International Journal of Pharmacy and Chemistry
2022; 8(3): 35-38
http://www.sciencepublishinggroup.com/j/ijpc
doi: 10.11648/j.ijpc.20220803.12
ISSN: 2575-5730 (Print); ISSN: 2575-5749 (Online)

A Study on *Garcinia kola* Seeds in the Niger Delta, Nigeria

Victoria Bennett*, Ibrahim Olabayode Saliu

Department of Chemical Sciences, Faculty of Basic and Applied Sciences, University of Africa, Toru-Orua, Sagbama, Nigeria

Email address:

vkalapoi@gmail.com (V. Bennett)

*Corresponding author

To cite this article:

Victoria Bennett, Ibrahim Olabayode Saliu. A Study on *Garcinia kola* Seeds in the Niger Delta, Nigeria. *International Journal of Pharmacy and Chemistry*. Vol. 8, No. 3, 2022, pp. 35-38. doi: 10.11648/j.ijpc.20220803.12

Received: June 14, 2022; **Accepted**: July 6, 2022; **Published**: July 20, 2022

Abstract: *Garcinia kola* also known as Bitter kola belongs to the family, Clusiaceae. *Garcinia kola* seeds have proven to possess enormous medicinal and pharmacological abilities. Locally, *Gracinia kola* seeds are used to cure abdominal pains, chest cold and cough. It is also used as snake repellant. *Garcinia kola* seeds are served as snack in the Niger Delta, Nigeria. This research is to investigate the proximate, mineral and bioactive compounds in *Garcinia kola* seeds in the Niger Delta, Nigeria. Samples of freshly harvested *Garcinia kola* seeds were purchased from Swali market, Yenagoa, Bayelsa State, Nigeria. Proximate analysis of *Garcinia kola* seeds showed 44.65%, 0.20%, 2.88%, 8.77%, 1.09% and 42.41% moisture, ash, protein, fat, fibre and carbohydrate contents respectively. Varying compositions were reported by various researchers. This may indicate that proximate composition of *Garcinia kola* seeds varies with season, environment and/ or condition or time of evaluation. Moisture content of *Garcinia kola* seeds in the Niger Delta, Nigeria was lower than the moisture content values reported in the literature. Moisture content plays an important role in the physical appearance, shelf-life and resistance to bacterial contamination of nuts. The higher the amount of moisture, the more susceptible the seed becomes to bacterial contamination, implying that *Garcinia kola* seeds in the Niger Delta may have longer shelf-life, hence more resistance to bacterial contamination. Mineral analysis showed 0.26%, 0.002%, 0.001%, 0.03%, and 0.18% K, Fe, Mn, Ca, P contents respectively. Gas chromatography-mass spectrometry (GC-MS) analysis of methanolic extract of the seeds of *Garcinia kola* showed fifteen bioactive components. Substantial amounts of Caryophyllene, 56.1% and Humulene, 87.7% were identified in the seeds of *Garcinia kola*, confirming its use in folk medicine in the Niger Delta, Nigeria. All the different components identified from the seeds have different biological activities – anti-microbial, anti-cancer, anti-inflammatory and anti-malaria activities. Therefore, this research authenticates the medicinal and pharmacological abilities of *Garcinia kola* seeds; hence, recommends isolation of these bioactives to replace synthetic antibiotics in the pharmaceutical industry.

Keywords: *Garcinia kola*, Proximate, Mineral, Bioactive, Medicinal

1. Introduction

Medicinal plants, also called medicinal herbs, are plants used in traditional medicine practices since prehistoric times, plants synthesize hundreds of chemical compounds for various functions which includes defense against insects, Fungi, and other diseases, and they are also viable for treating various ailments/sicknesses [1]. Medicinal plants are as old as mankind itself [2]. In most of the developing world, especially in rural areas, local traditional medicine, including herbalism, is the only source of health care for people. All plants produce chemical compounds which give them an evolutionary advantage, such as defending against several types of disease and illness, these phytochemicals found in plants are use as drugs and the content and known pharmacological activity of these substances in medicinal plants is the scientific basis for their use in modern medicine, if scientifically confirmed. [1] From ancienttimes to present, Ayurvedic medicine as documented in the Atharva veda and the Sushruta Samhita has used hundreds of pharmacologically active herbs and spices such as turmeric, which contains curcumin [3].

