Asian Journal of Biochemistry

ISSN 1815-9923

Academic
Journals Inc.

www.academicjournals.com

OPEN ACCESS Asian Journal of Biochemistry

ISSN 1815-9923
DOI: 10.3923/ajb.2018.9.14

Research Article
Proximate, Mineral and Phytochemical Composition of *Cocos nucifera* Nut

[1]Chinedu Imo, [1]Chukwuma Stephen Ezeonu, [2]Nkeiruka Glory Imo and [1]Chigozie Joshua Anigbo

[1]Department of Biochemistry, Faculty of Pure and Applied Sciences, Federal University Wukari, Nigeria
[2]Department of Animal Production and Management, College of Animal Science and Animal Production, Michael Okpara University of Agriculture, Umudike, Nigeria

Abstract

Background and objective: *Cocos nucifera* nut is widely consumed in different forms by indigenes of many countries. It is used in preparation of some drinks and oil. *Cocos nucifera* nut is believed to have many potential nutritional, medicinal and pharmaceutical uses. This study evaluated the proximate, mineral and phytochemical composition of *Cocos nucifera* nut. **Materials and Methods:** The *Cocos nucifera* nut was bought in Wukari, Nigeria. It was sun-dried and pulverized. The proximate, mineral and phytochemical composition were analyzed using AOAC method, AAS and GC-MS, respectively. **Results:** The results showed the abundance (%) of the proximate parameters evaluated to be in dry matter>Carbohydrates>crude fiber>lipids>protein>moisture> ash order. The results of mineral analysis showed the amount of potassium, magnesium and sodium to be higher than other minerals evaluated in *Cocos nucifera* nut. The abundance (ppm) of the minerals evaluated were recorded in potassium>magnesium>sodium>calcium>iron>phosphorus>zinc>chromium >manganese>copper order. There were wide range of phytochemicals detected in ethanolic extract of coconut which possess important industrial, medicinal, physiological and antibiotic properties. **Conclusion:** The results established that coconut is a good source of energy and could play immunological, physiological, nutritional and pharmacological roles.

Key words: Coconut, mineral, nutrition, phytochemical, proximate

Citation: Chinedu Imo, Chukwuma Stephen Ezeonu, Nkeiruka Glory Imo and Chigozie Joshua Anigbo, 2018. Proximate, mineral and phytochemical composition of *Cocos nucifera* nut. Asian J. Biochem., 13: 9-14.

Corresponding Author: Chinedu Imo, Department of Biochemistry, Faculty of Pure and Applied Sciences, Federal University Wukari, P.M.B. 1020, Wukari, Taraba State, Nigeria Tel: +2348037505543

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Cocos nucifera commonly known as coconut belong to the family Arecaceae commonly cultivated in many parts of the world. Some people believe that the plant may have originated from Southeast Asia. In Nigeria, it is called "Aki Oyibo" or "Aki bekee" in Igbo, "Kwakwa" in Hausa and "Agbon" in Yoruba.

Among all palms, coconut has been reported to be among the most importantly and extensively grown in the world[1]. The nut is usually consumed in its raw form and most times eaten alongside other products such as cassava chips, maize and date fruit, among others. Coconut can be processed into desired texture in cakes, cookies, pies and desserts. Coconut is also known to be commercially viable as a result of its nutritional uses[2]. It is used as food and believed to possess many medicinal properties. Coconut is used with date fruit and tiger nut in preparation of some drinks such as the nutritious drink known as "Kunu aya" popularly consumed in Nigeria (especially, Northern Nigeria). This drink (Kunu aya) is believe to serve as food and also serve as a sexual fertility booster.

