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Nutritional and Chemical Composition of Three Fruit Tastes of *Chrysophyllum albidum* (African Star Apple) in Nigeria

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ABSTRACT: Indigenous fruit trees contribute to food security and health care, they provide a significant nutritional and medicinal contribution to the people especially during the period of drought and famine. Three fruit tastes (very sweet, sweet and sour fruit) of *Chrysophyllum albidum* were identified and analyzed, for their nutrient and anti-nutritional composition using standard methods of AOAC. Result showed that 100 g portion of fresh *C. albidum* fruit type varied significantly ($p \leq 0.001$) in proximate and anti-nutritional properties between the three fruit tastes identified. From the study, proximate analysis of the very sweet fruit were significantly higher ($P \leq 0.001$) in moisture and protein contents (48.36±1.08 and 6.48±0.28) respectively compared to the sweet fruit (32.92±1.56 and 4.09±0.51) and the sour fruit (29.84±0.85 and 4.23±0.26). However, the sour fruit was significantly higher ($P \leq 0.001$) in carbohydrate, fibre and ash contents (51.7±0.80, 3.68±0.13, 3.30±0.19) respectively compared to the sweet fruit (49.06±0.53, 3.01±0.10, 3.48±0.16) and the very sweet fruit (33.51±1.71, 2.51±0.23, 2.56±0.13) respectively. Notably, there was no significant difference in the crude fat in the three fruit tastes analyzed. The anti-nutritional composition in the sour fruit was significantly ($P \leq 0.001$) higher in tannin, phenols, flavonoids, oxalate and phytate while alkaloids and saponin were significantly ($p \leq 0.001$) higher in the very sweet fruit compared to the sweet and sour fruit. These results indicates that despite the consumption of the very sweet fruits, the sour fruits has more potentials and will contribute towards providing nutritional and medicinal supplements for children and women in rural communities. Thus, proffering information on the need for more research and critical exploration of the fruit into different by-products and derivatives. This will enable more revelation on the important benefits of the species to common man; its wide utilizations may guarantee sustainable socio-economic development and management of the species among many other indigenous fruit trees in Nigeria.

KEY WORDS: Nutritional composition, chemical composition, health care, food security, *Chrysophyllum albidum.*

I. INTRODUCTION

Food security, poverty and lack of alternative sources of livelihood are the main drivers of degraded agricultural landscapes in developing countries. To combat this trend, stakeholders including smallholder farmers' are giving more attention to the cultivation and utilization of indigenous fruit trees like *Chrysophyllum albidum* commonly known as African star apple. This specie is a tropical edible fruit tree belonging to the family of Sapotaceae (Ehiagbonare *et al.*, 2008), whose fruits and seeds are known for its economical purposes (Okwu, *et al*., 2018). This indigenous fruit tree which is been relished by old and young has the potential of contributing directly to the nutritional and medicinal needs of the rural poor; It also creates an opportunity to diversify the people's tree based system and income.

The nutritional and medicinal properties of these species has led to an increase awareness of these smallholder farmers' to cultivate this species in their home garden, cash crop farm and also in tree based systems (Okwu, *et al*., 2018; Onyekwelu, *et al*., 2011). Few studies has been reported by scientist and developmental partners on the use of indigenous fruit trees to reduce the level of food insecurity, boost income generation and its potential of contributing to their health care in the rural areas of the developing world. This may probably be due to the fact that nutritionists concentrate on what are considered agricultural food rather than the bush berries and tiny reptiles, mammals or insects derived from the wild (Olapade and Kio, 1991; Ball *et al*., 1995). However, there is need to create more awareness on the importance of indigenous fruits consumed by the local people. One of the approaches is community involvement for biodiversity conservation, sustainable agricultural production as well as environmental preservation (Tchoundjeu, *et*

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al., 2002). Furthermore, there exist a knowledge gap in the potential of this fruit bearing trees and their capacity to contribute to food production (Adepoju, *et al*., 2012), as this will enhance the efforts to conserve forests or woodlands and make them more productive. As the demand for this fruit increase, there is need to investigate its contribution to nutrient intake especially that of the sour fruit. Various scientist has researched on the nutritional and anti-nutritional composition of this fruit but there are scanty information on the medicinal and nutritional properties of the very sweet, sweet and sour pulp of *C. albidum*. Thus, the study aims to examine the nutritional and anti-nutritional composition of three fruit tastes of *C. albidum* in their natural habitat.