Medicinal plants are widely used in non- industrialized societies, mainly because they are readily available and cheaper than modern medicines. The World Health Organisation estimates, without reliable data, that about 80 percent of the World's population depends mainly on

traditional medicine (including but not limited to plant); perhaps some two billion people are largely reliant on medicinal plants. [4]. Medicinal plants can cause adverse effects and even death, whether by side-effects of their substances, by adulteration or contamination, by overdose, or by inappropriate prescription [5].

Garcinia kola also known as Bitter Kola and African wonder nut belongs to the family Clusiaceae. It is a dicotyledonous plant found in moist rain forest and swamps. *Garcinia kola* is a typical multipurpose agroforestry species regarded as one of the most important medicinal plants in Nigeria. Traditionally, the nuts were chewed as a masticatory substance to stimulate the flow of saliva (Figure 1), but they are now widely consumed as a snack in West and central Africa [6].

Figure 1. *Gracinia kola [7].*

Gracinia kola is believed to clean the digestive system, without side effects such as abdominal problems, even when a lot of nuts are eaten [8].

The fruit, seeds (bitter kola nuts) and bark of the plant have been used for centuries in folk medicine to treat ailments from cough to fever. According to a report from the center for international forestry research, *Garcinia kola* trade is still important to the indigenous communities and villages in Nigeria.

Although, manifold medicinal and pharmacological effects of *Garcinia kola* seeds have been reported in the literature, there is still limited knowledge on the proximate analysis and biochemical composition of *Garcinia kola* seeds in the Niger Delta, Nigeria.

2. Materials and Methods

2.1. Materials

All chemicals used were of analytical grades and obtained from BDH, Labtech chemicals, Ken Light Laboratories, Kermel.

2.2. Methods

Freshly harvested *Garcinia kola* (Bitter kola) seeds were purchased from Swali market, Yenagoa, Yenagoa Local Government Area, Bayelsa State, Nigeria and properly identified at the Biological Sciences Department of the University of Africa, Toru-Orua. Bitter kola seeds were peeled and pulverized using an electronic blending machine and stored in a desiccator prior to the analysis.

2.2.1. Proximate Analysis

Standard procedures as described by the Association of Official Analytical Chemists were used in the determination of moisture, Fat, Ash, Crude fibre, Crude Protein and Carbohydrate Content [9].

2.2.2. Mineral Analysis

Standard procedures as described by the Association of Official Analytical Chemists were used to determine Manganese (Mn), Iron (Fe), Calcium (Ca), Phosphorus (P) and Potassium (K) [9].

2.2.3. Bioactive Chemicals

2 g of the sample was soaked in 5 mL methanol overnight, 2 ul of the sample extract was then injected into the Gas chromatography (GC) column for analysis. The GC (Agilent 6890) and Mass Spectroscopy (5973 MSD) was equipped with Restek capillary column (30 m×0.53 mm; film thickness 0.12 µm). The initial temperature was set at 40°C which increased to 150°C at the rate of 10°C/min. The temperature was again increased to 230°C at the rate of 5°C/min. The process continued till the temperature reached 280°C at the rate of 20°C/min which was held for 8 minutes. The injector port temperature remained constant at 280°C and detector temperature was 250°C. Helium was used as the carrier gas with a flow rate of 1 mL/min. Split ratio and ionization voltage were 110:1 and 70 eV respectively.

3. Results

Results of proximate and mineral analyses of *Garcinia kola* seeds are presented in Table 1, while results of bioactive chemicals in *Garcinia kola* seed are presented in Table 2.

