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Chemical Profile of *Nypa fruiticans* from Cross River Estuary, South Eastern Nigeria

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Abstract: The nutritional value, mineral element compositions and phytochemical screening of *Nypa fruiticans* (mangrove swamps) were investigated. Proximate analyses of the husk showed that it contained moisture (65.14±.0.04% DM), fat (1.5±0.13% DM), crude protein (2.00±0.64% DM), fibre (2.47±0.09% DM), ash (4.20±0.14% DM), carbohydrate (24.63±0.17% DM) while the seeds contained moisture (41.96±0.28% DM), fat (0.94±0.01% DM), crude protein (1.27±0.01% DM), fibre (2.50±0.19% DM), ash (2.70±0.11% DM) and carbohydrate (51.0±1.71% DM). The moisture and carbohydrate contents revealed increased levels in both husk and seeds than other proximate parameters. The toxicant compositions of the husk revealed that hydro cyanide, oxalate and phytate contents were 0.63±0.02, 6.50±0.025 and 4.03±0.09 mg/100g DM respectively while the seeds revealed 0.08±0.01, 9.90±0.08 and 8.50±0.64mg/100g DM respectively. The hydro cyanide, oxalate and phytate contents were quite low in both seeds and husk. Mineral elements concentrations revealed potassium contents of 147.28±0.65mg/100g DM for the husk while the seeds showed 128.52±0.6mg/100g DM. The magnesium, sodium, iron, calcium, copper and zinc contents were virtually low in both seeds and husk of *Nypa fruiticans*. The vitamin A contents of the seeds and husk show that it contained 30.50±0.64 and 8.00±0.21mg/100g DM respectively.

Key words: Husk and seeds of *Nypa fruiticans*, mangrove swamps

Introduction

Nigeria abounds in a wide varieties of plants which are both of nutritional and economic importance (Ebana *et al*., 1995). In the literature, there are considerable information on the nutrient compositions of most well known and easily cultivated foods in Nigeria. There are little or no information regarding the nutrient compositions of the lesser known fruit. However, analyses carried out on some of these lesser known fruits show that they are nutritionally useful and should be exploited further as source of food for man and animals (Temple, 1998). *Nypa fruiticans* (Mangrove swaps) are plants with a creeping, horizontal stem from which branches with erect tips arises. It is found in areas of low salinities and calm water. The mature leaves are used for thatching materials and young leaves for cigarette wrappers. The sap from the inflorescence stalk can be used to make toddy, vinegar or boiled dawn to sugar (Kelvin *et al*., 2001). *Nypa fruiticans* is among the few palms that grows in the mangrove swamps. They can be found in land as far as the tide can deposit the palm floating seeds. *Nypa fruiticans* has been used effectively to check the biodiversity of mangrove forest in the Niger delta region of Nigeria (Peters, 1993).

The purpose of this study was to evaluate the nutritional values and biologically active compounds of *Nypa fruiticans* obtained from Cross River estuary.

Materials and Methods

Matured fruits and roots of *Nypa fruiticans* were collected from the Obafa Esuk fishing pond at the Great Kwa River, Calabar, Cross River State, Nigeria. The samples brought from the field were identified at the University of Calabar botanical garden. The fruits were dehusked and the endosperms were collected and oven dried in an Astell Hearson type oven at 60°C for 24h. The dried samples were ground into power with an electric grinder. The powdered samples were then stored in a desiccator. Chemical analysis of proximate compositions, elemental compositions, toxicant contents, vitamins and phytochemical screening were carried out on the seeds, and husk of *Nypa fruiticans*.

Chemical analysis

Mineral compositions: *Nypa fruiticans* (5g) were accurately weighed and ashed in a furnace at 550°C for 24h. The ash was cooled in a desiccator and later weighed. 2.0ml of concentrated HCl was added to dissolve the ash and few drops of concentrated HNO_3 was added as outlined by (A.O.A.C, 1990). The solution was placed in a boiling water bath and evaporated almost to dryness. The contents were then transferred to 100ml volumetric flask and diluted with distilled deionized water to volume. Appropriate dilution was made for each element. Calibration curves were prepared for each element using the standard solutions. The appropriate lamps and correct wavelength for each

elements were used as specified in the instrumental manual of atomic absorption spectrophotometer.

