[Mbosowo et. al., Vol.6 (Iss.1): January, 2018] ISSN- 2350-0530(O), ISSN- 2394-3629(P)
(Received: Jan 17, 2018 - Accepted: Jan 30, 2018) DOI: 10.5281/zenodo.1167666

INTERNATIONAL JOURNAL OF RESEARCH – GRANTHAALAYAH
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Science

VARIATIONS IN NUTRIENT AND PHYTOCHEMICAL CONSTITUENTS IN LEAF, STEM AND ROOT OF *Garcinia Manni Oliv.* DOMESTICATED IN TROPICAL SOIL

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Abstract

Variations in nutrient and phytochemical constituents in leaf, stem and root of Garcinia manni (Oliv.) domesticated in tropical soil of Akwa Ibom State were assessed. Plant materials (leaf, stem and root) were collected from three (3) sampling locations in the study area. Elemental nutrient, proximate and phytochemical contents in the leaf, stem and root of G. manni were determined using standard procedures. There were significant ($P < 0.05$) variations in contents of nutrient elements, proximates and phytochemicals in leaf, stem and root of the test plant. The contents of anti-nutrients (cyanide, phytate, oxalate and glycoside) were relatively lower in stem than those of the leaf and root of the test plant. This study suggests that the test plant parts could be used as valuable material for the production of pharmaceutical drugs. In addition, the lower contents of anti-nutrients in the stem attest to its utilization as chewing stick.

Keywords: Variations; Nutrient; Phytochemical; Garcinia Manni; Tropical Soil.

Cite This Article: Etukudo Mbosowo M., and Fubara Gift E.. (2018). "VARIATIONS IN NUTRIENT AND PHYTOCHEMICAL CONSTITUENTS IN LEAF, STEM AND ROOT OF GARCINIA MANNI OLIV. DOMESTICATED IN TROPICAL SOIL." *International Journal of Research - Granthaalayah*, 6(1), 400-407. https://doi.org/10.5281/zenodo.1167666.

1. Introduction

The role of plants as sources of medicinal compounds for the maintenance of human health cannot be over emphasized (Etukudo and Osim, 2018). Studies on the use of plant for natural therapies have increased due to their importance as valuable sources of natural products for maintaining human health (Abdillahi *et al*., 2010, Inbathamizh and Padmini, 2013). Similarly, the use of plant compounds for pharmaceutical purposes has gradually increased in some areas. Interestingly, more individuals from developed countries use traditional medicine, which has compounds derived from medicinal plants (Okeke and Nwachukwu, 2009, Garboni *et al*., 2009, Atangwho *et al*., 2009). Therefore, it becomes pertinent to investigate such plants to better

 ISSN- 2350-0530(O), ISSN- 2394-3629(P)
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understand their properties, safety and efficiency (Nascimento *et al.,* 2000). Antimicrobial and antioxidant activities have been reported as crucial functions of phytochemicals such as terpenoids, flavonoids, alkaloids, polyphenols, tannins, saponins, pigments, enzymes and minerals have antimicrobial and antioxidant activity (Oboh and Masodje, 2009, Atangwho *et al*., 2009). One of the basic steps in the discovery of antimicrobial drugs is the antimicrobial screening of plant extracts and phytochemical analysis (Okwu and Ekeke, 2003, Selma *et al*., 2010). The test plant *Garcinia manni* is an important species in terms of its medicinal, nutritional and ecosystem benefits. It is because of the economic importance of non-timber forest products (NTFP) to the people that much interest and consideration have been given to studies in this area (Akande and Hayashi, 1998).

Garcinia manni Oliv. Belongs to the family Guttiferae *(Clusiaceae)*, and is one of the commonly used plant species for maintenance of oral hygiene (Akande and Ajao, 2011). In Africa, it is usually employed in form of chewing stick, which has been recommended for oral hygiene by the World Health Organisation. Extracts from this species have been reported to exhibit antimicrobial potency against some microorganisms (Rotimi *et al*., 1988). The antimicrobial properties of plants have been investigated by a good number of researchers globally and a vast number of known plant species have been used for therapeutic treatments. This research was conducted to evaluate the variations in nutrient and phytochemical constituents in leaf, stem and root of *Garcinia manni* domesticated in tropical soil of Akwa Ibom State.

