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COMPARATIVE STUDY ON THE PROXIMATE, MINERAL AND VITAMIN COMPOSITIONS OF *BORASSUS AETHIOPUM* AND *COCOS NUCIFERA*

[*1]Jibrin Mohammed, [1]Galadima, O. Eunice and [2]Ahmed Abdulhanan O.

[1]Department of Chemistry, Faculty of Natural & Applied Sciences, Nasarawa State University, Keffi, Nigeria.

[2]Department of Chemical Sciences, Faculty of Sciences, Federal University of Kashere, Gombe State Nigeria.

*Corresponding author's email: jibrilmohammed50@gmail.com

ABSTRACT

Vitamins and minerals are essential nutrients needed by human to develop and function normally and effectively. This study investigated the proximate, minerals and vitamins compositions in Coconut *(Cocos nucifera)* and Deleb palm nut *(Borassus aethiopum)*. The proximate parameters (moisture, ash, crude fat, carbohydrates and crude fibre) were determined using standard analytical procedures. The vitamins were determined using titrimetric method and UV Spectrophotometer, minerals were determined using Flame Photometer and Atomic Absorption Spectrophometer (AAS). The results showed higher percent moisture (10.81%) crude fat (16.75%) and protein (10.22%) contents in coconut than in deleb palm nut while percentage ash (6.67%), crude fibre (8.23%) and carbohydrate (63.83%) were found to be higher in deleb palm nut. The mineral analysis revealedthat concentrations of Mg(466.20mg/100g), K(37.55 mg/100 g), and Zn(39.12 mg/100g) were higher in deleb palm nut than in coconut while concentrations of Cu(0.24mg/100g), Ca(0.74 mg/100g), and Fe(0.12mg/100g) were higher in coconut. The results obtained for the concentrations of vitamins in the samples showed that coconut had higher concentrations of all the vitamins (A, B_2, C and D) compared to deleb palm nut but both samples were found to be higher than the recommended dietary allowances except for vitamin B_2.Based on the results from this study, both the coconut and deleb palm nut samples are rich sources mineral elements and vitamins, therefore, both could serve as good sources of nutrients to the body.

Keywords*:* Coconut, Deleb palm nut, Minerals, Proximate, Vitamins

INTRODUCTION

Attention of many developing countries especially Nigeria, has been shifted to agriculture as another means of diversifying her economy, addressing the problems of malnutrition among children and most importantly attaining foods security. In view of this, food chemists and other related researchers in the field have redirected most of their researches to exploring the nutritional and medicinal potentials of some consumed plant foods with a view to supplementing or replacing the common ones which are believed to be scarce or costly due to high demand by the populace. Deleb Palmisa species of Borassus palm grown in many parts of African countries including Nigeria [1]. It is called “Giginya” by the Hausas, “Agbonoludu” by the Yorubas and the Igbos call it “Ubiri” [2]. *Borassus aethiopum* is a solitary palm growing up to 25m in height and 1m in diameter at the base. The fan-shaped leaves are 3m wide with petioles 2m long, the margins are armed with spines. In male plants, the small flowers are largely concealed within the scaly catkins; the much larger female flowers reach 2 cm wide and produce yellow to brown fruits. Each fruit contains 1-3 seeds, each enclosed within a woody endocarp [3]. The` fruit contains sugar, provitamin A and vitamin C [4].

Cocos nucifera commonly known as coconut belongs to the family Arecaceae commonly cultivated in many parts of the world. Some people believe that the plant may have originated from Southeast Asia [5]. In Nigeria, it is called "Aki Oyibo" or "Aki bekee" in Igbo, "Kwakwa" in Hausa and "Agbon" in Yoruba. Studies had shown that among all the palms, coconut has been reported to be among the most importantly and extensively grown in the world [6]. The nut is usually consumed in its raw form and most times eaten alongside other food products such as cassava chips, maize and date fruit among others. However, a lot of research works have been published on the nutritional compositions of coconut [6-8]. This research work therefore, was aimed at assessing the proximate, minerals and vitamin contents of deleb palm nut and coconut in order to compare their nutritive values.

