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Nutrient and anti-nutrient evaluation of wonderful kola (*Cola. nitida*, vent) of fresh nuts at different sizes and colours

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ABSTRACT

Different sizes and colours of fresh *C. nitida* nuts were collected from "Ogunmakin market" Ogun state, nutritive and anti- nutrient evaluation was investigated. There was a significant increase in all the mineral elements analyzed from the smallest (very young) nuts to the biggest (matured) nuts with the preponderance of potassium (K) which ranged from 9.72mg/100g dry matter to 12.60mg/100g dry matter, followed by phosphorus (p) with values 4.21mg/100mg dry matter to 6.43mg/100g dry matter and the least was obtained for zinc with values 1.87mg/100g dry matter to 3.14mg/100g dry matter. The result obtained for different colours shows that the red nuts had the highest value in potassium (11.96mg/100g dry matter), followed by pink nuts (11.82mg/100g dry matter) and the white nut the least (10.41mg/100g dry matter); followed by P with value 5.94mg/100g dry matter (red nuts), 5.58mg/100g dry matter (pink nuts) and 4.69mg/100g dry matter (white nuts). Similar result was obtained for proximate with increase values from the smallest (very young) nuts to the biggest (matured) nuts with the preponderance of moisture content which ranged from 83.26 for the smallest (very young) nuts to 91.54 for the biggest (matured) nuts, followed by carbohydrate with values 82.97 for the smallest (very young) nuts to 88.43 for the biggest (matured) nuts and the least was obtained for % crude fat with values 1.87 for the smallest (very young) nuts to 2.72 for the biggest (matured) nuts. White nuts had the highest value for moisture content (90.25), followed pink (89.84) and red the least (86.09). Oxalate had the highest value in all the parameters tested with 1.70mg/100g dry matter for the smallest (very young) nuts to 3.16mg/100g dry matter for the biggest (matured) nuts; followed by trypsin inhibitors with value 1.29mg/100g dry matter for the smallest (very young) nuts to 2.08mg/100g dry matter for the biggest (matured) nuts and least, phytate with value 1.28mg/100g dry matter to 2.07mg/100g dry matter. These results reveal that these seeds/nuts contain appreciable amounts of nutrients especially carbohydrates and proteins with good caloric value and low levels of toxicants and should be included in human diets to supplement our daily allowance needed by the body.

Introduction

Cola nitida (Kola nut) also known as cola, goro nut, is an important commercial and economic crop for many West African countries (Lovejoy, 1980). It grows into a tree form and it is cultivated to a large degree in Nigeria, Ghana, Ivory Coast, Brazil and the West Indian Islands (Ejinatten, 1973; Opeke, 2005). About fifty kola species have been described out of which only seven have edible nuts and only two have been commercially exploited: *Cola acuminata* (Beauvoir) Schott and Endlicher ("abata") and *Cola. nitida* (Ventenat) Schott and Endlicher ("gbanja") (Quarcoo, 1973; Daramola, 1978). The cultivation of *C. nitida* and it is estimated that the country produces 88% of the world's kola nuts (Mokwunye, 2009) with an annual production of 200,000 metric tones mostly from South Western Nigeria. About 90% of the kola nuts produced in Nigeria is consumed in the country while the remaining 10% is exported as sun-dried nuts to other parts of Africa especially neighbouring West African countries (Ogutuga, 1975; Akinbode, 1982) where they are used as stimulants or as sources of colorants for cloth dyeing. *C. acuminata* is frequently used for social and religious ceremonies in Southern and Middle-belt Nigeria while *C. nitida* which is referred to as "the true kola of commerce" has featured in the internal trade of West Africa for

a number of centuries (Jaiyeola, 2001). The crop is important because of its nut ("Obi") that has important pharmacological properties (Atawodi et al., 2007) and also contains some active principles found in coffee and cocoa (caffeine, theobromine, kolatin) (Opeke, 2005) which prevents sleep, thirst and hunger and also acts as an anti-depressant (Mokwunye, 2009). However, high consumption of kola nut has some negative consequences like high blood pressure, insomnia or ulcer in pregnant women and being carcinogenic due to its high nitroso compounds content (Artfield, 1985). Jayeola (2001) reported the possible use of kola nut for the production of soft drinks.

