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Nutrients, Antinutrients and Physicochemical Compositions of *Blighia Sapida* Pulp and Pulp Oil (Ackee Apple)

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Abstract: *Proximate, mineral and antinutrients of Blighia sapida fruit (Isin) were determined using standard analytical techniques. The physicochemical properties of the oil were also investigated. The mean values of various parameters for proximate composition (%) were: moisture (3.95±0.01), ash (6.20±0.03), ether extract (51.58±0.04), crude protein (15.27±0.01), crude fibre (16.14±0.04) and carbohydrate (by difference) (6.86). The calculated fatty acids were noted to be 41.26% and energy was 2284.67KJ/100g. Minerals (mg/100g) included: Na (29.20), K (29.52), Mg (21.12), Ca (25.07), Mn (0.07), Fe (1.95), Cu (0.09), Zn (0.28) and P (0.49) while Pb is not detected. The relationship between Na and K as well as between Ca and P, are desirable with the respective ratios of Na/K (0.99) and Ca/P (51.16). The results of physicochemical properties of Blighia sapida fruit oil with showed colour (yellow), refractive index (1.462), specific gravity (0.956), acid value (21.31mgKOH/g), saponification value (75.73mgKOH/g), iodine value (4.56mgIodine/100g), peroxide value (2.20), free fatty acids (10.71mgKOH/g), smoke point (174^{0}C), fire point (320^{0}C), flash point (278^{0}C) and melting point (18^{0}C). The antinutrients properties were phytates (0.928mg/100g), oxalate (5.422mg/100g) and Tannins (0.372mg/100g). The investigation showed that Blighia sapida fruit is highly nutritive in minerals and fat content, the oil is non-drying and may not be suitable for soap making and edible (margarine).*
Keywords*: Blighia sapida, pulp, nutrients, antinutrients, oil, physicochemical*

I. Introduction

In Nigeria, the major sources of edible oils are peanut (*Arachis hypogoea*) and oil palm (*Elvesis guineensis*). These oils are used mainly as cooking oils, for the production of soap, margarine and cosmetics (29). With increasing demand which has led to importation of cooking oils, there is need to source for local oil-bearing fruit apart from vegetables which can be used in production of oils, both for consumption and industrial uses.

Blighia sapida, commonly referred to as Ackee, Akee or vegetable brain or Akee apple and locally as "Isin", is an evergreen tree more widely known for the edible part of its fruit. It belongs to the family sapindaceae and grows to a height of 10 to 12m at maturity. The fruit is pear shaped and when it is fully mature, it splits open revealing 3 cream-coloured, fleshy, glossy arils somewhat nutty-flavored, attached to the large, black, nearly round, smooth, hard, shining seeds (19). The Ackee, Akee or Akee apple is indigenous to the forests of the Ivory Coast and Gold coast of west tropical Africa where it is little eaten but various parts have domestic uses. The ripe fruit is consumed to lower fever and control dysentery (11). There are limited information in the nutritional composition, utilization and physicochemical properties of the *Blighia sapida* oil extract. The study is aimed at investigating the nutrients, anti-nutrients, minerals and physicochemical characteristics of *Blighia sapida* oil extract. Such information may expand the scope of knowledge on the utilization and nutritional qualities of *Blighia sapida* oil extract.

II. Materials And Methods

Collection and Preparation of Samples: The *Blighia sapida* fruit that served as sample for analysis were obtained from Okuku farmland, Osun State, Nigeria. The edible portions were removed from the fruit using knife and sun dried for average of 2 weeks. Dried sample were milled using Moulinex blender. The powdered sample was stored in polythene bags and kept in a refrigerator at 4^{0}C until used for analysis.

The proximate analysis of the sample: Moisture, total ash and crude fibre were carried out in triplicate using the methods described in AOAC, 1990. The nitrogen was determined by the micro Kjeldahl method described by Pearson (29) and the nitrogen content was converted to protein by multiplying by a factor of 6.25. Carbohydrate was determined by difference. All the proximate values were reported in %.

Antinutrient analyses of the sample: Phytin was determined according to the method of Belewu et al, (9). Oxalate content was by the titrimetric method as modified by while tannins according to the method of Makkar et al (20).