Cocos nucifera nut is believed to have low toxicity, but many potential nutritional, medicinal and pharmaceutical uses. Lima *et al.*[3], reported that constituent of coconut water and the endocarp possess antioxidant activity. Different parts of coconut fruit have different industrial uses. Based on the age of the coconut, the solid albumen which some refer to as the nut or kennel vary in thickness and usually sweet. The fruit contain fluid usually referred to as coconut water[4]. Different extracts from parts of *C. nucifera* are used for treating diarrhea in Brazil[5], Ghana[6], stomach aches in New Guinea and prevent hair loss and renal disease in Fiji[7]. The fruit is reported to be consumed as an aphrodisiac by men in Mozambique[8]. In traditional medicine, coconut is believed to be effective in treatment of certain poisons, stomach, kidney and hair problems.

Evaluation of the mineral, proximate and phytochemical component of *Cocos nucifera* nut will reveal its nutritional and medicinal properties from consumers' stand point. Therefore, the study carried out into the proximate, mineral and phytochemical composition of *Cocos nucifera* nut warrants research.

MATERIALS AND METHODS

Duration and year of study: This study was carried out from the month of March-May, 2017.

Plant material used: *Cocos nucifera* nut was purchased at New Market, Wukari, Nigeria. The *Cocos nucifera* nut was cut into small pieces, sun-dried and milled with manual blender.

Preparation of plant extract: The plant powder was macerated in 70% ethanol for 48 h with occasional shaking, thereafter filtered and the filtrate concentrated to eliminate the ethanol. The crude plant extract was used for phytochemical analysis.

Determination of mineral and proximate composition of *Cocos nucifera* nut: The proximate component (fiber, moisture, protein, carbohydrates, lipid, ash and dry matter) of *Cocos nucifera* nut was determined using the method of AOAC[9], while the concentration of minerals (Ca, Mg, Cr, Mn, Zn, Cu, Na, K, Fe and P) was carried out with the use of atomic absorption spectroscopy (model AA280FS, Agilent Technologies, U.S.A). The conditions recommended by the manufacturer was followed.

Determination of phytochemical composition of ethanolic extract of *Cocos nucifera* nut: GC (model no 7890B) and MS detector (model 5977A) was used for the phytochemical analysis. It was equipped with column: Agilent HP 5MS ultra Inert (350°C) 30 m × 250 × 0.25 µm. Helium (He) was used with flow: 0.7 mL min^{-1}, pressure: 4.4867psi and average velocity: 30.641 cm sec^{-1}. The injection volume was 1 mL, inlet temperature 250°C, split ratio 20:1 and split flow 14 mL min^{-1}. The temperature of the oven used was 60°C with equilibrating time of 1 min, maximum oven temperature 350°C and total run time 35.857 min. Identification of the phytochemical constituent was done by matching the spectra of the phytochemical to be identified with the mass spectra of reference compounds contained in the database of National Institute of Standards and Technology (NIST 14). The amounts of phytochemicals suggested were then expressed as area percent which is comparable to the total peak area.

RESULTS

The results (Table 1) showed that the amount of carbohydrates and crude fiber were higher than lipids and crude proteins in *Cocos nucifera* nut. The abundance (%) of the parameters evaluated were in dry matter>Carbohydrates >crude fiber>lipids>protein>moisture> ash order.

The results of mineral analysis in Table 2 showed that the amount of potassium, magnesium and sodium were higher than other minerals evaluated in *Cocos nucifera* nut. The abundance (ppm) of the minerals evaluated were in potassium>magnesium>sodium>calcium>iron>phosphorus >zinc>chromium>manganese>copper order.

There are wide range of chemicals detected in ethanolic extract of coconut (Table 3 and Fig. 1). Most of the chemical constituents are food additives (flavouring agents), while some possess divers physiological functions.

