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Phytochemical, Proximate and Mineral Composition of *Gmelina arborea* Fruits (White Teek).

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Abstract
The minerals and nutritional values of leaves, fruits and seeds of many plants have been reported to vary, depending on factors like generic background, location, environmental and cultivation methods. Thus, phytochemical, proximate and mineral compositions of *Gamelina arborea* (*G. aborea*) fruits from Kaduna state in North central part of Nigeria were assessed using standard analytical procedures. Qualitative phytochemical screening revealed that the fruit contained tarnnis, phenols, flavinods, saponins, reducing sugar and anthraquinones. The analysed *G. aborea* contained 7.30 % w/w ash, 5.00% w/w moisture, 5.31% w/w fat, 4.30% w/w fibre, 2.00% w/w protein and 75.00% w/w carbohydrate while its mineral compositions (mg/100g) were shown to contain Na (21.70±1.00); Ca (29.70 ±2.00), K(14.50±1.50), P (10.36±0.90), N (0.18±0.00), Cu (9.40±0.08), and Mn (21.70±1.00). Therefore, this finding accounts for the use of *G. arborea* as supplement for minerals in animal feeds.

Key words: Phytochemical, mineral composition, proximate composition, *Gmelina arborea*

Introduction

Gmelina arborea, also known as Malina, is the most widely cultivated species of the genus Gmelina in the family *Lamiaceae* is a well-known medicinal plant in the India and Africa (Sedgley and Gardner, 1990; Conn and Barry, 2001; Hyland, Whiffin and Zich, 2010; Rogier, 2012,). The fruit of the plant is used in treatment of scorpion sting, snake-bites (Nadkarni, 2000) and diabetes (Khan and Khanum, 2005; Kulkarni and Veerajanlu, 2009) and the leaves may be used as forage for livestock which are considered good for cattle and are also used as a feed to Eri silk worm (Kirtikar and Basu, 1999). Akyala, David and Simon (2013) also concluded that

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Gmelina arborea fruits possess antibacterial activity. This corroborates the rationale for the use of the plant in the treatment of ailments like wounds, sores, burns, vaginal discharges, aphrodisiac, astringent, analgesic, antipyretic, antidiabetic, diuretic, anti-inflammatory in traditional medicine (Lauridens and Kjer, 2002; Shirwaikar and Padma, 2003; Giri and Divakar, 2009; Nayak, Jena, Dinda and Ellaiah, 2011; Akyala, David and Simon, 2013).

The fruits, leaves and seeds extracts of *G. arborea* has been reported by many authors from various locations to contain nutrients, mineral constituents and phytochemicals like alkaloids, steroids, carbohydrates, anthraquinone, glycosides, triterpenoids, saponinns gums, mucilages, tannins, phenolic compounds and flavonoids and proteins (Adegbehin and Abayomi, 1988; Nayak, Jena, Dinda and Ellaiah, 2012). Phytochemicals are bioactive compounds which works with nutrients and dietary fibre to protect against diseases (Sangeeta and Sujata, 2006). They are secondary metabolites that contribute to flavour and colour (Craig, 2009). These compounds have been hypothesized to be responsible for much of the disease protection conferred from diets high in fruits, vegetables, beans, cereals, and plant-based beverages such as tea and wine. They can be classified as phenolic acids, flavonoids and stilbenes/lignans based on their chemical structures. Flavonoids are further divided into anthocyanin, flavones, flavanones, isoflavones, and flavonols, among others (Anjanelu and Jaganmoha, 1975; Arts and Hollman, 2005).

The relevance of phytochemical analysis in plants is to enable detection the non-nutritive chemicals found in plants that may affect health in order to modify their products by suitable biological and chemical means into patent drugs (Guinder and Daljik, 2009). The methods used for the determination of these different non-nutritive chemicals in plants vary according to the plant material being analyzed and in the details of evaluation (Gulcinet *et al.,* 2010).

Also, the minerals and nutritional values of leaves, fruits and seeds of many plants have been reported to vary, depending on factors like generic background, location, environmental and cultivation methods. Therefore, the aim of this study is to investigate the chemical composition, phytochemicals, proximate and moisture content of *Gamelina arborea* fruit from Kaduna, north-central Nigeria.

Materials and Methods

Standards and Reagents

Standard BHA (butylatedhydroxyanisol), Quercetin, Folin-ciocaiteus, phenol DPPH (2, 2-diphenyl-1-picrylhydrzyl) were all purchased from British Drug House limited (BDH), Poole, England. All the chemicals used were of analytical grade. Deionized –distilled water was used throughout the experiment.

Extraction

The samples were rinsed with distilled water to remove sand, cut into pieces and lyophilized to remove the moisture contents. Resulting dried samples were powdered using Mouling blender. These ground samples were extracted twice with a total volume of 100.0 ml of 70% aqueous methanol. The mixture was shaken on an orbital shaker for 75 min at 250 rpm and then filtered through Whatman No 1 filter paper. The combined methanolic extract was the evaporated at 55^0C using water bath and dried to powder in a lyophilizer.