Due to 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 was therefore aimed at investigating the proximate, mineral composition, anti-nutrient of kola nut in relation to their vary levels of maturity 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.

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Materials And Methods

This research work was carried out in January, 2014 at Cocoa Research Institute of Nigeria, Idi -Ayunre, Ibadan, Oyo State.

Fresh *C. nitida* nuts with three different sizes and colours purchased from "Ogunmakin" village market, Ogun State were used for this study. The nuts were classified into sizes as follows: 1-10g, 11-20g and 21-40g and into colours: red, pink and white. The chosen sizes were based on different levels of maturity of kola nut with maturity increasing from the smallest to the biggest. The nuts of the different sizes and colours were crushed separately into smaller particle sizes using perforated grater and stored in a capped container until they were needed for analysis.

Nutritional, Proximate and Anti-nutrients analyses of *Cola. nitida*

Proximate composition of kola nuts

The nuts were washed, chopped into pieces and dried in oven at 70 ^{0}C for 24h. After drying, the nuts were ground into a fine powder using mortar and pestle and stored in a well labeled air-tight container for analysis. The proximate analyses were carried out according to the Association of Official Analytical Chemists AOAC (2005). Moisture content was determined by oven drying at 105°C for 2 h to a constant weight, ash by igniting kola in a muffle furnace at 550°C, crude protein by multiplying the Kjeldahl nitrogen with a factor of 6.25, fat by the reflux Soxhlet extraction method with petroleum ether and crude fibre by the Weende Method as described in AOAC (2005). Total carbohydrate was obtained by difference.

Mineral composition of kola nuts

The phosphorus content was determined by the Vanado-Molybdate colorimetric method as described in AOAC (2005) and the absorbance read at 470 nm on a Spectronic 20 spectrophotometer. Iron and zinc contents were determined by the bulk 200 atomic absorption spectrophotometer while the sodium and potassium content was read on a Jenway digital flame photometer (AOAC, 2005). Phytates was determined by the method of Early and DeTurk (1944) modified by Thompson and Erdman (1982). Total oxalate was determined by the method described by Ukpabi and Ejidoh (1989) and trypsin inhibitors by the method described by Kakade *et al.* (1974).

Statistical analysis

All data generated were analyzed using Analysis of Variance (ANOVA); and where means were significantly different, they were separated using Least Significant Difference (LSD).

Results And Discussion

The mineral content in *C. nitida* nuts showed a common trend of increasing quantities from smallest (very young) nuts to biggest (matured) nuts of different sizes (Table 1). The most abundant mineral element for fresh *C. nitida* nuts obtained was potassium which ranged from 9.72mg/100g dry matter to 12.60mg/100g dry matter, followed by phosphorus which ranged from 4.21mg/100g dry matter to 6.43mg/100g dry matter and the least was observed for iron which ranged between 1.87mg/100g dry matter to 3.14mg/100g dry matter respectively. Other mineral elements ranged between 2.07mg/100g dry matter to 3.35mg/100g dry matter for calcium, 2.53mg/100g dry matter to 4.81mg/100g dry matter for sodium, 2.54mg/100g dry matter to 4.81mg/100g dry matter for magnesium and 2.40mg/100g dry matter to 3.99mg/100g dry matter for manganese. All the minerals analyzed were significantly different from each other at 5% level of probability. The mineral composition of *C. nitida* nuts at different colours shows that the red nut had the highest

