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Review Article

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Fatty Acid Composition, Physico-Chemical and Antibacterial Activities of Oil Extracted from Bitter-Cola (Garcinia kola)

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Abstract

Garcinia kola (Bitter cola) is a medicinal plant which is exclusively tropical in distribution. Traditionally, African medicine regards the plant in high esteem. Oil extract from Garcinia kola had a deep brown color percentage yield of 3.3522 ± 0.01, Specific gravity of 0.9158 ± 0.01, Refractive index of1.5400 ± 0.01 and Viscosity (30°C)(Pas/sec) of 74.4383 ± 0.02 as its physical parameters respectively. All the physical parameters observed were very high compared with normal convectional oil. The chemical parameters wereAcid value 17.3910 ± 0.20mg/g, Free fatty acid 1.2174 0.20mg/g, Iodine value 26.9028 0.10g/100g, Saponification value 33.6600 ± 0.2mmol/kg and Peroxide value 24.000 0.2mg/g respectively. The saponification value which is inversely proportional to the mean molecular weight of the glycerides in the oil was very low. The antibacterial activities were Klebsiellapneumonia 0.20 ± 0.01, Streptococcus cereus 0.60 0.01, Staphylococcus aureus0.50 ± 0.02 and Salmonella typhii 0.30 ± 0.01 respectively. The fatty acid composition of the oil were palmitic acid (C16:0) 22.3528 as the only highest saturated fatty acid, Oleic acid (C18:1) 26.2410 as the only highest monounsaturated fatty acid, Linoleic acid (C18; 2) 42.9273 and linolenic acid (C18: 3) as the only polyunsaturated fatty acids present.The oil extracted from this seed showed that the seed had a low yield and the oil is a non-drying oil and very viscous. It can be effectively used for variety of domestic and pharmaceutical applications for curative purpose and fatty acid composition of this oil, suggest some industrial potentials.

Keywords: Bitter Cola, Fatty Acid, Physico-Chemical, Antibacterial, Medicinal

Introduction

Garcinia kola (Heckel) is a medicinal plant which is exclusively tropical in distribution [1]. Traditionally, African medicine regards the plant in high esteem. It is well known in West Africa for its edible fruit and seeds which are used as a rejuvenating agent for masticatory purposes and as a general antidote [2]. Many pharmacological effects have been demonstrated for the biflavonoids in Garcinia kola extractives. Amongst them are anti-viral, anti-inflammatory, anti-diabetic and bronchodilatory properties [3, 4]. Some proprietary dietary supplements containing G. kola extractives already exist in the USA and African markets [4]. The exploration of Garcinia kola, alongside other antimicrobials in the fight deadly human diseases like HIV is presently on.

Experimentations using Garcinia kola kernels as hop substitutes in several indigenous alcoholic drinks, as well as a flavour enhancer in the beverage industry also exist FDA, 1999. It has a bitter astringent taste when chewed resembling that of raw coffee bean, followed by a slight sweetness. The bitter taste gained the seed its common name "bitter Kola". It also enhances the flavour of some local beverages. It is an economic and highly valued tree used extensively in African traditional medicine for the treatment of various diseases.

Garcinia Kola is forest tree indigenous to sub-Saharan Africa and has been referred to as a 'wonder plant' because almost every part of it has been found to be of medicinal importance [5]. Bitter cola (Garcinia Kola) seeds are smooth elliptically shaped, with yellow pulp and brown seed coat. Garcinia Kola has economic value across West African countries where the seeds are commonly chewed and used for traditional ceremonies

The seeds are also used in folk medicine; many herbal formulations have potential therapeutic benefits due to the activity of their flavonoids and other bioactive compounds [6].

Constituents of Garcinia Kola

Phytochemical and biochemical studies of Garcinia kola showed the presence of sterols, terpenoids, flavonoids, glycosides, pseudotannins, saponin, proteins and starch [7, 8]. Maduniyi reported that some workers isolated kolanone, a poly-isoprenyl-benzophenone compound from the fruit pulp [9].

Some Previous Studies and Case Reports on Garcinia Kola

(a) Anti diabetic (Blood Glucose Lowering) Effect: There is a vast documentation of the anti diabetic effects of Garcinia Kola.