II. MATERIALS AND METHODS.

A. Sample collection

Samples of 10 fresh *C. albidum* fruits were collected each from 10 trees in their natural occurring habitat in Edo State, Nigeria for the purpose of this study. A trained panel of 5 people was used to carry out an organoleptic test on the fruit taste using a 3 point likert scale of 1 - 3 (1 – very sweet; 2- sweet; 3- sour) and thereafter labelled accordingly. Panelist evaluated the samples in 2 different sessions and the fruits were tasted anonymously in duplicates.

B. Sample Preparation

The fresh fruits were deposited in the laboratory. Sample of each fruit taste was washed and prepared by scraping the pulp of the fruit with a spatula and labelled as samples A (very sweet fruit), B (sweet fruit) and C (sour fruit). Each of the samples was divided into two portions. One portion was used for moisture content, while the other sample was oven dried at a temperature of 60^0C for 24 hours and used for other determinations. The dried samples were then dried, grounded with a manual grinder into powder and sieved to get very fine powder. It was then stored in air tight plastic container. Chemical analysis were performed on each of the samples in triplicate as follows:

C. Nutrition and anti-nutritional composition

1. Proximate nutrient composition

The proximate composition of the ripe fruit pulp were investigated to determine: Moisture content by oven drying at 100^0C according to (Pearson, 1980), crude protein, ethyl fat extract and crude fibre, determination was carried out using methods described by James (1995). Crude ash and carbohydrate was determined in accordance with the methods described by the association of official analytical chemist, AOAC (2010).

2. Anti-nutritional composition

Chemical analysis was carried out on the pulp to determine; alkaloids and phenols content using Harborne (1973) method, tannins and flavonoid contents were determined as described by Trease and Evans (1989), saponin and glycoside contents using standard procedures to identify the active constituents as described by Sofowara (1993).

D. Experimental design and statistical analysis

The experimental design for the nutritional and anti-nutritional was a complete randomized block design with the three selected samples (fruit tastes) as treatments. Analysis for the nutritional and anti-nutritional assessment were conducted in triplicate while those of the organoleptic/sensory was done in duplicate.
Statistical analysis was carried out using a statistical package SPSS16.0 edition. Where the f-probability from ANOVA results revealed significant difference between fruit samples, the LSD at $P \leq 0.001$ level was calculated to determine the mean difference between fruit taste samples.

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III. RESULTS AND DISCUSSION

The results of proximate composition of *Chrysophyllum albidum* (African Star Apple) fruit tastes is represented in table (1) and illustrated in figure 1. There was a significant difference (P≤0.001) in the nutritional composition of the fruit except ethyl fat extract which was non-significant (P≥0.001) across the three fruits tastes analyzed.

The very sweet fruits were significantly higher (P≤0.001) in moisture and protein contents (48.36±1.08 and 6.48±0.28) respectively and least in the sour fruits (Table 1). Fresh fruits are known to contain water which contributes to their refreshing character; it also acts as a dissolving medium for substrates, transport materials and regulates temperature (Uwakwe and Ayalogu, 1998). The relative high moisture contents observed in the very sweet pulp is an indication of its short shelf life (Edem et al., 2009). Crude proteins are complex organic compounds that contain the element nitrogen as well as carbon, hydrogen and oxygen that are vital to every living cell. Generally, aside its nutritional value, it also repair and replace worn out cells (Olusanya, 2008).

Notably, the sour fruits were significantly higher (P≤0.001) in crude fibre, crude ash and carbohydrate (3.68 ± 0.13, 3.30 ± 0.19 and 51.71 ± 0.80) respectively and least in the very sweet fruits (Table 1). Crude fibre is the indigestible carbohydrate component that is present in plants. They are either soluble or insoluble fibre, the soluble fibre consists of pectins, gums and mucilage found in plants. The solubility makes it useful for thickening, gums, jelly and this attributes are some of the economic importance of this species. Nearly all fruits are low in fibre, this corroborates with the findings in this study of relatively low crude fibre in the pulp which may also be attributed to the removal of the fruit skin (fruits were depulped). Crude ash is an incombustible inorganic residue or final product of food combustion remaining after incineration which contains minerals and vitamins (IUPAC, 1997). The low percentage of ash contents in the pulp in this study is an indication that most of mineral contents present in fruit are low (Hassan *et al.*, 2009). Carbohydrate is a polyhydroxyl aldehydes which are found in fruits mainly as monosaccharide and are broken down in the body into simpler forms to pentoses and hexoses. The carbohydrate content of the fruit types investigated was low, fruits with low contents of carbohydrates are ideal for diabetic and hypertensive patients requiring low sugar diet. Consumption of the sour fruit will produce energy to power the cells and tissues, metabolizes fat and prevent dehydration in the body (Olusanya, 2008).