Mineral Analysis: The minerals were analyzed by dry ashing the samples at 55^0C to constant weight and dissolving the ash in volumetric flask using distilled, deionized water with a few drops of concentrated hydrochloric acid. Sodium and Potassium were determined by using a flame photometer (Model, 405, Corning, UK) using NaCl and KCl to prepare the standards. All other metals were determined by Atomic Absorption Spectrophotometer (Perkin-Elmer Model 403, Norwalk CT, USA). All determinations were done in duplicate. All chemicals used were of analytical grade (BDH, London). The minerals were reported as mg/100g.

Extraction of oil: The oil sample was extracted from the dried sample of *Blighia sapida* fruit by Soxhlet extractor using petroleum ether of Analar grade (British Drug House, London) boiling point range 60-80^0C for 8 hours (18).

Physicochemical Characteristics Determination: The physicochemical determination of the oil extract of *Blighia sapida* fruit for acid value, iodine value, free fatty acid and specific gravity were carried out according to the methods of AOAC (5). The refractive index was measured on acetone-cleaned surfaces of prisms through the telescope (5).

III. Results And Discussion

Table 1: Proximate Composition (%) of Edible Portion of Blighia sapida

Sample	% ash	% moisture	% crude fat	% crude fibre	% crude protein	% CH_2O
Blighia sapida (fruit)	6.20	3.95	51.58	16.14	15.27	6.86
± SEM	0.03	0.01	0.04	0.04	0.01	0.06
	[a] Fatty Acids : 41.26% (0.8 x crude fat)					
	[b] Energy KJ/100g : 2284.67					

- Calculated metabolizable energy (KJ/100g) (protein x 17+fat x 37+CH_2O)

The proximate compositions of edible portion of *Blighia sapida* studied are shown in table 1. From the data, it was observed that the ash mean value of the sample under investigation was 6.20±0.03%: It has been recommended by Pomeranz and Clifton (30) that ash contents of nuts, seed and tubers should fall in the range 1.5-2.5% in order to be suitable for animal feeds. The ash content of *Blighia sapida* fruits does not fall within this range, hence it cannot be recommended for animal feeds. The moisture content of *Blighia sapida* fruit was 3.95±0.01%. This value is somehow low when compared with the mean value of moisture of legumes ranging between 7.0% and 11.0% as reported by Arkroyed and Doughty, (7).

This low moisture contents is an indication that the fruit could be stored for a longer time without spoilage. The ether extract (crude fat) with a mean value of 51.58±0.04 compared favourably with the values for varieties of melon oil seeds ranging between 47.9-51.1% reported by Ige et al (17) and high when compared with Pumpkin seeds 49.2% and 47.01% by Aisegbu (1) and Fagbemi and Oshodi (14) respectively. Fat is important in diets because it promotes fat soluble vitamin absorption (10). It is a high energy nutrient and does not add to the bulk of the diet. The crude fibre of *Blighia sapida* fruit was very high when compared with legumes, mean values ranging between 5-6% (4). Maintenance of internal distention for a normal peristaltic movement of the intestinal tract is the physiological role which crude fibre plays. Okon (23) reported that a diet low in fibre is undesirable as it could cause constipation and that such diets have been associated with diseases of colon-like piles, appendicitis and cancer. The crude protein of 15.27±0.05% is low compared to protein rich foods such as soybeans, cowpea, pigean peas, melon, pumpkin and guard seeds ranging between 23.1-33.0% as reported by 26. The recommended daily allowance for protein for children ranges from 23.0-36.0g and for adult, 44-56g (22). The calculated metabolizable energy value (2284.67KJ/100g) was higher than 2242.8KJ/100g reported for Cashew nut flour by (6)

Table 2: Mineral Content (mg/100g) of *Blighia sapida* fruit

Mineral	**Value (mg/100g_)**
Na	29.20
K	29.52
Mg	21.12
Ca	25.07
Mn	0.07
Fe	1.95
Cu	0.09
Pb	ND
Zn	0.28

