



Proximate and Mineral Composition of the Whole Seeds of *Chrysophyllum Albidum* Fruit

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Abstract

*The proximate composition of the whole seed of *Chrysophyllum albidum* was determined. Mineral elements were determined using a tri-acid digestion method. The results of the proximate analysis of the whole seed showed moisture content ($35.99 \pm 0.02\%$), ash ($1.01 \pm 0.02\%$), lipids ($1.00 \pm 0.02\%$), crude fibre ($27.51 \pm 0.02\%$), crude protein ($0.77 \pm 0.03\%$), soluble carbohydrate ($33.73 \pm 0.02\%$). The energy value of the fruit was found to be ($623.51 \pm 0.30 \text{kJ}/100\text{g}$) in the whole seed. Similarly, mineral analysis revealed that potassium content ($183.33 \pm 5.77 \text{mg}/100\text{g}$), Sodium ($25.00 \pm 0.00 \text{mg}/100\text{g}$), phosphorus ($2.33 \pm 0.05 \text{mg}/100\text{g}$), Calcium ($71.67 \pm 28.43 \text{mg}/100\text{g}$), Magnesium ($35.00 \pm 26.46 \text{mg}/100\text{g}$), Copper ($0.66 \pm 0.06 \text{mg}/100\text{g}$), Zinc ($0.29 \pm 0.16 \text{mg}/100\text{g}$), and Iron ($8.71 \pm 0.01 \text{mg}/100\text{g}$). Others include heavy metal such as Lead ($0.10 \pm 0.17 \text{mg}/100\text{g}$), Chromium (ND) and Cadmium appeared very low ($0.12 \pm 0.19 \text{mg}/100\text{g}$). It also contained high percentage of vitamin C ($9.00 \pm 1.50 \text{mg}/100\text{g}$). The results showed that *Chrysophyllum albidum* seed contained essential nutrients and mineral elements. The whole seed is therefore recommended for seed cake compounding of animal feeds as the value is $< 2.5\%$.*

Keywords: Proximate composition; Mineral composition; *Chrysophyllum albidum*; White star apple; Commercial fruit.

1.0 INTRODUCTION

African star apple (*Chrysophyllum albidum*) is a forest tree specie and its natural occurrence is found in many ecozones of Africa especially in Cameroun, Cote D'Ivoire, Niger Republic, Nigeria and Uganda (Orwa, *et. al.*, 2009a). Presently, the plant is of commercial value in Nigeria. It is common in both rural and urban markets especially between the months of December and April (Orwa, *et. al.*, 2009a). In addition, the seed of the plant is a very good source of oil which is used for many purposes (Amusa *et al.*, 2003). Adewoye, *et al.*, (2010) reported that *Chrysophyllum albidum* has anti-plasmodia effect.

1.1 Botanical description

Chrysophyllum albidum is a small tree in size which grows up to 25-37m and frequently free of branches for about 21m height. The leaves are simple, dark green above, pale green below when young and silver white below when mature and grow to about 12-30cm long, 3.8-10cm wide. The fruits are almost spherical, slightly pointed at the tip, greenish-grey when immature and turning orange-red when ripe with 5 brown seeds, beans like, shiny when ripe and star-shaped arrangement in the fruit (Orwa, *et al.*, 2009b). Despite the role of ecological barrier, the Dahomey Gap played in the distribution of many

evergreen rain forests species in Western Africa (Salzmann and Hoelzmann, 2005), *Chrysophyllum albidum* is present in Benin.

The plant is a native of Ghana, Kenya, Sierra Leone, Sudan and Uganda. It is a canopy tree of lowland mixed rainfall and sometimes riverine. It is widely distributed from West Africa to the Sudan with a limit at Kakamega forest by east in Kenya (Species information, 2008). Falade, 2001 reported the importance of *Chrysophyllum albidum* species for local community livelihood improvement and its potentiality for food industries.

The fruit is widely eaten in southern Nigeria especially by children and women (Cenrad, 1999, Okafor, 2001). The fleshy and Juicy fruit are also a potential source of a soft drink. The seeds when not processed are also used for local games (Bada, 1997). The common names by which the plant is known in various part of the world include: white/African star apple (English), Agbaluma (Yoruba), Mululu (Ghana) Udala (Igbo) and Agwalima (Hausa). The main objective of this research was to determine the proximate and mineral compositions, energy value and vitamin C content of the seeds of *Chrysophyllum albidum* fruit.