2. Materials and Methods

2.1. Study Area

Plant materials used for this research were obtained from Ukanafun Local Government Area in Akwa Ibom State, Nigeria. Ukanafun has coordinates of 4^o 54'N and 7^o 36'E Akwa Ibom State records a mean annual rainfall of about 2000mm with an average annual minimum (23^oC) and maximum (31.7^oC) temperatures (Ayang, 2013, Wokocha and Nneke, 2011).

2.2. Collection of Plant Samples

Leaf, stem and root samples of *G. manni* were collected from three (3) sampling locations in Ukanafun Local Government Area.

2.3. Analysis of Nutrient Element

The plant samples (Leaf, stem and root) of the test plant were treated separately. Plant materials were dried after rinsing thoroughly with distilled water. The plant materials were crushed into powdered form followed by sieving through a 0.001mm wire mesh to obtain a fine powdered form. The samples were placed in small bottles for analysis. Ammonium-vanadate-molybdate method was used to determine phosphorus content by spectrophotometry. Potassium was determined by frame photometer, while other elements were assayed by atomic absorption spectrophotometer (A.O. A.C, 1999, Hack, 2000).

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2.4. Proximate Analysis

Proximate values of the plant material (leaf, stem and root) were determined using standard procedure (A.O.A.C, 1999, Hack, 2000).

2.5. Phytochemical Analysis

The plant materials (leaf, stem and root) were analysed for the proportion of simple alkaloids, tannins, flavonoids, saponins, and glycosides, phytates, oxalates and cyanides using standard procedures [Bohn and Kocipai-Abyazan, 1994, Harborne, 1973, Obadoni and Ochuko, 2001, Pearson, 1976, Ikediobi *et al*., 1980, Olugboji, 1987, Oberlease, 1962].

2.6. Statistical Analysis

Standard errors of the mean values were calculated and were subjected to analyses of variance (ANOVA) at 0.05% probability level (Obi, 2002).

3. Results and Discussions

3.1. Results

The magnesium, potassium, phosphorus, nitrogen, zinc and copper contents in leaf of *Garcinia manni* were significantly ($P<0.05$) higher than those of the stem and root (Table I). The calcium, sodium and iron contents in root of *G. manni* were comparatively ($P<0.05$) higher than those of the leaf and stem (Table I). Although, the stem of the test plant did not record any highest value of nutrient element, its value of magnesium and copper were higher than those of the root (Table I).

The moisture content, crude protein and crude lipid were significantly ($P<0.05$) higher than those of the stem and root, while the dry matter and carbohydrate contents in stem of the test plant were comparatively higher than those of the leaf and root (Table 2). Similarly, the ash and crude fibre contents in root of *G. manni* were relatively higher than those of the leaf and stem (Table 2).

The alkaloid, tannin, saponnin, phytate and oxalate contents in leaf of *G. manni* were comparative ($P<0.05$) higher than those of stem and root, while the flavonoid, glycosides and cyanide contents in roots lower than those of the leaf and stem (Table 3). However, the stem recorded the lowest values of all phytochemicals analyzed in this study (Table 3).

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Table 1: Mineral element in leaf, stem and root samples of *Garcinia manni*

Mineral elements (mg/100g)	Leaf	Stem	Root
Calcium	5.67± 0.23	3.77±0.40	7.54±0.62
Magnesium	3.84±0.41	2.89±0.36	2.67±0.33
Sodium	4.60±0.21	3.54±0.77	5.74±0.42
Potassium	6.47±0.10	4.77±0.21	5.29±0.42
Phosphorus	0.45±0.02	0.27±0.06	0.31±0.04
Nitrogen	3.47±0.16	2.19±0.24	2.42±0.20
Iron	0.22±0.04	0.17±0.06	0.25±0.03
Manganese	0.03±0.01	0.03±0.02	0.01±0.01
Zinc	0.44±0.07	0.29±0.05	0.35±0.02
Lead	-0.002±0.00	-0.000±0.00	-0.00±0.00
Copper	0.015±0.01	0.012±0.01	0.010±0.01

Mean ± standard error from 3 replicates

Table 2: Proximate contents in leaf, stem and root samples of *Garcinia manni*

Proximate content (%)	Leaf	Stem	Root
Moisture content	6.72±0.20	4.92±0.49	5.47±0.64
Ash	2.21±0.42	1.86±0.21	3.30±023
Crude Protein	6.87±0.33	3.54±0.64	3.40±0.49
Crude fibre	2.86±0.49	2.57±0.20	2.91±0.28
Dry matter	93.36±0.70	95.06±0.38	94.54±0.42
Carbohydrates	87.26±0.56	91.72±0.45	90.21±0.17

