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Assessment of Proximate, Phytochemical and Anti-Nutrient Composition of *Ufuku* (*Hildegardia barteri*) Seed

Asogwa, O.N & Ejinkeonye, U.B
Department of Home Economics/Hotel Management and Tourism
Michael Okpara University of Agriculture, Umudike

Abstract

The study assessed the proximate, phytochemical and anti-nutritional composition of *Ufuku* (*Hildegardia barteri*) seed. Proximate analysis showed that Ufuku seed contains 4.91±1.13% moisture, 4.12±0.02% ash, 34.13±0.12% fat, 21.93±0.20% crude fibre and 21.48±1.29% carbohydrate by difference. These contents compared favourably with already known oilseed like peanut (*Arachis hypogaea*) with 21.80% crude protein and a higher ash content than that in melon seed (*Cococynthis citrullus*) of 2.94±0.11%. Ufuku seed contains some phytochemicals such as Alkaloids (2.07±0.04mg), Flavonoid (1.60±0.02mg), Saponin (0.37±0.01mg), and Phenols (0.075±0.001mg), and also anti-nutrients which include Phytate (0.25±0.01mg), Tannin (0.36±0.00mg) and Oxalate (0.53±0.001mg). It is recommended that more research should be carried out to identify best processing techniques that could eliminate the anti-nutrients present in *Hildegardia barteri* seed before its consumption can be encouraged for maximum benefits.

Key words: Ufuku, *Hildegardia barteri*, proximate, phytochemical, anti-nutrients

Introduction

Ufuku (*Hildegardia barteri*) is primarily an ornamental tree in West Africa grown only for its beautiful flowers which blossom during the dry season (Ogunsina, Olaoye, Adegbenjo & Babawale, 2012). *Ufuku* is found in dry tropical forest in West Africa from Ivory Coast to south eastern Nigeria. It is a tree growing from 10 to 30 meters high (Lameed & Ayodele, 2010). In Ghana, *Ufuku* is found mostly near forest and savannah ecotones (Attua & Pabi, 2013). The fruit is borne on long gynophores (Dike & Aguguom, 2010), which is twice the length of the persistent calyx, and is composed of about five spreading, membranous, one-seeded carpel, each about 5 centimetres in length. The matured carpels/seed pods drop completely when dry. The seeds are smooth and light yellow in colour with a peculiar resemblance to groundnuts. Common names of *Hildegardia barteri* in West Africa are *Ando bomole* in Ivory Coast,

Adangme-krobo and *Akan-asante fante* in Ghana, *Ufuku* (Ibo), *Eso, Okurugbedu, Shishi* (Yoruba) and *Kariya* (Hausa) in Nigeria.

The production and utilization of *Ufuku* (*Hildegardia barteri*) seeds is largely limited in Nigeria to an ornamental plant that the seeds are not recognised. This is owing to the fact that the seeds are inconspicuously covered by a rough leathery shell and further enclosed in long leafy gynophores. The mature pods drop completely when dry, gathered and burnt indiscriminately with the intension of keeping the environment clean in many places (Inglett, Cavins & Spencer, 1973), as the seeds and its economic importance are not yet known. The researchers observed that children who consume the seeds raw out of joy of discovery and also because of it resemblance to groundnuts, stop eating it as they grow older because they do not know how safe the seeds are for consumption.

Some studies on the proximate component of *Hildegardia barteri* seed have been carried out. Inglett, Cavins, and Spencer (1973) studied the Seed Composition of *Hildegardia barteri* and their source of *Hildegardia barteri* seeds were from *Hildegardia barteri* trees in Accra, Ghana. Ogunsina, Olaoye, Adegbenjo, and Babawale (2011) studied the nutritional and physical properties of Kariya (*Hildegardia barteri*) seeds and the *Hildegardia barteri* seeds were from *Hildegardia barteri* trees in Obafemi Awolowo University, Ile-Ife, Nigeria. Information on the nutritive, phytochemical and anti-nutrient composition of raw *Hildegardia barteri* seeds from trees of *Hildegardia barteri* found in South Eastern Nigeria is quite scanty. This baseline information will form part of educational and health library, facilitating a better understanding of the seed, thus a major tool that the home economists, nutritionists, food scientists in the processing, product development to improve the consumption of *Hildegardia barteri* seeds. The information can also be used by agriculturist to advocate for an increased cultivation and consumption of *Hildegardia barteri*, hence the importance of the study.