Table 1: Proximate composition of *Cocos nucifera* nut

Component	Concentration (%)
Moisture content	2.39±0.02
Dry matter	97.62±0.02
Crude protein	9.22±0.23
Crude fiber	27.84±0.33
Lipid	23.64±0.00
Ash content	1.56±0.06
Carbohydrates	35.36±0.48

Values are Mean±Standard deviation (n = 3)

Table 2: Mineral composition of *Cocos nucifera* nut

Mineral	Concentration (ppm)
Magnesium	4.040±0.0005
Calcium	2.085±0.0008
Manganese	0.137±0.0002
Chromium	0.203±0.0002
Copper	0.047±0.0005
Zinc	0.546±0.0004
Iron	1.961±0.0003
Potassium	6.367±0.0817
Sodium	3.567±0.1081
Phosphorus	1.957±0.0180

Values are Mean±Standard deviation (n = 3)

Table 3: Phytochemical composition of ethanolic extract of *Cocos nucifera* nut

Compound	RT (min)	Area (%)
2-Hexenal diethyl acetal, trans	23.385	1.800
Dodecanoic acid, ethyl ester	26.139	0.310
Glutamic acid, N-isovaleryl-, dimethyl ester	28.383	1.780
Tetradecanoic acid, ethyl ester	30.801	0.220
Lauric acid, 3,4-dichlorophenyl ester	32.017	0.510
Undecanedioic acid, monomethyl ester	32.928	22.880
Hexadecanoic acid, methyl ester	33.640	0.200
Hexadecanoic acid, ethyl ester	35.034	0.130
Myristic anhydride	36.184	0.340
8-Octadecanone	36.702	1.450
Glycidyl palmitate	37.183	2.140
2-Oxecanone, 10-methyl-	39.997	0.250
Dodecane	40.054	1.470
2-Dodecylcyclobutanone	40.812	6.570
Pentanoic acid, morpholide	41.011	1.350
1-Acetyl-2-t-butyl-3-methyl-5-(2-methylthioethyl) imidazolidin-4-one	41.794	0.970
9-Octadecenoic acid, (E)-	43.101	0.540
4-Dibenzofuranamine	43.909	11.400
Cyclopentadecanone, 2-hydroxy-	44.100	0.800
Cyclononanone	44.281	2.370
6-Octadecenoic acid	45.187	0.200
Pyridine, 1,2,3,6-tetrahydro-1-methyl-4-phenyl-	45.293	1.090
2H-Pyran-2-one, tetrahydro-6-undecyl-	45.527	1.530
1H-Indene, 2-butyl-1-hexyl-2,3-dihydro-	46.628	0.410
Butyl 9-tetradecenoate	46.770	0.430
2-Pentadecanone	47.106	5.620
Glycerol tricaprylate	48.259	5.600
1,3-Dioctanoin	48.528	11.610
1-Methyl-1,2-cis-cyclopropane dicarboxylic acid	48.973	0.400
3-Eicosene, (E)-	49.760	0.290
16-Hentriacontanone	50.074	5.100
Fumaric acid, 4-heptyl tridecyl ester	50.353	0.240
3-Quinolinecarboxylic acid, 6,8-difluoro-4-hydroxy-, ethyl ester	50.629	0.220