Bioflavonoid obtained from Garcinia Kola has been shown to have significant hypoglycemic effect when administered intraperitoneally at 100mg/kg body weight to normal and alloxan diabetic rabbits [10].

(b) Weight Loss and Lipid-Lowering Effect: The medical literature is rich in research documentation on the weight loss and lipid lowering activity of the plant.

(c) Anti-Oxidative Stress (Antioxidant) Effects: It was discovered that kolaviron from Garcinia kola at 200mg/kg body weight significantly reduced a tetra-butyl hydro peroxide induced in 2-amino-adiposemialdehyde (2-AAS) a maker of protein oxidation in both plasma and liver, hence decreasing oxidative damage to DNA in the liver [11].

(d) Detoxification of the Toxic Effects of Toxicants: Nwokocha et al. observed a detoxification of lead poisoning by Garcinia kola in wistar rats [12]. It displayed antihepatotoxic and antihaematotoxic effects in lead poisoned in wistar rats.

(e) Antibiotic Effects: Aqueous and alcohol extracts of Garcinia kola was found to inhibit organisms like staphylococcus aureus, klebsiella pneumonia, beta-hemolytic streptococci, Escherichia coli and neisseria gonorrhea [13].

(f) Red Blood Cell Count:A Garcinia kola extract caused an increase in the red blood cell (RBC) count in rat.

(g) Anti-Ulcer Effect: Garcinia kola has shown protective effect against HCl and ethanol induced gastric ulcer in rats. Pretreatment of animals with kolaviron at 100mg/kg, orally once a day, reduced formation of ulcers induced by an HCl/ethanol mixture. Due to paucity result or no research work on the oil extract from Garcinia Kola, this research work targeted to carry out the fatty acid composition and physico-chemical properties of the oil from the sample and compare it with already existing results from convectional oil for pharmaceutical purposes. To compare antibacterial activities of oil the extracted from Garcinia kola with the results obtained from its aqueous and ethanolic extract from already existing results from same sample used for healing / curative purposes.

Collection and Preparation of Seed Samples

Bitter cola (Garcinia Kola) was bought from Alade Market in Idanre Local Government Area, Idanre and Ondo state.

The samples were manually dehulled and kept inside clean bucket. It was sorted to remove the dirt and immature ones, sundried for two weeks and the samples were reduced to fine powder with the aid of a mechanical grinder to pass through 40 mesh sieves to increase the surface area for proper analysis. The milled powder samples were collected and stored in glass jars, tightly covered and kept for extraction process and analysis of the extracted oil. 2 Extraction Procedure was done by soxhlet extraction method

Characterization of the Extracted Oil

In evaluating the quality of the extracted oil, the percentage yield, Specific gravity, refractive index of the oil were determined using AOAC, fatty acid composition of the oil were determined using Gas Chromatography (fatty-methyl Esther method).Antibacterial activity by Pelczerand Black [14, 15].

Figure 1: Peel and unpeel Garcinia colafig 2: Extracted oil

Results and Discussion

Table 1: Result of the physical parameters of oil from Sample Bitter Kola (garcinia Kola)

	Parameters	Results
Oil extract	% Yeild	3.3522 ± 0.01
	Specific gravity	0.9158 ± 0.01
	Refractive index	1.5400 ± 0.01
	Colour	Deep-brown

± SDV of triplicate results

Table2: Results of Chemical composition of oil from Bitter Kola (garcinia Kola)

Parameter	Values
Acid Value(mg/g)	17.3910 ± 0.20
Iodine value (g/100g)	26.9028 ± 0.10
Saponification Value (mg/g)	33.6600 ± 0.20
Peroxide Value (mmol/kg)	24.0000 ± 0.20
Free Fatty Acid (mg/g))	1.2174 ± 0.20

± SDV of triplicate results

Table3: Results of fatty acid composition of oil from Bitter Kola (garcinia Kola)

Parameter (%)	Values
Myristic Acid	0.2991
Palmitic Acid (C16:0)	22.3528
Palmitoleic Acid (C16:1)	0.5793
Margaric Acid (C17:1)	0.0537
Stearic Acid (C18:0)	5.5402
Oleic Acid (C18:1)	26.2441
Linoleic Acid (C18:2)	42.9273
Lenolenic Acid (C18:3)	0.8275
Arachidic Acid (C20:0)	0.6992
Behenic Acid (C22:1)	0.4768

