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Determination of Chemical Composition of *Gnetum africanum (*AFANG) Seeds

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Abstract: The study on the chemical composition of the seeds of one of the most popularly known and popularly consumed tropical plant, *Gnetum africana* (afang) has been carried out by analyzing samples of the plant seeds collected from some plantations located within Akwa Ibom State (South Eastern Nigeria) for chemical Composition. The proximate, elemental and toxicant composition of the seeds (*Gnetum africana*) were determined by analyzing samples of the identified seeds for their carbohydrate, protein, lipid, ash, fibre, moisture and caloric value (proximate composition), iron, zinc, lead, potassium, sodium, magnesium and calcium (mineral compositon) and tannin, hydrocyanic acid, oxalate and phytic acid (toxicant composition) using recommended method of analysis. The result of the analysis shows that the percentage moisture content, crude protein, crude fat, crude fibre, ash content and carbohydrate of this seeds are 31.60%, 17.50%, 3.15%, 0.80%, 1.20% and 87.62% respectively while its caloric value is 448.83kcal/100g. The percentage sodium, potassium, calcium, magnesium, iron, zinc and lead content of the seed were 15.57, 38.56, 7.01, 5.48, 1.50, 1.50, 1.07 and 0.03 respectively while its toxicant content were 540mg/100g, 100.74mg/100g, 209.00mg/100g and 238.26mg/100g for hydrocyanic acid, tannin, oxalate and phytic acid respectively. The proximate, mineral and toxicant composition of the seeds were also compare with values reported in literature for other edible vegetable and the results show that the seeds are poor source of essential elements compared with other vegetable seeds. The antinutritional content of the seeds were very high when compare to values reported for other vegetables. Based on the result of the present study, it has been found that afang seeds are rich in proximate composition (when compare with other edible vegetables). Their low mineral content and their high toxicant content therefore suggest that these seeds should be properly processed before consuming them and its consumption should be supplemented with other food whose elemental content are high.

Key words: *Gnetum africanum* seeds, chemical composition, green leafy vegetable

Introduction

Gnetum africanum is one of the most popular green leafy vegetable in Nigeria and is gaining equal popularity as a delicious food leaf in other African countries such as Cameroon, Gabon, Congo and Angola (Eyo and Abel, 1983). *G.africanum* leaves are widely consumed in the South Eastern Nigeria due to its palatability and taste. It is now eaten as a vegetable salad when mixed with palm oil. The popularly known afang soup that is often listed in many continental restaurant menu is prepared from these leaves which sometimes is cooked with water leaves (*Talicum traiangulare*) to give the soup a special savour.

Gnetum africanum (afang) grows as a wild evergreen climbing plant in the rainforest of Nigeria where it is searched for and highly priced in the regional markets. It is recently being cultivated in South Eastern Nigerian homes as exotic plants. It belongs to the family *Gnetacea* and the order *Gnetales* (Dutta, 1981). The seed of Afang is oval in shape and small in size, about 0.5cm in diameter. They are greenish in color when unripe and reddish when ripe.

Available literature reveals that both the leaf and the seed in particular have shown medicinal efficacy in the treatment of enlarged spleen, sore throats, deduction of pains of child-birth, antidotes to some forms of poison and snake bite. The seeds are specially used as fungicide for dressing fresh and septic wounds. It is also chewed raw in the management of excessive urination by infantile diabetic patients in Traditional Medical (Smith, 1983; Shiembo, 1984; Mialoundama, 1993).

The mineral element content, amino acid content and proximate composition of the leaves has been reported by (Eyo and Abel, 1983). Little or no information is available on the chemical composition of the seeds of *G. africanum*.

This study is designed to determine the chemical composition of the seed *G. africanum* for public and dietary awareness of its nutritional status.

Materials and Methods.

Matured seeds of *G.africanum* were collected in three batches between the months of August and September, 2005 from Agro-forestry Series-1, Mbiabong Ikono, Uyo L.G.A and randomly from a thick bush around the rain forest of Calabar in Southern Nigeria. Samples taken to the laboratory were washed with deionized water and spread on a clean paper for a two-hour air-drying.