Objectives of the Study

The general objective of the study was to assess the nutritional, phytochemical and anti-nutrient composition of breadfruit. Specifically the study determined the:

1. proximate content of *Ufuku* (*Hildegardia barteri*) seed
2. phytochemical content of *Ufuku* (*Hildegardia barteri*)seed
3. anti-nutrient content of *Ufuku* (*Hildegardia barteri*) seed

Materials and Methods

***Materials*:** *Ufuku* (*Hildegardia barteri*) seeds used in this study were gathered from three *Ufuku* trees in Michael Okpara University of Agriculture, Umudike, Abia State.

***Sample preparation*:** The nuts were extracted from the dry pods, shelled manually to obtain kernels and allowed to dry in the sun. Then, the

seeds were cleaned to remove sand particles from the husk, sorted to remove stones and mouldy seeds. Two cups of this cleaned seeds were ground using a manual grinder (corona traditional corn mill), secured in an airtight container and was analysed in the National Root Crop Research Institute, Umudike analytical laboratory for its nutrient, phytochemical and anti-nutrient composition.

***Nutrient analysis*:** The proximate value of the sample was determined using standard procedure. Moisture content of the sample was determined by gravimetric method of Association of Analytical Communities (AOAC) as outlined by Pearson (1976). The ash contents of the samples were determined by furnace incineration gravimetric method discussed by Pearson (1976) and James (1995). The crude protein was determined by the Kjedahl method described by AOAC (1995). The protein was calculated using the general factor 6.25. The crude fibre content was determined by the Weende method outlined by Onwuka (2005). The crude fat contents of the sample was determined as the ether extract in a continuous Soxhlet lipid extraction method using Soxhlet reflux apparatus as outlined by Mingboff in Onwuka (2005) while the carbohydrate content was estimated by the arithmetic difference method as described by Pearson (1976) and James (1995). In this method, the percentage carbohydrate was estimated as the difference between 100 and the sum total of the proximate composition of the sample.

***Phytochemical analysis*:** Alkaloids were determined using the alkaline precipitation gravimetric method described by Okwu (2004). Five grams of the sample was mixed with 100ml of 10% acetic acid in ethanol. It was filtered and concentrated. The concentrated extract was treated with drop-wise addition of concentrated ammonium hydroxide until full turbidity was observed. The alkaloid precipitates were recovered by filtration, washed and then oven dried. The process was repeated two more times and the average was taken. The weight of alkaloid was determined by the differences and expressed as a percentage of weight of sample analyzed.

Ethyl acetate precipitation gravimetric method described by Harbone (1973) was used to determine the Flavonoids. Ten grammes(10g) of the plant sample was extracted repeatedly with 100ml of 80% aqueous methanol at room temperature. The whole solution was filtered through Whatman filter paper No.42 (125mm). The filtrate was later transferred into a crucible and evaporated to dryness over water bath and weighed to a constant weight.

To determine Saponin, Obadoni and Ochuko method as described by Okwu (2004) was used. 20g of ground samples were put into a conical flask and 100ml of 20% aqueous ethanol was added. The samples were heated over a hot water bath for 4 hours with continuous stirring at about 550C. The

mixture was filtered and the residue re-extracted with another 200ml 20% ethanol. The combined extracts were reduced to 40ml over water bath at about 900C. The concentrate was transferred into a 250ml separatory funnel and 20ml of diethyl ether was added and shaken vigorously. The aqueous layer was recovered while the ether layer was discarded. The purification process was repeated. 60ml of n-butanol was added to the extracts and washed twice with 10ml of aqueous sodium chloride. The remaining solution was heated in a water bath. After evaporation, the extracts were dried in the oven to a constant weight, and percentage saponin content determined.

***Anti-nutrient analysis*:** Phytate was determined by the spectrophotometric method was used in the determination of phytate. 1g of the sample was dissolved in 25 ml of 0.5 M HNO_3 and centrifuged at 4,000rpm for 10 min. 1 ml of 0.03 M Ferric solution was added to the supernantant and left to stand for 15 min in order to allow chelation of the iron molecules by the indigenous plant phytate. At the end of the incubation, it was capped and heated for 20 min, 7.5ml of distilled water was added to it and vortexed. Thereafter, 0.1ml of 1.33 M NH_4SCN (Ammonium sulphocyanide) solution was added and absorbance read at 465nm. The amount of phytate was extrapolated from a standard calibration curve for calcium phytate.

