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Nutrional composition of the fruit, leave, root and bark of Africa black velvet tamarind (*Diallum guineense*)

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Abstract
The study is to identify the presence of phytochemical composition, proximate composition and mineral composition of the fruit, leave, bark and root of Africa Black Velvet Tamarind *(dialium guineense)*. It is aimed at investigating the nutritionall constituenrs of the fruit, leave, bark and root of Africa Black Velvet tamarind. The crude extract were obtained and were screened for the presence of Phytochemicals, in order to identify the therapeutic potential of the plant. The result of the findings shows that phytochemicals such as tannis, saponins, flavonots, terpe**,** noids, Alkanoids, steroids and glyocoside were present in the sample except phlobotannins which is only present in the bark but absent in leavve, fruit and root of Africa Black velvet tamarind. The results also showed that Flavovoids and terpenoids and Glycoside were absent in the fruit of *Diallum Guineense* but present in other samples.
The results of the proximate analysis are as follows: moisture (15.03±0.05%, 37.70±0.09%, 40.49±0.06% and 57.12±0.04%), ash (13.01±0.05%, 18.53±0.01%, 15.02±0.00% and 15.41±0.00%), crude fat (4.89±0.5%, 9.40±0.00%, 0.79±0.00%, and 0.18±0.00%), crude fiber (1.70±0.00%, 1.05±0.001%, 1.00±0.00%, and 1.01±0.00%), carbohydrate (61.35±0.05%, 40.94±0.01%, 41.37±0.05,% and 23.99±0.00%), protein (4.02±0.12%, 1.91±0.01%, 1.33±0.02%, and 1.69±0.02%) respectively.
The following are the results of mineral analysis conducted on the fruit, leave, root and bark of *Diallum Guineense*
Phosphorus Bark (1.53±0.01mg/l) leave (0.75±0.00 mg/l) and root (0.51±0.00mg/l), fruits (0.59±0.00mg/l). Magnesium was the most abundant mineral in the examined parts of *D iallum Guineense*, fruit (2.91±0.01), leave 2.16±0.00), root (2.28±0.00) and bark (2.31±0.00 mg/l). Iron, fruit (1.61±0.00), leave (0.83±0.02), root (0.47±0.00), and bark (0.55±0.00mg/l). Calcium (Ca) fruit (0.44±0.01), leave (0.78±0.00), root (0.58±0.00), and bark (0.37±0.001mg/l). And lastly the sodium fruit (0.73±0.02), leave (0.42±0.00), root (0.41±0.00), and bark (0.71±0.00mg/l).

Keywords: *Diallum guineense,* black velvet tamarind, nutrional

Introduction
Plants are generally useful at the synthesis of medicinal compounds, whose properties has led to discovery of new, affordable drugs with excessive therapeutic potential (Ukwuani *et al*., 2013). Medicinal plants contribute significantly to rural livelihoods. Apart from the fact that traditional healers use them for herbal medicine, many people also are involved in the collecttion and trading of medicinal plants. It has been established by the World Health Organization (WHO) that 80% of the world's population depends on medicinal plants for healing and maintenance of their health and (primary health care) (Ngoci *et al*., 2011; Prakash and Sandhu, 2012) [5].
Drugs and semi synthetic drugs derived from natural products or natural sources accounted for 78% of the recent drugs approved by the United States Food and Drug Administration (FDA) between 1983 and 1994 (Suffredini *et al*., 2006; Ngoci *et al*., 2011) [7, 5]. A survey on medicinal plant usage by American public indicated that there is increasein the usage of plant from 3% in 1993 to over 37% in 1998. This shift to herbal drugs has been as a result of ilow cost of herbal drugs, endearing them with the poor mass of developing world; the 'green' movement in the developed world that campaigns on the inherent safety and desirability of natural products and the individualistic philosophy of western society that encourages self-medication, with many people preferring to treat themselves with phyto-medicines (Sharma *et al*., 2012) [6].
Dialium guineense commonly known as African black velvet tamarind, is a large tree found in many parts of Africa such as West Africa, Central African Republic and the Chad. The tree belongs to the family *Fabaceae-caesalpinioidaea*, it is 30 meters high, with a closely packed leafy crown head, but often shrubby. The leaves are broadly elliptic, blunt at the apex. Its flowers is whitish and the branches spread horizontally (Szolnok, 2015).
Fruits are circular and flat, black in colour with stalk 6mm long, a little collar is seen near the apex and a britle shell encloses one or two seeds in a dry, brownish edible pulp (Hong *et al*., 2006). Native to Southern Thailand and Malaysia (Ogungbenle, 2014) [16, 17],

