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CHEMICAL COMPOSITION OF THE KERNEL OF *NYPA FRUTICANS* (NYPA PALM) AND ITS APPLICATION IN CONFECTIONERY PREPARATION

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ABSTRACT

The chemical composition of the kernel of *Nypa fruticans* (Nypa palm) in terms of proximate compositions, mineral elements, vitamins (A and C) and some anti-nutrients (toxic substances) were determined. Nypa kernel flour was also prepared and used in making a confectionery product (biscuit); the proximate composition and acceptability evaluation of biscuits were also made. The air dried fresh sample kernel had the following composition: moisture (34.80 ± 0.15%), ash (3.40 ± 0.04%), crude protein (5.60 ± 0.03%), crude fat (0.04 ± 0.06%), crude fibre (2.45 ± 0.05%), carbohydrate (87.56 ± 0.27%) while the caloric value was 394.69 ± 0.29kcal/100g; Vitamin A (retinol) and Vitamin C (ascorbic acid) levels were 2.57 ± 0.23mg, and 20.36 ± 0.07mg per 100g sample respectively; the mineral elements levels in mg/100g sample were: Mg (90.60 ± 8.50), K (47.93 ± 4.00), Na (128.0 ± 0.24), Mn (10.63 ± 0.04), Fe (2.13 ± 0.05) and Cu (0.70 ± 0.02); the anti-nutrient levels were: hydrocyanic acid (15.60 ± 0.00), phytic acid (1.13 ± 0.09), soluble oxalate (83.60 ± 0.93) and tannins (2.26 ± 0.39) in mg per 100g sample of nypa kernel. Both the mineral elements and the toxic substances (anti-nutrients) levels were within the acceptable values in man. The biscuits formulated from 37.5% nypa flour and 62.5% wheat flour compared well in nutritive value levels and acceptability evaluation with the 100% wheat biscuits. Therefore nypa palm kernel may be used for preparing low fat confectionery products.

KEYWORDS: Nypa Palm, Kernel, Chemical Composition, Nutritive value, Confectionery Product

INTRODUCTION

Nypa fruticans (nypa palm) is a palm which belongs to the family of Arecaceae of the flowering plants. It produces fruits in bundles, each fruit containing freshly white kernel. Nypa palm is regarded as wild palm in Nigeria and at present none of its products is utilized as feed stock for industrial products.

Nypa palm was introduced in Nigeria as exotic plant between 1905 and 1912 from Indonesia and Malasia, to check erosion menace along the coast of Calabar and Oron in the south eastern states (Ojebo, 2002). However, the plant has become invasive and has spread extensively along the coastal region of the Bight of Bonny, conspicuously destroying and replacing the traditional mangrove trees that used to form natural habitat for aquatic life. The plant also blocks the creeks and river estuaries with its numerous floating leaves and fruits which are not easily biodegraded.

The nypa palm fruit bundles consist of small fruits numbering between 30 and 50 a bundle, each being made up of brown epicarp, fibrous mesocarp, a thin endocarp and finally the white kernel at the centre. Nypa palm fruits many times in a year and produces many fruits.

This study centres on the determination of the chemical composition of nypa palm kernel and assessed its suitability for confectionery (biscuit) preparation.

MATERIALS AND METHODS

The nypa palm fruit bundles with matured fruits were collected from nypa palms at a swamp near Oron Museum Beach in Akwa Ibom State of Nigeria. The fruits were split into two with a clean machete and the kernel dehusked.

The nypa kernel flour was prepared by grating the fresh kernel into pulp, drying in a hot air circulating oven at 60^{0}C for 24 hours, then grinding in a Mouliner mill before sieving in a 0.001m^2 mesh into powder. The flour was stored in airtight containers at room temperature (27^{0}C).

Proximate analysis

The methods used for proximate analysis for both the kernel and the biscuits were the conventional procedures recommended by Association of Official Analytical Chemists (A. O. A. C., 1985).

The moisture content determined was based on fresh samples and was obtained as the difference between the weight of the fresh sample and the same sample dried at 105 ± 5^{0}C; the crude fat was obtained by extraction with petroleum ether (bp. 40 – 60^{0}C) using Soxhlet extractor; the crude fibre was obtained by consequential treatment with 1.25% (w/v) H_2SO_4 and 1.25% (w/v) NaOH solutions and thorough washing with hot water and 90% ethanol before drying at 100^{0}C and igniting at 550^{0}C in a furnace. The difference in weight of the dry residue and the ash constituted the crude fibre.

The crude protein was determined as ammonia nitrogen using Kheldahl apparatus, while the carbohydrate content, excluding the crude fibre was obtained as the difference after subtracting the sum of crude protein, crude fat, crude fibre and ash contents from the dry matter. The caloric value of the kernel was calculated by multiplying the values of the crude protein, crude fat and carbohydrate contents by 4, 9 and 4 respectively and taking the sum as the caloric value expressed in kcal/100g sample. The anti-nutrients determined by standard methods (A.O.A.C., 1985) were hydrocyanic acid (HCN), phytate, oxalate (dissolved, insoluble, total) and tannins.