Tannin content of the test sample was determined by the Follins-Dennis spectro photometric method by Pearson (1976). A measured weight of the dry test sample (1g) was dispensed in 50ml of distilled water and shaken to mix well for 30 min in the shaker. The mixture was filtered and the filtrate was used for the experiment. Five millilitres of the extract was measured into 50ml volumetric flask and diluted with 35ml of distilled water. Similarly, 5ml of standard tannin solution (tannic acid) and 5ml of distilled water were measured into separation flasks to serve as standard and blank respectively. Both were also diluted with 35ml of distilled water. 1ml of Follin-Dennis reagent was added to each of the flasks followed by 2.5ml of saturated sodium carbonate (Na2C03) solution. The content of each flask was made up to mark and incubated for 90min at room temperature. The absorbance of the developed colour was measured at 760nm wavelength with the reagent blank at zero. The experiment was repeated two more times to get an average. The tannin content was calculated as shown below:

$$\% \text{ Tannin} = \frac{100}{1} \times \frac{Au}{As} \times C \times \frac{Vf}{Va} \times D$$

Where:
Va = Weight of sample analyzed
Au = Absorbance of the test sample
As = Absorbance of standard tannin solution
C = Concentration of standard in mg/ml

The titrimetric method of Day and Underwood (1986) was used in the determination of oxalate. 150 ml of 15 N H_2SO_4 was added to 5 g of the sample and the solution was carefully stirred intermittently with a magnetic

stirrer for 30 minutes and filtered using Whatman No 1 filter paper, after which 25 ml of the filtrate was collected and titrated against 0.1 N $KMnO_4$ solution until a faint pink color appeared that persisted for 30 seconds.

Findings of the Study

The following findings were made:

Proximate composition of *Ufuku*

Table 1: Proximate composition of *Ufuku* (*Hildegardia barteri*) seed

Constituent	Kernal (%)
Moisture	4.91 ±1.13
Ash	4.12 ± 0.02
Fat	34.13 ± 0.12
Crude protein	21.93 ± 0.20
Crude fibre	3.48 ± 0.02
Carbohydrate	21.48 ± 1.29

Mean + SD of 3 Replications

Table 1 shows the proximate composition analysis (on dry weight basis) of *Hildegardia barteri* seed based on the analysis, the seed contained 4.91 ±1.13% moisture, 4.12 ± 0.02% ash, 34.13 ± 0.12% fat, 21.93 ± 0.20% crude protein, 3.48 ± 0.02% crude fibre and 21.48 ± 1.29% carbohydrate by difference.

Phytochemical composition of *Ufuku*

Table 2: Phytochemical composition of *Ufuku* (Hildegardia barteri) seed

Constituent	Kernel(mg/100g)
Alkaloid	2.07 ± 0.04
Saponin	0.37 ± 0.01
Flavonoid	1.60 ± 0.02
Phenols	0.075 ± 0.001

Mean + SD of 3 Replications

Table 2 shows Phytochemicals analysis of *Ufuku* seed. Based on the analysis, Alkaloids, Flavonoid, Saponin and Phenols contained 2.07 ± 0.04mg/100g, 1.60 ± 0.02mg/100g, 0.37 ± 0.01mg/100g and 0.075 ± 0.001mg/100g respectively

Anti-nutrient content of *Ufuku*

Table 3: Anti-nutrient content of *Ufuku* (Hildegardia barteri) seed

Constituent	Kernel (mg/100g)
Phytate	0.25 ± 0.01
Tannin	0.36 ± 0.00
Oxalate	0.53 ± 0.001

Table 3 shows that *Ufuku* seed contains Phytate (0.25 ± 0.01mg), Tannin (0.36 ± 0.00mg) and Oxalate (0.53 ± 0.001mg).