D. guineense known variously as: tumble tree, black velvet, (English); icheku (Igbo); awin (Yoruba); Tsamiyar kurm (Hausa); Yoyi (Ghana); belongs to the family of *leguminosae* (Ewédjè and Tandjiékpon, 2011) [19]. Mature fruits are available from January to May, but the peak harvest period is between March and April (Okafor, 1975). Fruits contain fiber, sugars (especially fructose, glucose, sucrose and maltose), acids, polysaccharides, small amounts of protein and lipids (Okegblie and Taiwo, 1990) [1]. Fruits, and herbs can be used for medical treatment, and as a flavoring agent in snacks and non-alcoholic beverages. (Adame, L., 2012) [4]. The pulp provides a lot of trace elements such as sodium, magnesium and potassium. Bark and leaves can be used to fight many diseases, such as malaria. (Effiong G.S. and I.F. Udo, 2010). The pulp can also be soaked in water to make a drink to treat dysentery and stomach upset. The pulp is sweet.
In this study, proximate analysis, phytochemical and vitermin were done in the laboratory on the four parts (fruit, leave, root and back) of *Diallum Guineense* in other to assess their therapeutical, and nutritive and medicinal benefits.

Materials and method
Materials
Petroleum ether, KOH, HCl, H2SO4, acid, kjedahl catalyst, NaOH, mixed indicator, weighing balance, filter paper, petridish, round bottom flask, soxhlet apparatus, oven, dessicator, burette, burner, muffle furnace, heating mantle, crucible, thread, beaker, musling cloth and pipette etc.

Preparation of sample
Mature tamarind fruits were collected from Isuada owo ondo state Nigeria in the month of March 2021. The root, leave and the bark were collected around same time too and the samples were air dried. The fruits for 2week, leave root and bark for 2months. They were milled and seived inside a metch to achieve a fine sample. They were kept inside airtight containers for laboratory Analyses

Proximate analysis
1. Fats content determination
A fat free and clean filter paper was weighed (W1) and 5g of each of the sample was added to the filter paper and was then weighed again as (W2). This was tied with thread and dropped inside the thimble of soxhlet apparatus. 250ml of petroleum ether was poured into the round bottom flask of the apparatus. The soxhlet apparatus was set up on a heating mantle and the extraction process occurred for four hours. Petroleum ether siphoned over the barrel, the condenser was detached and the thimble was removed.
The solvent-extract (lipids) mixture was carefully poured into a clean dried petridish and transferred into a fume cupboard for 2 hours and the solvent evaporated and it was remaining the fat that was extracted. The filter paper containing the residue was dropped in a beaker and then in an oven at 50°C and was dried to a constant weight. The filter paper was later cooled inside desiccators and reweighed again (W3). The percentage fat was calculated.

$$\% \text{ fat content} = \frac{W2-W3}{W2-W1} \times \frac{100}{1}$$

2. Moisture content determination
Three clean and dry crucibles were weighed and their weight were recorded (W1), each sample was added into the empty crucibles and their weight were also recorded as (W2).
The crucibles containing the samples were transferred into the oven at 105°C and were dried for four hours. The crusibles were transferred into desiccator and was cooled for one hour and they were reweighed again (W3). The percentage moisture content was calculated
The moisture content was determined by using drying method which is based on weight loss. Moisture content =

$$\text{loss. Moisture content} = \frac{W2 - W3 \times 100}{W2 - W1}$$

3. Ash content determination
Three clean crucibles were weighed and the weight was recorded (W1). 2g of each sample was weighed into the crucible (W2) and was transferred into the muffle furnace and the muffle furnace was ignited at 600 C for four hours until a grayish white substance was obtained. The crucibles were transferred into a desiccator and was cooled and was reweighed again (W3).