Table 1. *Proximate analysis of Garcinia kola seed per 100 grams.*

Proximate analysis (%)	Mean ± S.D of Composition of dry sample (%)	Mineral composition (%)	Mean ± S.D of Composition of dry sample (%)
Moisture	44.65± 0.02	Potassium (K)	0.26± 0.01
Ash	0.20± 0.03	Iron (Fe)	0.002± 0.04
Protein	2.88± 0.01	Manganese (Mn)	0.001± 0.02
Fat	8.77± 0.02	Calcium (Ca)	0.03± 0.03
Fibre	1.09± 0.01	Phosphorus (P)	0.18± 0.01
Carbohydrate	42.41± 0.02		

Table 2. *Result of bioactive components analysis on Garcinia kola seed.*

S/N	RETENTION TIME	NAME OF COMPOUND	MOLEULAR FORMULAR	MOLECULAR WEIGHT	PEAK AREA%
1.	1.908	Silane, dimethoxymethyl	$C_3H_{10}O_2Si$	106	98.1
2.	2.999	Dodecanedioic acid, diethyl ester	$C_{16}H_{30}O_4$	286	98.7
3.	3.417	2-Furanmethanol	$C_5H_6O_2$	98	91.4
4.	4.548	Linalool	$C_{10}H_{18}O$	154	91.5
5.	4.617	2-Furanmethanol, 5-ethenyltetrahydro-α,5-dimethyl	$C_9H_{16}O_2$	156	92.9
6.	5.503	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	$C_{14}H_{16}O$	232	92.1
7.	7.006	Caryophyllene	$C_{15}H_{24}$	204	56.1
8.	7.314	Humulene	$C_{15}H_{24}$	204	87.7
9.	7.617	(3S,3aS,8aR)-6,8a-Dimethyl-3-(prop-1-en-2-yl)-1,2,3,3a,4,5,8,8a-octahydroazulene	$C_{15}H_{24}$	204	67.2
10.	8.155	Peruviol	$C_{15}H_{26}O$	222	75.5
11.	9.115	3-Furanacetic acid, 4-hexyl-2,5-di hydro-2,5-dioxo-	$C_{12}H_{16}O_5$	240	96.6
12.	9.320	p-Menth-8-en-3-ol, acetate	$C_{12}H_{20}O_2$	196	87.9
13.	9.498	O-Trifluoroacetyl-neoisomenthol	$C_{12}H_{19}F_3O_2$	252	66.9
14.	15.996	3-Decanone, 1-(4-hydroxy-3-methoxyphenyl)-	$C_{17}H_{26}O_3$	278	94.9
15.	18.934	2-(Acetoxymethyl)-3-(methoxycarbonyl)biphenylene	$C_{17}H_{14}O_4$	282	92.9

4. Discussion

Table 1 presents results of proximate and mineral analyses of *Garcicia kola*. The amount of moisture in *Garcinia kola* was 44.65%. The seed moisture content (MC) is one of the key factors affecting the seed longevity. It was generally recognized that a further reduction in seed moisture content below the empirical critical moisture content (5%) could induce harmful effect on seed viability [10]. Moisture content has much to do with the physical appearance, shelf-life and resistance to bacterial contamination [11]. The moisture content value was significantly lower than previously reported value, 75.50% [12]. Ash content was 0.20%, a little lower than what was previously reported, 0.47% [13].

Ash refers to the inorganic residue remaining after either ignition or complete oxidation of organic matter in a food sample. Determining the ash content of a food is part of proximate analysis for nutritional evaluation and it is an important quality attribute for some food ingredients [14]. The protein content of *Garcinia kola* was 2.88%. These values are different from what had been previously reported 3.95% [15]. Protein plays a part in metabolic reactions, immune response, assist in cellular repair and form blood cells [16]. Fat content of *Garcinia kola* was 8.77%. These values are different from what had been reported, 4.33% [15]. The fiber content of *Garcicia kola* seeds was 1.09%. This is significantly low compared to previous report, 11.4% [15]. The carbohydrate content of *Garcinia kola* seeds was 42.41%. Carbohydrates help fuel your brain, kidneys, heart muscles, and central nervous system [17]. The varying composition reported by various researchers may imply that proximate composition of this snack varies with season, environment and/or condition or time of evaluation.

The amount of potassium (K) in *Garcinia kola* seeds was 0.26%. This amount is higher than previously reported value, 0.0025% [18]. Iron is an essential element for hemoglobin synthesis [19]. Concentration of Fe in the Garcinia kola was 0.002%. The concentration is high compared with 0.01775% [18] but still within the normal range for normal body functions. The concentration of manganese (Mn) in Garcinia kola is almost negligible, 0.001%. This was higher compared to the concentration of Mn in Garcicia kola oil, 0.0063% [20]. Manganese helps the body form connective tissue, bones, blood clotting factors, and sex hormones [21]. Calcium is required for the proper functioning of muscle contraction, nerve conduction, hormone release, and blood coagulation. [22]. The concentration of Ca in Garcinia kola was 0. 0.03%. This value is lower compared to previously reported value, 0.22% [13]. The concentration of Phosphorus (P) in Garcinia kola was 0.18%.