EXPERIMENTAL

Sample Collection and Preparation

Samples of deleb palm and Coconut fruitswere obtained in different locations from AgyereguKoro in Lafia Local Government Area ofNasarawa State, Nigeria. The samples were broken and the shells were removed from the nuts. The nuts were thoroughly washed with

distilled water, sun dried and finally dried in an oven at the temperature of 105^{o}C for 5 h. The samples were transferred to a dessicator to cool for 30 minutes after which they were finely ground using a manual blender and stored in air tight containers for further analysis.

Proximate Analyses

The moisture, ash, crude fat, crude protein contents (N x 6.25), carbohydrate and crude fibre were determined using the method described by the Association of Official Analytical Chemists [9]. All parameters in the samples were determined in triplicates and the values were reported in percentage. The chemicals used were of analytical grade.

Determination of Mineral Content

The mineral contents such as zinc (Zn), magnesium (Mg), copper (Cu), calcium (Ca), lead (Pb) and iron (Fe) were determined using computer control thermo fisher scientific ICE 300 series Atomic Absorption Spectrophometer (AAS) while sodium (Na) and potassium (K) were determined using Flame Photometer.

Determination of Vitamins

Vitamins A, B, C and D were determined using standard analytical procedures.

Vitamin C was determined using titrimetric method: Each sample 100g) was blended using electric blender. Distilled water (10 cm^3) was added 3 times while blending the sample. The blended sample was decanted into 100 $cm^3$of volumetric flask, then strained through cheesecloth, and the filtrate was collected. 25 $cm^3$of the filtrate was pipetted into a conical flask and added 10 drops of 1% starch indicator. The content was titrated with iodine solution until a blue black colouration was observed. The titration was carried out in triplicatein order to obtain mean value [10]. Other Vitamins were determined using UV- Spectrophotometer[11].

RESULTS AND DISCUSSION

Proximate Compositions

Table 3.1 shows the result of the proximate compositions of *Cocos nucifera* and *Borassus aethiopum*

Table 3.1: Proximate Compositions of *Cocos nucifera* and *Borassus aethiopum*

Parameters (%)	*Cocos nucifera*	Borassus aethiopum
Moisture content	10.81 ± 1.22	8.74 ± 1.07
Ash content	2.75 ± 0.25	5.25 ± 0.25
Crude fibre	6.67 ± 0.18	8.23 ± 0.22
Crude fat	16.75 ± 0.05	7.86 ± 0.60
Crude protein	10.22 ± 2.73	6.09 ± 0.03
Carbohydrate	52.80 ± 0.66	62.83 ± 0.60

Each value represents the mean ± standard deviation of three determinations.

From the Table (3.1), moisture contents in coconut and deleb palm nut were found to be 10.81% and 8.74% respectively. This shows that moisture content was higher in coconut than in deleb palm nut. The low moisture content in deleb palm nut may be attributed to the hardness nature of the nut. Jatto *et al.* [12] reported that high moisture in any food sample could make the sample viable for microbial growth. This implies that deleb palm nut sample will be less vulnerable to microbial attack compare to coconut considering their moisture contents. The results of the ash contents in the samples revealed that deleb palm nut had 5.25% andcoconut2.75%. This shows that deleb palm nut recorded higher percent ash content than the coconut sample. The higher percent ash content observed in deleb nut is an indication of the presence higher amount of mineral elements in the sample compared to coconut sample [13]. Fibre plays a vital role in providing roughage that aids digestion [14]. Dietary fibre reduces the risks of cardiovascular diseases. Literature revealed that increase in fibre consumption might reduce the incidence of certain diseases such as diabetes, coronary heart disease, colon cancer and various digestive disorder [15].However, the results presented in Table 3.1 for the crude fibre values showed that deleb palm nut had 8.23% which is higher than 6.67% in coconut sample . This implies that consumption of deleb palm nut will be more advantageous than coconut in terms of the roles of dietary fibre in human body. The crude fat values in*Cocos nucifera* and *Borassus aethiopum*were 16.75% and 7.86% respectively. This indicates that *Cocos nucifera* has higher fat content than