Apparatus and reagents: A Pye Unican atomic absorption spectrophotometer with acetylene flame was used to analyse for calcium, manganese, zinc, iron, magnesium and copper as described by (A.O.A.C, 1990). Sodium and potassium were determined by flame photometer (Galler Kamp) as described by Vogel (1962). Emarck concentrated volumetric solutions were used as standard metallic ions solution for the calibration. All the reagents used were of analytical grade and the water was double distilled.

Proximate analysis: The proximate composition of seeds and husk were determined using the methods of (A.O.A.C, 1990). The proximate analysis include, moisture, crude protein, fibre, ash, fat and carbohydrate.

Toxicant analysis: Hydrocyanic acid (HCN) was estimated by the alkaline titration method of (A.O.A.C, 1975). Phytic acid was determined by the method of (McCane and Widdowson, 1953) while the method described by Dye (1956) was used for the determination of oxalate.

Phytochemical screening: This was carried out as described by Sofowora (1980) and Harbone (1973). The plant were screened for alkaloids, saponins, tannins, anthraquinones, flavonoids, polyphenols, phlobatannins and cardiac glucosides.

Extraction of seeds and husk: In order to obtain the crude aqueous extract, 200g of dried powdered samples was soaked in 500cm^3 of distilled water for 8h. This was then filtered through Whatman No. 1 filter paper and the excess water removed by concentration using a rotary evaporator reduced to 50cm^3 and stored in the refrigerator for used. The ethanolic extract was obtained by soxhlet extraction of 200g of the plant samples followed by evaporation and concentration to remove the alcohol (Harbone, 1973).

Test for alkaloids: 0.5g of the sample was stirred with 5ml of 1% aqueous HCl on a steam bath and then filtered. 1ml of the filtrate was treated with a few drops of Mager's reagent and a second 1ml portion was treated similarly with Dragendroff reagent. Turbidity or precipitation with either of these reagents was taken as evidence for the presence of alkaloids in the extract (Harbone, 1973).

Test for saponins: The ability of saponins to produce frothing in aqueous solution and to haemolyse red blood cells was used for the screening test. 5.0g of each plant extract was shaken with water in a test tube. Frothing which persisted on warming was taken as evidence for the presence of saponins (Harbone, 1973).

Test for tannins: 5.0g of dried extract was stirred with 10.0ml of distilled water. This was filtered and ferric chloric reagent was added to the filtrate. A blue-black precipitate was taken as evidence for the presence of tennins (Harbone, 1973).

Test for anthraquinones: 5g of each plant extract was shaken with 10ml of benzene, filtered and 5ml of 10% ammonia solution was added to the filtrate. The mixture was shaken and the presence of a pink, or violet colour in the ammoniacal (lower) phase indicated the presence of free hydroxy anthraquinones (Trease and Evans, 1996).

Test for polyphenols: 2ml of aqueous plant extract was heated for 30 minutes in a water bath. 1ml of 1.00% $FeCl_3$ was added to the mixture then followed by the addition of 1ml of 1.00% potassium ferrocyanide. The mixture was filtered and the formation of a green-blue colour indicates the presence of polyphenol (Harbone, 1973).

Test for cardiac glycoside: 0.5g of plant extract was dissolved in 2.0ml glacial acetic acid containing one drop of ferric chloride solution. This was then underlain with 1.0ml of concentrated H_2SO_4 solution. A brown ring obtained at the interface indicated the presence of cardioglycosides (Harbone, 1973).

Test for phlobatannins: An aqueous extract of the sample was boiled with 1.0% aqueous hydrochloric acid. The deposition of a red precipitate was taken as evidence for the presence of phlobatannins.

Results

Table 1 shows the results of proximate compositions of the husk and seeds of *Nypa fruiticans*. These include those of the moisture, crude protein, fat, crude fibre, ash and carbohydrate.