Table 1: Proximate composition of *G.africanum*

Parameters	Percentage
Moisture	31.60±0.07
Crude Protein	17.50±0.03
Crude fat (lipid)	3.15±0.01
Crude fiber	0.80±0.02
Ash content	1.20±0.01
Carbohydrate	87.62±0.04
Caloric value	448.83kcal

Table 2: Elemental composition of *G.africanum*

Parameters	Percentage
Sodium (Na)	15.57±0.02
Potassium (K)	38.56±0.04
Calcium (Ca)	7.01±0.01
Magnesium (Mg)	5.48±0.02
Iron (Fe)	1.50±0.02
Zinc (Zn)	1.07±0.04
Lead (Pb)	0.03±0.03

Table 3: Toxicant composition of *G.africanum*

Parameters	Content (mg/100g)
Hydrogen cyanide	540.00
Tannin	100.74
Oxalate	209.00
Phytic acid	238.26

Table 4: Summary of the Results for Comparative Studies with Some Other Vegetable Seeds

Parameter	Afang Seeds (*Gnetum africanum)*	Fluted pumpkin seeds (Telferia occide-ntalis)*	B. horse 'eye; beans (M.ureans)**
Moisture content %	31.6	54.8	31.79
Crude protein %	17.5	7	24.33
Crude fat (lipid) %	3.15	50.9	4.3
Crude fibre %	0.8	4.6	4
Ash content %	1.2	6.9	6
Carbohydrate %	87.62	31.25	61.37
Caloric value (kcal)	448.83	60.53	381.5
Magnesium ppm	5.48	7.434	7.17
Calcium ppm	7.01	22.5	32.5
Iron ppm	1.5	4	3.318
Copper ppm	0.39	0.9	0.733
Zinc ppm	1.07	2.9	2.275
Potassium ppm	38.56	640	560
Sodium ppm	15.57	160	140
Lead ppm	0.03	-	-
Oxalate mg/100g	209	325.6	352
Hydrocyanide mg/100g	540	17.28	15.12
Tannin mg/100g	100.74	454.44	340.755
Phytic acid mg/100g	238.26	-	-

Source: *Etim (2000); **Ekop and Eddy (2005a,b)

Weighed samples were transferred into a hot air-drying oven (Gallen Kamp) set at a temperature 80-100°C for 48 hour-drying to constant weight. The outer shell of the seed was removed and the seeds ground into fine powder with a food blender (without metal contamination). The ground sample were stored in an air-tight labeled plastic container from which samples were removed for chemical analysis.

The hydrocyanide, tannin, oxalate and phytic acid content of the seeds were determined by titrimetric and colorimetric methods as described by Kirshna and Ranjhan (1980).

Sodium and potassium content of the seeds were determined by wet acid digested samples using flame emission spectrophotometry (A.O.A.C. 1984). Calcium, magnesium, iron, copper, zinc and lead were quantitatively determined from the digest using the Perkin Elmer Model 2280, Atomic Absorption Spectrophotometer with appropriate hollow cathode lamps. Accuracy was assessed by analyzing the samples in triplicates.

In the determination of the proximate composition of these seeds, the methods recommended by A.O.A.C (1984) were used.

Results

The results of the determination of the proximate, elemental and antinutients compositions of *G.africanum* seeds are presented in Table 1, 2 and 3 respectively.

Discussion

Comparing the chemical composition of the seeds of *G.africanum* with other edible vegetable seeds (presented in Table 4) shows that the seed is rich in carbohydrate with low crude fibre, ash and lipid content. The relatively low moisture contents of 31.60±0.07% promises a long shelf life for the plant seed before cultivation. Crude protein and crude fat are lower than what is obtained in most vegetable seeds. The low ash content of 1.12 correlated positively with the elemental composition of the seed ($P > 0.05$) implying that these seeds are not good source of mineral nutrition.

The crude protein content of 17.50% for the seeds is higher than the literature value of 5.6% recorded for its leaves. It is also higher than what is present in most vegetable seeds except legumes. For instance, fluted pumpkin leaves has an average of 7.00% and it is cherished by most people as being affordable source. Plant protein still remains a veritable source of food nutrient for the less-privileged population in developing countries, including Nigeria where the cost of animal protein is beyond their income per capita.