2.0 MATERIALS AND METHODS

2.1 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 whole seeds were collected. The whole seeds were 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 mineral determinations.

2.2.0 PROXIMATE ANALYSIS

2.2.1 Determination of Moisture content

Hot air drying oven, the Soxhlet extraction and Micro-Jeldahl methods of AOAC (1990) were used to determine the 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 samples were determined using a method described by James (1995), whereas ascorbic acid was determined using a method described by The Association of Vitamin Chemists (1951).

2.2.2 Sample Digestion

The tri acid digestion procedure was adopted as described by Sahrawat *et. al.*, (2002) and the acids were as follows: 9cm³ dilute nitric acid, 2cm³ dilute

perchloric acid and 1cm³ of conc. Sulphuric acid 9:2:1 ratio.

2.3.0 MINERAL ANALYSIS

2.3.1 Determination of Mineral Elements

Sodium and Potassium were 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 Phosphorus from the sample was calculated using the formula below:

$$\%P = \frac{\text{Abs} \times 0.61 \times \text{D.F.}}{\text{Atomic weight of P.}} \quad \text{----- (i)}$$

Where Abs = absorbance and

D.F = Dilution factor

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

$$\% \text{ Ca +Mg} = \frac{\text{T.V} \times 0.01}{20} \times 100 \quad \text{----- (ii)}$$

Where, T.V = Titre value for Ca + Mg

The percentage for calcium alone was calculated as:

$$\% \text{ Calcium alone} = \frac{\text{T.V} \times 0.01}{20} \times 100 \quad \text{----- (iii)}$$

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.

2.3.2 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).

3.0 RESULTS AND DISCUSSION

3.1 Proximate composition

Table 1 shows the result of proximate composition obtained from the whole seed of *Chrysophyllum albidum* fruit.

Moisture content of the whole seed of the fruit was 35.99%. This value is greater than the values obtained in *Ceasia Siamea* seeds 15% (Hassan, *et al.*, 2005), 8.5% in *Annona muricata* (Onimawo, 2002), 9.74% in Pride of Barbados (*Caesalpinia pulcherima*) (Oloafe, *et al.*, 2004), 10.00% in *Ceiba pentandra* seeds (Hassan, *et al.*, 2006) and 7.50% in *Cassipourea congoensis* (Nkafamiya, *et al.*, 2007). According to Onimawo, *et al.*, (2003), any seed with a moisture content > 15% is subject to deterioration from mould growth, heat, insects' damage and sprouting. 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 (1.01%). This value was very 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 *Balanite aegyptiaca* (0.59%) and *Gmelina arborea* (0.85%) (Nkafamiya, *et al.*, 2007). Therefore, the ash content obtained from the whole seed is good for seed cake compounding of animal feeds as the value is < 2.5% (Akintayo, 2004).

The percentage crude lipid content of the whole seed is (1.00± 0.02) which is 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). This value was lower to the values reported for some seeds such as 22.47% in *Parkia biglobosa* (Hassan and Umar, 2004). Due to the low oil content of the whole seed it shows that it is not economical for commercial exploitation (Hassan *et al.*, 2005).

The crude fibre content of *Chrysophyllum albidum* seed $27.51 \pm 0.02\%$ is high than the crude fibre of African bread fruit (3.3%) (Achinewhu, 1982), 9.0% in *Ceasia Siamea* (Hassan. *et al.*, 2005), and 15.00 ± 2.05 in silk cotton seed (*Ceiba pentandra*) Hassan *et al.*, 2006). It was reported that, consumption of fruit containing high fibre content can reduce serum cholesterol level, colon and 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* seed was very low compared to other values reported for some seeds such as 20-25% in cowpea (Nigri *et al.*, 2001, Preet and Punia, 2000). The values were also very low compared to 26.15% in *D. guineanse*, 18.75% in *T. tetraptera*

(Adenipekun and Fasidi, 2005) and 22.32 ± 1.00 *Nuclea latifolia* (Nkafamiya, *et al.*, 2007).