value in all the mineral elements with the preponderance of potassium analyzed except for calcium and was highly significant. This was followed by pink nuts values except for sodium where the pink nut had the least and the least was observed for white nuts except for sodium (Table 2). Similar result was obtained for anti- nutrients which increased from the smallest (very young) nuts to the biggest (matured) nuts with oxalate having the highest value which ranged from 1.70mg/100g dry matter for the smallest (very young) nuts to 3.16mg/100g dry matter for the biggest (matured) nuts. This was followed by trypsin inhibitors with value 1.29mg/100g dry matter for the smallest (very young) nuts to 2.08mg/100g dry matter for the biggest (matured) nuts and phytate, the least with values 1.28mg/100g dry matter for the smallest (very young) nuts to 2.07mg/100g dry matter for the biggest (matured) nuts and were highly significant. (Table3). The red nut had the highest value in trypsin inhibitors and phytate and is highly significant when compared to pink and white nuts. This was followed by pink nuts and white nuts the least. The pink nut had the highest value in oxalate and was significant when compared to red and white nuts (Table 4). The result obtained from this study compared favorably with that reported by other Workers (Jayeola, 2004). Similar distribution of mineral elements was observed in *V .volvacea* and *P. tuber-regium* (Kuforiji, 2005). Similar result was obtained by earlier workers (Ugioro *et al.*, 2012, Khanna and Garcha, 1982; Fasidi and Kadiri, 1990; Kadiri and Fasidi, 1990a). The preponderance of potassium may be due to the absorption and accumulation of this element on the matured nuts. The implication of the above findings of increasing mineral elements with maturity is that most mature *C.nitida* nuts is the most nutritious and is therefore the ideal stage recommended for human consumption. Phytate functions as a phosphorous store and a source of cation and a source of myoinositol. Tannins bind and precipitate proteins and other organic compounds including amino acids and alkaloids (McGee, 2004). Oxalates combines with divalent metallic cations such as Calcium and Iron to form crystals of the corresponding oxalates which are then excreted in the urine (Coe *et al.*, 2005).These are considerable amount of anti-nutrients that may inhibit the absorption of minerals.

Table 1: Mineral composition (mg/100g dry matter) of fresh *C nitida* nut at different sizes

Nuts sizes(g)	K	Ca	Na	P	Mg	Fe	Zn	Mn
21-40	12.60[a]	3.35[a]	4.81[a]	6.43[a]	4.81[a]	3.83[a]	3.14[a]	3.99[a]
11-20	11.87[b]	2.90[b]	3.98[b]	5.53[b]	3.99[b]	3.14[b]	2.56[b]	3.35[b]
1-10	9.72[c]	2.07[c]	2.53[c]	4.21[c]	2.54[c]	2.18[c]	1.87[c]	2.40[c]

1-10 very young nuts, 11-20 young nuts and 21-40 matured nuts Means followed by the same letters are not significantly different at 5% level of probability using Duncan Multiple Range Test.

Table 2: Mineral composition (mg/100g dry matter) of fresh *C. nitida* nut at different colours

Nut colours	Ca	K	Na	P	Mg	Fe	Zn	Mn
Pink	3.09[a]	11.82[b]	3.21[c]	5.53[b]	3.62[b]	3.11[b]	2.39[b]	3.23[b]
Red	2.72[b]	11.96[a]	4.63[a]	5.94[a]	4.60[a]	3.20[a]	2.93[a]	3.77[a]
White	2.49[c]	10.41[c]	3.48[b]	4.69[c]	3.12[c]	2.84[c]	2.26[c]	2.72[c]

Means followed by the same letters are not significantly different at 5% level of probability using Duncan Multiple Range Test.

Table 3: Anti-nutrient composition (mg/100g dry matter) of fresh *C.nitida* nut at different sizes

Nuts sizes (g)	Trypsin inhibitors	Oxalate	Phytate
21-40	2.08[a]	3.16[a]	2.07[a]
11-20	1.85[b]	2.70[b]	1.79[b]
1-10	1.29[c]	1.70[c]	1.28[c]

1-10 very young nuts, 11-20 young nuts and 21-40 matured nuts Means followed by the same letters are not significantly different at 5% level of probability using Duncan Multiple Range Test.

