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PROXIMATE AND MINERAL ANALYSIS OF KOLANUTS (Cola nitida and Cola acuminata)

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Abstract

The proximate and mineral analysis of both *Cola nitida* (Goro) and *Cola acuminata* (Abata) have been studied. The samples were analyzed for minerals i.e. Mg, K, Na, Ca, Mn, Fe, Cu, Zn, P, Pb and Hg by the method of atomic absorption spectrophotometer for the first nine minerals and spectrophotomeric (dithizone) method for the remaining two elements. The *Cola nitida* and *Cola acuminata* contained high moisture content and the carbohydrate content of kola nuts are virtually the same, on the average of 33.83%. The ash contents of *Cola nitida and Cola acuminata* are 1.94% and 1.46% respectively. Th+e results suggested that both Kola nuts are not rich sources of fat, protein, calcium, manganese and iron. However, they are good sources of carbohydrate, magnesium, potassium, sodium and phosphorus. The lead and mercury (heavy metals) were present in trace amounts. Hence, both kolanuts do not make significant contribution to the diet but provide substantial amount of calorie and some essential minerals.

Introduction

The genus cola which is indigenous to tropical Africa is among the common nuts of commerce and international trade. It has over 40 species recorded in West Africa, but only two species are of economic importance particularly in the northern province of Nigeria. The *Cola nitida* is known as larger Kolanut (Goro) and *Cola acuminata* is called small kolanut (Abata).

They have high social and ceremonial values among Yoruba of Nigeria. The Kolanuts are important component of many industrial and pharmaceutical preparations and are often eaten whole for its stimulating effect (Ogutuga, 1975).

Earlier works (Oguntuga, 1975; Somorin, 1976; Umar and Blackburn, 1989; Opeke, L.K. 1987; and Umar I.M and Blackburn R, 1989; Opeke L.K. 1987; and Umar, 2000) attempted to report the proximate, organic constituents (Caffeine, amino acid and vitamins) and limited to few elements present in Kolanuts.

The increasing eating habits and likely health implications are of interest and this called for detailed analysis of the mineral contents to complement existing information in the literature, which will ultimately be useful for the much needed food composition table in Nigeria.

Materials and Methods

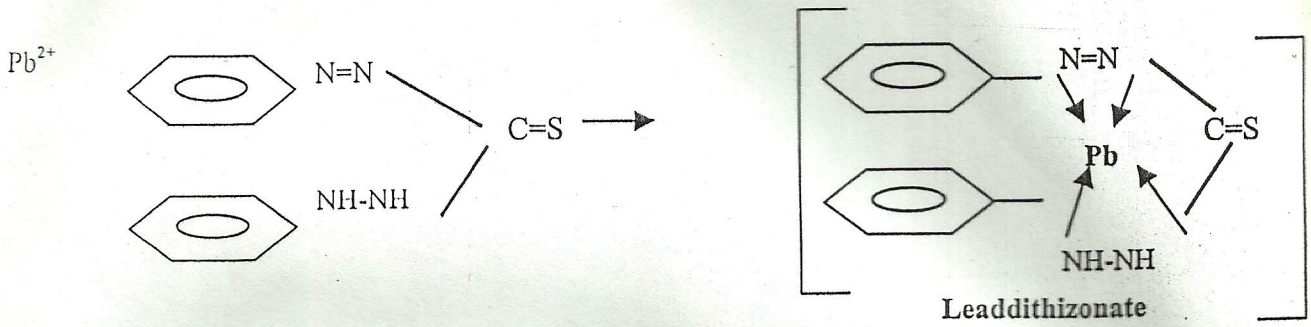
The samples of *Cola nitida* and *Cola acuminata* were obtained from a local farm settlement in Offa, Kwara State, Nigeria. The random sampling was carried out on each bulk of the samples with a view to eliminate extraneous variation. About 5.0g of the representative sample of each variety were washed, dried at 80^{0}C to constant weight and grinded to powdery form while the remaining samples were stored in wilted banana leaves for further use.

The proximate analyses of the Kolanut samples for moisture, crude fat, dry-matter, carbohydrate and ash were carried out in at least triplicate determinations using the methods described by AOAC (1975). Nitrogen was determined by the microkjeldahl method described by Pearson (1976) and the percentage nitrogen was converted to crude protein by multiplying by 6.25.

The minerals were analysed from solution obtained by first dry-ashing the samples at 525^{0}C and dissolving the ash in volumetric flasks using distilled, de-ionised water with a few drops of concentrated hydrochloric acid. Sodium and Potassium were then determined using a flame photometer (Corning, UK, model 405), using Nacl and Kcl for preparation of standards. Phosphorus was determined colormetrically using a spectronic 20 (Gallen Kamp, UK) as described by Pearson (1976), with KH_2PO_4 as a standard. Lead and mercury were determined by spectrophotometric (Dithizone) method of Ajayi O.S (1986). All other metals in the report were determined by means of an atomic absorption spectrophotometer (PYE Unicon, UK, Model SP9) using the following salts:

FeSO4. $(NH_4)_2SO_4.6H_2O$; MnO_2, $Zn(NO_3)_2$ and $CuSO_4$, $CaCO_3$, $MgSO_4.7H_2O$ for the preparation of standards.