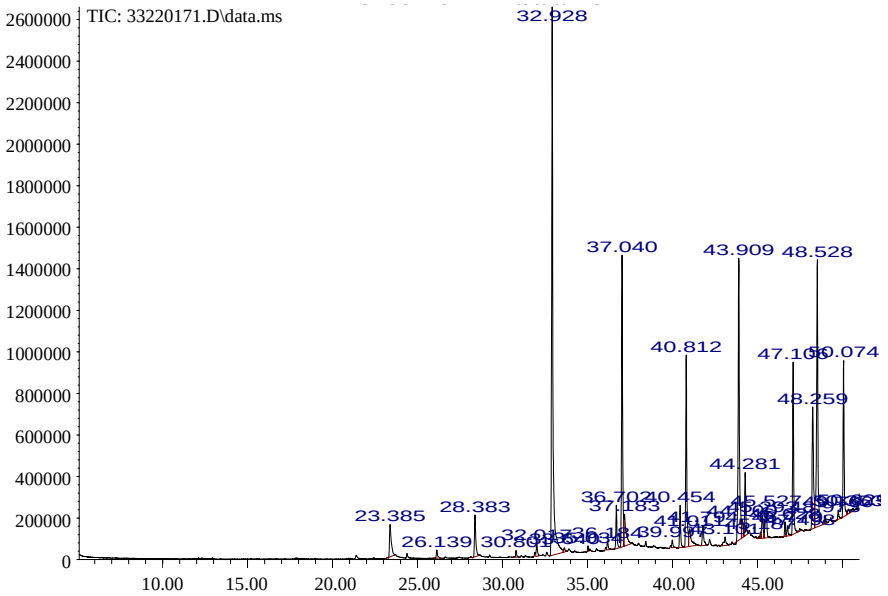

Fig. 1: GC-MS chromatogram of ethanolic extract of *Cocos nucifera* nut

DISCUSSION

The results in (Table 1) showed that among the three basic macromolecules evaluated (carbohydrates, proteins and lipids), the amount (%) of carbohydrates was highest, while lipid was higher than proteins. This shows that *Cocos nucifera* nut is a better source of carbohydrates than lipids and proteins. However, the result shows it is also a good source of lipids and proteins. The high amounts of lipids and carbohydrates confirms the reason for the widely use of coconut in nutrition all over the world and as a good source of ATP for driving many important biological processes. Edeoga *et al.*[10], reported that carbohydrates play essential role by providing energy and nourishment to animals. This high amount of lipid and carbohydrates shows coconut can play a vital role for the sustenance of animal life, especially human. In nutrition, coconut is used in various forms. It is usually consumed in raw form or alongside with other foods or plant materials such as cooked or roasted corn, cassava chips, groundnut, date palm fruit and tiger nut. The high nutritive content of coconut is believed to be one of the reasons why coconut is used alongside date fruit, bread and tiger nut in the preparation of "kunu aya" which is a commonly known nutritious drink in Northern Nigeria. The high amount of lipid and carbohydrates is believed to be one of the reasons why the drink or other types of drinks and milk made from coconut could prevent hunger when consumed. The high lipid content also shows that coconut could be important for the synthesis of certain hormones of lipid origin and could also help in proper utilization of some fat-soluble vitamins.

The protein content of coconut also shows it could contain certain important amino acids which may play vital immunological, physiological, nutritional and pharmacological roles. Proteins aids in growth regulation and in catalytic activities of certain enzymes. Proteins from coconut could aid in these functions thereby improving human health system. Coconut possess high fiber content. Fiber is known to play a key role in reduction of constipation. It is believed that this high fiber present in coconut could aid in the reduction of constipation. It can also promote the constant elimination of bowel content. This can be detrimental since constant elimination of bowel content could result to a decrease in digestibility and utilization of nutrients. This means that excessive consumption of coconut may result to frequent bowel movement and may cause stomach discomfort.

The amount of moisture (%) was low in coconut thereby showing a very high amount of dry mater. The presence of moisture shows the plant material will deteriorate with time when stored in its fresh form. This is because moisture could encourage certain microbial activities which may reduce the quality and overall acceptability of foods. The amount of ash was the lowest among the proximate parameters evaluated. It reveals the corresponding amount of mineral elements in coconut.

Although mineral elements do not yield energy, they are essential for the proper functioning of human immune system and for sustaining life[11]. Consumption of food materials rich in minerals aid in supplying the individual mineral elements that may help boost the immune system and sustain life. The result of this study shows potassium is more abundant in coconut among the mineral elements evaluated. However, the amount of magnesium, sodium and calcium were appreciable (Table 2). The high level of potassium and magnesium show that consumption of coconut could aid in various biochemical processes and may possibly aid certain enzyme catalysis. Also, the high amount of potassium show consumption of coconut may improve osmoregulation in human body system. Availability of sodium, calcium and phosphorus confirms that coconut could help in regulation of homeostatic balance. This will aid the proper functioning of bodily cells, nerves, bones and muscles. Phosphorus is a component of ATP and nucleic acid[11].

