ORIGINAL RESEARCH REPORT **NIGER. J. PLT. PROT. 37(2) 127-134 (2023)**

EVALUATION OF NUTRIENT AND ASSOCIATED MYCOFLORA OF ROASTED CASHEW NUT SOLD IN PORT HARCOURT

AGBAGWA S. S., CHUKU E. C., WEKHE E. O. and BROWN J.

Department of Plant Science And Biotechnology, Rivers State University, Port Harcourt.
Email: samuelagbagwa@gmail.com

SUMMARY

Nutrient evaluation of cashew nut and its associated mycoflora was carried out in the Department of Plant Science and Biotechnology, Rivers State University. Samples were subjected to AOAC analysis and cultural isolation technique and data obtained were assessed statistically. Proximate composition investigation showed the presence of moisture, ash, lipid, fibre, carbohydrate and protein. Lipid content was highest (44.1±0.1%) while ash recorded lowest content (1.55±0.05%). Mineral profiling revealed calcium, iron, magnesium, phosphorus, potassium and sodium to be present in the tested samples. Sodium had highest value (340.5±0.5 g/100g) while iron had lowest value (4.5±0.00 mg/100g). Vitamin assessment indicated the availability of vitamins A (0.3±0.2mg/100g) and thiamine (1.055±0.005 mg/100g). Although, vitamin C recorded no value for tested cashew nut. Phytochemical screening showed glycoside, oxalate, saponin, tannin, carotenoid, polyphenol, flavonoid and lignant to be present. Two fungal organisms (Mucor sp. and Aspergillus flavus) were isolated from spoilt cashew nut samples and highest incidence of 80% was recorded for Mucor sp. and 20% for A. flavus. Generally, cashew nut is rich with so many nutrients and proper measures should be adopted to protect it from contamination.

Keywords: Cashew nut (*Anarcardium occidentale*), nutrient and mycoflora, Mucor sp., *Aspergillus flavus*, phytochemical analysis

Anacardium occidentale *commonly known as cashew is a member of the Anacardiaceae family comprising over 600 species* (18). The plant could either be a shrub or tree with pinnate or trifoliate leaves alternately arranged and known to produce exudates from its resinous bark (2). Cashew produces unisexual or bisexual flower that results into the formation of drupe fruit consisting a stoney seed and fleshy portion (18).

Literatures has shown the crop plant to be grown in different parts of the world including, Africa, South Eastern Asia and South America (3). Cashew cultivation has been recorded on sandy, stony and loamy soils and can withstand several environmental stress such as drought and strong wind (4).

Cashew has been reported by early researchers to contain vital nutrients including moisture, protein, carbohydrate, lipid, fiber, calcium, phosphorus, potassium, magnesium, sodium, iron, vitamins A, B, C and E (14;35;21;20). The plant is also rich in amino acids as well phytochemicals including flavonoid, alkaloid, saponin, oxalate tannin, carotenoid, polyphenol and many others (25;6).

The plant also faces the challenge of pest and diseases resulting from insect, bacteria,

fungi and virus attacks (37). The menace of these organisms on cashew plant and produce don not only affect the fruit appearance but also its quality and income generation (13).

The cashew is also cherished because of its nut which contains vital nutrients as the whole plant. The nut production has been exploited by many countries including Brazil and Nigeria as it does not only serve as a source of food but also source of national income generation (9;10).

Cashew has enormous importance ranging from medical, industrial, environmental and agricultural sectors as it services as a source of medicine, food and chemical products, shade and fodder as well as income (19;33;36).

It is on this basis this research was carried out to assess the nutrient and associated spoilage pathogen of roasted cashew nut sold in Port Harcourt.

MATERIALS AND METHODS

Collection of Sample

Roasted cashew nuts including both healthy and spoilt forms were gotten from Port Harcourt, Rivers State at the fruit garden market. The obtained samples were carried down to the Department of Plant Science and Biotechnology, Rivers State University for subsequent assessment.

Fungi Isolation and Identification from cashew nut

Sabouraud Dextrose Agar (SDA) was the medium adopted to the studied. All utilized glassware were firstly sterilized in a dry oven while 70% ethanol was used to disinfect other equipment as well the surface of the work bench. The utilized medium was prepared in accordance to the standard method outlined by Cheesebrough, (15) within the conical flask. This was immediately autoclaved for 15 minutes at 121°C and pressure of 1.1kg cm-3. After autoclaving, the medium was introduced into sterile Petri dishes and allowed to cool and solidify (16).