Borassus aethiopum, this makes *Cocos nucifera*a distinct potential for the oil industry [16]. Fat is an important energy source of the body. They are required for brain structure and are necessary for the production of hormones and initiate body activities [17]. The values of crude protein in the samples were 10.22% and 6.09% for *Cocos nucifera* and *Borassus aethiopum* respectively. This indicates that *Cocos nucifera* has higher protein content than *Borassus aethiopum* . However, the protein concentrations of *Cocos nucifera* satisfied the FAO/WHO requirement [18]. The carbohydrate contents were 52.80% in *Cocos nucifera* and 63.83% in *Borassus aethiopum* .The result showed that carbohydrate content of *Borassus aethiopum* is higher than thatof *Cocos nucifera* . Carbohydrates supply energy to cells such as brain, muscles and blood. It contributes to fat metabolism and spare proteins as an energy source and act as natural laxative for humans beings and generally add to the bulk of the diet [19]. This means that consumption of *Borassus aethiopum* provides more energy than *Cocos nucifera* considering the values obtained for carbohydrate in both samples. Therefore, *Borassus aethiopum* could serve as alternative source of carbohydrate in place of *Cocos nucifera* .

Mineral Composition

Table 3.2 shows the result of the mineral composition *Cocos nucifera* and *Borassus aethiopum* .

Table 3.2: Mineral Composition of *Cocos nucifera* and *Borassus aethiopum* .

Mineral (mg/100g)	*Cocos nucifera*	Borassus aethiopum
Zn	20.10 ± 0.04	439.20 ± 0.02
Mg	461.40 ± 0.30	466.20 ± 0.30
K	24.48 ± 0.60	37.55 ± 0.60
Cu	0.24 ± 0.10	0.20 ± 0.04
Na	21.23 ± 0.03	16.12 ± 0.01
Ca	0.74 ± 0.06	0.41 ± 0.06

Pb	ND	ND
Fe	0.12 ± 0.02	0.02± 0.01

From the Table (3.2), concentration of zinc in *Borassus aethiopum* (39.12 mg/100g) sample was higher than 20.10 mg/100g obtained in *Cocos nucifera* . This implies that *Borassus aethiopum* could serve as a better source of zinc compared to *Cocos nucifera* considering their concentrations in this study. Literature revealed that zinc is important for normal sexual development especially for the development of testes and ovaries and it also stimulates the activity of vitamins, formation of red and white corpuscles [20].The study revealed that concentrations of magnesium in *Cocos nucifera* and *Borassus aethiopum* ranged from462.40 to 466.20mg/ 100 g respectively. Magnesium plays a vital role in regulating blood sugar levels, there by promoting normal blood pressure. Magnesium also supports energy metabolism and protein synthesis [21]. However, the values obtained from this study are high compared with the reported values of 126.3 mg/100 g in deleb palm (*Borassus aethiopum* , Mart)and 219.6 mg/100 g in *Dioscorearotundata*. It was also reported that the recommended dietary allowance for magnesium in adult is 300 mg/day and 170mg/day in children [22]. Therefore, from the values obtained, it could be inferred that the *Cocos nucifera* and *Borassus aethiopum* samples are rich sources of magnesium. The concentration of potassium in *Borassus aethiopum* , 37.55 mg/100 g was found to be higher than24.48 mg/100 g in *Cocos nucifera* .Studies revealed that potassium is needed in the regulation of heart beat, neurotransmission and water balance in the body [23-24].It was recommended that potassium needs to be consumed regularly because human body does not store it while kidney continues to excrete it in the urine even when potassium intake ceases[25].Thus, the recommended dietary allowance (RDA) for potassium is 300 to 350 mg per day for adults and 100 to 150 mg/day [26]. This implies that the values obtained from this study is far below the recommended standard especially in *Cocos nucifera* (depending on the quantity consumed per day).The result also showed that *Cocos nucifera* and *Borassus aethiopum* have Sodium compositions of 21.23 mg/100 g and 16.12 mg/ 100g respectively. Sodium plays an important role in osmoregulation. Also, along with potassium, it plays a crucial role in blood pressure regulation depending on the ratio of sodium to potassium in thebody.However, the values obtained from this study shows that the ratio of Na/K is less than one in both samples

