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Evaluation of Nutritional and Phytochemical Profiles of *Garcinia manni* Oliv. Used as Chewing Ntick in Mbiama, River State

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Abstract: This study evaluated the mineral element, proximate, and phytochemical composition of Garcinia manni used as chewing sticks in Mbiama, Ahoada Local Government Area, River State, Nigeria. This species was rich in minerals in stem segments in sequence from the highest proportion as follows: potassium (3.54±0.30mg/100g), calcium (3.23±0.20 mg/100g), magnesium (2.42±0.84 mg/100 g), sodium (2.30±0.25 mg/100 g), phosphorus (1.04±0.70mg/100g), zinc (0.31±0.03 mg/100 g), iron (0.21±0.09 mg/100 g), manganese (0.04±0.06 mg/100g), and copper (0.03±0.02 mg/100g). Proximate composition analysis revealed rich proportions of food materials in stem segments of the test plant in sequence from the highest proportion as follows: carbohydrate (84.90± 0.41%), crude fat (4.66±0.70%), moisture (3.18±0.11%), crude protein (3.31±0.30%), crude fibre (2.23±0.60%) and crude ash (1.73±0.42%). Phytochemical analysis showed considerable levels of bioactive substances in stem segments of the test plant in sequence from the highest proportion as follows: tannin (7.22±0.42%), alkaloid (2.02±0.40%), saponin (1.70±0.32%), phytate (0.05±0.02%) and oxalate (0.04±0.01%). This study revealed that G. manni are a potential source of nutritional and medicinal value for oral health maintenance and industrial purposes.

Keywords: *Nutritional, phytochemical, Garcinia manni,, River State*

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1.0 Introduction

A wide range of plant parts such as root, stem, flower, fruit, twig exudates and modified plant organs is known to be beneficial for both domestic and industrial purposes due to their nutritional and medicinal properties (Akande and Ajao, 2011; Maňourová *et al*., 2019). *Garcinia manni* Oliv. Belongs to the family Clusiaceae, and is one of the commonly used plant species for maintenance of oral hygiene, as well as an important species in terms of its medicinal, nutritional and ecosystem benefits (Akande and Ajao, 2011). *Garcinia manni* is a medium-sized evergreen tree that can reach a height of about 15 to 20 meters (49 to 66 feet), and has a straight trunk covered with smooth, grayish-brown bark. The leaves are dark green, glossy, and elliptical, with a prominent midrib. The tree produces small, yellow flowers that give way to round or ovoid fruits, similar in appearance to mangosteen, with a thick rind (Ndoye *et al*., 2011, Lengkeek *et al*., 2013). *Garcinia manni* is native to tropical rainforests in West and Central Africa. It can be found in countries such as Cameroon, Nigeria, Gabon, and Congo. Much interest and consideration have been given to studies of this species because of the economic importance of non-timber forest products (NTFP) to the people (Akande and Hayashi, 1998).

In Africa, chewing sticks have been recommended for oral hygiene by the World Health Organisation, hence the use of this species for this purpose for cleaning teeth and

gums and for traditional prevention of tooth decay. Most parts of Africa and Nigeria in particular, especially the southwestern part have an abundant proportion of this species with peoples' preference based on its cleansing action of the teeth; the therapeutic value, or preferred taste or flavour (Osuntokun, 2015). Leaves and flowers of experimental plants have be in the treatment of different varieties of infections and diseases. The fruit of *Garcinia manni* is edible and has a pleasant, tangy taste. It can be consumed fresh or used in the preparation of juices, jams, desserts, and other culinary. *Garcinia manni* has been used in traditional medicine in some regions. Various parts of the plant, including the leaves and bark, are believed to possess medicinal properties. They are used to treat ailments such as fever, stomach disorders, and skin conditions (Ndoye *et al*., 2011; Osuntokun, 2015; Lengkeek *et al*., 2013)..

The processing of this indigenous material involves cutting the desired part of the stem and root, washing in water to remove the debris and dirt and removing or retention of the bark. It is important to note that hygienic herbal toothpaste could be produced using the potent bioactive components from chewing sticks, which could serve not only as a cleaning agent but also as an antipathogenic product (Osuntokun, 2015). This species belongs to the group of species regularly chewed and have varied socio-cultural importance, however, very few scientific studies have been carried out on them. Apart from the biochemical characterization and the nutritional properties of this plant, it is important to investigate the anti-nutritional factors. Therefore, this study was aimed at analyzing the Nutritional and phytochemical composition of *Garcinia manni* stem obtained from Mbiama, River State, Nigeria.

