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COMPARATIVE STUDY OF NUTRIENT AND ANTI-NUTRIENT CONTENT OF *GNETUM AFRICANUM* (AFANG) AND *HEINSIA CRINITA* (ATAMA)

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ABSTRACT

The proximate composition (moisture, ash, crude fat, crude protein, fibre content, and carbohydrate), the mineral compositions (Na, K, P, Ca, Mg, Fe and Zn); and anti-nutrients (oxalate, phytate, hydrocyanic acid and tannin) were determined in *Gnetum africanum* (Afang) and *Heinsia crinita* (Atama). The percent crude protein, crude fat, moisture content, carbohydrate values (38.40%, 24.69%, 84.70% and 10 48%) of *Heinsia crinita* were significantly ($p<0.05$) higher than values obtained from *Gnetum africanum* (26.50%, 14.34%, 63.78% and 6.75%) respectively. The concentrations of mineral elements phosphorus, potassium, iron, magnesium and calcium were (1.25%, 1.64%, 3.05%, 2.39% and 2.22%) respectively in *Heinsia crinita* and (0.14%, 0.10%, 1.15% 0.92% and 0.45%) respectively. The values of mineral elements were significantly higher ($p<0.05$) higher in *Heinsia crinita* than *Gnetum africanum*. The percent hydrogen cyanide, phytate, oxalate, and tannin values (3.51%, 6.12%, 24.4% and 2.80%) of *Gnetum africanum* were significantly ($p<0.05$) higher than values obtained from *Heinsia crinita* (1.20%, 3.51%, 10.12% and 0.78%) respectively The results showed that *Heinsia crinita* had more nutritive values than *Gnetum africanum* which are needed for a variety of cellular functions in humans, and which could reduce the problem of protein energy malnutrition (PEM).

KEY WORDS: Nutrients, Anti-Nutrients; *Gnetum Africanum*; *Heinsia Crinita*.

INTRODUCTION

Non forest timber products are commonly used as a source of vegetable in the south-south and south-east of Nigeria. Vegetable is fresh edible portion of a plant consumed in either raw or cooked form. Technically all plants are vegetables. Encyclopedia Britannica (1975) reported that food value of vegetables varies from species to species and also owning to the large amount water present in each species. Opeke (2000) observed that the nutritive value of some vegetables lies in the presence of mineral element and vitamins.

In the rural areas where the popularly eaten food is mainly carbohydrate, indigenous vegetables play useful role in providing food quality like proteins, minerals, vitamins and fats. Also the roughage part of the vegetable aids in digestion. Onyeagocha, (1995) reported that most important features of some leafy vegetables from our forests is that they contain the nutritional value of economic importance and they a source of food and many of these vegetables are available during dry seasons when most of the staple foods are out of season. Bello, (2004) observed that leafy vegetables from forest produced new leaves during dry season when the conventional vegetables are scarce or unavailable. Okafor and Okoro, (2004) assessed the nutritive value of some indigenous species such as *Heinsia crinita, Ocimum gratissmum*, and Gnetum *africanum* and found that they have high content levels of vitamins and minerals including lysine, calcium, phosphorus, iron, magnesium, thiamine, riboflavin, carotene, ascorbic acid and among other carotene content of vegetables is usually high during early growth period and declines rapidly with maturity (Ibrahim, 1985). Yet some vegetables are exception to that observation because they tend to retain carotene contents for long periods. Realizing the wide spread usage of *Gnetum africana* and *Heinsia crinita* which are indigenous species in the southern part of Nigeria, it become necessary to ascertain the contribution of these species to the wellbeing of the populace.