The percentage ash content was calculated

$$\% \text{ ash content} = \frac{W3 - W1}{W2 - W1} \times \frac{100}{1}$$

4. Crude fibre content determination

5g of the defatted sample was weighed (W1) into 2500ml of conical flask. 200ml of 1.25% H2SO4 was added and was brought to boiling 30minutes then was allowed to cool and was filtered through poplin cloth by suction using Bunchier funnel and was rinsed well with hot distilled water. The residue was scrapped back into flask with spatula and 200ml of 1.25% NaOH was added and was boiled gently for 30minutes and was cooled and filtered through poplin cloth and was washed with hot distilled water, and once with 10% HCL, four times again with hot water, twice with methylated spirit. The residue was savage into crucible after drain, and was dried in an oven at 105°C and cooled in desiccator and was weighed (W2). The crucible containing the residue was placed in muffle furnace at about 300°C for about 30 minutes, and removed into desiccator and cooled to room temperature and weighed again (W3).

$$\% \text{ crude fibre} = \frac{W2 - W3 \times 100}{W1}$$

5. Determination of protein contents

2g of each sample was weighed into three different 50ml kjedahl flask, and 12.5ml of concentrated H2SO4 was added to each flask with one kjedahl catalyst tablet. The flask was heated on a heater with a low heat for about 15minutes, and increase to medium heat for about 30minutes and finally at high heat until digested. The flask was rotated at intervals until the digest is clear, and the heating continue for few minutes after that to ascertain completed digestion. The flask was allowed to cool and the sample residue was washed and filtered, to make the digest up to 50ml (V1).

After the digestion was completed, 5ml of 2% boric acid (H3BO3) was placed into 100ml conical flask (as receiving flask) and 3 drops of mixed indicator was added. The receiving flask, was placed so that the tip of the condenser tube is below the surface of the boric acid, out of the 50ml of the digest 5ml (V2) was pipetted into the distillation tube and 10ml of 40% NaOH was added. The heater was turn on and the distillation continues until approximately 50ml of distillate has been collected into the receiving flask, and then the heater was turn off. The distillate was titrated with 0.01M HCl and blank was titrated with the acid as well.

$$\%N = \frac{MxTx0.014 \times V1}{W \quad V2} \frac{\times 100}{1}$$

% protein = % N x 6.25

6. **Carbohydrate content determination**

This carbohydrate content determination was done by subtraction of the sum of all the nutrient content determination from total weight.

CHO = 100 - (% protein + % fat + % ash +% moisture + % fibre)

Quantitative analysis of the phytochemicals of the sample

1. Test for tannins

Each sample (0.30g) was weighed into a test tube and boiled for 10 minutes in a water bath containing 30cm3 of water. Filtration was carried out after boiling using number 42 (125mm) whatman filter paper. To 5cm3 of the filtrate was added 3 drops of 0.1% ferric chloride. A brownish green or blue black coloration showed positive test. (Eikeme *et al.,* 2009).

2. Test for phlobatannins

To each sample (0.30g) weighed into a beaker was added 30cm3 of distilled water. After 24hours of extraction (10cm3) of each sample was boiled with 5cm3 of 1% aqueous hydrochloric acid. Deposit of red precipitate showed positive test. (Eikeme *et al.,* 2009).

3. Test of saponnin

Distilled water (30cm3) was added to the sample (0.30g) and boiled for 10minutes in water bath and filtered using whatman filter paper number 42 (125mm). A mixture of distilled water (5cm3) and filtrate (10cm3) was agitated vigorously for a stable persistent froth. The formation of emulsion on addition of three drops of olive oil showed positive result. (Eikeme *et al.,* 2009).