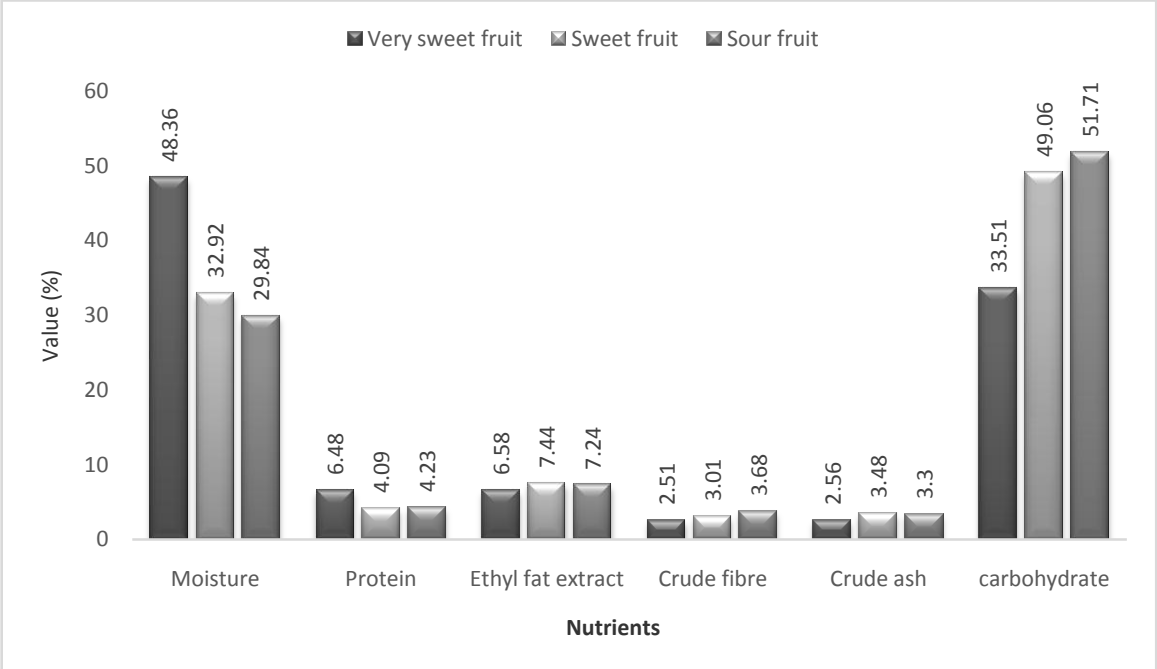

Fig 1: Proximate composition of the very sweet, sweet and sour fruits of *C. albidum*

The results for the anti-nutritional composition of the three fruit tastes of *C. albidum* is represented in table 2. The result show that there was a significant difference (P≤0.001) in the anti-nutritional composition in the fruit tastes of *C. albidum* except glycosides which was non-significant (P≥0.001) across the three fruits tastes analyzed. Alkaloids and

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saponin contents (0.73±0.03 and 1.15±0.02) respectively were significantly higher in the very sweet fruits but lower in the sweet and the sour fruit. Alkaloids are a group of naturally occurring bitter-taste nitrogen-containing compound occurring mainly in animals and about 10% of plant especially vegetables. In *C. albidum*, their composition was found in minute quantity in the different fruit types analyzed.

Saponin is a chemical compound found in plant species, it impairs the performance through irritating effect on the lining of the mouth and gut through their bitter taste. Low values of saponin in the pulp reduce health risk in humans.