The isolation process was done using the direct plating technique where about 0.5cm of the of the spoilt samples revealing the spoilage signs was cut from the region boarded by both healthy and rot portions of the nut and was introduced onto the prepared SDA containing 500µg/ml of ampicillin. The setup was replicated thrice and incubated at 25 ± 3° C for five days. Subsequent isolations were done to obtain pure cultures (26).

The pure culture isolates obtained were identified and characterized microscopically and macroscopically. Macroscopically, the isolates were characterized using their colony morphology, colony colour, mycelia structure and other outlined keys by Barnett and Hunter, (12). The needle mount method of Cheesebrough, (15) was adopted for microscopic examination where the teased fungal spores were stained with lacto phenol in cotton blue and observed using the low and high objective lens.

Evaluation of percentage incidence

The method of Chuku *et al*., (16) was used to evaluate percentage incidence of fungal occurrence.

$$\frac{X}{Y} \times \frac{100}{1} = \% \text{ incidence}$$

Where:

X= total number of each organism in a variety

Y= total number of all identified organism in a variety

Assessment of nutrient components of *cashew nut*

The Association of Official Analytical Chemist (AOAC) method was adopted for the determination of the nutrient contents of healthy roasted cashew nuts (11). This was

carried out in the Food Science and Technology Laboratory.

Data analysis

The version 22 of SPSS software was used to produce the mean and standard deviation of the data obtained.

RESULTS

Result of proximate Composition of cashew nut presented in Table 1 shows the availability of moisture, ash, lipid, fibre, carbohydrate and protein

Table 1: Proximate Composition of Cashew nut

Parameter	Composition
Moisture	6.11 ± 0.01
Ash	1.55 ± 0.05
Lipid	44.1 ± 0.1
Fibre	1.25 ± 0.05
Carbohydrate	27.45 ± 0.05
Protein	19.55 ± 0.05

*± mean and standard deviation

Result of mineral composition of cashew shown in Table 2 reveals calcium, iron, magnesium, phosphorus, potassium and sodium in tested cashew nut.

Table 2: Mineral Composition

Parameter	Composition (mg/100g)
Calcium	50.05 ± 0.05
Iron	4.5 ± 0.00
Magnesium	32.15 ± 0.05
Phosphorus	221.5 ± 0.5
Potassium	275.00 ± 0.00
Sodium	340.5 ± 0.5

*± mean and standard deviation

The result of vitamin composition tabulated in Table 3 shows the presence of Vitamins A, C and Thiamin

Table 3: Vitamin Composition

Parameters	Composition (mg/100g)
Vitamin C	0.00 ± 0.00
Vitamin A	0.3 ± 0.2
Thiamin	1.055 ± 0.005

*± mean and standard deviation

The result of fungal isolation and incidence presented in table 4 showed *Mucor* and *Aspergillus* values to responsible for cashew nut spoilage.

Table 4: Fungal isolates from cashew nut and their percentage incidence

Isolates	Incidence %
Mucor spp	80
Aspergillus flavus	20

The result of phytochemical composition of cashew in table 5 revealed the occurrence of glycoside, oxalate, saponin, tannin, carotenoid, polyphenol, flavonoid and Lignan.

Table 5: Phytochemical composition.

Parameter	Composition
Glycoside	0.055 ± 0.005
Oxalate	0.02 ± 0.00
Saponin	0.041 ±0.001
Tannin	0.03 ± 0.00
Carotenoid	0.515 ± 0.005
Polyphenol	7.89 ± 0.01
Flavonoid	4.57 ± 0.01
Lignan	1.09 ± 0.01

*± mean and standard deviation

DISCUSSION

The result of this study has shown the availability of several nutrients in cashew nut. Highest proximate value was recorded for lipid (44.1 ± 0.1) while Ash recorded the lowest value (1.55 ± 0.05). Low moisture content (6.11 ± 0.01) was seen as a result of the roasting production technique and is in line with the report of Oladapo *et al.,*(31). Several authors have also implicated the presence of these nutrients in both fresh and roasted cashew (24;32). Emelike *et al.,* (21) reported higher contents of all tested parameters in this study with an exception of moisture, for defatted and undefatted cashew Kernel flour.