4. Test for steroid

Each sample (0.30g) weighed into a beaker was mixed with 20cm3 of ethanol. The component was extracted for 2hours. To the ethanol extract of each sample (5cm) 3 was added 2cm acetic acetic anhydride followed with 2cm3 of concentrated tetraoxosulphate (vi) acid. A violet to blue or green colour change in sample indicates the presence of steroids. (Eikeme *et al.,* 2009).

5. Test for terpenoids
Each wood powder sample (030g) was weighed into a beaker and extracted with 30cm3 and component extracted for 2 hours. A mixture of chloroform (2cm3) and concentrated tetraoxosulphate (VI) acid (3cm3) was added to 5cm3 of each extract to form a layer. The presence of a reddish brown colouration at the interface shows positive results for the presence of terpenoids. (Eikeme *et al.,* 2009).

6. Test for flavovoids
Each sample (0.30g) weighed into a beaker was extracted with 30cm3 of distilled water for 2hours and filtered with whatman filter paper number 42(125mm). To 10cm3of the aqueous filtrate of each Sample extract was added 5cm3 of 1.0m dilute solution followed by the addition of 5cm3 of concentrated tetraoxosulphate (vi) acid. Appearance of yellow colouration which disappeard on standing shows the presence of flavonoids. (Sofowara and Harborne**)**

7. Test for alkaloids
Extraction of component from 2 grams of each sample was carried out using 5% tetraoxosulphate (vi) acid (H2SO4) (20cm3) in 50% e tothanol by boiling for 2 minutes and filtered through whatman filter paper number 42 (125mm). The filtrate was made alkaline using 5cm3 of 28% ammonia solution (NH3) in a separating funnel. Equal volume of chloroform (5.0cm3) was used in further solution extraction in which chloroform solution was extracted with 5cm3 portions of 1.0m dilute tetraoxosulphate (VI) acid. This final acid extract was then used to carry out the following test: 0.5cm3 of Draendorff's reagent (Bismuth potassium iodide solution) was mixed with 2cm3 of acid extract and precipitated orange colour infers the presence of alkaloids. (Eikeme *et al.,* 2009).

8. Test for glycoside
To 2.00g of each sample was added 20cm3 of water, heated for 5 minutes on a water bath and filtered through Gem filter paper (12.5cm). The following tests were carried out with the filtrate.

a. 0.2cm3 of Fehling's solution A and B was mixed with 5cm3 of the filtrate until it became alkaline (test with litmus paper). A brick-red colouration on healing showed a positive result.

Instead of water, 15cm3 of 1.0M sulphuric acid was used to repeat the above test and the quantity of precipitate obtained compared with that of (a) above. High precipitate content indicates the presence of glycoside while low content show the absence of glycoside. (Eikeme *et al.,* 2009).

Determination of mineral composition
The sample nutmeg was analysis for mineral contents like calcium, magnesium, sodium, potassium and iron by instrumentation using atomic absorption spectrophotometer (AAS Model; 2000).
Firstly the digestion of the sample were first carried out, If the sample was measured each and mixture of nitric acid and hydrochloric acid In ratio 1:3 was added, it was added up to 100mi with distilled water in a measuring cylinder. It was poured into a beaker and sieved then poured inside a bottle and kept at room temperature.

Atomic absorption spectrophotometer (AAS)
For atomization, a liquid or dissolved sample (e.g. the solution of salt in water) is sprayed into a spray chamber and then passed in the form of a fine aerosol into flame, first desolation takes pplace.
The rate of dissolution is dependent upon the solvent. The solid particles formed (e.g. salt crystals) can undergo various changes depending on the flame temperature.