Tannin, phenols, flavonoids, oxylate and phytate contents (8.06±0.06, 1.14±0.07, 5.05±0.02, 3.37±0.10 and 8.20±0.03) respectively were significantly higher in the sour fruit and lower in the very sweet fruit. Tannin is a complex polyphenolic substance that is known to reduce palatability in fruits, it is found more in the bark and seeds of fruit tree. This explains the low value of Tannin in the fruit pulp. Tannin contains astringency and bitter taste which hasten the healing of wounds and inflamed mucus membrane (Okwu and Okwu, 2004).

Phenols are chemical compounds found naturally in plant occurring most in the skins and seeds of fruits. They are anti-inflammatory, anti-clotting, anti-oxidants, immune enhancers (Faleyimu *et al.*, 2008). Low values were recorded in the pulp, this may be attributed to the removal of fruit skin.

Flavonoids are polyphenolic compounds with power antioxidant properties found in fruits, vegetables and beverages that may prevent or delay some types of cell damage caused by free radicals (Anaka *et al*., 2009).

Oxalate content was detected in the pulp but in appreciable quantity. Oxalate belong to a group of molecules called organic acids but has no function in humans (www.litholink.com).

Phytate is found in all plants because it stores the phosphorus needed to support germination and growth, energy source, cations and myoinositol. The presence of this anti- nutritional factors is one of the major draw backs limiting the direct use of some fruits (Onyekwelu *et al*., 2011). However, the low value of Phytate in the pulp in this study makes direct consumption of the fruits not detrimental to human health

Table 1: Proximate nutrient composition of the very sweet, sweet and sour for *C. albidum* (%)

Parameters	**Fruit taste**		
	Very sweet	Sweet	Sour
Moisture content	48.36±1.08[a]	32.92± 1.56[b]	29.84 ±0.85[b]
Protein	6.48± 0.28[a]	4.09 ± 0.51[b]	4.23 ± 0.26[b]
Ethyl Fat extract	6.58±0.16	7.44 ± 0.29	7.24 ± 0.32
Crude Fibre	2.51± 0.23[b]	3.01 ± 0.10[b]	3.68 ± 0.13[a]
Crude Ash	2.56± 0.13[b]	3.48 ± 0.16[a]	3.30 ± 0.19[a]
Carbohydrate	33.51 ± 1.71[b]	49.06 ± 0.53[a]	51.71 ± 0.80[a]

* Value represent mean ± SEM of triplicate determinations

*Values on the same row with different superscripts are significantly (p≤0.001) different.

Table 2: Anti- nutritional composition of the very sweet, sweet and sour for *C. albidum* (mg/100g)

Constituents	Fruit tastes		
	Very sweet	Sweet	Sour
Alkaloids	0.73±0.03[a]	0.47±0.02[b]	0.45±0.02[b]
Saponin	1.15±0.02[a]	0.62±0.04[b]	0.61±0.03[b]
Glycosides	0.13±0.00[a]	0.15±0.00[a]	0.15±0.01[a]
Tannin	3.60±0.08[b]	8.00±0.03[a]	8.06±0.06[a]
Phenols	0.51±0.02[b]	1.08±0.01[a]	1.14±0.07[a]
Flavonoids	3.11±0.03[b]	4.98±0.07[a]	5.05±0.02[a]
Oxalate	2.06±0.08[b]	3.25±0.05[a]	3.37±0.10[a]
Phytate	6.61±0.05[c]	7.98±0.04[b]	8.20±0.03[a]

* Value represent mean±SEM of triplicate determinations

*Values on the same row with different superscripts are significantly (p≤0.001) different.

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IV. CONCLUSION AND RECOMMENDATION

The present study revealed the nutritional and anti-nutritional composition of the three fruit tastes of *Chrysophyllum albidum*. The result obtained from the nutritional composition of this fruit show that the sour fruit contain a considerable quantity of nutrients; the sour fruit has a higher percentage of carbohydrate content compared to the sweet fruits. This makes consumption of the sour fruit a good source of human energy. Thus, the sour fruit which is often not palatable to the consumers has more nutritional value and may offer better health services than the sweet fruit. The anti-nutritional constituents of the fruit tastes identified and analyzed were found to be low in value which makes the fruit safe for consumption.

Conclusively, consumption of *C. albidum* fruit will directly contribute towards providing nutrients supplement mostly for children and women in the rural poor communities. Efforts should be geared towards supporting a better utilization of the specie in food and allied industries.

