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Proximate and Mineral Composition of the Pulp of *Chrysophyllum albidum* Fruit

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ABSTRACT
The proximate composition of *Chrysophyllum albidum* fruit pulp was determined. Mineral elements were determined using a tri-acid digestion method. The result of the proximate composition of the fruit pulp showed moisture content (64.00 ± 0.02%), ash (3.00 ± 0.02%), lipids (8.50 ± 0.02%), crude fibre (4.00 ± 0.02%), crude protein (0.24 ± 0.03%) and soluble carbohydrate (20.26±0.03%). The energy value of the fruit was found to be (663.12±0.60%kJ/100g) in the fruit pulp. Similarly, mineral analysis revealed potassium with (256.57± 5.77mg/100g), sodium (40.00 ± 0.00mg/100g), phosphorus (2.21 ± 0.03mg/100g), calcium (61.67±5.77mg/100g), magnesium (33.33 ± 20.21mg/100g), copper (0.94 ± 0.20mg/100g), zinc (0.26 ± 0.10mg/100g), and iron (3.46± 0.06). Others include heavy metal such as lead (0.09 ±0.08mg/100g), chromium (6.83± 6.26/100g) and cadmium was not detected. The pulp also contained appreciable amount of vitamin C (3.70 ± 0.17mg/100g). The results showed that the fruit pulp of *Chrysophyllum albidum* contained essential nutrients and mineral elements.

Keywords: *Chrysophyllum albidum*, minerals, proximate

INTRODUCTION
African star apple (*Chrysophyllum albidum*) is a forest tree species and its natural occurrence is found in many ecozones of Africa especially in Cameroun, Nigeria and Uganda (Bada, 1997). Presently, the plant becomes a crop of commercial importance in Nigeria. The fruit is common in both rural and urban markets especially between the months of December and April and the seed of the plant is a good source of oil which is used for many purposes (Amusa *et. al.*, 2003).

Chrysophyllum albidum is a small tree in size which grows up to 25-37m and frequently free of branches for 21m height (Bada, 1997). The leaves are simple, dark green above and pale green below when young and silver white below when mature. The fruits are almost spherical with 5 brown seeds, beans like and star-shaped arrangement in the fruit (Bada, 1997).

The plant is a native of Ghana, Kenya, Sudan and Uganda. It is a canopy tree of low land mixed rainfall and sometimes riverine. It is widely distributed form West Africa with a limit at Kakamega forest by east in Kenya to the Sudan (Species information, 2008).The fruit is widely eaten in southern Nigeria especially by children and women (Okafor, 2001). The fleshy and Juicy fruit are also a potential source of a soft drink. Other components of the tree such as leaves and roots are used in ethno medicine (Bada, 1997). The fruits can also be fermented and distilled for the production of wine and spirits (Species information, 2008). The common names by which the fruit is known in various part of the world include: white/African star apple (English), Agbaluma (Yoruba), Mululu (Ghana) and Agwalima (Hausa).

The main objectives of this research are to determine the proximate and mineral compositions, energy value, vitamin C content of the pulp of *Chrysophyllum albidum* fruit.

MATERIALS AND METHODS
Sample Collection and Treatment
Fruit samples of *Chrysophyllum albidum* were collected from the selling point at the Sokoto central market. The samples were identified and authenticated at Botany unit of Biological Sciences Department, Usmanu Danfodiyo University, Sokoto.

The sample fruits were washed with distilled water and opened in which the pulp (flesh) was collected. The pulp was separately crushed mechanically using a clean ceramic mortar and pestle and stored in a covered plastic container for

analysis. The sample was then divided into two for both proximate and minerals determinations.

Proximate Analysis

Hot air drying oven, the soxhlet extraction and micro-Kjeldahl methods of AOAC (1990) were used to determined moisture, crude lipid, crude fibre and crude protein contents of the samples respectively based on their principles. The ash, carbohydrate and energy value of the sample were determined using James method (1995).Whereas ascorbic acid was determined using a method described by The Association of Vitamin Chemists (1951).

