

Fruit nutritive composition of *Maesobotrya barteri*, an under-exploited tropical African tree

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Fruit nutritive composition of *Maesobotrya barteri*, an under-exploited tropical African tree.

Abstract — Introduction. In Nigeria, the species *M. barteri* is under-exploited although the tree is of both medicinal and nutritional importance. It bears succulent black-purple fruits that are edible and stain the tongue. The seeds are often with a conspicuous caruncle, with the endosperm present or absent. We studied the nutritive values of the fruit and seeds. **Materials and methods.** After sampling the fruits in a forest of Abia State, Nigeria, they were washed and opened. The seeds were removed from the succulent portion (pulp). Both pulp and seeds were dried in an oven at 65 °C for 5 h, before being ground to obtain powdery samples. The crude protein, moisture, crude fat, crude fiber, ash contents, total carbohydrate, vitamin contents (A, C, E, thiamine, riboflavin and niacin) and mineral elements were determined. **Results and discussion.** The analyses showed that both the fruit and seed of *M. barteri* are good sources of essential dietary nutrients. The values obtained are comparably higher than those reported for some common tropical African fruits.

Nigeria / *Maesobotrya barteri* / fruits / seeds / proximate composition / vitamins / mineral content

Composition nutritive du fruit de *Maesobotrya barteri*, un arbre tropical africain sous-exploité.

Résumé — Introduction. Au Nigéria, l'espèce *M. barteri* est sous-exploitée bien que l'arbre ait une importance médicinale et alimentaire. Il porte des fruits pourpre-noir succulents qui sont comestibles et colorent la langue. Les graines présentent souvent une caroncule remarquable, avec présence ou absence d'endosperme. Nous avons étudié la valeur nutritive de ces fruits et graines. **Matériel et méthodes.** Après échantillonnage des fruits dans une forêt de l'État d'Abia (Nigéria), ceux-ci ont été lavés et ouverts. Les graines ont été séparées de la partie succulente (pulpe). Pulpe et graines ont été séchées dans un four à 65 °C pendant 5 h, avant d'être moulues pour obtenir les échantillons de poudre. La teneur en protéine brute, le taux d'humidité, les corps gras bruts, les fibres brutes, la teneur en cendres, les hydrates de carbone, la teneur en vitamines (A, C, E, thiamine, riboflavine et niacine) et les éléments minéraux des échantillons ont été déterminés. **Résultats et discussion.** Les analyses ont montré que le fruit et la graine de *M. barteri* sont de bonnes sources d'éléments nutritionnels essentiels. Les valeurs obtenues sont comparativement plus élevées que celles rapportées pour certains fruits tropicaux communs en Afrique.

Nigéria / *Maesobotrya barteri* / fruits / graine / composition globale / vitamine / teneur en éléments minéraux

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1. Introduction

Nigeria is rich in a wide variety of plants that are of both medicinal and nutritional importance. However, most of these plant species have remained under-exploited because of lack of useful information on their potential as sources of substances that are vital to human health with respect to nutrition and medicine. One such plant species is *Maesobotrya barteri*.

M. barteri, a member of the family Euphorbiaceae, is the most widely distributed *Maesobotrya* species in Nigeria. It is an under-storey of high forest, with trees up to 10 m high. It is a rainforest plant occurring in Sierra Leone, Southern Nigeria and Western Cameroon [1]. *M. barteri* bears fruit from April to June, which is up to 1 cm long, ovoid and often distinctly pointed [2]. The fruits are succulent black-purple berries. They are edible and stain the tongue. The seeds are often with a conspicuous caruncle, with the endosperm present or absent.

At present, some species of plants are used worldwide in the pharmaceutical, food, cosmetics and perfumery industries; for example, as flavoring agents and natural pigments [3]. For a very long time, *M. barteri* has been in use in the local communities for the treatment of diarrhea, stomachache, dysentery, urethral discharge, venereal disease, jaundice, cough, measles and others [2].

Our paper presents the nutritive values of the fruit and seeds of the *M. barteri* tree.

2. Materials and methods

The fruits were collected in one of the forests in Ikwuano Local Government Area of Abia State, Nigeria, where the university is situated. Then, they were properly washed with water and opened. The seeds were carefully removed from the succulent portion (pulp). The outer covering of the fruits was carefully removed. Both pulp and seeds were dried in the oven at 65 °C for 5 h, then they were ground to obtain the powdery

samples of the dried pulp and seed used for the tests.