Gnetum africana commonly known as Afang (Efik), Okazi (Ibo), Eru (Cameroun) grows naturally in humid forest is from the family Gnetaceae. It is widely distributed in the forest zones from Nigeria through Cameroon, Central African Republic and Gabon to Angola. *Gnetum africanum* is a source of rapid incomes to farmers as buyers visit local villages in Akwa Ibom State and Cross River State on daily basis. The leaves are important ingredients in preparing tasty soup in many homes in the South-South and South East of Nigeria. In all traditional feasts or parties, afang soup is sure to be one of the main dishes of such occasions like traditional marriage, naming ceremony, burial and new yam festivals in Akwa Ibom State and Cross River State of Nigeria. *Gnetum africana* can be propagated through vines, seeds and roots. The common pests and

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diseases are termite that attacks the stakes, mealy bugs that attack the leaves and wounds on the vines which may occur during harvest that exposes the plant to fungal attack. *Heinsia crinita* commonly known as Atama (Efik and Ibibio) is from the family Rubiaceae. It is found in the tropical rain forest and requires annual rainfall of about 2500mm (Brokaw, 1989). It is shrub in nature and it be propagated by stems, seeds and roots. The leaves of *Heinsia crinita* are popular and much cherished vegetable considering its aroma and lasting sweet taste left in the mouth long after its consumption. The soup is sometimes prepared using oil palm fruit extract in water. *Heinsia crinita* soup is very common in almost all the homes in Akwa Ibom State and Cross River State of Nigeria. The most important features of this plant is that the leaves are very cheap compare to that of *Gnetum africana.* Termite and mealy bugs are the common pest and diseases that can attack the stem and the leaves of the plant.

MATERIALS AND METHODS

Leaves of *Gnetum africana* (Afang) and *Heinsia crinita* (Atama) were obtained from Akwa Ibom State College of Agriculture, Obio Akpa Teaching and Research Farms, Oruk Anam Local Government Area, Akwa Ibom State. Leaf Collections were five stands of both Gnetum and Heinsia sp respectively and were kept separate per stand as replications. About 100g of each of the 5 stand sample was taken for dry matter determination while the remaining samples were dried at 60^0C for 24hrs.

The leaves were milled separately and stored in 500ml conical flask tightly corked to prevent air penetration for chemical analysis.

Proximate analysis

The method of AOAC, 1990 was used to determine the proximate composition of the plant samples. The percentage crude ash was determined by igniting 50g of milled samples in crucible inside a muffled furnace of a temperature of 600oC. The ashing was terminated on formation of white ash from the samples. The ash formed was cooled in a desicator and Weighed. The weight after ashing was expressed as a percentage of samples before ashing and this gives the percentage crude ash of the samples *Gnetum africanum* and *Heinsia crinita*.

The crude protein content of the samples was determined by Kjeldahl method as described by James (1995). About 30g was digested with concentrated tetraoxosulphate (IV) acid using lithium tetraoxosulphate (IV) as catalyst. This oxidized the organic matter and the nitrogen present in the form of ammonium tetraoxosulphate (IV) was distilled with aid of excess caustic soda (NaOH) during which NH_3 was released. The NH_3 released was allowed to react with 0.1ml HCl in the presence of methyl red and brom-cresol green indicator. The percentage crude protein was estimated by multiplying the titre with 6.25 and expressed as percentage of weight of sample before digestion. The crude fibre was determined by defatting 20g of the samples with petroleum ether the samples were boiled with 1.25% dilute H_2SO_4 and washed with distilled water. The same samples were again boiled with 1.25% KOH with each boiling lasting for 30 minutes. The insoluble residue was separated by filtration, washed, dried, weighed and ashed. The losses of weight resulting from ashing were expressed as percentage of the samples weight before ashing. The lipid contents of the samples were determined using soxhlet extractor. About 10g of the milled samples (*Gnetum africanum* and *Heinsia crinita*) was weighed and placed on a dry soxhlet suspended in a beaker. The beakers were placed in soxhlet condenser attached to flask containing sufficient ether to fill the thimble. Heat was supplied to the flask by means of electric hot plate so as to keep the ether gently boiling The percentage crude lipid was estimated by expressing the weight of the lipid as percentage of sample weight before extraction.

