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Proximate and Mineral Compositions of Different Species of Kola nuts

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ABSTRACT

Proximate and Mineral compositions of three different species of Kola nut obtained from Minna central market were carried out using standard analytical methods. From the result obtained from the analysis, the proximate parameters ranged between 60.50- 63.50, 2.50-3.00, 8.65-8.70, 83.10-86.25 and 0.80-0.90% for moisture, ash, crude protein, carbohydrate and crude fat respectively while the mineral compositions ranged between 0.10-1.35, 0.09-0.60 and0.11-2.35mg/g for Cola nitida, Cola acuminata and Garcina cola respectively with Garcina cola having highest mineral compositions and Cola acuminata.

INTRODUCTION

Kola nut (Cola spp) belongs to the plant family *steruliacea* having over 20 species of trees native to the tropical rain forest of Africa [1-3]. Of these, two species are particularly very common among the Yoruba's of south western Nigeria; these are the *Cola acuminata* and the *Cola nitida* species. These two species have very great socio economic importance because of their applications in native ceremonies. It also act as sources of caffeine in processing and pharmaceutical industries and often chewed individually or in group settings as stimulants [4]. Most people in Nigeria chew kola nut as a habit, others as stimulants or for mental alertness in order to remain awake for a longer time. Of the three species *Cola acuminata*, *Cola nitida* and *Garcina cola* commonly consumed in Nigeria, *Garcina cola* have been reported to have important medicinal potency and have been used to treat various ailments such as cough, asthma, migraine, diarrhea, act as antidepressant, mental alertness and diuretics etc [1, 5-10]. High consumption of kola nut also has some negative consequences like high blood pressure, insomnia or ulcer in pregnant women and being carcinogenic due to its high nitroso compounds content [11].

Kola has a wide application in the food and pharmaceutical industrials where it is used as sources of caffeine in foods and pharmaceutical products. Jayeola reported the possible use of kola nut for the production of soft drinks [12]. Kola nut also contain traces of essential minerals like K, Ca, Mg Na, Fe Zn, Mn, and P [13]. Some of these minerals act as sources of macro and micro nutrients needed for growth and development and metabolic activities by man. Calcium is essential for the development of bones, sodium relevant for acid base balance and osmotic regulation of the body fluids and the transmissions of nerve impulses. Deficiency leads to lowering of osmotic pressure and reduces utilization of digestive proteins [14]. Iron is relevant for metabolic processes involving oxygen transport, storage as well as oxidative metabolism and circular growth [15]. Deficiency of iron in the body leads to anemia, fatigue and palpitation, depressed growth in children, anorexia and resistance to infection. Potassium also influences osmotic equilibrium and the maintenance of acid-base balance in the body. It also facilitates the amino acids uptakes by cells and influences carbohydrate metabolism in cells. It is also required for normal tissue protein synthesis and functioning of the heart and kidney muscles.

Due o the high rate of consumption of Kola nuts in the country both by the young and elderly and considering the medicinal importance and the health implications of its consumption, this work is therefore aimed at investigating the proximate and mineral compositions of different species of kola nuts with a view to ascertaining if their mineral content could help to replicate the deficiency of some of these minerals in the body in order to meet the human daily dietary intakes of these minerals for effective growth and development.

MATERIALS AND METHODS

Three different varieties of fresh kola nuts; *Cola acuminata*, *Cola nitida* and *Garcina cola* purchased from Minna central market of Niger state were used for this study. The different species were crushed separately into smaller particle sizes using perforated grater and stored in a capped container till needed for analysis.

Sample digestion

Two grams of each of the kola nut species were weighed into a Petri-dish and ashed in a muffle furnace for 8 hours at a temperature of 550 ^{0}C until a constant weight was obtained. 1g of the ashed sample was then transferred into a conical flask and was digested with 20ml of perchloric acid, nitric acid and sulphuric acid mixture which were in the ratio of 4:2:1. The digested sample was then stored in a 100ml volumetric flask prior to analysis with AAS.

The mineral compositions in various species of kola nuts were analysed using PU 9100 atomic absorption spectrophotometer by Philip Japan and the percentage mineral compositions were evaluated using the formula;

$$\% \text{ Ca, Fe, Na, and K} = \frac{DF \times R \times V}{X} \times 100$$

Where DF = Dilution factor
R = Reading from calibration graph
V = Volume of sample used
X = weight of sample used

The moisture, total ash, crude fat, crude proteins and carbohydrate content were determined using the AOAC method [16]. The percentage moisture content was evaluated using the formula

$$\% = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Where W2 = weight of sample + evaporating dish before drying
W3 = weight of sample + Petri dish after drying
W1 = weight of evaporating dish

The ash content was evaluated using the formula

$$\% = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Where W2 = weight of sample + evaporating dish before ashing
W3 = weight of sample + Petri dish after ashing
W1 = weight of evaporating dish