Table 4: Anti-nutrients composition (mg/100g dry matter) of fresh *C. nitida* nut at different colours

nuts colours	Trypsin inhibitors	Oxalate	Phytate
Pink	1.45[b]	2.87[a]	1.50[c]
Red	2.33[a]	2.75[b]	2.11[a]
White	1.44[b]	1.92[c]	1.53[b]

Range Test Means followed by the same letters are not significantly different at 5% probability level using Duncan Multiple

The result of proximate analysis of the different sizes of C. nitida nuts shows that the biggest (matured) nuts had the highest value in all the parameters determined and are highly significant. This was followed by the medium (young) nuts and the smallest (very young) nuts the least (Table 5). The pink had the highest value in crude protein 3.59, organic matter 10.09, organic carbon 5.85 and carbohydrate 86.41 respectively and is highly significant when compared to the red nut with value 3.23 for crude protein, 86.09 for moisture content, 5.33 for organic carbon, 8.81 for organic matter and 83.82 for carbohydrate and white nut with value 3.32 for crude protein, 5.39 for organic carbon, 9.29 for organic matter and 86.10 for carbohydrate respectively.

Table 5: proximate composition of *C.nitida* fresh nuts at different sizes

Nut sizes(g)	Crude protein (%)	Crude fibre (%)	Crude fat (%)	Moisture content (%)	Organic carbon (%)	Organic matter (%)	Carbo hydrate (%)	Ash content (%)
21-40	3.95[a]	6.63[a]	2.72[a]	91.54[a]	6.43[a]	10.71[a]	88.43a	3.61[a]
11-20	3.53[b]	6.14[b]	2.46[b]	91.37[b]	5.74[b]	9.89[b]	84.92b	3.36[b]
1-10	2.66[c]	4.39[c]	1.87[c]	83.26[c]	4.39[c]	7.58[c]	82.97[c]	2.23[c]

1-10 very young nuts, 11-20 young nuts and 21-40 matured nuts Means followed by the same letters are not significantly different at 5% probability level using Duncan Multiple Range Test

This was simply followed by white nut and red nut (the least) (Table 6). The nutrient composition of kola nut differs relatively from what has been reported by other workers. Jaiyeola (2001) had earlier reported 8.90% protein, 0.92% fat and 2.40% ash in the fresh nut of kola and Ogutuga (1975) also reported a protein content of 8.0%. All these are quite different from what had been reported in this study with the exception of ash content. The varying composition reported by various workers might be due to the fact that nutrient compositions of these snacks vary with season, environment and/or condition or time of evaluation. This result has confirmed that *C. nitida* has a higher percentage of carbohydrate (88.4%) than *Sorghum bicolor* L. stem flour (44.52%) as reported by Adeteyi and Akpanbang (2005) and can be used as a source of carbohydrate. They also provide readily accessible fuel for physical performance and regulate nerve tissue (whitney and Rolfes, 2005). The samples shows a considerable amount of protein, 3.95 for big, 3.53 for medium and 2.66 for small even though is low compared to the protein level in some commonly consumed oil seed in Nigeria like rapeseed (25%) and sun flower (28.7%) as reported by Jackson (2000). *C.nitida* can therefore be used as a source of protein. Other gross components are present in considerable amount. Crude fiber content of 6.63 for big, 6.14 for medium and 4.39 for small shows that they contain little amount of cellulose, hemicelluloses and lignin which aid digestion.

Table 6: proximate composition of fresh *Cola nitida* nuts at different colours

Nut colours	Crude protein (%)	Crude fibre (%)	Crude fat (%)	Moisture content (%)	Organic carbon (%)	Organic matter (%)	Carbo hydrate (%)	Ash content (%)
Pink	3.59[a]	5.08[b]	2.04[c]	89.84[a]	5.85[a]	10.09[a]	86.41[a]	2.87[b]
Red	3.23[c]	6.78[a]	2.72[a]	86.09[b]	5.33[b]	8.81[b]	83.82[c]	3.46[a]
white	3.32[b]	5.30[c]	2.29[b]	90.25[a]	5.39[b]	9.29[b]	86.10[b]	2.87[b]

Means followed by the same letters are not significantly different at 5% probability level using Duncan Multiple Range Test

Conclusion

This study showed that fresh *C. nitida* nuts contain high percentage of carbohydrate which makes it a good source of human energy. It also contain moderately amount of minerals, proximate needed for growth and development and metabolic activities by man, development of bones, regulation of acid base balance and osmotic regulation of the body fluids and the transmissions of nerve impulses. This work has shown that *C. nitida* has a good medicinal value for the management of certain health conditions like hypercholesterolemia.

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