2.0 Materials and Methods

2.1 Study area

This study was conducted in Mbiama, Ahaoda Local Government Area, River State, Nigeria, and is located at coordinates of 5° 03' 38.1" N and 6° 27' 11.6" E. Ahoada is a city in Orashi Region of Rivers State, Nigeria, located northwest of Port Harcourt. Ahoada is a small place in the region of Rivers in Nigeria with a population of approximately 12,848 people and is one of the largest places. Rivers's capital Port Harcourt is approximately 53 km/ 33 mi away from Ahoada. The distance from Ahoada to Nigeria's capital Abuja is approximately 450 km / 280 mi. The inhabitants are mainly farmers, traders and fishermen. It is located in the tropical region with moderately acidic sandy loam soil, and maximum rainy season (MAPLOGS, 2023; Niger Delta Budget, 2024).

2.2 *Collection of plant samples*

Plant samples, mainly stem segments of *G. manni* were collected from secondary forests in Mbiama, Ahaoda, River State. Plant samples were identified by a taxonomic expert in the Department of Biology Federal University Otuoke, Bayelsa State, Nigeria.

2.3 Mineral analysis in stem segments of G. manni

Mineral nutrient contents in stems of the test plant were determined by first shadow-drying the stem segments for 3 days and macerated to small components. They were then oven-dried at 100^0C for 4 hours. They were crushed and ground to powder, then 2 grams each of the powders were weighed into Porcelain crucibles and placed in a muffle furnace and the furnace was set at 450^0C to ash. The ashing was done for 6 hours. The resulting ash was acid-digested in 15ml of concentrated HNO_3 (Trioxonitric acid) on a hot plate. 20ml of distilled water was then added to the crucible to dilute the acid in the crucible. The mixture was then filtered in 100ml volumetric flask and made up to the mark with distilled water. All the samples were then ready for AAS analysis. The AAS machine was then set-up and the various elements were analysed at the specific wavelengths, lamps, currents, and gas mixtures and recorded (A.O.A.C., 1999).

2.5. Phytochemical and proximate analysis of stem segments of G. manni

Phytochemical (alkaloid, tannin, saponin, oxalate, and phytate) and proximate (carbohydrate, fat, protein, fibre, ash and moisture) composition in stem segments of *G. manni* were analyzed using standard procedures (A.O.A.C., 1999).

3.0 Results and Discussion

3.1 Mineral elements in Stem of *Garcinia manni* from River State The mineral elements in the tem of *Garcinia manni* are presented in Table 1. The mineral element contents in stem segments of the test plant were in sequence from the highest proportion as follows: potassium (3.54±0.30mg/100g), calcium (3.23±0.20 mg/100g), magnesium (2.42±0.84 mg/100g), sodium (2.30±0.25mg/100g), phosphorus (1.04±0.70mg/100g), zinc (0.31±0.03mg/100g), iron (0.21±0.09mg/100g), manganese (0.04±0.06mg/100g), and copper (0.03±0.02mg/100g) (Table 1). Mineral ions are of prime importance in determining the fruit's nutritional value. Potassium, calcium, and magnesium are the major nutrients while iron, zinc, copper and other microelements are also crucial nutrients in plants. In the tissue of many plants, mineral elements play significant roles in the growth and development of plants (Lechaudel *et al*., 2005). The importance of minerals such as potassium, calcium, sodium etc. to human health is well known. The content of mineral elements in plants depends to a high degree on the prevailing soil conditions, including the intensity of nutrient enhancement (Kruczek, 2005). Mineral elements play several important roles in plants, some of which include structural, catalytic and electro-chemical functions (Anoliefo, 2006). Elements may be incorporated into the chemical structure of biological molecules or become part of a structural polymer needed for membrane hence performing the structural role, while elements may be involved in the active sites of enzymes and the enzymic reactions, indicating their catalytic roles (Anoliefo, 2006).

Table 1: Mineral elements in Stem of *Garcinia manni* from Mbiama, River State

Element	Concentration (mg/100 g)
Calcium	3.23±0.20
Magnesium	2.42±0.84
Sodium	2.30±0.25
Potassium	3.54±0.30
Phosphorus	1.04±0.70
Iron	0.21±0.09
Manganese	0.04±0.06
Copper	0.03±0.02
Zinc	0.31±0.03