Note: C:0= Number of Carbon atoms and level of saturation or unsaturation

Table 4:: Result of the antimicrobial activity of oil from Bitter Kola (garcinia Kola)

Sample	Organism	Zones of Inhibition (mm)
Oil extract	Klebsiella pneumonia	0.20 ± 0.01
	Streptococcus cereus	0.60 ± 0.01
	Staphylococcus aureus	0.50 ± 0.02
	Salmonella typhii	0.30 ± 0.01

±SDV of triplicate results

Discussion

Table 1 revealed the physical properties of Garcinia kola. The percentage yield was very low (3.3522 ± 0.01), which indicated that its production at larger quantity for industrial purposes may prove difficult. The refractive index of Garcinia kola (1.5400 ± 0.01) was not in same agreement with the value of 1.46 obtained for B. sapida oil. This shows that the oil is very thick compared with most drying oils whose refractive indices were between 1.48 and 1.49 [16]. The value of the specific gravity (0.9158 ± 0.01) was higher than most of the convectional oil. The colour was deep-brown.

Table 2 showed the chemical values of the sample. The acid value of 17.3910 ± 0.20mg KOH/g was obtained and was relatively high compared to that reported for tropical almond (7.6mg KOH/g) and that of fluted pumpkin (3.5mg/KOH/g) [17]. The high acid value of the oil indicates that it is not a good source as edible oil except in a little proportion for curative purposes. The iodine value of the oil, 26.9028 ± 0.10g /100g is extremely lower to those of unsaturated fatty acid-rich oils such as peanut (86.0 – 107.0), cottonseed (100.0 – 123.0), sesame (104.0 – 120.0), sunflower (118.0 – 141.0) but higher than that of soybean oil (24.0 – 29.0) [18]. Garcinia kola oil has a peroxide value of 24.0000 ± 0.20mg/kg. This value is higher than the value recorded for Bauchiniaracemoraseed oil (4.9) [19]. Peroxide value depends on a number of factors such as the state of oxidation (quality of oxygen consumed), the method of extraction used and the type of fatty acids present in the oil. Low saponification value of the oil (33.6600 ± 0.20mg/KOH/g) disagrees with values obtained for some vegetable oil ranging from 188 – 196mgKoH/g [20]. However, there were some vegetable oils with higher saponification values such as coconut oil (253.0mg/KOH/g), palm kernel oil (247.0mg/KOH/g) and butter fat (225.0mg/KOH/g) [18]. Pearson 1976, reported that oil with lower saponification values contain high proportion of lower fatty acids

Table 3 revealed the fatty acid profile of the oil. This showed that the oil had high saturated palmitic acid (22.3528), high percentage of monounsaturated Oleic acid (26.2441) and linoleic (13.885), higher polyunsaturated omega-6 linoleic acid (42.9273). The lower value in lenolenic acid (0.8275) reduced the off-flavour and oxidation of some harmful product as reported by Warner and Gupta.

Table 4 showed the antibacterial activities of the oil. The antibacterial activities obtained were higher than 300µg/ 100ml (0.3mm) of the aqueous extracts of the Garcinia kola obtained by Amaluet al. for Staphylococcus aureusto oil extract (0.5mm), but equivalent to 400µm/20% ethanolicexract [21]. Other pathogenic organisms recorded in this research are susceptible to the oil extract and the higher value was noticed in Streptococcus cereus (0.60 ± 0.01).

Conclusion

Though the sample has lower yield in oil production, the oil has long shelf life than its aqueous and ethanolic extract and very thick compared with most drying oils. The high acid value of the oil indicates that it is not a good source as edible oil except in a little proportion for curative purposes lower saponification values obtained in y]the oil showed that it contains high proportion of lower fatty acids except high saturated palmitic acid, monounsaturated Oleic acid, linoleic and polyunsaturated omega-6 linoleic acid. The lower value in lenolenic acid reduced the off-flavour and oxidation of some harmful products. The oil was susceptible to all the pathogenic organisms under observation in this work. The oil from Garcinia kolacan be effectively used for variety of domestic and pharmaceutical applications for curative purpose and fatty acid composition of this oil, suggest some industrial potentials.

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