Equation 1: **Reaction of Dithizone with Lead**



Equation 2: Reaction of Dithizone with Mercury

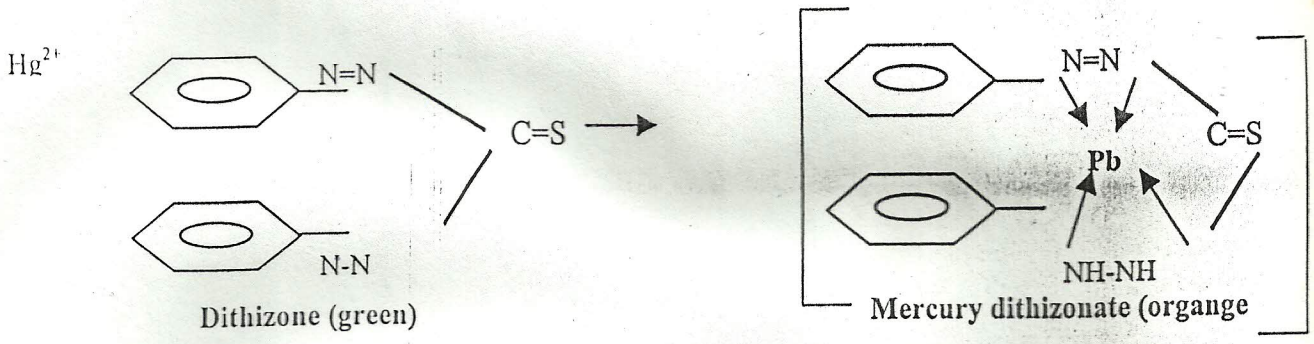


Table 1: Proximate composition of matured *Cola nitida* and *Cola acuminata* (%)

Constituent	Cola nitida	Cola acuminata
Moisture	53.8	54.4
Dry matter	46.2	45.6
Ash	1.94	1.46
Crude protein	9.2	8.8
Crude fat	1.25	1.5
Carbohydrate	33.81	33.84

Table 2: Mineral Constituents of Matured Cola nitida and Cola acuminata (mg/100g dry Sample)

Constituents	Cola nitida	Cola acuminata
Calcium	15.6	13.3
Magnesium	182.2	116
Potassium	775	662
Sodium	53.4	578
Manganese	1.1	0.8
Iron	1.5	1.3
Copper	0.3	0.4
Zinc	1.1	1.0
Phosphorus	87.7	78.3
Lead	0.16	0.13
Mercury	0.091	0.075

Results and Discussion

Table 1.0 shows the results of the proximate composition of both *Cola nitida* and *Cola acuminata* reported in percentages (%), while Table 2.0 present the values of minerals in milligrams per 100 grammes of the dry sample (mg/100g of dry sample) respectively. All the values are average of three determinations. As shown in Table 1.0, the moisture contents of *Cola nitida* and *Cola acuminata* were formed to be 53.8% and 54.4% respectively. The high water content of the nita could be attributed to the tropical lowland rainforest areas where the Kolanuts are grown and ambient temperature (average daily temperature of 23^{0}C to 28^{0}C). These high water contents partly account for the reason why harvested kolanuts annually affected by pests. However, the result agrees with those reported by Ogutuga D.B.A (1975). Dry matter, which is dependent on the moisture content, were found to be 46.2% and 45.6% for *Cola Nitida* and *Cola acuminata* respectively.

The dry matter contained protein, fat, minerals, vitamins and carbohydrates. The ash inorganic compounds in the samples were found to be 1.94% and 1.46% for *Cola nitida* and *Cola acuminata* respectively. Slight variations of ash content might be due to slight variation in percentages of other constituents. However, most tropical fruits have low ash content as equally reported by Ogutuga (1975). The two kolanuts have low protein content which are *Cola nitida* (9.2%) and *Cola acuminata* (8.5%). The results agreed with average value of 8.6% protein reported for Kolanuts by Ogutuga (1975). Kolanuts are not rich sources of fat, *Cola nitida* (1.25% and *Cola acuminata* (1.5%). The carbohydrates in both species were moderately present. Hence, kolanuts make significant caloric contribution to the diet (Brent Q. Hafen, 1980).

The results in Table 2.0 shows that both Kolanut samples are not good sources of calcium, 15.6mg/100g for *Cola nitida* and 13.3mg/100g for *Cola acuminata*. The recommended dietary intake of calcium per day is between 360 – 1200mg (Robert H.R. 1981). Therefore in order to obtain this amount of calcium from kolanut, one would need to consume between 3-8kg of kolanut per day. However, this appears too much for a person per day, hence kolanut is definitely not a good source of calcium.