Mean ± standard error from 3 replicates

3.2 : Proximate composition in Stem of *Garcinia manni* from River State

The proximate composition in the Stem of *Garcinia manni* is presented in Table 2. The proximate composition in stem segments of the test plant was in sequence from the highest proportion as follows: carbohydrate (84.90± 0.41%), crude fat (4.66±0.70%), moisture (3.18±0.11%), crude protein (3.31±0.30%), crude fibre (2.23±0.60%) and crude ash (1.73±0.42%) (Table 2). Proximate analysis in plants is an important index used to evaluate the nutritional value of a plant material **(**Sousa *et al*., 2014: Etukudo *et al*., 2015**).** Carbohydrates and proteins, which are regarded as complex organic chemical substances are the fundamental components of plants (Esenowo, 2004). Carbohydrates, proteins, lipids, proteins and nucleic acids are present in the plant protoplasm as large carbon molecules (Gupta *et al.,* 2005). Thus, carbohydrates provide the carbon skeleton for most of the organic compounds in plants and facilitate the storage of energy in plants. About 60% of the total dry mass of the living cell consists of proteins, which function as the

essential part of the metabolic machinery, as well as provide supporting filament to the cell (Esenowo, 2004). In developing countries where the cost of animal protein is beyond their income per capita, plant protein is often used as a substitute for food nutrients for the less privileged population (Ekop, 2007). Similarly, the oxidation of lipids produces a very high amount of energy as compared to carbohydrates, therefore, lipids constitute part of the bulk of energy components in plants (Verma and Verma, 2007). Therefore, the presence of an optimum proportion of food materials in plants would result in enhanced rapid growth rate, increased concentration of cytoplasm and rate of cell division (Esenowo, 2000; Verma and Verma, 2007), as well as present an indication of potential economic and industrial values (Dubey, 2006).

Table 2: Proximate composition in Stem of *Garcinia manni* from Mbiama, River State

Proximate	Contents (%)
Moisture	3.18 ± 0.11
Crude fibre	2.23 ± 0.60
Crude ash	1.73 ± 0.42
Crude fat	4.66 ± 0.70
Crude protein	3.31±0.30
Carbohydrate	84.90± 0.41

Mean ± Standard error from three replicates

3.3 : Phytochemical composition in Stem of *Garcinia Manni* from River State

The phytochemical composition in the stem of *Garcinia manni* is presented in Table 3. The phytochemical composition in stem segments of the test plant was in sequence from the highest proportion as follows: tannin (7.22±0.42%), alkaloid (2.02±0.40%), saponin (1.70±0.32%), phytate (0.05±0.02%) and oxalate (0.04±0.01%) (Table 3). This result is in line with those earlier reported by various researchers that medicinal plants contain bioactive compounds with different effects, and these secondary metabolites are known to have many biological and therapeutic properties (Egwaikhide *et al.*, 2008). Therefore, this species is expected to have many medicinal uses although, the contents of these phytochemicals were varied in distribution, such variability has been reported (Ogwuche *et al*., 2014; Etukudo and Osim, 2018). It is of interest to note that the antimicrobial constituents are present across the entire Garcinia genus with its activity spectrum including antibacterial, antifungal, antiparasitic and antiviral effects. This becomes necessary and of interest in considering the cultivation of Garcinia plants for potential commercial use (Kapadia and Rao, 2011). Alkaloids is associated with the treatment of intestinal infections (Akinpelu *et al.,* 2006; Parekh *et al.,*2007). Tannins are effective in the treatment of inflamed tissues (Parekh *et al.*, 2007, Musa, *et al*., 2009) and possess astringent properties (Igboko, 1983). Saponin has been implicated to possess medicinal value in the treatment of hyperglycaemia and human cancer (Olaleye *et al.,* 2007; Hodek *et al.,* 2002). Flavonoids have been reported to exhibit antimicrobial, anti-inflammatory and antioxidant properties (Das *et al.,* 1989). Therefore, the presence of the appropriate amount of bioactive substances in plants is an indication of potential medicinal values.

Table 3: Phytochemicals in Stem of *Garcinia manni* from Mbiama, River State

Phytochemicals (%)	Contents
Tannin	7.22±0.42
Saponin	1.70±0.32
Alkaloid	2.02±0.40
Oxalate	0.04±0.01
Phytate	0.05±0.02

Mean ± standard error from 3 replicates

4.0 Conclusion

This study has evaluated the nutritional and phytochemical characteristics in stem of

Garcinia manni from River State, Nigeria. This species indicated mineral element contents in stem segments of the test plant in sequence from the highest proportion as follows: potassium, calcium, magnesium, sodium, phosphorus, zinc, iron, manganese, and copper, while the proximate composition indicated the following in sequence from the highest proportion: carbohydrate, crude fat, moisture, crude protein, crude fibre and crude ash. In addition, the phytochemical composition in stem segments of the test plant indicated the following in sequence from the highest proportion: tannin, alkaloid, saponin, phytate and oxalate. This study revealed that the stem of *Garcinia manni* are potential source of nutritional and medicinal values for oral health enhancement and industrial purposes.

5.0 References

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Compliance with Ethical Standards

Declaration

Ethical Approval

Not Applicable

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Availability of data and materials

Data would be made available on request.

Author's Contribution

Chidiogo Evelyn Ezechukwu collected the plant samples, and processed the samples for analysis. Ikimi Charles German prepared the manuscript and conducted data analysis.