Result of phytochemical screening of africa black velvet tamarind (*dialium guineense*)

Table 1

Phytochemical parameters	Stem back.	Leave.	Root.	Fruit
Tannins.	++	+	+	-
Phlobatannin.	+	_	_	-
Saponin.	++	+	++	++
Flavornoid.	++	+	++	-
Terpenoid.	++	+	+	-
Alkaloid	++	+	+	+
Steroids	++	++	+	++
Glycosides.	++	+	++	-

+ indicates present, ++ indicates more present while- indicate not present.

The result of some phytochemical analysis (qualitative) of *Dialium guineense* fruit were presented in Table 1 below, the following are the phytochemical screening: tannins, phlobatannin, saponin, flavonoid, terpenoid, alkaloid, steroids and glycosides that were carried out. The result in table 1 shows that saponnin, steroids, tannin, flavornoid, terpenoids, alkaloids and Glycoside were highly present (++) in the stemback of this plant and Only

Phlobatannins is lightly present (+). The results also shows that Tannin is lightly present in the leave and the root (+), but absent in the fruit (-). Saponnin, Flavovoids, and Glycoside were highly present in the root (++) but lightly present in the back of this plant, (+) meanwhile, Saponnin and steroids are highly present in the fruit (++). The results indicated that Phlobatannins is completely absent in the leave, root and fruits of *Diallum Guineense* (-), also that Flavovoids, terpenoids and Glycoside were absent in the fruit (-) but present slightly in root, leave of the plant. Whereas Steroid is slightly present in root but higher in the leave. Alkaloids is present slightly in the leave, root and back of *Diallum Guineense.*

Saponins are naturally foam produced by glycosides plants and lower animals of the marine environment (Yoshiki *et al*., 1998). Saponins are known to affect cell membrane by interfering with cell membrane reactions. Helps in the absorption and uptake of important nutrient in the body and function in other health based implication in animals (Das *et al*., 2012).

The bark leave fruit and leave revealed the presence of bioactive compounds comprising glycosides, tannins, phlobatannins, saponins, terpenoids, steroids, terpenoids, alkaloids, flavonoids which is the same with the result gotten by (Gideon and Raphael (2013) [9], (David *et al.*, 2011; Ogu and Amiebenemo, 2012) [11, 10].

Alkaloids is bitter in taste. They can either be used for therapeutic and recreational purposes, or as poisons. They are medicinally applied in form of salts to kill pain and as insecticides in farms. They also function as psychoactive drugs and narcotics as pain Killers.

Mineral composition of Africa Black Velvet tamarind (mg/l)

Table 2

Minerals	Fruit.	Leave.	Root.	Back
Phosphorus.	1.53±0.01	0.75±0.00	0.51 ±0.00	0.59±0.00
Magnesium	2.91±0.01	2.16±0.00	2.28±0.00	2.31±0.00
Iron.	1.61±0.00	0.83±0.002	0.47±0.00	0.55±0.00
Sodium	0.73±0.02	0.42±0.00	0.41±0.00	0.71±0.00
Calcium	0.44±0.001	0.78±0.00	0.58±0.00	0.37±0.00

Important elements were analyzed from different parts of the plant indicated that the plant is rich in some nutrients like Fe, Ca,, Zn, and are very useful for biological metabolic system.

TableTable 2 showed the result of the mineral composition of *Dialium guineense* (tamarind) fruit. From the results above, the back contains high amount of phosphorus (1.53±0.01mg/l) which is followed by the leave (0.75±0.00 mg/l) and the root and the fruits has (0.51±0.00mg/l) (0.59±0.00mg/l) respectively. Magnesium was the most abundant mineral in the examined parts of *Diallum Guineense*, (2.91±0.01, 2.16±0.00, 2.28±0.00 and 2.31±0.00 mg/l) respectively, just according to table 2, which was followed by Iron (1.61±0.00, 0.83±0.02, 0.47±0.00, 0.55±0.00mg/l). Calcium (Ca) of the back, leave, root and the fruit were almost the same in concentration value with (0.44±0.01, 0.78±0.00, 0.58±0.00, 0.37±0.001mg/l) respectively. And lastly the sodium level in the plant are considerably good (0.73±0.02, 0.42±0.00, 0.41±0.00, 0.71±0.00mg/l) respectively.