which is the recommended standard [27]. This signifies that both samples can promote blood pressure regulation when consumed in a diet. Calcium is an important mineral required for bone formation and neurological function of the body [28]. Calcium concentrations fell within the range of 0.41 to 0.74 mg/100 g. However, the concentrations were lower than the reported value of 16.02 mg/ 100g in coconut shell [29]. Iron is essential protein component for metabolism and the human body needs it to produce red blood cells [30]. This study revealed that concentration of iron in *Borassus aethiopum* and *Cocos nucifera* were 0.12mg/100g and 0.02mg/100g respectively. The copper contents of *Cocos nucifera* and *Borassus aethiopum* were 0.24 mg/100g and 0.20 mg/100g respectively. Copper is required in the body for enzyme production and biological electron transport. But the values obtained from this study were below the recommended dietary allowance [31].

Vitamin Concentrations

Table 3.3 presents the concentrations of vitamins (A, B, C and D) in *Cocos nucifera* and *Borassus aethiopum* in mg/ 100g.

Table 3.3: Concentrations of Vitamins in *Cocos nucifera* and *Borassus aethiopum*

Vitamins (mg/ 100g)	*Cocos nucifera*	*Borassus aethiopum*
Vitamin C	8.88 ± 0.05	6.71 ± 0.05
Vitamin B_2	0.23 ± 0.06	0.02 ± 0.01
Vitamin A	8.89 ± 0.60	6.67 ± 0.60
Vitamin D	4.45 ± 0.62	1.12 ± 0.60

Analyses of vitaminsin the samples revealed the following concentrations: Vitamin C contents in *Cocos nucifera* and *Borassus aethiopum* ranged from 8.88 – 6.71 mg/100g respectively. The recommended dietary allowance for vitamin C is 65 mg to90 mg/day in adults and 15 to 25 mg/day in children. This implies that both samples are rich sources of vitamin C since their vitamin C concentrations were more than the recommended dietary allowance [32] .The study revealed that concentrations of vitamin A ranged from 8.89 – 6.67 mg/100g which were also

higher than the recommended dietary allowance of 0.7 to 0.9 mg for adults and 0.3 to 0.4mg/day for children. Vitamin A is needed for eye health, vision, immune function, cell growth, reproduction and fetal development. However, it was recommended that for adults, it should not exceed the tolerable upper limit of 3 mg in order to prevent toxicity [33]. It was observed from Table 3.3 that concentration of vitamin D in *Cocos nucifera* (4.45 mg/100g)was higher than 1.12mg/100g in *Borassus aethiopum* .The concentrations of vitamin D in both samples were much higher than the recommended dietary allowance of 0.025 to 0.1mg for adults and 0.015mg/day for children. Studies had shown that vitamin $B_2$is needed for growth and overall good health [34]. Thus, it helps the body break down carbohydrates, proteins and fats to produce energy and it allows oxygen to be used by the body [35]. This study also revealed that concentrations of vitamin B_2fell within the range of 0.02 – 0.23 mg/100g in *Cocos nucifera* and *Borassus aethiopum* respectively. However, vitamin B_2 concentrations in both samples were found to be lower the recommended dietary allowance of 2.4 mg in adults and 1.2 mg/day in children [35].

CONCLUSION

The results obtained for the proximate analysis showed that *Cocos nucifera* recorded higher percent moisture,crude fat and crude protein contents while ash, carbohydrate and crude fibre contents were higher in *Borassus aethiopum* . The mineral analysis revealed that concentrations of Mg, K, and Zn were higher in deleb palm nutthan in coconut while concentrations of Cu, Ca and Fe were higher in coconut. The concentrations of vitamins in the samples revealed that coconut had higher concentrations of all the vitamins (A, B_2, C and D) analyzed than deleb palm nut though both samples proved to be rich sources of all the vitamins analyzed compared to the recommended dietary allowances except for vitamin B_2.However, based on the results obtained from this study, it could be concluded that both the coconut and deleb palm nut samples are rich sources mineral elements and vitamins, therefore, both samples could serve as good sources of nutrients to the body.

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