascorbic acid, thiamine, riboflavin and niacin. **Conclusion.** Our work justifies the use of *Dennettia tripetala* fruits as food and a drug in herbal medicine in Southeastern Nigeria.

Nigeria / *Dennettia tripetala* / fruits / proximate composition / nutritive value / energy value / medicinal properties

Teneur minérale et valeur nutritive des fruits de *Dennettia tripetala*.

Résumé — Introduction. *Dennettia tripetala* G. Baker (Annonaceae) est une plante médicinale à épice bien connue au Nigeria. La composition minérale, les vitamines et la valeur nutritive de son fruit ont été déterminées. **Matériel et méthodes.** Des fruits mûrs de *D. tripetala* ont été analysés pour leur composition globale et leurs teneurs en éléments minéraux et en vitamines. **Résultats et discussion.** Nos travaux ont montré que le fruit de *D. tripetala* contenait des protéines brutes (15,31 %), des hydrates de carbone totaux (62 %), des fibres brutes (9,84 %), des lipides bruts (3,47 %) et 8,0 % d'humidité. Sa valeur calorifique est de 480,24 g cal·100 g⁻¹ de fruit frais et il contient du calcium (1,80 %), phosphore (0,33 %), potassium (2,50 %) et magnésium (0,42 %). Les oligoéléments du fruit incluent le fer, le cuivre, le zinc et le cadmium, mais le chrome n'a pas été détecté. Le fruit contient également des vitamines hydrosolubles comme l'acide ascorbique, la thiamine, la riboflavine et la niacine. **Conclusion.** Nos travaux justifient l'utilisation des fruits de *D. tripetala* pour l'alimentation humaine, la pharmacopée et la médecine traditionnelle dans le sud-est du Nigeria.

* Correspondence and reprints

Fruits, 2004, vol. 59, p. 437–442
© 2005 Cirad/EDP Sciences
All rights reserved
DOI: 10.1051/fruits:2005006
RESUMEN ESPAÑOL, p. 442

Nigéria / *Dennettia tripetala* / fruits / composition globale / valeur nutritive / valeur énergétique / propriété pharmacologique



Figure 1.
Fruits of *Dennettia tripetala*.

1. Introduction

In Nigeria, many indigenous plants are used as spices, food or medicine. A great number of these plants are traditionally noted for their medicinal and pesticide properties. *Dennettia tripetala* (pepper fruit) is a medium sized tree found commonly in the tropical rainforest region of Nigeria and sometimes in savannah areas. The young leaves and fruits have a distinctive spicy taste [1].

Pepper fruit tree is a tropical tree common in the mangrove forests of the west coast of Africa. It flowers at the beginning

of the rainy season, especially during the months of April and May [2]. The mature fruits (ripe or unripe, *figure 1*) constitute the major edible portions. However, some communities in parts of Southern Nigeria also utilise the leaves and the roots in addition to the fruits for medicinal purposes [2, 3]. *Dennettia tripetala* is used for masticating which, when chewed, produces a special peppery effect [4]. The peppery, spicy taste of mature fruits usually serves as a mild stimulant to the consumer. The fruits are sometimes taken with kola nut, garden egg and palm-wine in parts of Nigeria [2]. The fruit of *Dennettia tripetala* is quite popular in Southern Nigeria where it serves for cultural entertainment of guests, particularly during coronation, the new yam festival and marriage ceremonies [4]. It is used as a spice, seasoning or natural flavour which is added to prepared food such as meat, sausage, stew, soup and vegetables. The bark of *Dennettia tripetala* fruits is mixed with food to create variation in the taste and flavour of different foods [5–7]. It has been reported [2] that the peppery fruits of *Dennettia tripetala* usually find application in food meant for pregnant women. Moreover, *Dennettia tripetala* seeds are very important in the diets of women after childbirth, during which time it is claimed that spices and herbs aid the contraction of the uterus [8].

The various constituents of this important fruit have not been fully documented. Little is known of the composition of *Dennettia tripetala* fruit despite its widespread multipurpose uses as food and drugs. The present study was designed to determine the mineral and nutritive value of *Dennettia tripetala* fruit and, consequently, assess its potential usefulness as a pharmaceutical raw material in the formulation of drugs.

2. Materials and methods

2.1. Sample collection

Fruits of *Dennettia tripetala* were purchased from Ariam market, Ikwuano local government area of Abia State, Nigeria, on 10 May, 2000. The plant materials (leaves, flowers

Table I.Proximate composition, calorific value and hydrogen cyanide content of *Dennettia tripetala*.