P	0.49
Na/K	0.99
Ca/P	51.16

Values are mean of duplicate determinations
ND = Not detected

The mineral content (mg/100g) of edible portion of *Blighia sapida* are shown in Table 2. The least abundant minerals were P, Zn, Mn and Cu while K was found to be the most abundant mineral (29.52mg/100g). This results of analysis is in close agreement with the observation of Olaofe and Sanni, (26) and Aremu et al (6) that potassium,was the most predominant mineral in Nigerian Agricultural Products. Magnesium mean value (21.12mg/100g) indicates that the mineral content acts as an activator of many enzymes systems and maintains the electrical potential in nerves (15). Calcium mean value (25.07mg/100g) in this analysis is lower when compared with melon, pumpkin and Gourd seeds of 130.7, 72.3 and 54.9mg/100g respectively as reported by Olaofe et al (26). In bone formation, calcium in conjunction with phosphorous, magnesium, manganese, vitamin A, C and D, chlorine and protein are all involved (16). Calcium plays an important role in blood clothing muscle contraction and in certain enzymes in metabolic processes. Phosphorous is always found with calcium in the body both contributing to the blood. Ca/P ratio above two helps to increase the absorption of calcium in the small intestine (23). Ca/P ratio of the *Blighia sapida* fruit is greater than 1; hence it would serve as good source of mineral for bone formation. The ratio of sodium to potassium in the body is of great concern for prevention of high blood pressure. Na/K ratio less than one is recommended by (23). The Na/K ratio for the *Blighia sapida* fruit under investigation though less than one is an indication that consumption of the fruit would probably reduce high blood pressure disease.

Table 3: Physicochemical Characteristic of *Blighia sapida* oil

Parameter	**Value**
Colour	Yellow
Refractive index	1.462
Specific gravity	0.956
Acid value (mgKOH/g)	21.31
Saponification value (mgKOH/g)	75.73
Iodine value (mgIodine/100g)	4.56
Peroxide value	2.20
Free Fatty acids (mgKOH/g)	10.71
Smoke point (^{0}C)	174
Fire point (^{0}C)	320
Flash point (^{0}C)	278
Melting point (^{0}C)	18

Table 3 presents the physicochemical properties of *Blighia sapida* oil. The oil extracted from the sample under investigation is yellowish in colour. It had a specific gravity of 0.956 which showed that it is less dense than water and a refractive index of 1.462 which showed that it is not as thick as most drying oils whose refractive index fall between 1.475 and 1.485 (13). The iodine value 4.56mg/100g of *Blighia sapida* oil is lower when compared with 38.50±0.67% reported for Hausa Melon Seed by (25). Oils are classified into drying, semidrying and non-drying according to their iodine values. Since the iodine values of *Blighia sapida* oil is lower than 100. It could only be classified as non-drying oil. The low iodine value obtained indicates that the oil has a low content of unsaturated fatty acids which is evident in the acid and free fatty acid values of 21.31mgKOH/g and 10.71mgKOH/g respectively. The saponification value of the *Blighia sapida* fruit oil was 75.73mgKOH/g. this was lower than the values for some common oils like palm oil (196-205mgKOH/g), groundnut oil (188-196mgKOH/g) as reported by Cocks and Van Reed (12). Coconut oil (253mgKOH/g) and palm kernel oil (247mgKOH/g) reported by (30)The low saponification value is an indication that the oil may not be suitable for soap making.

Table 4: Antinutrient Properties of *Blighia sapida* fruit

Parameter	**Concentration**
Phytates (mg/100g)	0.928[a]
Oxalates (mg/100g)	5.422[a]
Tannins (mg/100g)	0.372[a]

Results are average of duplicate determinations.
Table 4 depicts the anti-nutrients properties of *Blighia sapida* fruit. The phytates content obtained was 0.928mg/100g, oxalate (5.422mg/100g) and Tannins (0.372mg/100g)

IV. Conclusion

The results of this analysis showed that the pulp of *Blighia sapida* and oil extracted are potential good sources of dietary energy, protein and minerals for human consumption and due to the overall nutritionally qualities of the pulp and pulp oil, their inclusion as alternative cheap source of protein, and energy in livestock diet by economically weak farmers found mostly in the developing countries should be encouraged.

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