Discussion of Findings

In Table 1, the proximate analysis showed that *Ufuku* seeds contain 4.91%, 4.12%, 34.13%, 21.93%, 3.48%, and 21.48% of moisture, ash, fat, crude protein, crude fibre and carbohydrate respectively. This proximate composition do not deviate significantly with that obtained by Ogunsina, *et al* (2011) and Adebayo, Ogunsina and Gbadamosi (2013) from

Ufuku seeds obtained from Obafemi Awolowo University Staff quarters, Ile Ife, Nigeria. The proximate analysis ascertained that the moisture content of *Ufuku* seed (4.91%) is comparable to those reported for legumes by Ezeagu, Metges, Proll, Petzke & Akinsoyinu (1996) ranging between 2.63 and 9.86% and slightly lower than that in groundnuts (5.8%) reported by Atasie, Akinhanmi and Ojiodu (2009).

The mean ash content value of 4.12% obtained for *Ufuku* seed in this study is highly comparable to that from melon seed (4.15%) as reported by Okorie and Abiara (2012) and above the range of 1.5-2.5% recommended for seeds and tubers for animal feed formulation. The fat content of 34.13% obtained from *Hildegardia barteri* seed in this study is lower than that obtained in *Egusi* seed 55.35% (Okorie & Abiara, 2012) and peanut 47% (Atasie, Akinhanmi & Ojiodu, 2009), but however, high compared with 27.15% obtained for soybean flour (Tharise & Nurminah, 2014). With the high amount of fat obtained from *Ufuku* seed in this study, *Ufuku* seed could be regarded as an oil seed. The protein content of 21.93% is comparable to that from cowpea with protein content ranged from 19.84 -26.61% from five varieties of cowpea in Nigeria (Owolabi, Ndidi, James & Amune, 2012) and 22.5 to 25.6% from four varieties of cowpea in Bulgaria as reported by Antova, Stoilova and Ivanova (2014). This protein content is however lower than 28.35% of *Egusi* (Okorie & Abiara, 2012) and do not compare favourably with the 38.61% crude protein in groundnuts (Atasie, Akinhanmi & Ojiodu, 2009). The protein content of *Ufuku* seed suggests that the flours could be used to fortify or supplement cereal and tuber flours which are very low in protein. The 3.48% crude fibres contained in *Ufuku* seed is higher than that in *Egusi* 3.05% (Okorie & Abiara, 2012) and lower than 3.7% obtained in groundnuts (Atasie, Akinhanmi & Ojiodu, 2009).

Table 2 showed the phytochemicals contained in *Ufuku* seed. The alkaloid content was found to be 2.07 $\pm$ 0.04mg/100g, saponin as 0.37 $\pm$ 0.01mg/100g, flavonoid was 1.60 $\pm$ 0.02mg/100g, while phenols were 0.075 $\pm$ 0.001mg/100g.

Table 3 outlined the anti-nutrients contained in *Ufuku* seed. From the table it was observed that *Ufuku* seed contained 0.25 $\pm$ 0.01mg/100g phytate, 0.36 $\pm$ 0.00mg/100g tannin and 0.53 $\pm$ 0.001mg/100g oxalate. The levels of anti-nutrients observed in *Ufuku* seed were relatively low when compared with many legumes and vegetables. Plant materials are known to contain higher levels of antinutritional factors. Cabbages for instance have been found to contain 1266mg/100g tannic acid while sweet potatoes contain 491mg/g tannic acid. A low oxalate diet is usually defined as less than 80mg oxalate per day. However, dietary oxalate restrictions will vary depending on the underlying condition causing high oxalate levels (Chai & Liebman, 2005) These values are also very much below the WHO

(2003) tolerable oxalate limit of 105 mg/100 g and phytate standard safe level of 22.10 mg/100 g (WHO, 2003).

Conclusion

The proximate, phytochemical and anti-nutritional constituent of *Ufuku* seed obtain in Michael Okpara University of Agriculture, Umudike were found to have considerable differences with that found in Accra – Ghana and in Ile-Ife – Nigeria. The nutritive values of *Ufuku* seed also compared favourably with indigenous oilseed – *Ufuku* seed having higher crude protein crude ash composition. Anti-nutrients, though present, were not in appreciable amounts.

Recommendations

It is then recommended that

1. Processing methods that can eliminate the anti-nutrients in *Ufuku* seed should be identified.
2. Sensory evaluation should be carried out on different dishes prepared with *Ufuku* seed to ascertain the most acceptable ones.
3. The preparation and consumption of such acceptable dishes should be promoted through nutrition education at women gatherings by Home Economics extension agents.

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