This research has uncovered *G.africanum* seeds to be a promising alternative source of food nutrient which hitherto had been ignored. The result of the elemental composition of afang revealed the seed to be a relatively poor source of all the mineral elements determined. It also has a low fat content compared to most tropical seeds. Higher values for mineral elements and crude fat are recorded in literature for other vegetable seeds as shown in Table 4. The need for supplementary diets rich in mineral content is necessary for a singular ration, to avoid metal deficiency syndrome like ricket and calcification of bones, as a result of calcium deficiency.

Distorted enzymatic activity and poor electrolyte balance of the blood fluid are related to inadequate Na, K, Mg and Zn; as they are the most required elements of living cells. Consumption of about 20 seeds of *G.africanum* a day may meet the daily requirements for poultry birds. Recommended daily requirement of 2.500- 3.00kcal per 100g weight have been documented (Maynard, 1997).

Table 3 shows the anti-nutritional factors of the studied seed. Values for all the four parameters are higher than tolerable limit permissible for children. Oxalate, 209.00; HCN, 540; Tannin 100.74 and phytic acid, 238.26mg/100g recorded for the seed is higher than 67.83, 5.40, 51.2 and 230mg/100g recorded respectively for afang leaves (Ifon and Bassir, 1980). On comparison, these toxic substances in the seed of *G.africanum* are also higher than those obtained for fluted pumpkin and M.*ureans* as shown in Table 4.

High level of HCN has been implicated for cerebral damage and lethargy in man and animals. Oxalate can complex with most essential trace metals therefore making them unavailable for enzymatic activities and other metabolic processes. Tannins are capable of lowering available protein by antagonistic competition and can therefore elicit protein deficiency syndrome, 'kwashiorkor'. Phytic acid has complicated effect in human system including indigestion of food and flatulence (Maynard, 1997). These relatively high anti-nutritional factors present in the afang seed studied in this work need not pose any threat of toxicity, because they can easily be detoxified by soaking, boiling or frying as rightly noted by Ekop *et al.* (2004); Eka and Osagie (1998); Ekop and Eddy (2005b); Ifon and Bassir (1980) among other researchers that most plant toxicants are drastically reduced to tolerable limits by proper processing. Total hydrogen cyanide in particular which is often present in food items both as free oxygen cyanide and bound cyanogenic glycoside from enzymatic hydrolysis of decarboxylated amino acids can be greatly reduced by boiling for more than 30minutes (Ekop and Eddy, 2005a).

Table 4 also shows the chemical composition of two other vegetable seeds namely; fluted pumpkin (*T.occidentalis)* and *Mucuna ureans* alongside the studied *G.africanum* seeds for easy perusal and fast casual comparison. It appears significant to note that *G.africanum* has the highest carbohydrate content of 84.62% which is significantly ($p<0.05$, $n = 4$) higher when compared with *M.ureans* (61.37%) and fluted pumpkin seed (31.25%). It should be remembered that most plant seeds are very poor source of carbohydrate contrary to the observation for afang seed. The sense of satiety experienced after eating 'afang soup' might be attributed to its high caloric value of 448.83kcal/100g. (Computed from its protein, fat and carbohydrate values by 4:6:4 factors respectively).

Conclusion: This research finding revealed *G.africanum* (afang) seeds as containing high percentage carbohydrate of 87.62 which is quite unique when compared with other vegetable seeds. The seed therefore promises a good nutritive supplementary source for rodents (rabbit) husbandry. Its mineral composition is relatively low and needs to be supplemented when utilized in isolation.

The results of this investigation also show that *G.africanum* seed contains substantial amounts of anti-nutrients. The preponderance of these toxic substances is presumed to be the main reason why the seeds of this popular vegetable is not consumed as is done to fluted pumpkin seeds except for medicinal purposes. Pretreatment and proper process of *G.africanum* seed is advocated before its incorporation into food formulation for animal and man. This work has provided research data which hitherto was very scanty about afang seed. Its high food caloric value of 448.83kcal/100g makes more research into its amino acids profile and characterization of its lipid content quite compelling.

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