The carbohydrate content of the samples were determined by difference obtained subtracting total organic nitrogen , ash and fibre content from the total dry samples (Ogunwale,1986 and James, 1995)
=100-%(a+b+c+d+e) where a=protein, b=fat, c=fibre, d=ash and d=moisture

Determination of mineral elements

The method of AOAC (1990) was used to determine the mineral contents of the plant samples. The dried samples were made moisture free. 1.0g 0f each sample was weighed out and ashed at a controlled temperature of 55^0C. The ash obtained was treated with hydrochloric acid and concentrated nitric acid before filtering and taken for Ca, P, K, Fe, Mg, and Zn mineral determination using Atomic Absorption Spectrophotometer (AAS) (Unicam, 919.model).

Determination of anti-nutrient substances

Chemical test were carried out on the aqueous extract. The samples were prepared by soaking 100g of dried powdered samples in 200ml of distilled water for 12hrs. The extracts were filtered using Whatman filter paper No 42 (125 mm). The chemical test was also carried on powdered samples using standard procedures to identify the constituents as described by Sofowara (1993); Trease and Evans (1989).

Test for tannins

About 5g each of the crude extracts of *Gnetum africanum* and *Heinsia crinita* were stirred with 10ml of distilled water, filtered and ferric chloride reagent added to the filtrate. A blue-black precipitate was formed which indicates the presence of tannins in the plant extracts (Trease and Evans, 1989).

Test for oxalates

About 5g of the milled samples were weighed into a beaker and 200ml of distilled water and 10ml of hydrochloric acid were added. The mixtures were digested on a steam bath for 4hrs at 50oC. The digested samples were centrifuged, filtered and the filtrate diluted to 250ml with distilled water. Three 50ml aliquots were taken and each evaporated to about 25ml. The solution was treated with concentrated ammonia until the purple-ink colour of methyl red indicator change to faint yellow. The determination was carried out in triplicate (Sofowara, 1993).
1ml of 0.05M $KMnO^4$ =2.22mg of oxalate.

Test for hydrocyanic Acid

About 10g of the samples were weighed into a round bottom flask and left to soak for 24hrs. It was then

steam distilled into 20ml of 2.5 % sodium hydroxide contained in Erlenmenyer flask. The distillation was continued until 150ml of the distillate was collected. 8.0ml of 6N ammonium hydroxide and 2.0ml of 5% potassium iodide were added to the distillate. And 1ml of 0.5% dithiozone (in absolute ethanol) was added as indicator. The distilled was then filtered with 0.02M silver nitrate to a red-purple colour. The determination was carried out in triplicate (Trease and Evans, 1989)
1ml of 0.02M $AgNO_3$ =1.08mg of HCN.

Test for phytic acid

About 5g of milled samples were weighed into a beaker and 50ml of 0.05M HCl was added, the mixture was allowed to stand for 2hrs. To extract phytic acid 40ml of the filtered extract were neutralized with NaOH and then rendered slightly acidic with the HCl. 2oml aliquot were treated in 50ml, centrifuge tube with 4ml $FeCl_3$ solution. The tubes were heated in boiling water bath for 15minutes to flocculate the precipitate of Ferric phytate (Wheeler and Ferrel, 1971).

RESULTS AND DISCUSSION

The result of the proximate chemical compositions of *Gnetum africanum* and *Heinsia crinita* leaves are presented in Table 1. The result showed a high percentage proximate fraction of crude protein, crude fat, carbohydrate in *Heinsia crinita* and *Gnetum* africanum. However, the higher values of proximate composition recorded in *Heinsia crinita* was higher than Gnetum africana and the result was in line with the work of Attah-krah and Reynolds (1994), who found that the variation in chemical content of various species of might be due to inherent genetic physiological differences between the species. The percentage crude protein, moisture content, crude fat and carbohydrate values (38.40%, 84.70%, 24.75% and 10.48%) of *Heinsia crinita* were significantly ($p<0.05$) higher than values obtained from *Gnetum africanum* (26.50%, 63.78%, 19.34%, and 6.75%). The result shows that *Heinsia crinita* had a higher value of crude protein, crude fat, moisture content and carbohydrate which are needed for a variety of cellular functions in humans, and which would reduce the problem of protein energy malnutrition (PEM).

