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Research Article

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Proximate and Mineral Content Analysis of African Star Apple (Chrysophyllum Albidum)

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Abstract

The proximate analysis of African Star Apple indicated that the moisture content of the plant material was 11.47 ± 0.10%, the ash content was 1.74 ± 0.02%, the crude fibre and crude fat were 2.42 ± 0.02% and 3.28 ± 0.04% respectively while the Nitrogen free extract was 0.51 ± 0.00%, crude protein was 1.86 ± 0.01% while carbohydrate was 81.64 ± 0.06% and a gross energy of 1.52 kcal. The result of mineral content analysis indicated that cupper had concertation of 2.44 ± 0.00 mg/kg, iron (2.24 ± 0.03 mg/kg), potassium (1.32 ± 0.00 mg/kg), Magnesium (1.26 ± 0.00 mg/kg), calcium (0.94 ± 0.00 mg/kg), nickel (0.51 ± 0.02 mg/kg), chromium (0.16 ± 0.01 mg/kg), cadmium (0.03 ± 0.00 mg/kg).

1. Introduction

Chrysophyllum albidum (*C. albidium*), commonly called white star apple, belonging to the family of *Sapotaceae* (which has up to 800 species) is a lowland rain forest tree species that grows up to 25 to 37 m in height at maturity with a girth varying from 1.5 to 2 m [1]. The Scottish botanist George Don described it as a forest fruit tree [2].

It is common throughout the tropical central East and West Africa regions and other parts of the world [3]. When it is ripe, the fruit is ovoid to sub-globose, pointed at the apex, and up to 6 cm long and 5 cm in diameter. The skin or peel, is orange to golden yellow when ripe and the pulp within the peel may be orange, pinkish, or light yellow. Within the pulp are three to five seeds which are not usually eaten.

The seed-coats are hard, bony, shiny, and dark brown, and when broken reveals white-coloured cotyledons. The (Figure.1.1) fruit is seasonal (usually from the months of December to March). The plant is a crop of commercial value in Nigeria [4]. The seeds are also used for local games or discarded. The fleshy fruit pulp is suitable for jams and is eaten especially as snack by many locals [5].

Plant picture

***Chrysophyllum Albidum* fruit**

***Chrysophyllum Albidum* tree**

Figure 1: Picture of Chrysophyllum Albidum Fruit and Seed
Source: [6]

2. Materials and Method

2.1 Collection and Identification of Plant Materials:

Ripe and fresh Chrysophyllum albidum fruits used for this study were purchased from Utako Market, in Abuja, Nigeria. The fruit were identified and authenticated at the Herbarium of the Department of Biological Sciences, University of Abuja, Nigeria.

2.2 Chemicals and Reagents:

The chemical and reagents used were all from Sigma Aldrich. Media used were from hi-media laboratories limited, India. Clinical test isolates used were collected from National Institute for Pharmaceutical Research and Development (NIPRD).

2.3 Preparation of Plant Materials:

The sample was prepared according to the methods described by Anibijuwon and Udeze [7]. The fruit samples were washed and the seeds removed from the fruits and air dried to constant weight. The dried seeds were deshelled and the cotyledon pounded into smaller granules using laboratory Mortar and pestle. The blender was used to pulverize the pounded cotyledon. The pulverized cotyledon sample was kept in an air tight container.

2.4 Proximate Composition Analysis:

The proximate analysis was carried out in the Department of chemistry SHEDA Science and Technology Complex Gwagwalada Abuja. Each sample (pulverized seed cotyledon of C. albidum fruits) was analysed in triplicate. This was carried out according to the method of AOAC [8].

2.5 Moisture Content Determination:

Two grams of each of the cotyledon sample was weighed into dried weighed crucible. The samples was put into a moisture extraction oven at 105 0C and heated for 3 hours. The dried samples was put into desiccators, allowed to cool and reweighed. The process was reported until constant weight was obtained the difference in weight was calculated as a percentage of the original sample

Percentage moisture =

Where;

W_1 = Initial weight of empty dish

W^2 = Weight of dish + Un-dried sample

W_3 = Weight of dish + dried sample

2.6 Ash Content Determination:

Two grams of each of the cotyledon samples was weighed into crucible, heated in a moisture extraction oven for 3hour at 100 0C before being transferred into a muffle furnace at 550 0C until it turned white and free of carbon. The sample was then removed from the furnace, cooled in a desiccator to a room temperature and reweighed immediately. The weight of the residual ash was then calculated as ash content Percentage Ash = x

2.7 Crude Protein Determination:

The micro kjeldahl method described by [105] was used. Two grams of each of the sample was mixed with 10ml of concentrated H2SO4 in a heating tube. One table of selenium catalysts was added to the tube and mixture heated inside a fume cupboard. The digest was transferred into distilled water. Ten millimeter portion of the digest mixed with equal volume of 45% NaOH. Solution and poured into a kjeldahl distillation apparatus. The mixture was distilled and the distilled collected into 4% boric acid solution containing 3 drops of methyl red indicator. A total of 50ml distillate was collected and titrated as well. The sample was duplicated and the average value taken The nitrogen content was calculated and multiplied with 6.25 to obtain the crude protein content. This is given as