The crude fibre was evaluated using the formula

$$\% = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Where W2 = weight of sample + crucible before incineration
W3 = weight of sample + crucible after incineration
W1 = weight of crucible

The fat content was evaluated using the formula

$$\% = \frac{\text{weight of sample before defatting – weight of sample after defatting}}{\text{Weight of sample taken}} \times 100$$

The percentage crude proteins was evaluated after calculating the % nitrogen using the formula and adding a correction factor of 6.25

$$\% \text{ Nitrogen} = \frac{\text{Titre value- blank} \times 0.0014 \times \text{vol. of the digested sample}}{\text{Aliquot taken} \times \text{weight of dried sample}} \times 100$$

% Crude proteins = % nitrogen + 6.25

The extraction of caffeine content was carried out using the method proposed by Allen et al [17] with few modifications and the caffeine content was evaluated using the formula

$$\% \text{ caffeine} = \frac{\text{weight of sample after extraction}}{\text{Weight of sample before extraction}} \times 100$$

RESULTS AND DISCUSSION

The results obtained from the study are shown in tables1and 2.

The result of proximate analysis of the different species of kolanut (table 1) showed that they have comparable proximate properties. The moisture content of the different species of kolanut ranged between 20.62 – 22.50, with *Cola nitida* having the highest moisture content and *Cola acuminata* the least. Other proximate parameters ranged between 2.50-3.00% for the ash, 8.65-8.70% for crude proteins, 61.11- 64.05% for carbohydrate, 0.80-90% for crude fat and 3.38 – 4.25% for crude fibre respectively. While the caffeine content ranged between 2.42-2.96%. The moisture content are comparable with that obtained in *Cola nitida* by other workers of 55% and 66.4% respectively [12, 18]. The variation is due basically to the lost of weight during storage and transportation since the studied samples were not obtained directly from the tree.

Table 1: Chemical composition of the different species of kolanut (%Wt/Vol.)

Parameters	*Cola nitida*	*Cola acuminate*	*Garcina kola*
Moisture	22.50	20.62	22.34
Ash	2.59	2.50	3.00
Crude Protein	8.68	8.65	8.70
Carbohydrates	61.11	64.05	62.23
Crude Fat	0.87	0.80	0.90
Crude fibre	4.25	3.38	3.83
Caffeine	2.42	2.65	2.96

The total ash content which is a measure of the mineral content in a specie ranged between 2.50-3.00 with *Garcina cola* having the highest ash (3.00%) content and *Cola nitida* the least (2.50). The crude fibre ranged between 3.38-4.25%. The results are comparable with that reported by other workers of 2.40% [12, 18]. The crude protein and carbohydrate content which ranged between 8.65-8.70 and 61.11- 64.05% could complement the body's need of these essential nutrients for growth and development. Other workers also reported crude protein content in kolanut of 8.06 and 8.90% respectively [1, 12]. These are also comparable with that obtained in this study. The caffeine content from this study of between 2.42-2.96% is within the range that will not be detrimental to health. Excessive consumption of kolanut without medical prescription can have some adverse effect on the health of the consumer. According to Rawlings and Thompson, concentration of 100g/kg must be exceeded by any consumer for it to have serious adverse effect on health [19].

Table 2: Mineral composition of the different species of kolanut (mg/g.)

Parameter	*Cola nitida*	*Cola acuminate*	*Garcina cola*
Calcium	0.72	0.60	0.80
Potassium	1.35	0.45	2.35
Iron	0.28	0.17	0.35
Sodium	0.10	0.09	0.11
Magnesium	0.32	0.25	0.40

The mineral content in the different species ranged between 0.10- 2.35 mg/g with *Cola nitida* having a range of 0.10-1.35mg/g with potassium having the highest concentration of 1.35mg/g and sodium the least. In *Cola acuminata*, the concentrations of the various minerals were 0.60 for calcium, 0.45, potassium 0.17, iron 0.09, sodium and magnesium 0.25 mg/g respectively. Also, the concentration of the various minerals in *Garcina cola* ranged between 0.11-2.35mg/g with potassium having the highest concentration of 2.35mg/g and sodium the least with 0.11mg/g. Generally, *Garcina cola* yielded the highest concentration of all the minerals followed by *Cola nitida* and the least *Cola acuminata*. This result goes to buttress the assertion that the higher the ash contents of a species the higher also its mineral content. Since *Garcina cola* which gave the highest ash content also yielded the highest mineral composition. The result obtained from this study compared favourably with that reported by other workers in their study [16, 18].

CONCLUSION

From our findings it can be suggested that kola nut could act as sources of some of these vital nutrients in order to complement their deficiency in our diet, but care should be taken to avert excessive consumption because of the negative health implication of their caffeine content.

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