The level of iron present in coconut implies that coconut could aid blood formation and proper supply of oxygen to different body cells, thereby preventing anaemia. This is because iron is essential for haemoglobin formation and active cellular respiration. The amounts of zinc, chromium, manganese and copper are low in coconut, but are appreciable for human life since they are required in small amount in humans. Their presence in coconut supports the fact that consumption of coconut could aid in various biochemical processes and may possibly aid certain enzyme catalysis. This is because these mineral elements are needed by certain enzymes as co-factors for effective catalysis. However, this may also be one of the reasons why coconut is commonly believed to interfere with some mechanisms of action of certain drugs. The consumption of coconut is encouraged since it could supply these minerals that are required for vital life processes. It will aid in preventing diseases that may arise as a result of deficiency of the minerals listed. It is important to note that excess accumulation of some of these minerals in animal body may result to different toxicities associated with the minerals.

2-Hexenal diethyl acetal, trans, Dodecanoic acid, ethyl ester, Dodecane and Hexadecanoic acid, ethyl ester are food additives (flavouring agents), but Hexadecanoic acid, ethyl ester can induce the expression of cyclooxygenase-2. Glutamic acid, N-isovaleryl-, Dimethyl ester (Table 3 and Fig. 1) has

been reported to play important physiological action in nervous system as an excitatory neurotransmitter[12]. Lauric acid is implicated in increasing high-density lipoprotein (HDL)[13]. Tetradecanoic acid, ethyl ester is used as a flavourings agent and has been reported to increase LDL-cholesterol thereby making it to be hypercholesterolemic[14]. Fumaric acid is used as a food acidulant and aids cellular defense against oxidative stress[15]. Glycidyl palmitate is used in lysophosphatidic acids preparation which inhibit apoptosis. 2-Dodecylcyclobutanone is a food irradiation marker. 9-Octadecenoic acid, (E)- is used in the preparation of some commercial products such as lotions and oleates. It causes an increase in HDL-cholesterol. 1H-Indene, 2-butyl-1-hexyl-2,3-dihydro-may be used in treatment of some types of cancers, while 16-Hentriacontanone is proven to possess anti-convulsant and antibiotic properties[16]. The functions of some of these different phytochemicals show that ethanolic extract of coconut possess these important properties. Some of these phytochemicals may contribute to the reason why coconut is used in traditional medicine, since some phytochemicals are used in traditional and modern medicine[17].

CONCLUSION AND FUTURE RECOMMENDATIONS

The results of this study show that *Cocos nucifera* nut is a good source of the basic macromolecules such as carbohydrates, lipids and proteins. This research established that coconut is a good source of energy and could play immunological, physiological, nutritional and pharmacological roles. Mineral elements that could boost the immune system, support proper functioning of human body cells and aid sustenance of life may be adequately obtained by consumption of coconut. There are wide range of chemicals detected in ethanolic extract of coconut which possess important industrial, medicinal, physiological and antibiotic properties. Further research is therefore required to isolate the individual chemical components in *Cocos nucifera* nut and examine their biochemical effects.

SIGNIFICANCE STATEMENT

Since *Cocos nucifera* nut is consumed by indigenes of many countries in different forms or used in preparation of some drinks or oil, this study is therefore significant because study into the proximate, phytochemical and mineral analysis of *Cocos nucifera* nut will aid in establishing the nutritional, mineral and pharmacological properties of the nut and also show the possible level of nutritional acceptance of the plant material.