The percentage carbohydrate obtained in the whole seed is (33.73 ± 0.02). This value was found to be high compared to the values reported in *Sesame indicum L* seeds (Aliyu *et al.*, 2005) and *Tamarindus indica* seed 17.10% and lower than 39.10% in *C. pulcherima* seeds (Shittu *et al.*, 2004). The values obtained from the fruit were also comparable to the values reported for 30.80 ± 0.01 . *Nuclea latifolia* and 36.75 ± 0.11 *Cassipourea congoensis* (Nkafamiya, *et al.*; 2007). This high percentage of carbohydrate makes the seed to be a good source of energy.

The energy value obtained from the seed of *C. albidum* was moderately low (623.51 ± 0.30) compared to the values obtained in *Cassia siamea* seed and pulp 1530.70% (Hassan, *et al.*, 2005), 7,833.32 in *Ceiba pentandra* seeds (Hassan *et al.*, 2006) and 4560 ± 0.07 in *Balanite aegyptiaca* (Nkafamiya, *et al.*, 2007). This low energy value of the seed is as a result of the percentage crude lipid content of the seed.

Table 1: Proximate Composition of the whole seed of *Chrysophyllum albidum* (% wet weighted).

Components	Whole seed
Moisture content	35.99 ± 0.02
Ash content	1.01 ± 0.02
Crude lipid	1.00 ± 0.02
Crude fibre	27.51 ± 0.02
Crude protein	0.77 ± 0.03
Carbohydrate	33.73 ± 0.02
Energy value (kJ/100)	623.51 ± 0.30

Data are presented as mean \pm standard deviation of three replicates.

3.2 Mineral Composition

In mineral analysis, Na and K were found to be the most abundant mineral elements in the sample with 25.00 ± 0.00 and 188.33 ± 5.77 respectively. The value of K obtained from the seed is comparable to the values reported for *Gmelina arborea* 189 ± 0.25 mg/100g, *Deterium microcarpum* 220 ± 2.11 mg/100g and *Cassipourea congolensis* 275 ± 0.99 mg/100g (Nkafamiya, *et al.*, 2007). The values obtained for Na and K in the fruit could contribute only 25% and 35% respectively when compared with recommended daily allowance by FAO. These high concentration of Na and K make the seed 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 comparable to the values reported in *Chrysophyllum roxburghi* by Barthakur and Arnold (1991) and contribute little to the recommended daily intake.

Heavy metal Chromium was not detected in the seed, but others like Lead and Cadmium were present in very low concentrations and comparable to the threshold limit value for the metals as a result of agricultural activities taken place around the area the fruit was obtained.

Vitamin C content of the seed (9.00 ± 1.50), indicates that, it has higher concentration than the values reported for some fruits such as *Adansonia digitata*, 3.87 ± 0.05 mg/100g and *Robinia acacia* 3.84 ± 0.08 mg/100g (Mukoshy, 1995), and contribute appreciably to the recommended daily allowance by (FAO, 1997).

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

Elements	Whole seed
Potassium	188.33 ± 5.77^a
Sodium	25.00 ± 0.00^a
Phosphorus	2.33 ± 0.05
Calcium	71.67 ± 28.43
Magnesium	35.00 ± 26.46
Copper	0.66 ± 0.06^a
Zinc	0.29 ± 0.16
Iron	8.71 ± 0.01
Lead	0.10 ± 0.17
Chromium	N.D
Cadmium	0.12 ± 0.19
Vitamin C*	9.00 ± 1.50^a

N.D = Not detected.

Data are presented as mean \pm standard deviation of three replicates.

* = mg/100g dry weight.

4.0 CONCLUSION

In the proximate analysis, the percentage compositions of food nutrients were determined using specific methods. The result obtained revealed that the

whole seed is a good source of nutrients and mineral elements.

The fruit is prone to deterioration as a result of high moisture content. It also contains appreciable amount

of mineral elements and it is good for animal feed since the ash value is <2.5%. The oil is also not economical for commercial exploitation due to its low content. Also the energy value obtained from the

whole seed can contribute a lot of energy required for some of our daily activities. The heavy metals present were Pb and Cd and falls below the toxicity level.

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