The crude protein was determined by using the Kjeldahl apparatus as described by James [4]. The moisture, crude fat (ether extract), crude fiber and ash contents were determined by the method of the AOAC [5]. The total carbohydrate was determined by estimation using the arithmetic difference described by James [4] and Pearson [6]. Vitamin A was determined by the method of the Association of Vitamin Chemists described by Kirk and Sawyer [7]. Vitamin C, thiamine, riboflavin and niacin were determined by the method of Barakat *et al.* [8]. Vitamin E was determined by the method described by Pearson [6]. The mineral elements – phosphorus, calcium, magnesium, potassium and sodium – were determined by various methods described by James [4].

3. Results and discussion

The analyses showed that both fruit and seeds of *M. barteri* are good sources of essential dietary nutrients.

3.1. Proximate composition

The carbohydrate contents of the fruit (68.9%) and seed (64.0%) are quite high when compared with other common fruits (*table I*). The carbohydrate content of some fruits has been estimated at between (5.1 and 23.0) g·100 g⁻¹ of dry matter [9]. High values have also been reported, such as 26 g·100 g⁻¹ of dry matter for orange and 25 g·100 g⁻¹ of dry matter for grape [10]. Because of the carbohydrates and the caloric value, fruits are usually recommended for weight-reducing diets as well as for providing energy for convalescing patients who often lack appetite during a period of ill health.

The crude fiber contents of the fruit (7.06%) and seed (4.54%) are quite reasonable. Values of between 0.1% and 6.8% for selected fruits and between 0.5% and 5.2% for selected seeds have been reported [10]. Dietary fiber promotes bowel regularity and

Table I.Proximate composition (% of dry matter) of pulp and seeds of *Maesobotrya barteri* fruit.

Part considered	Moisture	Ash	Fat	Protein	Fiber	Carbohydrates
Fruit pulp	6.65	5.24	7.40	11.40	7.06	68.90
Seed	3.85	3.85	14.30	13.30	4.54	64.01

Table II.Mineral composition of pulp and seeds of *Maesobotrya barteri* fruit.

Part considered	Ca	Mg	K	Na	P	Fe	Se
	(% of dry matter)		(mg·100 g ⁻¹ of dry matter)				
Fruit pulp	50.77	62.40	32.27	36.40	312.11	8.47	0.40
Seed	9.35	88.80	53.20	57.07	162.17	4.87	0

enhances frequent waste elimination, including bile acids, sterols and fat [11]. Fiber is of benefit in diverticular disease [12]. Fiber also lowers cholesterol absorption and prevents the formation of plaques whose components are cholesterol, some fats and protein [13].

The protein levels of *M. barteri* fruit (11.40%) and seed (13.30%) are quite high. However, the protein content of fruits is generally low. Platt [14] reported protein values between 0.5% and 0.8% for citrus fruits (*Citrus* spp.), 2.0% for Cape gooseberry (*Physalis peruviana*) and 1.5% for mulberry (*Morus alba*). The protein values of the fruit and seed indicate that the fruit and seed are very good sources of protein.

Fruits are not very good sources of fats and are usually recommended as part of a weight-reducing diet [15]. However, the fat content of *M. barteri* fruit (7.40%) and seed (14.3%) is quite reasonable when compared with *Treculia africana* (10.27%) and passion fruit (1.20%) [16]. High values have been reported for such fruits as avocado (*Persea americana*), 17% to 20% [17]. Very low values have been reported for such fruits as banana (0.3%), apple (0.4%), guava (0.4%) and traces for grape, mango and pawpaw [14].

3.2. Mineral composition

Both the fruit and seed of *M. barteri* are good sources of minerals (table II).

The fruit is particularly rich in phosphorus (312.11 mg·100 g⁻¹ of dry matter), magnesium (62.4 mg·100 g⁻¹) and calcium (50.77 mg·100 g⁻¹). Seed contents of magnesium (88.80 mg·100 g⁻¹) and phosphorus (162.17 mg·100 g⁻¹) are also reasonable. Selenium is present in the fruit but absent in the seed.

Values as low as 9.0 mg of Ca·100 g⁻¹, 15 mg of P·100 g⁻¹, 10 mg of Mg·100 g⁻¹, 17 mg of K·100 g⁻¹, 0.50 mg of Na·100 g⁻¹ and 0.2 mg of Fe·100 g⁻¹ have been reported for citrus species [18]. These values indicate that the fruit and seed of *M. barteri* are better sources of dietary minerals when compared with citrus fruits. However, the K to Na ratio of the sample is not of nutritional benefit since a very high K to Na ratio has been reported to be of nutritional benefit [19], especially to people with high blood pressure who have to restrict their sodium intake. However, high-K foods are omitted in the diets of people with renal failure.