The husk of *Nypa fruiticans* was found to contain 65.14±0.04 wet weight of moisture and the seed 41.96±0.28% wet weight (w/w). The percentages of crude protein of the husk of *Nypa fruiticans* is 2.06±0.64% DM while the seeds contained 2.27±0.01 DM. The sample contained less protein than the seeds. The crude fibre contents for the husk was found to be 2.47±0.09% DM.

The ash contents of the husk of *Nypa fruiticans* was found to be 4.20±0.14% DM and the seeds 2.70±0.11% DM.

The carbohydrate content of the husk and seed show 24.63±0.17% DM, and 51.08±1.71% DM respectively which indicate moderate carbohydrate content.

Table 1: Proximate compositions of the husk and seeds of *Nypa fruiticans* (%DM)

Nutrients	Husk	Seed
Moisture	65.14±0.04	41.96±0.28
Crude protein	1.27±0.64	2.27±0.01
Fat	1.56±0.13	0.94±0.01
Ash	4.20±0.14	2.70±0.11
Fibre	2.47±0.09	2.50±0.19
Carbohydrate	24.63±0.17	51.08±1.71

Result are mean of 3 determination±S.D

Table 2: Toxicant compositions of the husk and seeds of *Nypa fruiticans* (mg/100g DM)

Toxicants	Husk	seed
Hydro cyanide	0.63±0.02	0.08±0.01
Oxalate	6.50±0.25	9.90±0.08
Phytic acid	4.03±0.09	8.50±0.64

Mean of 3 determination±S.D

Table 3: Mineral elements composition of the husk and seeds of *Nypa fruiticans* (mg/100g DM)

Nutrients	Husk	Seed
Sodium	3.50±0.42	11.60±0.13
Potassium	147.28±0.65	128.52±0.64
Calcium	9.58±0.05	5.00±0.40
Magnesium	24.76±0.59	11.32±0.11
Iron	16.15±0.01	10.60±0.08
Copper	0.06±0.01	0.60±0.08
Zinc	7.10±0.08	7.67±0.05

Mean of 3 determination±S. D

Table 2 shows the toxicant compositions of the husk and seeds of *Nypa fruiticans*. The total hydrocyanic acid (HCN), oxalate and phytate levels in the husk and seeds were 0.71, 16.40 and 12.53mg/100g DM respectively. The levels of toxicants in the husk and seeds were relatively low.

Table 3 shows the mineral contents of the husk and seeds of *Nypa fruiticans*. Macro-elements ranged from 3.50±0.42mg/100g DM for sodium to 147.28±0.65mg / 100g for potassium for the husk while the seed contents ranged from 5.00±0.40mg/100g for calcium to 128.52±0.64mg/100g for potassium. The husk micro elements ranged from 0.06±0.01mg/100g for copper to 16.15±0.01mg/100g for iron while the seeds micro-elements ranged from 0.06±0.08mg/100g for copper to 7.67±0.05mg/100g for zinc.

Phytochemical screening of the husk, seeds and root of *Nypa fruiticans* revealed the presence of polyphenols and tannins in the husk while the seeds showed traces of alkaloids (Table 4). Flavonoids, anthraquinones and phlobatannins were noted to be absent in *Nypa fruiticans*.

Table 5 presents vitamin A compositions of the husk and seeds of *Nypa fruiticans* (dry weight). Vitamin A content of the husk was higher than that of the seeds of *Nypa fruiticans*.

Table 4: Phytochemical screening of the husk seed and root of *Nypa fruiticans*

Phytochemicals	Husk	Seeds
Alkaloids	-	+ -
Flavonoids	-	-
Polyphenols	++	-
Anthraquinones	-	-
Saponins	-	-
Tannins	++	-
Phlobatannins	-	-

\+ = Positive in moderate quantity
\- = Negative (absence)
\+ - = Positive in small amount
++ = Positive in large amount

Table 5: Vitamin A contents of the husk and seed of *Nypa fruiticans*

Vitamin (mg/100gDM)	Husk	Seeds
Vitamin A	8.00±0.21	30.50±0.64

Mean of 3 determination±S. D

Discussion

The present study was carried out to justify the utilization of the seeds of *Nypa fruiticans* for its nutritional potential and industrial utility. The moisture content of the husk of *Nypa fruiticans* was high when compared to seeds. This is in line with the report of Jeremiah (1992) that seeds of fruits often contain low moisture content when compared with other parts of fruits. Moisture content of food is usually used as a measure of stability and the susceptibility to microbial contamination (Scott, 1980).