The mineral elements Mg, Ca, Fe, Mn and Cu were determined using Atomic Absorption Spectrophotometer (AAS) after digestion in the appropriate reagents (Vogel, 1962); the actual values being read from the calibrated curves for each metal; K and Na were determined with flame photometer. Vitamins A and C were determined by standard methods (Vogel, 1962).

Preparation of Biscuits

Preliminary experiment carried out showed a flour mixture

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containing 37.5% nypa kernel flour and 62.5% wheat flour formed nice crispy biscuits therefore this flour mixture was used in preparing biscuits whose quality and acceptability were compared with 100% wheat biscuits. The recipes of the biscuits made are given in Table 1 below.

Table 1: Biscuits Recipe

Ingredients	Nypa-Wheat Biscuit	Wheat Biscuit
Wheat flour	150g (46.56%)	240g (74.49%)
Nypa kernel flour	90g (27.93%)	-
Sugar	40g (12.42%)	40g (12.42%)
Fat	20g (6.21%)	20g (6.21%)
Baking Powder	10g (3.10%)	10g (3.10%)
Salt	0.2g (0.06%)	0.2g (0.06%)
Egg	12.0g (3.72%)	12.0g (3.72%)
Total	322.2g (100.00%)	322.2g (100.00%)

The method used in the preparation of the biscuits was that reported by Adebisi (1985). It involved creaming of the fat and sugar mixture, mixing and sieving of the flours, addition of baking powder and salt (NaCl) to the flour mixture; then preparation of the batter by adding egg and cream mixture (fat and sugar) to the flour mixture, tossing of the batter over dried nypa or wheat flour spread on a board. The batter was rolled out into a suitable thickness and cut into shapes. The cut batter pieces were then baked in an oven at a temperature of 177^{0}C for 10 – 15 minutes after which they were cooled to room temperature (27^{0}C) and examined physically. Organoleptic test and proximate analysis of the baked biscuits were carried out and their acceptability and nutritive value levels assessed.

RESULT AND DISCUSSION

Table 2 shows the proximate composition and the caloric value of nypa palm kernel; Table 3 shows the mineral elements levels while Table 4 and 5 give the vitamin A and C content and the levels of the toxic substances (anti-nutrients) respectively. In Table 6 is given the proximate composition of the composite nypa – wheat biscuits and the wheat biscuit while Table 7 shows the results of the organoleptic tests.

Table 2: Proximate Composition and Caloric value of Nypa palm kernel

COMPONENT	Percentage on dry weight mean ± standard error
	Nypa Palm Kernel
Moisture content (fresh weight)	**34.80 ± 0.15**
Ash (dry weight)	**3.46 ± 0.04**
Crude fat (dry weight)	**0.40 ± 0.06**
Crude protein (dry weight)	**5.60 ± 0.03**
Carbohydrate (dry weight)	**87.56 ± 0.09**
Crude fibre (dry weight)	**2.45 ± 0.05**
Caloric value kcal/100g	**394.69 ± 0.29**

The moisture content for the fresh matured nypa palm kernel was 34.80 ± 0.15%. This value was high when compared with the values obtained for similar kernels: coconut 2.5% (Okwu, 2000), date palm kernel 22.5% (Watt and Marill, 1963), but was lower than the value of 70.0% reported by Ebung (2002). However, experience has shown that the moisture content of fresh kernels is related to the state of maturity of the kernels, and the high moisture content indicates that to retain the nutritive values of the kernel for a long time it must be dried and stored under specific conditions of temperature and relative humidity. It is therefore suggested that, for the kernel to have a long shelf life, it needs to be smoked dried or oven dried just as the copra is prepared from coconut kernel.

The crude protein value for nypa kernel was 5.60 ± 0.03% while the crude fat was 0.40 ± 0.06% which is very much lower than the values for most palm kernels, namely *Helian annus* (48.2 – 56.2%). *Arachis hypogaera* (50.9%), *Elaeis guineenis* (oil palm kernel) and *Cocos nucerifera* (65%) (Longstraat, 1976, Onyenuga and Fetigo, 1975 and Okwu, 2000). From the results, nypa palm kernel is not an oil seed; however the value compares with the crude fat content of raffia palm kernel (1.05%), Buri palm kernel (0.5%), date palm (0.5%) African Doum palm (0.8%) (Edem et al, 1984; Temple et al; 1998 and Hoebeke, 1989). Crude fat content of any kernel (seed) helps to determine the shelf life of any kernel/seed as well as undesirable changes such as rancidity that may occur.

The crude fibre content of 2.45 ± 0.05% of nypa kernel compares well with the values for palmae (2.69%) and limuran palm (2.4%) (Temple, et al; 1998 and Atchley, 1984). Deloreme and Wojick (1982) stated that the loss of fibre during food processing can lead to disabilities and that fibre content of such food may be replenished by adding crude fibre, thus nypa kernel may serve as food supplement to improve the fibre content of food. The carbohydrate content of nypa kernel was 87.56 ± 0.09%. This result is in agreement with those of most tropical palms ranging from 86.7 - 99% (Borin et al; 1996). Its caloric value is 394.69 ± 0.29 kcal/100g which compares well with those of salak palm (345 kcal/100g), Indian doum (406 kcal/100g) and African doum (406 kcal/100g). (Atchley, 1984 and Hoebehe, 1989). The values show that nypa kernels can serve as energy giving food.