The values of iron (Fe) in both *M. barteri* fruit (8.47 mg·100 g⁻¹) and seed (4.87 mg·100 g⁻¹) are very high. Iron is a component of

Table III.

Vitamins A, C and E, and thiamine, riboflavin and niacin composition ($\text{mg}\cdot 100\text{ g}^{-1}$ of dry matter) of pulp and seeds of *Maesobotrya barteri* fruit.

Part considered	Vitamin A	Vitamin C	Vitamin E	Thiamine	Riboflavin	Niacin
Fruit pulp	6.17	361.40	0	0.06	0.04	0.40
Seed	12.57	22.30	13.26	0.02	0.01	0.24

hemoglobin and helps in oxygen transport; hence, it is important for human nutrition and health.

Calcium (Ca) and phosphorus (P) help in building normal bones and teeth. Calcium also helps in cell wall formation and its absence may result in weak and stunted growth because of poor bone development [20]. Magnesium (Mg) is also used in bone formation, and muscle and nerve function.

3.3. Vitamins

The fruit and seed of *M. barteri* are good sources of vitamins A, C (ascorbic acid) and E, and they contain thiamine, riboflavin and niacin too (table III).

The vitamin A contents of both fruit ($6.17\text{ mg}\cdot 100\text{ g}^{-1}$ of dry matter) and seed ($12.57\text{ mg}\cdot 100\text{ g}^{-1}$) are very high when compared with mango fruit ($0.20\text{ mg}\cdot 100\text{ g}^{-1}$) [21]. Vitamin A (retinol) is necessary for growth, good vision, healthy tissue and reproduction. Lack of vitamin A results in night blindness [22].

The main contribution of fruits and their products to nutrition is undoubtedly their supply of vitamins, most especially the antiscorbutic vitamins [23]. High values of 300 mg of ascorbic acid $\cdot 100\text{ g}^{-1}$ of dry matter have been reported for guava, $112\text{ mg}\cdot 100\text{ g}^{-1}$ for pawpaw, $43\text{ mg}\cdot 100\text{ g}^{-1}$ for orange, $179.8\text{ mg}\cdot 100\text{ g}^{-1}$ for cashew [24] and $300\text{ mg}\cdot 100\text{ g}^{-1}$ for mango fruit [21]. Therefore, the value of 361.4 mg of ascorbic acid $\cdot 100\text{ g}^{-1}$ found for the fruit of *M. barteri* is very reasonable. However, the value of $22.3\text{ mg}\cdot 100\text{ g}^{-1}$ observed for the seed is quite low. Vitamin C is useful in the treatment of common cold and control of other diseases such as prostate cancer [25].

Vitamin E has a high value of $13.26\text{ mg}\cdot 100\text{ g}^{-1}$ in the seed of *M. barteri* but it is absent in the fruit. Vitamin E plays a role as an anti-oxidant. It protects the red blood cell membrane from damage and breakage (hemolysis). It also helps to improve vitamin A adsorption if the dietary intake of vitamin A is low; in addition, vitamin E is used to metabolize iron in the cell and helps maintain nervous tissues, immune and insulin function [26].

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References

- [1] Keay R.W.J., Trees of Nigeria, Clarendon Press Oxford, UK, 1989.
- [2] Dalziel J.M., The useful plants of tropical West Africa, Crown Overseas Agents Colon., London, UK, 1948.
- [3] Frantisek S., The natural guide to medicinal herb plants. Tiger Books Int., Twickenham, UK, 1998.
- [4] James C.S., Analytical chemistry of foods, Chapman and Hall, NY, USA, 1995.
- [5] Anon., Official methods of analysis, Assoc. Off. Anal. Chem. (AOAC), 15th ed., Washington D.C., USA, 1990.
- [6] Pearson D., The chemical analysis of foods, 7th ed., Churchill Livingstone, Edinburgh, UK, 1976.
- [7] Kirk R.S., Sawyer R., Pearson's composition and analysis of foods, 9th ed., Longman Sci. Tech. Group, UK, 1991.