The husk sample contained less protein than the seeds. The result is in conformity with the report by Umoh (1998) that seeds are usually higher in nitrogenous component than other parts of the fruit. The values obtained was within the ranged reported by Essien *et al.* (1991) for Tetra pleura tetraptera. The daily protein requirement for children and adults is 23-36g and 44-56g respectively (NRC, 1974).

The values obtained for fat were generally low but it conforms to report of raffia palm by (Edem *et al.*, 1984a). The knowledge of the fat content of any food item helps to ascertain the shelf life of the food.

The values of the crude fibre content of the husk and seeds of *Nypa fruiticans* were high but were within the range reported for *Chrysophyllum albidum* (Edem *et al.*, 1984b). Crude fibre cannot be digested by man, it plays a useful role in providing roughage that aids digestion and reduces the accumulation of carcinogen in the body. The high ash content of the husk shows that minerals are likely to be concentrated in the husk rather than the seeds (Oyoyede, 2005).

Nypa fruiticans can be ranked as carbohydrate rich fruit due to it high carbohydrate contents. The high carbohydrate contents of the seed samples show that it can serve as a good source of energy. The seeds could also serve as a raw material for production of industrial products like juices. When carbohydrate is deficient in food it prevents the unnecessary usage of protein and allows it to be used for body building processes.

The HCN levels in the seeds (0.63±0.02 mg/100g DM)

was much lower than the 36mg/100g DM considered lethal to man. The soluble oxalate values found were quite low compared to that reported for pulp and peels of *Chrysophyllum albidum* (Edem *et al.*, 1984b) and is unlikely to pose toxicity problems to man since it is much below the toxic levels 2-5g oxalate (Munro and Bassir, 1969; Oke, 1966). Consumption of oxalic acid can cause corrosive gastroenteritis, shock, convulsive symptoms, low plasma and renal damage (Fasset, 1973; Eastwood, 1986).

The phytate level in the seeds (8.50±0.64mg/100g DM) were higher than that reported for *chrysophyllum albidum* (Edem *et al.*, 1984b). The knowledge of phytate level in food is necessary because high concentration can cause adverse effects on digestibility (Nwokolo and Bragg, 1977). Phytate forms stable complexes with Cu^{2+}, Zn^{2+}, Co^{2+}, Mn^{2+}, Fe^{2+} and Ca^{2+} but the mechanism of the action has not been fully established.

The results of the mineral composition (Table 3) clearly show that *Nypa fruiticans* constitute a rich source of mineral elements, although the bioavailability of these elements has to be established. The elemental compositions showed increased iron, magnesium and potassium but zinc, copper, calcium and sodium were low in both husk and seeds. Their values are comparable to values reported in the literature of some commonly used fruits in Nigeria (Nwadinigwe, 1982; Umoh, 1998).

The vitamin A contents of *Nypa fruiticans* (Table 5) show an increased level in the seeds than the husk. The values obtained were in line with that reported for carotene in the fruits of raffia palm (Edem *et al.*, 1984a). Vitamin A is essential for normal growth, development and maintenance of epithelial tissues. It is also necessary for vision as well as normal bones and teeth development.

The phytochemical screening revealed that the *Nypa fruiticans* is rich in such bases as polyphenols, tannins and alkaloids which are known to have antimicrobial activity as well as other physiological activity (Sofowora, 1980). The presence of these secondary plant products accounts for its usefulness as a medical plant (Ebana *et al.*,1995).

Conclusions: *Nypa fruiticans* contain high amount of carbohydrate in both husk and seed, however, other proximate composition indices such as crude protein, crude fats, fibre, and ash were relatively low. *The toxicant levels were low and were found at concentrations that was not lethal. *The elemental compositions showed increased iron, magnesium and potassium contents but zinc, copper, calcium and sodium were very low. The vitamin A content of *Nypa fruiticans* was not very high.

Phytochemical screening shows the presence of polyphenols and tannins in the husk while the seed showed traces of alkaloids.

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