Table 3: Mineral content of the kernel of Nypa palm

Mineral Elements	Composition (mg/100g) mean ± standard error
	Nypa Palm kernel
Magnesium	**90.60 ± 8.5**
Potassium	**47.93 ± 4.0**
Calcium	**19.30 ± 0.40**
Sodium	**128 ± 0.24**
Manganese	**10.63 ± 0.14**
Iron	**2.13 ± 0.05**
Copper	**0.70 ± 0.02**

Its ash content of 3.46 ± 0.04% shows that the kernels contains some mineral elements as shown in Table 3. The metal element identified were Mg, K, Na, Mn, Fe and Cu and their levels are within the tolerable amount for man and animal hence do not pose danger to health if the nypa kernels are used as ingredient for food preparation.

Table 4: Vitamin content in the kernel of Nypa palm

Vitamins	mg/100g dry weight mean ± standard error
	Nypa Palm kernel
Vitamin A	**2.57 ± 0.23**
Vitamin C	**20.36 ± 0.07**

Table 4 gives the values of Vitamin A (retinol, 2.57 ± 0.23 mg/100g) and Vitamin C (ascorbic acid, 20.36 ± 0.07 mg/100g). These vitamins are useful for the normal functioning of the body because Vitamin A is needed for normal vision and growth of new cells which line the respiratory, digestive and reproductive tracks in the body while Vitamin C aids in the prevention of scurvy, formation of collagen and dentin, therefore using nypa kernel in food preparation will improve the quantity of these vitamins and promote healthy body growth.

Table 5: Levels of toxic substances (anti-nutrients) in the kernels of nypa palm

Toxic Substances	Composition (mg/100g dry weight) mean ± standard error
	Nypa Palm kernel
Hydrogen cyanide	15.6 ± 0.00
Tannin	2.26 ± 0.39
Phytic acid	1.13 ± 0.09
Total oxalate	139 ± 0.04
Soluble oxalate	83.60 ± 0.93
insoluble oxalate	55.44 ± 0.92

The levels of toxic substances namely hydrogen cyanide, phytate in the form of phytic acid, total oxalate and soluble oxalate, shown in Table 5 are lower than the lethal dose of 2.5g/100g for man (Oke, 1969; Edem et al., 1984) hence nypa kernel can be used as a component of food.
Besides, the presence of these toxic substances in the kernels prevents them from being attacked by insects and other pests during storage.

Table 6: Organoleptic Test Result on Nypa Biscuit and Wheat Biscuits

Test	Wheat Biscuit (Control)	Nypa Biscuit
Flavour	4	4
Texture	4	5
Appearance	5	5
Overall Acceptability	4	5

The organoleptic tests in Table 6 shows that the nypa biscuit i.e. biscuit made from flour composite mixture nypa flour 37.5% and wheat flour 62.5% had mostly liked flavour, definitely liked texture, definitely liked appearance and an overall acceptability by the testing panel. Its overall quality as showed in Table 6 compared very well with the quality of the 100% wheat flour biscuits. **Table 7**: Proximate Composition and Caloric Values of Biscuit Samples

Parameter	Percentage of dry weight	
	Wheat Biscuit	Nypa Biscuit
Moisture content (air dry)	2.51 ± 0.01	3.70 ± 0.10
Ash	1.20 ± 0.03	1.65 ± .03
Protein	3.92 ± 0.01	2.38 ± 0.50
Crude fat	14.50 ± 0.03	7.45 ± 0.01
Crude fibre	0.80 ± 0.00	1.13 ± 0.03
Carbohydrate	80.24 ± 0.60	86.78 ± 1.01
Caloric value (kcal/g)	464.62 ± 0.60	427.67 ± 1.20

Also the proximate analytical results of nypa biscuits in Table 7 compared favourable with these of wheat except in the case of crude fat in which the value of the wheat biscuit almost doubles that of nypa biscuits, however, this quality suggests that nypa biscuit should be made available to those people who require low fat content in their meals. These results show that nypa biscuits contain necessary nutrients for it to be consumed as food (confectionery) i.e. as snack while the organoleptic test results confirmed the general acceptability of nypa biscuit as a good confectionery product.

CONCLUSION

The proximate composition, the mineral elements and the toxic materials (anti-nutrients) content of the kernels of *Nypa fruticans* (nypa palm) have been determined. The proximate composition compares well with some members of Arecaceae family (palm species). It also contains Vitamin A and C. Both the mineral elements and the toxic materials contents were found to be within the tolerable levels hence the kernels of nypa palm were found to contain enough nutrients to make them suitable as food components for man and animals.

The flour made from the kernels when blended with wheat flour and baked, formed biscuits which were found to be nutritive enough for consumption and were generally accepted as good confectionery product.

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