- [8] Baraket M.Z., Shehab S.K., Daswish N., Zaherymy E.I., Determination of ascorbic acid from plants, *J. Anal. Biochem.* 53 (1973) 225–245.
- [9] Watt B.K., Merrill A.L., Composition of foods, Agric. Handb. No. 8, Consum. Food Econ. Res. Serv. US. Dep. Agric., USA, 1963.
- [10] Osee H., Bennion M., Introductory foods, 3rd ed., The MacMillan Co., Collier-MacMillan Ltd., London, UK, 1970.
- [11] 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., NY, USA, 1978, pp. 239–240.
- [12] Akobundu E.N.T., Healthy foods in human nutrition, *J. Sustain. Agric. Environ.* (1999) 1–7.
- [13] Scala J., Fiber: the forgotten nutrients, *Food Technol.* 20 (1) (1974) 34–36.
- [14] Platt B.S., Tables of representative values of foods commonly used in tropical countries, HMSO, Med. Res. Coun., spec. rep. ser., No. 302, London, UK, 1962.
- [15] Umoh I.B., Fats in fruits, in: *Nutritional quality of plant foods*, Osagie A.U., Eka O.U. (Eds.), Post harvest research unit, Dep. Biochem., Univ. Benin, Nigeria, 1998.
- [16] Ekpeyong T.E., Chemical composition and amino acid content of African breadfruit (*Treculia africana*), *Food Chem.* 17 (1985) 39–64.
- [17] Ihekoronye A.L., Ngoddy P.O., *Integrated food science and technology for the tropics*, Macmillan Publ., London, UK, 1985.
- [18] Reuther W., Webber H.J., Batchelor L.D., *The citrus industry, vol. I: History, world distribution, botany and varieties* (revis. ed.), Univ. Calif., Div. Agric. Sci., Berkeley, USA, 1967.
- [19] Meneely G.B., Barttablee H.D., Sodium and potassium, *Nutr. Rev.* 34 (1976) 225–235.
- [20] Ekpa O.D., Nutrient compositions of three Nigerian medicinal plants, *Food Chem.* 57 (1996) 229–232.
- [21] Vickery M.L., Vickery B., *Plant products of tropical Africa*, Macmillan Press Ltd., London, UK, 1979.
- [22] Wardlaw G.M., *Contemporary nutrition issues and insights*, 4th Ed., McGraw Hill, Boston, USA, 2000.
- [23] Mapson L.W., Vitamins in fruits, in: Hulme A.C. (Ed.), *The biochemistry of fruits and their products*, vol. 1, Acad. Press, London, UK, 1970, pp. 369–383.
- [24] Onyenuga V.A., *Nigerian foods and feeding stuffs. Their chemistry and nutritive value*, Ibadan Univ. Press, Ibadan, Nigeria, 1968.
- [25] Okogun J.I., The Nigerian battle against HIV/AIDS. The ignored but vital chemistry impute, *Chem. Nigeria* 2 (2002) 9–11.
- [26] Wardlaw G.M., Kessel M., *Perspectives in nutrition*, 5th Ed., McGraw Hill, NY, USA, 2002.

Composición nutritiva del fruto de *Maesobotrya barteri*, un árbol tropical africano poco explotado.

Resumen — Introducción. En Nigeria, la especie *M. barteri* se explota poco, a pesar de la importancia medicinal y alimentaria que posee el árbol. Éste produce succulentos frutos de color negro-púrpura que son comestibles y colorean la lengua. Las semillas presentan a menudo un distinguido carúnculo, con la presencia o ausencia de endosperma. Estudiamos el valor nutritivo de estos frutos y semillas. **Material y métodos.** Tras un muestreo de los frutos en un bosque del estado de Abia (Nigeria), éstos se lavaron y se abrieron. Se separaron las semillas de la parte succulenta (pulpa). Se secaron la pulpa y las semillas en un horno a 65 °C durante 5 h, antes de ser molidos para obtener las muestras en polvo. Se determinaron el contenido en proteína bruta, el índice de humedad, los cuerpos grasos brutos, las fibras brutas, el contenido en cenizas, los hidratos de carbono, el contenido en vitaminas (A, C, E, tiamina, riboflavina y niacina) así como los elementos minerales. **Resultados y discusión.** Los análisis mostraron que el fruto y la semilla de *M. barteri* son buenas fuentes de elementos nutricionales esenciales. Los valores obtenidos son más elevados en comparación con aquellos aportados por ciertos frutos tropicales comunes en África.

Nigeria / *Maesobotrya barteri* / frutas / semilla / composición aproximada / vitaminas / contenido mineral