REFERENCES

[1]Adepoju, O.T. and Adeniji, P. O. (2012). Nutrient composition and micronutrient potential of three wildly grown varieties of African star apple (*Chrysophyllum albidum*) from Nigeria. *African Journal of Food Science* Vol. 6(12), pp. 344-35

[2]Anaka, O. N., Ozolua, R.I., and Okpo, S.O.,(2009): Effect of the aqueous seed extract of Persea americana Mill (Lauraceae) on the blood pressure of Sprague Dawley rats , *African J.Pharm.Pharmacol*.,3(10): 485-490.

[3]AOAC, (2010): Official method of analysis. *Association of Analytical Chemist* 15th edition. AOAC Internatonal 93 (1) 221-22

[4]Edem, C.A. Dosunmu M.I, Bassey F.I. Wilson, C and Umoren,P. (2009b): A Comparative Assessment of the proximate composition, Ascorbic acid and heavy metal content of two species of Garden Egg Solanium gilo and and Solanium anbergrine. *Pakistan Journal of Nutrition* 8(8) 582-584.

[5]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 21(st) century. *Scientific Research and Essays* 3: 567-570

[6]Faleyimu, O.I and Oluwalana, S.A.,(2008). Medicinal value of forest plant seeds in Ogun state, Nigeria. Medicinal value of forest plant seeds

[7]Harborne, J.B. (1973). Phytochemical methods, London. Chapman and Hall, Ltd. pp. 49- 188

[8]Hassan, L.G., Usman, B.B., Kamba, A.S., Hassan, S.W. (2009). Nutritional compositions of Vegetable sphaghetti (Hastala pasta) *Nigeria Food Journal*, 27 (2) 35-39

[9]IUPAC (1997): Compendium of Chemical Terminology, 2nd ed. (the "Gold Book"). Compiled by A.D. McNaught and A. Wilkinson, Blackwell Scientific Publications, Oxford, UK.

[10]Okwu, C., Osazuwa, E.S., Oboho, E.G., Agbolagba, E.O and Omoigberale, J.A.(2018):Farmers' Perception And Socio-Economic Importance Of An Indigenous Fruit Tree In Two Agroecological Zones Of Edo State, Nigeria. A Case Study Of *Chrysophylum Albidum* (G. Don) . Research article accepted for publication

[11]Okwu, D.E. and Okwu, M.E.(2004): Chemical composition of *Spondias mombin* Linn plant parts. *J.Sustain Agric.Environ*.6:140-147.

[12]Olapade, E.O., Kio, P.R.O. (1991). Forestry-based traditional foods in Nigeria. Paper presented at the FBFI workshop on Promoting Traditional Foods and Nutrition Security in Nigeria. Univ. Ibadan, December, 1991.

[13]Olusanya, J.O.(2008): Proteins, In: Essentials of food and nutrition. Apex Books Limited, Lagos.pp.13-21.

[14]Onyekwelu, J.C., Stimm B., Mosandl, R., Olusola, J.A., (2011): Domestication of *Chrysophyllum albidum* from Rainforest and Derived savannah Ecosystems – Phenotype Variation and Selection of Elite Trees. Paper presented at the conference on International Research on food security, Natural Resource management and Rural Development. University of Bonn,October5-7, pp 12.

[15]Pearson, D. (1980): The Chemical Analysis of Food. Scheckwahtong Printing Press, 10-12.

[16]Sofowara,A.,(1993). Medicinal plants and Traditional medicine in Africa. Spectrum Books Ltd, sphaghetti (Hastala past a) *Nigeria Food Journal*, 27 (2) 13-1

[17]Tchoundjeu, Z., Avana, M. L., Leakey, R.R.B., Simons, A. J., Asaah, E., Duguma, B. and Bell, J.M. (2002). Vegetative propagation of *Prunus africana*: effects of rooting medium, auxin concentrations and leaf area. *Agroforestry Systems* 54: 183-192

[18]Trease, G.E. and Evans, W.C., (1989): Pharmacognsy. 11th edn. Brailliar Tiridel Can. Macmillian publishers 53pp.

[19]James, C.S. (1995): Analytical chemist of funds. Chapman and hall, New York, 18 Pp

[20]Uwakwe, A.A., and Ayalogu, O. (1998): Biochemistry (A tropical approach) Vol.1.Fius Publishers, Port Harcourt, Nigeria.6pp.