Griffin and Dean, (22), also reported higher lipid and carbohydrate. Although moisture and protein contents of the present study are higher than those reported for roasted cashew nut. The result of the current study agrees with the report of Orhevba and Yusuf (34) as they gave similar values based on the effect of varying temperature of roasted cashew nut nutrient quality. The finding of Akujobi *et al.,* (8) revealed varying nutrient quality for the red and yellow varieties of cashew and the values they reported are similar to those outlined in the present study. Aikpokpodion *et al.,* (7) also showed that the quality and nutrient composition of cashew is influenced by the nature and type of soils it grows on. Therefore, the varying composition from the current study and previous studies may be as a result of the difference in location and cultivated soil. Generally, the assessed proximate compositions play vital role in the day to day activities of man as they support in the supply of amino acids for body building (20;1).

The current study revealed different mineral elements in the assessed cashew nut. Notwithstanding, highest mineral value was recorded for sodium 34.0 ± 0.5 mg/100g and lowest mineral element 4.5 ± 0.00 mg/100g was recorded for iron. Early researchers have also implicated the presence of these mineral elements in both fresh and roasted cashew nut (22;24). Abubakar (1) reported lower mineral elements than those documented in the present study. Akujobi *et al.,* (8) also reported lower values of potassium, phosphorus and iron for both red and yellow varieties of cashew than their equivalents recorded in the current study. The mineral element values reported by (7) were also lower than those in the outlined in the present study. On the other hand, Orhevba and Yusuf, (34) reported higher mineral values for cashew nut. More so, Emelike *et al.,* (21) also reported higher calcium, magnesium and iron values than the present study. Mineral elements are very crucial in the metabolic process of life as they do not only serve as catalyst in these processes but also support bone strengthening and blood composition (20;23).

Three vitamins were assessed in the present study. Although no value was recorded for vitamin C, thiamin recorded highest value (1.055 ± 0.005 mg/100g). The result of the current study agrees with the findings of Griffin and Dean (22) as they reported several vitamins in cashew not excluding vitamin C. More so, they reported lower value of thiamin (0.045 ± 0.001 mg/100g). This was also similar to the findings of Nagaraja, (29) as no vitamin C was recorded. The result of the vitamin contents from the current study disagrees with the reports of Akujobi *et al*., (8) as they reported Vitamin C in cashew nut. Generally, the health importance of vitamins has increased their relevance to man as they do not only support proper vision but limit the occurrence of several diseases (beri-beri) (30).

Several phytochemical components were profilled in the present study with appreciable concentrations. Polyphenol

recorded highest content (7.89 ± 0.01 %) while lowest photochemical component was recorded for oxalate (0.02 ± 0.00). Early researchers have also indicated the occurrence of these phytochemical, in cashew nut, however at a varying concentration (24). Donkoh *et al.,* (20) reported higher value of tannin than its equivalent in the present study. In addition, Akujobi *et al.,* (8) reported higher concentrations of all the tested phytochemicals in the current study. Nonetheless, several literatures have shown the pharmaceutical relevance of phytochemicals as they have antimicrobial and anti-inflammatory properties (23;27).

The present study revealed two fungal organisms (*Mucor sp and Aspergillus flavus*) to be responsible for the Spoilage of cashew nut. However, *Mucor* recorded higher incidence of 80% while *A. flavus* had lowest incidence of 20%. The present study is in line with reports of early researchers as they implicated not only fungal mounds and yeast but other bacterial organisms as well (32;28). The fungal isolates of the present study agree with the findings of Oladapo *et al.,* (31) as they found *Mucor* and *Aspergillus* to be associated with cashew nut spoilage. Nevertheless, the activities of these isolates do not only affect the quality and appearance of cashew nut but also pose a risk to consumers as they could lead to several diseases as well as cancer due the production of Aflatoxins (4)

CONCLUSION

The current study has shown that cashew nut contains essential nutrient materials that are important to human development. Although, the nuts are still faced with the challenge of spoilage and contamination by microorganisms.