Crude protein (N × 6.25) (%)	Fat oil (%)	Carbohydrates (%)	Ash (%)	Crude fibre (%)	Moisture (%)	Calorific value g cal ⁻¹ ·100 g ⁻¹	Dry matter (g·100 g ⁻¹)	Hydrogen cyanide (mg·kg ⁻¹)
15.31 + 0.30	3.47 + 0.20	62.00 + 0.50	4.25 + 0.10	9.84 + 0.20	8.00 + 0.10	480.24 + 0.10	92.00 + 0.10	0.02 + 0.10

Values are means + standard deviation of five determinations.

and fruits) were identified and authenticated. The voucher specimens were deposited in the Forestry Department, Herbarium of Michael Okpara University of Agriculture, Umudike.

2.2. Sample preparation

One kilogram of ripe fruits of *Dennettia tripetala* was sun-dried. The dried samples were milled with an electric blender before being ground into powder with a manual blender and stored in airtight bottles until required for analysis.

2.3. Mineral and nutrient analysis

Total nitrogen content was determined by using a Kjeldahl apparatus [9]. The protein content was calculated by (N × 6.25). Moisture, crude fat (ether extract), crude fibre and ash content were determined according to the AOAC [10] methods. Total carbohydrate was estimated as the remainder after accounting for ash, crude fibre, protein and fats [11]. The gross food energy was estimated according to the method of Osborne and Voogt [12] using the equation: food energy in gram calories = (crude protein in % × 4) + (lipid content in % × 9) + (carbohydrates in % × 4).

The ground plant samples were sieved with a 2-mm rubber sieve and 0.2 g of the sieved plant sample was measured into 25 mL of perchloric acid using Johnson and Ulrich's method [13]. Following digestion, mineral content was determined by an Atomic Absorption Spectrophotometer (AAS), UNICAMP 919 solar model, after the development of colour

with ammonium molybdate. The results were expressed on a dry matter basis.

The B-complex vitamins, comprising thiamine, riboflavin and niacin, were determined according to the method of Barakat *et al.* [14].

3. Results and discussion

D. tripetala fruit is a good source of dietary nutrients. It has high protein content (15.31%, *table I*). Plant protein may be consumed as the raw plant or cooked [5]. The fruit is not only rich in protein but also in calories. *Dennettia tripetala* has food energy of 480.24 g calories. This high-energy value might be due to high oil content. The fruit contains both essential oils and volatile oils [15]. The essential oil contains fragrant, aromatic and pungent principles. The volatile oils are responsible for the aroma and taste of *D. tripetala* fruit [5]. This prompted its inclusion in food as a spice and flavouring agent for meal preparations, soups, sauces and canned foods [5].

The total carbohydrates (*table I*) available in the fruit are high (62%). They comprise sugars such as glucose, sucrose and fructose, hemicellulose and pectin, which act as dietary fibre, add bulk to the diet and may, sometimes, act as a mild natural laxative for human beings [5]. *D. tripetala* fruit contains crude fibre (9.8%). Most ripe fruits contain no starch while some unripe fruits may contain a reasonable amount of starch. The fruits therefore are regarded as healthy foods and their consumption is beneficial in many ways. They provide dietary fibre, which, among other things, promotes bowel regularity,

Table II.
Mineral composition of *Dennettia tripetala* on a dry weight basis.

Major elements (%)					Trace elements (mg·kg ⁻¹)							
Calcium	Magnesium	Phosphorus	Potassium	Sodium	Iron	Copper	Zinc	Cadmium	Nickel	Chromium	Manganese	Cobalt
1.80 + 0.40	0.42 + 0.30	0.33 + 0.10	2.50 + 0.10	0.72 + 0.10	17.75 + 0.30	0.78 + 0.20	2.30 + 0.01	0.29 + 0.10	0.35 + 0.20	0.00	2.01 + 0.50	0.55 + 0.20

Values are means + standard deviation of five determinations.

softens stools and enhances frequent waste elimination, including bile acids, sterols and fat [2]. Fibre has a physiological effect on the gastrointestinal function of promoting the reduction of tracolonic pressure, which is beneficial in diverticular disease [16]. This disease is characterised by small “blow-out-type” protruding lesions on the large intestine which progress to inflammation that may eventually burst, thus producing infection and cancer of the colon [16, 17].