Sample Digestion

The tri acid digestion procedure was adopted as described by Sahrawat *et al.*, (2002) and the acids are as follows $9cm^3$ dilute nitric acid, $2cm^3$ dilute perchloric acid and $1cm^3$ of concentrated Sulphric acid 9:2:1 ratio.

Sodium and Potassium was determined using flame photometer. The amount of sodium and potassium in the sample was determined from the standard curve as part per million (ppm). Phosphorus was determined using spectrophotometer as described by Bray and Kurtz, (1975). The percentage of Phosphurus from the sample was calculated using the formula below:

$$\% P = \frac{ABS\ x\ 0.61\ x\ DF}{Atomic\ weight\ of\ P} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (1)$$

Where ABS = absorbance, DF = Dilution factor

Calcium and Magnesium were determined using EDTA titration method as described by Black *et al.*, (1965). The titre value was recorded and the % of Ca+Mg was calculated as:

$$\% (Ca + Mg) = \frac{TV\ x\ 0.01}{20}\ x\ 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where, TV = titre value for Ca + Mg

The percentage for calcium alone was calculated as:

$$\% Ca = \frac{TV\ x\ 0.01}{20}\ x\ 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (3)$$

Where, T.V = Titre value for Ca alone.

Other elements were determined using AAS machine due to its good precision and accuracy as described by Hassan and Umar, (2004) except for Na and K. the absorbance measured is proportional to the amount of the analyte in the sample solution.

Statistical Analysis

All analyses were done in triplicates. The results were expressed in mean±standard deviation. Statistical significance was established using Analysis of Variance (ANOVA).

RESULTS AND DISCUSSION

Proximate composition

Table 1 shows the result of proximate composition obtained from the whole seed, the pulp and the peel of *Chrysophyllum albidum* fruit. Moisture content of the fruit pulp was 64.00%. This value is greater than the values obtained in *Annona muricata* 8.5% (Onimawo, 2002), and 9.74% in Pride of Barbados (*Caeselphina pulcherima*) (Oloafe *et al.*, 2004). According to Onimawo *et al.*, (2003), any fruit with a moisture content > 15% is subject to deterioration from mold growth, heat, insects damage and sprouting (Onimawo *et al.*, 2003). Therefore, this fruit should not be stored for a long period of time due to the high moisture content which is associated with rise of microbial activities during storage (Hassan *et al.*, 2006).

The ash content which is a measure of mineral content was found to be (3.00%) in the pulp of *Chrysophyllum albidum*. This value was low compared to *Ceiba pentandra* (5.00±0.35%) (Hassan *et al.*, 2006), 4.67 *Parkia biglobosa* (Hassan and Umar, 2004) and comparable to the values reported in *Deterium microcarpum* (3.76%), *Balanite aegyptiaca* (0.59%) and *Gmelina arborea* (0.85%) (Nkafamiya *et al.*, 2007).

Generally, the ash content obtained from the fruit pulp of *Chrysophyllum albidum* indicates it is not good for seed cake compounding of animal feeds as the value is > 2.5% (Akintayo, 2004).

The percentage crude lipid content of the fruit pulp was 8.50±0.02, though contrary to what was reported by (Amusa *et al.*, 2003), it is higher than the values reported in the fruits of *Dalium*,

guineanse, *Tetrapleura tetraptera*, *Cola millenii* and *Parkia biglobosa* with values 0.175, 0.075, 0.15 and 0.25mg/g respectively (Adenipekun and Fasidi, 2005). The value was low compared to the value reported in *Parkia biglobosa* 22.47% (Hassan and Umar, 2004). Due to the low oil content of the fruit pulp it shows that the fruit pulp is not economical for commercial exploitation (Hassan et al., 2005).

The crude fibre content of *Chrysophyllum albidum* fruit pulp was 8.50±0.02% which is higher than the crude fibre content of African bread fruit (3.3%) (Achinewhu, 1982). It was reported that, consumption of fruit containing high fibre content can reduce serum cholesterol level, colon, breast cancer, hypertension, enhance glucose tolerance and increase insulin sensitivity (Osilesi *et al.*, 1991). High fibre content in the diet at the same time reduces mineral, protein and carbohydrate bioavailability by hindering their hydrolytic breakdown (Plessi *et al.*, 1999, Vadivel and Janardhanan, 2000).