Mean ± standard error from 3 replicates

Table 3: Phytochemical contents in leaf, stem and root samples of *Garcinia manni*

Phytochemical content (%)	Leaf	Stem	Root
Alkaloid	3.20±0.14	2.29±0.40	2.33±0.36
Tannin	11.87±0.21	9.72±0.53	5.46±0.47
Flavonoid	0.26±0.06	0.38±0.02	0.42±0.06
Saponin	2.02±0.17	1.86±0.70	0.36±0.03
Glycoside	0.78±0.06	0.83±0.07	2.59±0.21
Phytate	0.036±0.02	0.030±0.01	0.022±0.01
Oxalate	0.06±0.01	0.03±0.02	0.04±0.01
Cyanide	0.001±0.00	0.002±0.00	0.004±0.00

Mean ± standard error from 3 replicates

3.2. Discussion

The result of mineral element composition clearly showed that there were marked variations in magnesium, potassium, phosphorus, nitrogen, calcium, sodium, zinc, iron and copper contents in leaf, stem and root of *Garcinia manni*. Similarly, the moisture, crude protein, dry matter, ash, crude fibre carbohydrate and crude lipid contents varied considerably in the leaf, stem and root of the test plant. This result agrees with the work of Mingzhu *et al*., 2015 that nutrient allocation and stoichiometric traits, together with water relations are fundamental features of shrubs. The pattern of nutrient concentrations in plant species have been reported to vary with geography and climate (Mingzhu *et al*., 2015, Etukudo and Osim, 2018). Nutrient distribution in leaves, stem and root is a function of the plant ability to obtain, transport and store nutrients (Lambers *et al*., 1998, Etukudo *et al*., 2015). Although, the leaves are the organs for production of plant food, the stems and roots apart from being the structural components of plants are the involved in uptake, transport accumulation, and storage of nutrients for plant biosynthesis (Chapin *et al*., 1990). Significant differences in contents of nutrient elements among leaves, stems and roots of *Reaumuria soongorica* were reported to be influenced by geography, climate and edaphic factors (Mingzhi, *et al*., 2015). This shows that the relative amount of biomass found in the various organs of plants is not fixed but may vary over time, across environments and among species (Nikias, 1994, Reich, 2002). According to Pooter *et al*. (2012) plant root receives more biomass if the limiting factors for growth such as water and nutrients are below ground while the shoot receives more biomass if the limiting factors such as light and Co_2 are above ground.

The results of the phytochemical analysis of Garcinia manni revealed that the leaf, stem and root contained varied amounts of alkaloids, tannins, flavonoids, saponins, and glycosides, phytates, oxalates and cyanides. Similar results have been reported by various researches that medicinal plants contain bioactive compounds with different effects [Egwaikhide *et al.*, 2008, Sofowora, 1993]. In addition, variations in distribution of phytochemicals among the leaf stem and root organs of plant have been reported (Ogwuche *et al*., 2014, Dikioye *et al.*, 2017, Etukudo and Osim, 2018). The importance of alkaloids has been reported (Akinpelu et al., 2006) and is associated in the treatment of intestinal infections [Mcdevitt *et al., 1996;* Parekh *et al.*, 2007]. Tannins have been implicated in the treatment inflamed tissues (Parekh *et al.*, 2007, Musa, *et al*., 2009) and posses astringent properties [Igboko, 1983]. Studies on saponin revealed its 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*).

4. Conclusions and Recommendations

The variations in the distribution of nutrients and phytochemicals among the leaf, stem and root of *G. manni* clearly reveal the specific organs for use in nutritional and pharmaceutical purposes. This study suggests that the test plant parts could be used as valuable material for the production of pharmaceutical drugs. In addition, the lower contents of anti-nutrients in the stem attest to its utilization as chewing stick.

Acknowledgements

We wish to appreciate the contributions from Mr. Sunday Okpata, Department of Biology, and Mr Awolabi Akeem, Department of Biochemistry, Faculty of Science, Federal University Otuoke, Bayelsa State, Nigeria.

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ISSN- 2350-0530(O), ISSN- 2394-3629(P)
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DOI: 10.5281/zenodo.1167666

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