Fibre also has a biological effect on the absorption and reabsorption of cholesterol and bile acid, respectively [16]. Fibre helps to prevent the reabsorption of bile acids and, consequently, of dietary fat cholesterol. This, in turn, lowers the cholesterol and prevents formation of plaques whose components are cholesterol, some fats and protein [17]. Rural communities, which consume large quantities of this fruit, have a low incidence of diverticular disease. It is therefore vital that high-fibre food such as *Dennettia tripetala* fruit should continue to form part of our diet in this part of the world.

The hydrogen cyanide level in the fruit was low (0.02 mg·kg⁻¹). The level of the cyanogenic glucosides is so low that man can consume this fruit raw without it being deleterious to health. The moisture content of *D. tripetala* fruits is high (8.00%). This characteristic is a function of quality and this definitely determines how fresh fruit was at harvest or how long it has been stored before analysis [2]. Some other factors apart from season affect the moisture content of *D. tripetala*. These include the location of the plant and the stage of maturity of the fruit.

Potassium and calcium of *D. tripetala* fruits are very high [(2.48 and 1.80)%, respec-

tively] (*table II*). The sodium content is fair (0.72%). Zinc, copper, manganese, cobalt, nickel and cadmium are available in trace quantities. The zinc content could mean that it can play a valuable role in the management of diabetes, which results from insulin malfunctioning. Zinc is essential for the production of insulin, a hormone and carbonic anhydrase, an enzyme in the body [18].

The iron level is high in the fruit (17.75 mg·kg⁻¹). This element is known to be important in the human body because it is a component of haemoglobin. It helps oxygen transport and, together with haemoglobin and ferredoxin, it plays a vital role in man's metabolism. Chromium was not detected.

D. tripetala fruit contains several nutrients and biologically active components that prolong and enhance life. It is a good source of ascorbic acid, riboflavin, thiamine and niacin (*table III*). Therefore, this fruit is nutritionally necessary for a well-balanced diet because it contributes important vitamins such as vitamin C (ascorbic acid) which can be used for the treatment of the common cold and the control of other diseases such as prostrate cancer [19].

Lack of ascorbic acid impairs the normal formation of intercellular substances throughout the body, including collagen, bone matrix and tooth dentin. A striking pathological change resulting from this defect is the weakening of capillaries due to a reduction in the amount of intercellular substances [20]. Therefore, the clinical manifestation of scurvy haemorrhaging from the mucous membranes of the mouth and gastrointestinal tract, anaemia, pains in the joints and defects in skeletal clarification can be related to the association of ascorbic acid and normal connective

Table III.
Vitamin content of *Dennettia tripetala* fruits.

Vitamins (mg·100 g ⁻¹ on a dry weight basis)			
Thiamine (vitamin B1)	Riboflavin (vitamin B2)	Niacin (nicotinic acid)	Ascorbic acid (vitamin C)
0.12 + 0.10	0.56 + 0.01	10.08 + 0.20	58.48 + 0.20

Values are means + standard deviation of five determinations.

tissue metabolism [20]. This function of ascorbic acid also accounts for its requirement for normal wound healing [20].

4. Conclusion

Based on our findings, it is apparently clear that *D. tripetala* contains important nutritive substances such as vitamins, minerals and fibre. The outcome of this investigation has greatly elucidated the nutritive composition of these fruits, which can be considered as quality food with good medicinal properties. They can serve as potent, nutritious food supplements and drugs.

Acknowledgements

Special gratitude goes to the Senate of Michael Okpara University of Agriculture, Umudike, Nigeria, for a grant given to D.E. Okwu in support of this work. We are also grateful to Dr A. Nmergini of the Forestry Department, Michael Okpara University of Agriculture, Umudike, who authenticated the samples.