Table 1: Proximate Chemical analysis of Heinsia Crinita and Gnetum africana (% Dry matter)

Compositions %	*Heinsia crinita*	*Gnetum africanum*	LSD(0.05)
Moisture	84.70	63.78	1.991
Crude Protein	38.40	26.50	2.192
Crude Fat	24.69	6.75	1.405
Total Ash	4.60	8.59	1.000
Crude fibre	24.68	36.43	2.159
Carbohydrate	25.74	19.34	1.228

Similar result was obtained by Guerin (2004) who reported high value contents of fresh leaves of *Heinsia crinita.* Sullivan *et al* (1974) reported that fresh leaves of *Gnetum africanum* had more nutritive content than dried leaves of *Gnetum africanum.* They observed that fresh leaves of some tropical vegetables have a higher level of digested crude protein and crude fat than dried leaves.

The values of crude fibre and ash content were higher in *Gnetum africanum* than *Heinsia* crinita. This is because the leaves of Gnetum africanum under go faster lignification, which increases with ages than leaves of Heinsia crinita species. Similar result was obtained in the earlier works of Omokanye *et al* (2000); Smith (1991) and Wilson (1999) who found that some species of vegetables have high value of crude fibre content than others.

Table 2: Mean Mineral content of Heinsia Crinita and Gnetum africana

Elements	*Heinsia crinita*	*Gnetum africanum*	LSD (0.05)
Phosphorus (g/100g)	1.25	0.14	0.0585
Potassium (g/100g)	1.64	0.10	0.204
Iron (g/100g)	3.05	1.15	0.777
Magnesium (g/100g)	2.39	0.92	0.542
Calcium (g/100g)	2.22	0.45	0.762

The mineral content (Ca, P, K, Fe, Mg, and Zn) of Heinsia crinita had values significantly (P<0.05) higher than those of Gnetum africanum (Table 2). The variation in the mineral content of these species under similar experimental conditions could be due to both genetic characteristics and the nutrients and minerals content of the edaphic status of their site.

The anti-nutrient components were higher in *Gnetum africanum* than *Heinsia crinita*. This may be as a result of the fast lignification of the leaves of Gnetum africanum and early maturing of the leaves. The percentage hydrogen-cyanide, phytate, oxalate and tannins values (3.51%, 6.12%, 24.4% and 2.80%) of Gnetum africanum were significantly (P<0.05) higher than values obtained from Heinsia crinita (1.20%, 3.51%, 10.12% and 0.78%). The high concentration of these anti-nutrient components in *Gnetum africanum* might have accounted for the believe that high consumption of dry leaves of *Gnetum africanum* causes internal heat which results in constipation.

Abara *et al*., (2002) reported that anti-nutrients inhibits the activities of some enzymes (amylase and lipase), it also interfere with dietary iron absorption. This may be due to reduction in digestibility of the dietary proteins. High consumption of anti-nutrient is dangerous to health (Gatachew, 2000).

Table 3: Mean Anti-Nutrient Contents of Heinsia Crinita and Gnetum africana

Components	*Heinsia crinita*	*Gnetum africanum*	LSD(0.05)
HCN (mg/100g)	1.20	3.51	0.429
Phytate (mg/100g)	3.51	6.12	1.269
Oxalate (mg/100g)	10.12	24.4	0.395
Tannins (mg/100g)	0.78	2.80	1.327

CONCL USION

The study reveals that *Heinsia crinita* has more nutritive content than *Gnetum africanum*. However, both plants contain adequate nutrients and mineral elements which are needed for normal growth by human beings. Moreover, it is recommended that people should consume more of *Heinsia crinita* than *Gnetum africanum* which are more common in the southern part of Nigeria.

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