LITERATURE CITED

1. **Abubakar, S. M. 2018.** Evaluation of nutrient content of raw and roasted cashew nut (Anacardium occidentale) kernel. *Biological and Environmental Sciences Journal for the Tropics*, *15*(1):41-46.
2. **Adeigbe, O. O., Olasupo, F. O., Adewale, B. D. and Muyiwa, A. A. 2015.** A review on cashew research and production in Nigeria in the last four decades. *Scientific Research and Essays*, *10*(5): 196-209.
3. **Adejumo, T. O., and Otuonye, A. H. 2002.** The use of botanicals in the control of inflorescence blight disease of cashew, *Anacardium occidentale*. Nigr. *J. Sci*, *36*(1): 75-80.
4. **Adetumi M. C. Alika O. P, Awa N. P, Atanda O. O. and Mwanza M. 2018**. Microbial quality and risk assessment for atlatoxins in groundnuts and roasted cashew nuts meant for human consumption. *Hindawi j. toxicology,* 1308748.
5. **Adewale, B. D., Ibiremo, O. S., Odoh, N. C. and Adeyemi, E. A. 2013.** Genetic estimates and trend analysis of some growth parameters of cashew (*Anacardium occidentale L.*) as influenced by nine nutrient combinations. *Journal of Agricultural Biotechnology and Sustainable Development*, *5*(1): 6-11.
6. **Adeyeye, E. I., Asaolu, S. S. and Aluko, A. O. 2007.** Amino acid composition of two masticatory nuts (Cola acuminata and Garcinia

kola) and a snack nut (*Anacardium occidentale*). *International Journal of Food Sciences and Nutrition*, *58*(4): 241-249.

7. **Aikpokpodion P.E., Uloko B. and Edibo G. 2009.** Nutrient dynamics in soil and cashew (Anarcadium occidentale, L.) leaf and kernel in Kogi State, Nigeria. *Journal of Applied Biosciences*, *25*, 1573-1578.
8. **Akujobi, I. C., Afam-Anene, O. C., Nnoka, K. and Amadi, J. A. 2018.** Nutrient composition, phytochemical and sensory properties of nuts from red and yellow varieties of cashew fruit. *Intl. J. Inno. Food, Nutrition and Sustainable Agric*, *6*(3), 40-47.
9. **Aliyu, O. M. 2012.** Genetic diversity of Nigerian cashew germplasm. *Genetic diversity in plants*, 163-184.
10. **Aliyu, O. M., Adeigbe, O. O. and Awopetu, J. A. 2011.** Foliar application of the exogenous plant hormones at pre-blooming stage improves flowering and fruiting in cashew (*Anacardium occidentale L.*). *Journal of crop science and biotechnology*, *14*(2): 143-150.
11. **AOAC, 2005.** Official methods of analysis of AOAC international. 18th edition. Association of official analytical chemists, Washington, D.C., USA.
12. **Barnett, H. L. and Hunter, B. B. 1998.** *Illustrated genera of imperfect fungi*, 4th edition. American Phytopathological Society Press, St. Paul Minnesota, 218.
13. **Behravan, E., Heidari, M. R., Heidari, M., Fatemi, G., Etemad, L., Taghipour, G. and Abbasifard, M. 2012.** Comparison of gastric ulcerogenicity of percolated extract of *Anacardium occidentale* (cashew nut) with indomethacin in rats. *Pak. J. Pharm. Sci*, *25*(1): 111-115.
14. **Belonwu, D.; Ibegbulem, C.; Nwokocha, M. and Chikezie, P. 2014.** Some phytochemicals and hydrophilic vitamins of anacardium occidentale. *Research Journal of Phytochemistry*, 8(1): 78–91.
15. **Cheesebrough, M. 2000.** *Distinct laboratory practice in tropical countries* part 2. Cambridge University Press London, 143-156.
16. **Chuku, E. C. 2009.** Fungi responsible for the spoilage of plantain (*Musa paradisiaca*) at various ripening stage. *Acta Agronomical Nigeriana*, 9(1&2), 35-45.
17. **Chuku, E. C., Agbagwa, S. S. and Worlu, C. 2019.** Nutrient quality and associated spoilage fungi of English pear (Pyrus communis L.). *International Journal of Agriculture, Environment & Bioresearch*, 4(6), 317-325.
18. **Correia, S. D. J., David, J. P. and David, J. M. 2006.** Secundary metabolites from species of *Anacardiaceae*. *Química Nova*, *29*(6): 1287-1300.
19. **Dendena, B. and Corsi, S. 2014.** Cashew, from seed to market: a review. *Agronomy for sustainable*

development, *34*(4): 753-772.