Percentage Nitrogen =

Where;

N = Normality of the titrate (0.1N)

VF = Total volume of the digest = 100ml

T = Titre value

Va = Aliquot volume distilled

2.8 Crude Fiber Determination:

Two grams (2g) sample and 1g asbestos were put into 200ml of 1.25% of H2SO4 and boiled for 30 minutes. The solution and content then poured into Buchner funnel equipped with muslin cloth and secured with elastic band. This was allowed to filter and residue was then put into 200ml boiled NaOH and boiling continued for 30 minutes, then transferred to the Buchner funnel and filtered. It was then washed twice with alcohol. The material obtained washed thrice with petroleum ether. The residue

obtained was put in a clean dry crucible and dried in the moisture extraction oven to a constant weight. The dried crucible was removed, cooled and weighed. Then, difference of weight (i.e. loss in ignition) is recorded as crucible fiber and expressed in percentage crude fiber,

Percentage crude fibre = x

Where;

W_1 = Weight of sample before incineration

W_2 = Weight of sample after incineration

W_3 = Weight of original sample

2.9 Fat Content Determination:

Two grams of the cotyledon sample was loosely wrapped with a filter paper and put into the thimble which was filled to a clean round bottom flask, which has been cleaned, dried and weighed. The flask contained 120ml of petroleum ether. The sample was heated with a heating mantle and allowed to reflux for 5hours. The heating was then stopped and the thimbles with the spent samples kept and later weighed. The difference in weight was received as mass of fat and is expressed in percentage of the sample. The percentage oil content is percentage fat

Percentage fat = x

Where;

W_1 = Weight of the empty extraction flask

W_2 = Weight of the flask and oil extracted

W_3 = Weight of the sample

2.1.0 Carbohydrate Content Determination:

The nitrogen free method described by [105] was used. The carbohydrate is calculated as weight by difference between 100 and the summation of other proximate parameters as Nitrogen Free Extract (NFE) percentage carbohydrate

(NFE) = 100 – (M + P + F1 + A +F2)

Where;

M = Moisture

P = Protein

F^1 = Fat

A = Ash

F_2 = Crude Fibre

2.1.1 Energy Content Determination:

Gross energy was calculated based on the formula used by: Gross energy (kJ per 100 g dry matter) = (crude protein × 16.7) + (crude lipid × 37.7) + (carbohydrate × 16.7) [9].

2.1.2 Mineral Analysis:

In the mineral analysis, the samples were ashed at 550OC and the obtained ash was boiled with 10 ml of 20 % hydrochloric acid in a beaker and then filtered into a 100 ml volumetric flask. The filtrate was made up to the mark with deionized water. The minerals were determined from the resulting solution. Flame emission photometer was used for sodium (Na) and potassium determination while Atomic Absorption Spectrophotometer (AAS) (PerkinElmer, Analysist A700) was used for calcium (Ca), magnesium (Mg), iron (Fe), zinc (Zn), chromium (Cr) and copper (Cu) at SHEDA Science and Technology Complex Gwagwalada Abuja. All values were expressed in mg/100g [10].

3. Results

Parameter (%)	**Values**
Moisture	11.47 ± 0.10
Ash	1.74 ± 0.02
Crude fibre	2.42 ± 0.02
Crude fat	3.28 ± 0.04
Nitrogen free extract	0.51 ± 0.00
Energy gross	1518 ± 2.00
Crude protein	1.86 ± 0.01
Carbohydrates	81.64 ± 0.06
Values are Expressedas Mean ± SEM.	

Table 1: Proximate Composition Value of C.Albidum Cotyledon

Iron (Fe)	2.24 ± 0.03
Chromium (Cr)	0.16 ± 0.01
Nickel (Ni)	0.51 ± 0.02
Lead (Pb)	0.06 ± 0.02
Cadmium (Cd)	0.03 ± 0.00
Cupper (Cu)	2.44 ± 0.00
Manganese (Mn)	0.62 ± 0.02
Sodium (Na)	0.26 ± 0.00
Magnesium (Mg)	1.26 ± 0.00

Calcium (Ca)	0.94 ± 0.00
Potassium (K)	1.32 ± 0.00
Values are Expressed as Mean ± SEM.	