REFERENCES

1. Onifade, A.K. and Y.A. Jeff-Agboola, 2003. Effect of fungal infection on proximate nutrient composition of coconut (*Cocos nucifera* Linn) fruit. Food, Agric. Environ., 1: 141-142.
2. Akubugwo, I.E., G.C. Chinyere and A.E. Ugbogu, 2008. Comparative studies on oils from some common plant seeds in Nigeria. Pak. J. Nutr., 7: 570-573.
3. Lima, E.B.C., C.N.S. Sousa, L.N. Meneses, N.C. Ximenes and M.A. Santos, Jr. *et al*., 2015. *Cocos nucifera* (L.)(Arecaceae): A phytochemical and pharmacological review. Brazil. J. Med. Biol. Res., 48: 953-964.
4. De Andrade, A.M., P.R. de Assis Passos, L.G. de Costa Marques, L.B. Oliveira, G.B. Vidaurre and J. das Dores de Sa Roch, 2004. Pirolise de residuos do coco-da-baia (*Cocos nucifera* Linn) e analise do carvao vegetal. Rev. Arvore, 28: 707-714.
5. Esquenazi, D., M.D. Wigg, M.M. Miranda, H.M. Rodrigues and J.B. Tostes *et al*., 2002. Antimicrobial and antiviral activities of polyphenolics from *Cocos nucifera* Linn.(Palmae) husk fiber extract. Res. Microbiol., 153: 647-652.
6. Yartey, J., E.K. Harisson, L.A. Brakohiapa, D.O. Troph and F.K. Nkrumah, 1993. Carbohydrate and electrolyte content of some home-available fluids used for oral rehydration in Ghana. J. Trop. Pediatr., 39: 234-237.
7. Singh, Y.N., 1986. Traditional medicine in Fiji: Some herbal folk cures used by Fiji Indians. J. Ethnopharmacol., 15: 57-88.
8. Amico, A., 1977. Medicinal plants of Southern Zambesia. Fitoterapia, 48: 101-139.
9. AOAC., 2010. Official Methods of Proximate Analysis. AOAC International, Gaithersburg, MD., pp: 15.
10. Edeoga, H.O., D.E. Okwu and B.O. Mbaebie, 2005. Phytochemical constituents of some Nigerian medicinal plants. Afr. J. Biotech., 4: 685-688.
11. Soetan, K.O., C.O. Olaiya and O.E. Oyewole, 2010. The importance of mineral elements for humans, domestic animals and plants: A review. Afr. J. Food Sci., 4: 200-222.
12. Meldrum, B.S., 2000. Glutamate as a neurotransmitter in the brain: Review of physiology and pathology. J. Nutr., 130: 1007S-1015S.
13. Mensink, R.P., P.L. Zock, A.D.M. Kester and M.B. Katan, 2003. Effects of dietary fatty acids and carbohydrates on the ratio of serum total to HDL cholesterol and on serum lipids and apolipoproteins: A meta-analysis of 60 controlled trials. Am. J. Clin. Nutr., 77: 1146-1155.

14. Hughes, T.A., M. Heimberg, X. Wang, H. Wilcox and S.M. Hughes *et al*., 1996. Comparative lipoprotein metabolism of myristate, palmitate and stearate in normolipidemic men. Metabolism, 45: 1108-1118.
15. Gold, R., L. Kappos, D.L. Arnold, A. Bar-Or and G. Giovannoni *et al*., 2012. Placebo-controlled phase 3 study of oral BG-12 for relapsing multiple sclerosis. N. Engl. J. Med., 367: 1098-1107.
16. Gonzalez-Trujano, M.E., L. Lopez-Meraz, A. Reyes-Ramirez, M. Aguillon and A. Martinez, 2009. Effect of repeated administration of *Annona diversifolia* Saff. (ilama) extracts and palmitone on rat amygdala kindling. Epilepsy Behav., 16: 590-595.
17. Imo, C. and F.O. Uhegbu, 2015. Phytochemical analysis of *Gongronema latifolium* Benth leaf using gas chromatographic flame ionization detector. Int. J. Chem. Biomol. Sci., 1: 60-68.