The analysis of the Gas chromatography-Mass spectrometry (GC-MS) of the methanol extract of the seeds of *Garcinia kola* is presented in Table 2. Fifteen identified bioactive compounds with their retention time, molecular weight, molecular formular and peak area percentage are presented. These bioactive compounds include: Silane, dimethoxymethyl, 98.1%, Dodecanedioic acid, diethyl ester, 98.7%, Caryophyllene, 56.1%, Humulene, 87.7% and 3-Furanacetic acid, 4-hexyl-2,5-dihydro-2,5-dioxo-, 96.6%. The maximum peak, 94.9% was shown by 3-Decanone, 1-(4-hydroxy-3-methoxyphenyl)- and the lowest peak, 66.9% was shown by O-Trifluoroacetyl-neoisomenthol. The bioactive components whose peak area percentages were less than 5% were considered to be insignificant. Caryophyllene is one of the chemical compounds that is responsible for the smell of *Garcia kola*. Caryophyllene has been given GRAS (generally regarded as safe) designation by the FDA and is approved by the FDA for use as a food additive, typically for flavoring [23]. The presence of a moderate amount of caryophyllene in *Garcinia kola* seeds corroborates its use as an additive. Humulene has proven antibacterial properties against many harmful bacteria, including *Bacteroides fragilis* (cause of inflammatory bowel disease) and *Staphylococcus aureus* (causes staph skin infections) [24]. A significant amount of humulene in *Garcinia kola* seeds confirms its use as an antibiotic in folk medicine. All the different components identified from *Garinia kola* seeds were found to have various biological activities such as anti-microbial, anti-cancer, anti-inflammatory and anti-malaria activities. The presence of

significant amounts of bioactive compounds in Garcinia kola seeds justifies its use for the treatment of various ailments by traditional practitioners in the Niger Delta, Nigeria.

5. Conclusion

Proximate, minerals and bioactive components in methanol extract of *Garcicia kola* seeds have been analysed. Varying proximate and mineral compositions were reported by various researchers. This could be attributed to season, environment, condition or time of sample collection. Moisture content of *Garcinia kola* seeds in the Niger Delta, Nigeria was lower (44.65%) than the moisture content values reported by Asaola, 75.50% [12]. Moisture content plays a pivotal role in the physical appearance, shelf-life and resistance to bacterial contamination of nuts. The higher the amount of moisture, the more susceptible the seed becomes to bacterial contamination [24]. Results from this research could imply that *Garcinia kola* seeds in the Niger Delta have longer shelf-life, hence more resistance to bacterial contamination. Proximate result also confirmed that *Garcinia kola* seeds are rich in carbohydrate. Gas chromatography-mass spectrometry (GC-MS) analysis of methanolic extract of *Garcicia kola* seeds presented 15 biochemicals. *Garcicia kola* seeds contain moderate amount of caryophyllene and Humulene. Humulene is a compound with antibacterial properties and humulene content in the seeds was significantly high, confirming its use in folk medicine in the Niger Delta, Nigeria. All the different components identified from *Gacinia kola* seeds have various biological activities such as anti-microbial, anti-cancer, anti-inflammatory and anti-malaria activities. Therefore, this research authenticates the medicinal and pharmacological abilities of *Garcinia kola* seeds; hence, recommends isolation of these bioactives to replace synthetic antibiotics in the pharmaceutical industry.

References

[1] Ahn K. "The worldwide trend of using botanical drugs and strategies for developing global drugs". BMB Reports. 2017; 50 (3): 111–116. doi: 10.5483/BMBRep.2017.50.3.221.

[2] Biljana BP. Historic Review of Medicinal Plants' Usage. Pharmacogn. Rev. 2012; 6 (11): 1-5.