Table 2: Heavy Metals/Minerals of C.Albidum Cotyledon

4. Discussion and Conclusion

The proximate composition of *Chrysophyllum albidum* (African star apple) is shown in Table 1. The result of the proximate analysis indicated that the moisture content of the plant material was 11.47 ± 0.10%, the ash content was 1.74 ± 0.02%, the crude fibre and crude fat were 2.42 ± 0.02% and 3.28 ± 0.04% respectively while the Nitrogen free extract was 0.51 ± 0.00%, crude protein was 1.86 ± 0.01% while carbohydrate was 81.64 ± 0.06% and a gross energy of 1.52 kcal. The gross energy observed in this study is in agreement with report of [11]. The authors reported a gross energy of 1.53 kcal from the seed shell pericarp of *C. albidum.*

However, the moisture content, crude protein, fat, crude fibre, ash content, and carbohydrate reported by was different from values observed in this study [11]. The difference could be attributed to the different parts of *C. albidum* studied. The result of the proximate analysis of *Chrysophyllum albidum* cotyledon indicates that it is rich in carbohydrates and so has high gross energy (1.52 kcal). This result is in agreement with the proximate composition of *C. albidum* flour reported by [12]. The authors reported that the seed flour of *C. albidum* had the following proximate composition; 9.93 ± 0.04% moisture, 8.14 ± 0.13% crude protein, 12.82 ± 0.04% crude fat, 2.84 ± 0.23% crude fibre, 2.32 ± 0.02% ash and 66.79 ± 0.12% carbohydrate.

The heavy metal analysis is indicated in Table 2. The result of analysis indicated that cupper had concertation of 2.44 ± 0.00 mg/kg, iron (2.24 ± 0.03 mg/kg), potassium (1.32 ± 0.00 mg/kg), Magnesium (1.26 ± 0.00 mg/kg), calcium (0.94 ± 0.00 mg/kg), nickel (0.51 ± 0.02 mg/kg), chromium (0.16 ± 0.01 mg/kg), cadmium (0.03 ± 0.00 mg/kg). The result of the heavy metal analysis was lower than heavy metal reported by [12]. The authors reported 5100.00 mg/kg of potassium, 2100.00 mg/kg of magnesium, 1960.00 mg/kg of calcium, 210.00 mg/Kg of sodium, 47.20 mg/kg of iron, 24.20 mg/kg of manganese, 12.90 mg/kg of copper and 6.70 mg/kg of zinc.

The authors also reported absence of nickel, chromium and lead which were present in this study. Minerals are critical in the regulation of a number of cell membrane, permeability, muscles contraction, heart function, blood clothing, protein and red blood synthesis [13]. These essential minerals are important components of the daily diet. The high contents of potassium, magnesium, iron, calcium, and copper content in the extract is an indication that *C. albidum* fruit can supply some essential minerals needed for healthy life.

References

1. Adebayo, A. H., Abolaji, A. O., Kela, R., Ayepola, O. O., Olorunfemi, T. B., & Taiwo, O. S. (2011). Antioxidant activities of the leaves of Chrysophyllum albidum G. *Pak. J. Pharm. Sci, 24*(4), 545-551.
2. Ehiagbonare, J. E., Onyibe, H. I., & Okoegwale, E. E. (2008). Studies on the isolation of normal and abnormal seedlings of Chrysophyllum albidum: A step towards sustainable management of the taxon in the 21st century. *Sci. Res Essay, 3*(12), 567-570.
3. Amusa, N. A., Ashaye, O. A., & Oladapo, M. O. (2013). Biodeterioration of the African star apple (Chrysophylum albidum) in storage and the effect on its food value. *African Journal of Agriculture, 1*(1), ii+-11.
4. Oboh, I. O., Aluyor, E. O., & Audu, T. O. K. (2009). Use of Chrysophyllum albidum for the removal of metal ions from aqueous solution
5. Cenrad, Q. (1999). Centre for Environmental Renewable Natural Resources Management. *Research and Development Jericho, Ibadan. Publication. No CEN, 11*(1999), 85.
6. Akin-Osanaiye, B. C., Gabriel, A. F., Salau, T. O., & Murana, O. O. (2018). Chrysophyllum albidum seed (African star apple) as an additive in agricultural feed and a potent antimicrobial. *Direct Research Journal of Agriculture and Food Science, 6*(5), 107-113.
7. Anibijuwon, I. I., & Udeze, A. O. (2009). Antimicrobial activity of Carica papaya (pawpaw leaf) on some pathogenic organisms of clinical origin from South-Western Nigeria. *Ethnobotanical leaflets, 2009*(7), 4.
8. Helrich, K. (1990). *Official methods of analysis of the Association of Official Analytical Chemists*. Association of official analytical chemists.
9. Ekanayake, I. J. (1990). Evaluation of potato and sweet potato genotypes for drought resistance.
10. AOAC International. (2000). *Official methods of analysis of AOAC International* (Vol. 17, No. 1-2). AOAC international.
11. Ibrahim, H. O., Osilesi, O., Adebawo, O. O., Onajobi, F. D., Karigidi, K. O., & Muhammad, L. B. (2017). Nutrients compositions and phytochemical contents of edible parts of Chrysophyllum albidum fruit. *J. Nutr. Food Sci, 7*(2), 1-9.
12. Ajayi, I. A., & Ifedi, E. N. (2015). Chemical and preliminary toxicological evaluation of Chrysophyllum albidum seed flour in dietary formulation of albino rats. *IOSR J. Env. Sci. Toxic. Food Tech, 9*(6), 59-67.
13. Aremu, M. O., Olonisakin, A., Otene, I. W., & Atolaye, B. O. (2005). Mineral content of some agricultural products grown in the middle belt of Nigeria. *Oriental Journal of Chemistry, 21*(3), 419.