References

- [1] Keay R.W.J., *Trees of Nigeria*, Clarendon Press Oxford, UK, 1989, pp.19–30.
- [2] Umoh I.B., Commonly used fruits in Nigeria. Nutritional quality of plant foods, Osagie A., Eka O.A. (Eds.), Postharvest Res. Unit Publ., Univ. Benin, 1998, pp. 256–262.
- [3] Iwu M.M., Food for medicine, in: Iwu M. (Ed.), dietary plants and masticators as sources of biologically active substances, Univ. Ife Press, Ile Ife, Nigeria, 1989, pp. 303–310.
- [4] Okigbo B.N., Plants and food in Igbo culture, Ahiajoku lect. publ. by Cult. Div., Minist. Inf., Cult. Youth and Sports, Owerri Imo State, Nigeria, 1980.
- [5] Enwere N.J., Foods of plant origin, Afro-Orbis Publ. Ltd., Univ. Nigeria, Nsuka, Nigeria, 1998.
- [6] Okwu D.E., Flavouring properties of spices on cassava fufu, Afr. J. Roots Tuber Crop 3 (1999) 18–20.
- [7] Okwu, D.E., Evaluation of the chemical composition of indigenous spices and flavouring agents, Glob. J. Pure Appl. Sci. 7 (2001) 455–459.
- [8] Achinewhu S.C., Ogbonna C.C., Hart A.D., Chemical composition of indigenous wild herbs, spices, fruits, nuts and leafy vegetable used as food, J. Plant Food Hum. Nutr. 48 (1995) 341–388.
- [9] Anonymous, Methods of analysis, 12th ed., Assoc. Offic. Anal. Chem. (AOAC), Washington D.C., USA, 1975.
- [10] Anonymous, Official methods of analysis, 13th ed., Assoc. Offic. Anal. Chem. (AOAC), Washington D.C., USA, 1980.
- [11] Muller H.G., Tobin G., Nutrition and food processing, Croom Helm Ltd., London, UK, 1980.
- [12] Osborne D.R., Voogt P., Calculation of caloric value in the analysis of nutrients in roots, in: Osborne D.R., Voogt P. (Eds.), Analysis of nutrients in roots, Acad. Press, New York, USA, 1978, pp. 239–240.
- [13] Johnson C.M., Ulrich A. Analytical methods for use in plant analysis, Bill 766, California Agric Exp., Staberkeley, USA, 1956.

- [14] Barkat M.Z., Shehab S.K., Daswish N., Zahermy E.I., Determination of ascorbic acid from plants, *J. Anal. Biochem.* 53 (1973) 225–245.
- [15] Osisiogu I.U.W., Essential Oils of *Dennettia tripetala*, *Plant Med.* 27 (1975) 287–289.
- [16] Akobundu E.N.T., Healthy foods in human nutrition, *J. Sustain. Agric. Environ.* 1 (1999) 1–7.
- [17] Scala J., Fiber: the forgotten nutrient, *Food Tech.* 20 (1) (1974) 34–36.
- [18] Okaka J.C., Okaka A.N.O., Foods; composition, spoilage, shelf life extension, Ocjarco Acad. Publ., Enugu, Nigeria, 2001.
- [19] Okogun J.I., The Nigeria battle against HIV/AIDS: the ignored but vital chemistry input, *Chem. Nigeria* 2 (2002) 9–11.
- [20] Hunt S., Groff J.I., Holbrook J., Nutrition, principles and chemical practice, John Wiley and Sons, New York, USA, 1980.

Contenido mineral y valor nutritivo de los frutos de *Dennettia tripetala*.

Resumen — Introducción. *Dennettia tripetala* G. Baker (Annonaceae) es una planta medicinal y una especie bien conocida en Nigeria. Se determinó la composición mineral, las vitaminas y el valor nutritivo de su fruto. **Material y métodos.** Se analizaron algunos frutos maduros de *D. tripetala* para determinar su composición global y su contenido de elementos minerales y vitaminas. **Resultados y discusión.** Nuestros estudios mostraron que el fruto de *D. tripetala* contenía proteínas brutas (15,31%), hidratos de carbono totales (62%), fibras brutas (9,84%), materia grasa bruta (3,47%) y 8,0% de humedad. Su valor calorífico es de 480,24 g cal·100 g⁻¹ de fruta fresca y contiene calcio (1,80%), fósforo (0,33%), potasio (2,50%) y magnesio (0,42%). En los oligoelementos del fruto se encontró hierro, cobre, cinc y cadmio, pero no se detectó cromo. El fruto también contiene vitaminas hidrosolubles como ácido ascórbico, tiamina, riboflavina y niacina. **Conclusión.** Nuestros estudios justifican la utilización de los frutos de *D. tripetala* para la alimentación humana, la farmacopea y la medicina tradicional en el sureste de Nigeria.

Nigeria / *Dennettia tripetala* / frutas / composición aproximada / valor nutritivo / valor energético / propiedades medicinales