[3] Aggarwal, BB, Sundaram C, Malani N, Ichikawa H. Curcumin: the Indian solid gold. Adv. Exp. Med. Biol. 2007; 595, 175. doi: 10.1007/978-0-387-46401 5_1. ISBN 978-0-387-46400-8.

[4] Smith-Hall C, Larsen HO, Pouliot M. "People, plants and health: a conceptual framework for assessing changes in medicinal plant consumption". J. Ethnobiol. Ethnomedi. 2012; 8: 43. doi: 10.1186/17464269843. PMC 3549945. PMID 23148504.

[5] Ernst E. (1998). "Harmless Herbs? A Review of the Recent Literature" (PDF). Am. J. Med. 1998; 104 (2): 170–178. doi: 10.1016/S0002-9343(97)00397-5. PMID 9528737. Archived from the original (PDF) on 2019-11-05. Retrieved 2013-11-28.

[6] Leakey R. Potential for novel food production from agroforestry trees: A Review. 2001 http://www.wanatca.org.au/acotanc/Papers/Leakey-1

[7] Cheek M. "*Garcinia kola*". IUCN Red List of Threatened Species. 2004: e.T34715A9884648. doi: 10.2305/IUCN.UK.2004.RLTS.T34715A9884648.en. 2004; Retrieved 15 November 2021.

[8] Onochie CFA, Stanfield DF. Nigerian trees. Gov. Printer, Lagos, Nigeria. 1960; pp. 5-10.

[9] A. O. A. C. Official method of Analysis. 18th Ed., Association of Officiating Analytical Chemists, Washington DC, Method 935.14 and 992.24; 2005.

[10] Wang FX., Jing, MX, Zheng GH. Effect of seed moisture content on seed storage longevity. Acta Bot. Sin. 2001; 43 (6): 551-557.

[11] Bennett V, Isaiah TD. Proximate, Nutritional and Phytochemical Analysis of *Treculia africana* (African Breadfruit) Decne in South-South, Nigeria. W JIR. 2022; 12 (4), 19-23.

[12] Asaola MF. Chemical Compositions and Phytochemical screening of the seeds of *Garcinia kola* (Bitter kola). Pak. J. Sci. Ind. Res. 2003; 46 (3) 145-147.

[13] Adesuyi A. O, Elumm IK., Adaramola FB, Nwokocha A. G. M. Nutritional and Phytochemical Screening of *Garcinia kola*. Adv J Food Sci Technol. 2012; 4 (1): 9-14.

[14] Baraem PI. Ash Content Determination In Book: Food Analysis Laboratory Manual pp. 2017; 117-119.

[15] Afolabi FE, David CB, Isiaka AA, Peter S, Aladesanmi AO. Chemical composition of bitter cola (*Garcinia kola*) seed and hull. Polish Food Sci. Nutr. 2006; 15/56 (4) 395–400.

[16] https://www.mana.md/how-important-is-protein/

[17] https://www.reidhealth.org/blog/carbohydrates-101-benefits-of-carbohydrates

[18] Alaje DO, Owolabi KT, Olakunle TP, Oluoti OJ, Adetuberu IA. Nutritional, Minerals and Phytochemicals composition of *Garcinia cola* [Bitter cola] and *Aframomum melegueta* [Alligator pepper]. IOSR j. environ. sci., toxicol. food technol. 2014; 8 (1) 86-91.

[19] Nazanin A, Richard H, Roya K. Review on iron and its importance for human health. J. Res. Med. 2014; 19 (2): 164–174.

[20] Fapohunda S, Arinola A, Otuneme O, Adaramola B, Jegede D, Adewumi A, Aleshinloye A, Onigbinde A. Evaluation of the nutraceutical potential of *Garcinia kola* Seed Oil. J. pharmacogn. phytochem. 2017; 6 (5) 1894-1901.

[21] https://www.mountsinai.org/health-library/supplement/manganese

[22] James LL III Overview of Disorders of Calcium Concentration MSD Manual for Professional; 2021.

[23] https://ntp.niehs.nih.gov/ntp/htdocs/chem_background/exsumpdf/betacaryophyllene_508.pdf] [CFR - Code of Federal Regulations Title 21.

[24] Moore S. (May 25, 2020) Why is Moisture Content Analysis of Food Important? 1-5 www.News-Medical.net