Similarly, from Table 2.0, it is shown that both kolanut samples are good sources of magnesium, potassium and sodium. The recommended dietary intake per day of magnesium. Potassium and Sodium are between 50 – 400mg, 350 – 5625mg and 115 – 3300mg respectively. Hence considering the results of the present studies in order to obtain this amount of magnesium, potassium and sodium from kolanut, one would need to consume between 50 – 100g, 55 – 100g and 250 – 350g.

These minerals are required in an appreciable amount in the body for metabolic processes including energy metabolism, protein synthesis, transmission of nerve impulse and maintenance of acid-base balance in all body fluids (Robert H., R. 1981). Also the kola nut samples are found to be good sources of phosphorus which is predominantly used for maintenance and building of the hard structures (bones) of many organisms.

Manganese which is considered as a part of the enzyme body system and iron, which exists as a co factor for enzyme are both found to be considerably low in the kolanut samples. The

recommended dietary intake per day for both manganese and iron are between 0.5 – 5 mg and 10 – 18mg respectively. The present results show in Table 2.0 indicate that to take the required amount of these minerals from kolanut, between 0.5-62g of the nut is sufficient for manganese, while between 1-1.5kg of the kolanut is required for iron.

Table 2.0 shown that copper and zinc contents of the kolanut samples are also very low, but in view of the fact, that they are microminerals required in the body in a very small amount, they are also very essential as co- factor for enzymes in protein and red cell formation (Debussy. J.H. 1975).

Also from the present results shown in Table 2.0, the heavy metal contents of the kolanut samples were surpassingly found to be too high. The joint FAO/WHO expert committee of food additives established a provisional tolerable weekly intake of 3mg of lead per person (Larson S.E.and Piscator, M. 1971) which is equivalent to 0.005mg of lead per kg of body weight. While an intake of 0.3mg of total mercury per person of which no more than 0.2mg should be present as methyl mercury per kg body weight has also be established for mercury. The range value for the lead content of total list samples such as fruits and preserves have been found to be between 0.01 – 0.27mg/kg. While a standard of 0.05g/g of lead has been suggested for food (Larson et al 1971).

Therefore, the present results for both lead and mercury contents are fairly tolerable, otherwise many kola nuts eaters would have died by now. Metals are known to be toxic to man at some levels of intake. At the moment, there is no reported case of metal poisoning in the consumption of kola nuts but the increase in the level of these toxicants could pose potential health hazards, for the increasing habitual eaters.

Conclusion

The high water contents of *Cola nitida*, 53.8% and *Cola acuminata*, 54.4% were found to contribute to the large amount of infested kola nuts obtained annually. And the dry matter of both *Cola nitida* and *Cola acuminata* were found to be 46.2% and 45.6% respectively.

Both *Cola nitida* and *Cola acuminata* were not rich sources of fat and protein. Thus, the possible use of Kola nut as a food material in human diet is not very important.

Though, typical symptoms of mineral deficiencies in kolanut have been described by Eijnathen (1973). Both *Cola nitida* and *Cola Acuminata* have been found to contain fair amount of inorganic matter as indicated by the percentage ash content which were 1.94% respectively.

i. The two kola nuts samples are good sources of potassium, magnesium, phosphorus and sodium.
ii. Minerals such as iron, zinc and manganese were present in relatively small amounts in the kolanut samples, while the copper content of each kolanut samples attract the lowest value.
iii. Both *Cola nitida* and *Cola acuminata* are definitely not good sources of calcium lead and mercury. However, they can contribute to the daily mineral intake.

References

Ajayi, O. S. (1986) Use of Flame and Non-flame Atomic Absorption Spectrophometry of Chemistry. *Ph.D Thesis University of Ibadan, Ibadan.*

AOAC (1975) *Official Methods of Analysis* (12th edn.). Washington DC: Association of Official Analytical.

Brent. Q. Hafen (1980). *Nutrition food and Weight Control.* (Expanded edn.). Brigham Young University pp 119-129.

Pearson, D. (1976). *Chemical Analysis of Food* (7th edition). London: J & A Churchill.

Ogutuga, D.B.A. Chemical Composition and Potential Commercial Values of Kolanut, Cola Nitida, Rent (School and Endlicha). *Ghana Journal of Agric Sc.* 8 (2) 1975 Pp 121-125.

Opeke, L.K. (1987) *Tropical Tree Crops.* Ibadan: Spectrum Book Ltd.

Quarco, T. (1985) Development of Kola and its Future in Nigeria. *Proceedings of Agric Society of Nig.* Vol. 6. pp 1-5, 19-22.

Umar, I.M. and Blackburn (1989) J. *Radiational Nucl.* Chem 93 pp 132.

Umar, I.M. (2000) Elemental Contents of Some Kolanuts. *Journal of Chemical Society of Nig.* Vol. 25 pp 69-70.