The percentage crude protein obtained in *Chrysophyllum albidum* fruit was very low compared to 26.15% in *Dalium guineanse*, 18.75% in *Tetrapleura tetraptera* (Adenipekun and Fasidi, 2005). The percentage carbohydrate content in the fruit pulp was 20.26±0.03. This value is comparable to the value reported for 25.00±0.13 *Balanite aegyptiaca* (Nkafamiya *et al.*, 2007). This high percentage of carbohydrate makes the fruit to be a good source of energy. The energy value obtained from the pulp of *Chrysophyllum albidum* was moderately low compared to the values reported by (Nkafamiya *et al.*, 2007), and is as a result of the percentage crude lipid content of the fruit pulp.

Table 1: Proximate composition of the pulp of *Chrysophyllum albidum* (% wet weighted)

COMPONENTS	PULP (% wet weighted)*
Moisture content	**64.00±0.02**
Ash content	**3.00±0.02**
Crude lipid	**8.50±0.02**
Crude fibre	**4.00±0.02**
Crude protein	**0.24±0.03**
Carbohydrate	**20.26±0.03**
Energy value (kJ/100)	**663.12±0.60**

*Data are presented as mean ± standard deviation of three replicates.

Mineral Composition

In the mineral analysis, Na and K were found to be the most abundant mineral elements in the fruit pulp with 40.00±0.00% and 256.57±5.77% respectively. These values obtained for Na and K in the fruit pulp contribute only 25% and 35% respectively when compared with recommended daily allowance by FAO, (1997). These high concentration of Na and K make this fruit not permissible for human consumption by people suffering from hypertension (Oloafe *et al.*, 2004), although Na and K are required for the maintenance of body fluid (Omole, 2003).

Other elements such as Ca, Mg, Cu, Zn, and Fe are generally comparable to the values reported in *Chrysophyllum roxburghi* by Barthakur and Arnold (1991) and contribute little to the recommended daily intake.

The heavy metals content of the *Chrysophyllum albidum* fruit pulp (Pb and Cr) were present in low concentration, comparable to the threshold limit value for the metal as a result of industrial and agricultural activities taken place around the area where it was obtained. Cadmium concentration in the fruit pulp was not detected.

Vitamin C content of the fruit pulp contained 3.70±0.17mg/100g. The value obtained is comparable to the values reported for some fruits such as *Adansonia digitata*, 3.87±0.05mg/100g, *Robinia acacia* 3.84±0.08mg/100g and *Balanite aegyptiaca* 2.92±0.05mg/100g and contribute very little to the recommended daily allowance by (FAO, 1997).

Table 2: Mineral composition of the pulp of *Chrysophyllum albidum* (mg/100g).

ELEMENTS	PULP (mg/100g)
Potassium	**256.57±5.77**
Sodium	**40.00±0.00**
Phosphorus	**2.21±0.03**
Calcium	**61.67±5.77**
Magnesium	**33.33±20.21**
Copper	**0.94±0.20**
Zinc	**0.26±0.10**
Iron	**3.46± 0.06**
Lead	**0.09±0.08**
Chromium	**6.83±6.26**
Cadmium	**N.D**
Vitamin C*	**3.70±0.17**

N.D = Not detected.
Data are presented as mean ± standard deviation of three replicates.
* = mg/100g dry weight.

CONCLUSION

In the proximate analysis of the fruit pulp, the percentage compositions of food nutrients were determined using specific methods. The result obtained revealed that the fruit is a good source of nutrient and mineral elements. The fruit is prone to deterioration as a result of high moisture content of the pulp. It also contains appreciable amount of mineral elements, though it is not good for animal feed since the ash value is above 2.5%. The oil is also not economical for commercial exploitation due to its low content. The energy value obtained from the fruit pulp can contribute a lot of energy required for some of our daily activities. The heavy metals present were Pb and Cr. But Pb was below the toxic level while Cr was generally at a toxicity level.

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