20. **Donkoh, A., Attoh-Kotoku, V., Osei Kwame, R. and Gascar, R. 2012.** Evaluation of nutritional quality of dried cashew nut testa using laboratory rat as a model for pigs. *The Scientific World Journal*, *4(2): 7-155.*
21. **Emelike, N. J. T., Barber, L. I. and Ebere, C. O. 2015.** Proximate, mineral and functional properties of defatted and undefatted cashew (Anacardium occidentale Linn.) kernel flour. *European Journal of Food Science and Technology*, *3*(4): 11-19.
22. **Griffin, L. E. and Dean, L. L. 2017.** Nutrient composition of raw, dry-roasted, and skin-on cashew Nuts. *Journal of Food Research*, *6*(6), 13-28.
23. **Heyze, V., Tran, G., Haassoun, P., Bastianeli, D. and Lebas, F. 2016.** Cashew (Anarcadium occidentale, L.) Nuts & by products. Feedipedia, a programme by WRA, (IRAI) AFZ and FAO. http://www.feedipedia.org/node/56. Retrieved 21st January, 2022.
24. **Ijarotimi, O. S., Oluwalana, I. B. and Ogunedojutimi, M. O. 2012.** Nutrient composition, functional, sensory and microbial status of popcorn-based (Zea May Everta) complementary foods enriched with cashew nut (Anacardium occidentale L.) flour. *African Journal of Food, Agriculture, Nutrition and Development*, *12*(5), 6424-6446.
25. **Konan, N. A. and Bacchi, E. M. 2007.** Antiulcerogenic effect and acute toxicity of a hydroethanolic extract from the cashew (*Anacardium occidentale L.)* leaves. *Journal of ethnopharmacology*, *112*(2): 237-242.
26. **Mehrotra, R. S. and Aggarwal, A. 2003.** Pythopathological techniques in plant pathology: In *Plant pathology* 2nd edition. Tata McGraw-Hill publishing company limited, 821.
27. **Muhammad, A. and Muhammad, T. 2021.** Medicinal Uses of Cashew (Anacardium occidentale). *Journal of Science Technology and Research (JSTAR)*, *2*(1): 18-26.
28. **Muniz, C.R, Freire, F. C. O., Lemos, E. H., Pinto, G. A. S., Defigueiredo, E. A. T. and Figueiredo, R. W. 2006.** Effect of processing conditions on the microbial quality of cashew nuts. *Braz. J. food tech* 9 (1):33-38.
29. **Nagaraja, K.V. 2008.** Nutritive value of cashew. *Codeword process & Printers, falnir, Mangalore, India. PP12*
30. **Ogunwolu, S.O., Henshaiw, F. O., Oguntona, B.E. and Afolabi, O.O. 2015.** Nutritional evaluation of cashew (Anarcadium occidentale, L.) Nut protein concentration and isolate. *Afri. J. food sci.,* 9(1): 23-30
31. **Oladapo, A. S., Abiodun, O. A., Akintoyese, O. and Adepeju, A. 2014.** Effect of packaging materials on moisture and microbiological quality of roasted cashew nut (Anarcardium

Occidentale L). *Research Journal in Engineering and Applied Sciences*, *3*(2), 98-103.

32. **Olalekan-Adeniran, M. A. and Ogunwolu, S. O. 2018.** Comparative Quality Evaluation of Oven-Roasted and Honey-Coated Cashew (Anarcadium occidentale, L.) Nut produced using Locally Fabricated Cashew Nut Processing Machine in Nigeria. *International Journal of Environment, Agriculture and Biotechnology*, *3*(5), 266194.
33. **Olife, I. C., Jolaoso, M. A. and Onwualu, A. P. 2013.** Cashew processing for economic development in Nigeria. *Agricultural Journal*, *8*(1): 45-50.
34. **Orhevba, B. A. and Yusuf, I. B. 2016.** Effect of Roasting Temperature on Nutritional Quality of Cashew Nut (Anacardium Occidentale). *Hit. J. scientific & tech. res*, 5(7): 182 – 184.
35. **Rico, R., Bulló, M. and Salas-Salvadó, J. 2016.** Nutritional composition of raw fresh cashew (Anacardium occidentale L.) kernels from different origin. *Food science & nutrition*, *4*(2): 329-338.
36. **Salehi, B., Gültekin-Özgüven, M., Kırkın, C., Özçelik, B., Morais-Braga, M. F. B., Carneiro, J. N. and Cho, W. C. 2019.** Anacardium plants: chemical, nutritional composition and biotechnological applications. *Biomolecules*, *9*(9): 465.
37. **Wonni, I., Sereme, D., Ouedraogo, I., Kassankagno, A. I., Dao, I., Ouedraogo, L. and Nacro, S. 2017.** Diseases of cashew nut plants (*Anacardium Occidentale L.*) in Burkina Faso. *Adv Plants Agric Res*, *6*(3): 1-6.