Proximate Analysis

The proximate analysis of the samples for moisture, total ash, crude fibre, fat were carried out in triplicate in accordance with the methods described by Onwuka (2005). The nitrogen was determined by micro Kdjeldah method (Onwuka, 2005), the nitrogen content was then converted to protein by multiplying with a factor of 6.25. Total carbohydrate contents were estimated by difference'. All the proximate values were reported in percentage (%).

Determination of Moisture

Moisture was determined by oven drying method. 2 g of well-mixed samples was accurately weighed in clean, dried crucible (W_1). The crucible was allowed in an oven at 100-105^{0}C for 6-12 hours until a constant weight was obtained. Then the crucible was placed in the desiccators for 30min to cool. After cooling it was re-weighed (W_2) and the percentage moisture was calculated by the formula:

$$\% \text{ Moisture} = \frac{W_1 - W_2 \times 100}{W}$$

Where

W_1 = Initial weight of crucible + Sample
W_2 = Final weight of crucible + Sample
W= Weight of sample

Determination of Antioxidants and Phytochemicals

Antioxidant activity was determined by standard chemical test of DPPH radical scavenging and reducing power assays. A portion of each extract was subjected to standard chemical test for detection of saponins, flavonoids, phenolics, steroids, anthraqunones, and cardiac glycosides using the method described by Harbone (1973) and Odebiyi and Sofowora (1978). Total phenols and flavonoids content were also determined.

Mineral Analysis

The powdered sample was subjected to nitric acid and perchloric acid digestion (Asaolu, 1995). The minerals (sodium, potassium, calcium, and magnesium) contents in the sample were determined using atomic absorption spectrophotometry.

Determination of Ash

Clean empty crucible was placed in a muffle furnace at 550^{0}C for an hour, cooled in desiccators and then weight of empty crucible was noted (W_3). Two gram of each of sample was put in the crucible (W_4), and was allowed to charr in the burner. The crucible was then placed in muffle furnace at 550^{0}C for 3 hours until the contents in it were ashed. The appearance for gray white ash indicates complete oxidation of all organic matter in the sample. After ashing, the crucible was cooled and re-weighed (W_5). Percentage ash was calculated by the formula:
Percentage Ash = W_4-W_5/W_4-W_3 x 100.

Statistical analysis

All results are expressed as mean ± standard deviation. All results are means of three replicates.

Results

Proximate composition

The proximate composition as shown in table 1 indicated that the analysed *G. Aborea* contained 2.00±0.05 protein, 5.30±0.08 fat, 5.30±0.08 crude fiber, 4.30±0.05 moisture, 75.90±2.50 carbohydrate and ash content of 7.50±0.09 mg/100g.

Table 1: Proximate Composition of *G. arborea* fruit

Component	% composition
Protein	2.00± 0.05
Fat	5.30±0.08
Ash	7.50±0.09
Moisture	4.30±0.05
Crude fibre	5.00±0.05
Carbohydrate	75.90±2.50

Data are means ± standard deviation of 3 replicates

Mineral composition

The mineral composition indicates that *G. arborea* contained *potassium* (14.50±1.50), sodium (61.50±2.00), calcium (29.70±2.00) and manganese (21.70±1.00) mg/100g (Table 2). The results also show that the fruit contain an appreciable amount of phosphorous, copper and potassium (Table 2).

Table 2: Mineral Composition of *G. arborea* fruit

Mineral	Composition (mg/100g)
Ca	29.70±2.00
Cu	9.40±.0.08
Mn	21.70 ±1.00
Fe	1.30±0.03
Pb	N/D
Na	61.50±2.00
K	14.50±1.50
P	10.36±0.90
N	0.18±0.00

Data are means ± standard deviation of 3 replicates; N/D – not detected

Phytochemical contents

The phytochemical screening of *G. arborea* fruit revealed that the fruit contained phytochemicals like phenols, tannin, saponins, flavonoids, alkaloids and anthraquinones (Table 3).

Table 3: Phytochemical Composition of *G. arborea* fruit

Phytochemical	% Composition
Tannins	+
Flavonoids	+
Saponins	+
Terpenes	-
Glycosides	-
Volatile Oil	-
Alkaloids	-
Saponins Glycosides	+
Reducing compound/ sugar	+
Cardiac Glycosides	+
Phenols	+
Phlobatannins	-
Anthracene	-
Anthraquinones	+
Steroid	-
Carotenoids	-

+ = detected; - = not detected

Discussion

Proximate analysis estimates and determines the major components, i.e. moisture, fats, proteins, ash, crude fiber in a given food (Rajamohamed, 2003). In the *Gmelina arborea* fruits analysed, carbohydrate has the highest value (75.90%). This agrees favourably with Aberoumand (2011) who similarly got high carbohydrate contents in fruits of *Myrtus communis* and *Cordia myxa* (Hasan *et al.*, 2011). Vunchi *et al.* (2011) also stressed that, most fruits have high carbohydrate contents depending on the fruit type, maturity and environment. Carbohydrates play several vital roles in living organisms and they can be oxidized to yield energy while their polymers act as energy storage molecules. This result therefore indicates that *G. arborea* is a good source of energy. Protein, which plays vital role in biological processes, is responsible for transportation of molecules, oxygen and messages from cell to cell and keeps human body healthy (FAO, 1976), is relatively low in the analyzed *G. arborea*. The results oppose the findings of Amata (2012) and Omokanye (2014) in the fruits and leaves of *G. arborea* respectively. Ash content is a measure of mineral content of the original food (Onwuka, 2005); this is important in biochemical reactions, functioning as co-enzyme. The appreciable content of ash in *G arborea* is a reflection that it contained high amount of minerals and a source of dietary minerals. *G. arborea* will also probably be suitable as a good source of dietary fibre because of its reasonable crude fiber contents. Evidences have shown that consumption of reasonable amount of fiber lowers the risk of coronary heart disease, obesity, bowel cancer and type II diabetes mellitus (Houghton, 2007). Moisture content, an indication of the amount of water present in a sample is low in *G arborea*; this could hinder the growth of bacteria or any microorganisms and elongate its shelf life.

The presence of potassium in *G. arborea* signifies that potassium plays significant roles in enhancing crop quality, high levels of available potassium improve the physical quality, disease resistance, and shelf life of fruits and vegetables used for human consumption. The absence of detectable level of lead indicates that *G. arborea* is consumable since, lead taken internally in any of its forms is highly toxic. The effects are usually felt after it has accumulated in the body over a period of time. The symptoms of lead poisoning are anemia, weakness, constipation, colic, palsy, and often a paralysis of the wrists and ankles.

Phenolics and flavonoids have been shown to contribute significantly to antioxidant of fruits and vegetables. The test for cardiac glycosides, tannins, and flavonoids, and saponins, saponin glycosides, reducing compound/sugar, phenols and anthraquinones were positive in this analysed fruits sample (Vogel, 2005; Halliwell, 2007; Tiwari and Yadav, 2008). The presence of tannins in the *G arborea* may be due to the presence of polyphenolic compounds which medically are antidiarrheal and haemostatic compounds (Sofowora, 1983; Foo and Joseph, 1989; Akyala and Davies, 2013). The presence of flavonoids gives a pleasant aroma to the *G. arborea* fruit which is important in the human diet for controlling cholesterol level in the body

(Haruna, 2008). Saponins were found to be present in the fruit even though it makes the fruit to have stimulating effect. The presence of saponins in the *G arborea* fruit indicate that the fruit can be used as antibacterial and antimicrobial agent (Sofowora, 1983). Phenols in the sample also indicate its usage in the manufacture of resins, plastics, insecticides, explosives, dyes, and detergents, and as raw material for the production of medicinal drugs such as aspirin.

Glycosides are also found to be absent in the fruit. These are bitter tasting, and it is believed that they help keep birds and insects from eating seeds and fruit of this plant before they are fully grown, by which time the glycosides have been converted to sweet sugars. *G. arborea* contain phenols, which are strong antioxidants that prevent oxidative stress/oxidative damage to DNA, lipids and proteins that play roles in prevention of diseases such as cancer and cardiovascular diseases (Satyanarayana and Kasai, 1985; Hosny and Gemelinoside, 1998).

The study conducted by Nayak *et al.* (2012) revealed that this fruit contains cardiac glycosides and steroids which are similar with the outcome of our present study. The ethanol extract contains alkaloids, carbohydrates, anthraquinone glycosides, gums, mucilages, tannins, phenolic compounds and flavonoids. The ethyl acetate extract contains gums, mucilages, proteins and amino acids. The n-butanol extract contains alkaloids, anthraquinone glycosides, gums, mucilages, tannins, phenolic compounds, triterpenoids, saponins and flavonoids. The petroleum ether extract contains alkaloids, carbohydrates, anthraquinone glycosides, proteins, amino acids, triterpenoids and saponinns (Nayak *et al.*, 2012). From the research conducted by El-Mahmood (2010), phytochemical screening of the *Gmelina arborea* revealed the presence of carbohydrates, alkaloids, saponins, tannins, anthraquinones and cardiac glycosides which shows some similarities with our present study.

Conclusion

The phytochemical, proximate and mineral composition of *Gmelina Arborea* were assessed. This study shows that *Gmelina Arborea* could be a good source of potassium, and a good diet for the diabetics because of the high potassium/sodium ratio, K/Na (25:1) and also a source of carbohydrate and mineral (75.9% of carbohydrate and 7.5% of ash). The phytochemical studies of the fruit serve as a lead in establishing the active ingredient in the fruit. The proximate composition of the fruit show the fruit is a good source of healthy food good for human consumption.

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