Sodium has the highest concentration in the fruit which have a significant benefit to the body. Sodium (natrium) is present in most foods and its dietary deficiency is rare. Sodium promotes a healthy blood pressure, regulate the body water balance, maintain normal heart rhythm and is responsible for nerve impulse conduction and muscle contraction. However, an increased level of sodium in the blood defines hypernatremia in muscle (Kalogeropoulos *et al*. 2015).

Result of proximate composition of fruit, leave, bark and root of Africa black velvet tamarind (100%)

Table 3

Proximate parameters	Fruit.	Leave.	Root back.	Back
Moisture	15.03±0.05	37.70±09	40.49±0.06	57.12±0.04
Protein	4.02±0.12.	1.91±0.01	1.33±0.02.	1.69±0.02
Fibre.	1.70±0.00	1.05±0.01	1.0±0.00	1.01±0.001
Fat	4.89±0.05	0.40±0.00	0.79±0.00	0.18±0.00
Ash	13.01±0.05	18.53±0.01	15.02±0.00	15.41±0.00
Cabohydrate.	61.35+0.05	40.94±0.01	41.37±0.05	23.99±0.00

This was done according to the method described by Association of Official Analytical Chemist (AOAC) and carried out in duplicate. Values obtained for the proximate analysis of the fruit, leave, root and back were: moisture (15.03±0.05%, 37.70±0.09%, 40.49±0.06% and 57.12±0.04%), ash (13.01±0.05%, 18.53±0.01%, 15.02±0.00% and 15.41±0.00%), crude fat (4.89±0.05%, 0.40±0.00%, 0.79±0.00%, and 0.18±0.00%), crude fiber (1.70±0.00%, 1.05±0.001%, 1.00±0.00%, and 1.01±0.00%), carbohydrate (61.35±0.05%, 40.94±0.01%, 41.37±0.05,% and 23.99±0.00%), protein (4.02±0.12%, 1.91±0.01%, 1.33±0.02%, and 1.69±0.02%) respectively. The fruit has the lowest moisture content which indicates that it can stay for longer periods without

getting spoilt than the leave bark and the root. The result also indicated that the fruit has highest level of cabohydrate and this makes it useful and effective for production of energy. The high moisture possessed by the leave, back and the root makes them prone to spoilage as the moisture gives room for the growth of bacteria. The crude fibre of the samples are low and the fat content were equally low and cannot be recommended as good sources of fiber and fat, except for the fruit with the higheest content of fat and fiber.

Conclusion and recommendation

Conclusion

This study indicates that the fruit, leave, root and bark of Africa black velvet tamarind (*Diallum Guineense)* are nutritional and useful for the body. From the proximate analysis, it was observed that the fruit could serve as a suitable source of energy owning to it's higher carbohydrate.

The phytochemical analysis of *Dialium guineense* fruit, back and root shows the presence of various biological secondary metabolites which plays an important role in the normal functioning of the body. Furthermore, the result showed that the plant could serve as important components of drug synthesis, design and manufacturing to tackle different sicknesses and illnesses.

Recommendations

Based on the results of this research, the following recommendations are suggested; enlightenment programs should be carried out to encouraged traders to go more into sales of other parts of the species and not just the fruits alone and Forestry extension should be carried out to enlighten the public on the need to plant and conserve the species. Nutritionist and pharmacologist should support research on this seed as further research will bring out the nutritional potentials in this plant. Research work should be carried out to discover further utilization of it's fruit and People should be enlightened on the benefit derived from the consumption of *Dialium guineense* fruit, leave, back and root.

Owing to the fact that the tree had shown promising antimicrobial properties, there is supposed to be a monitoring actions for the consumption of the tree products as many people do consume its fruits to an endless point and also, majority do take the herb even in

it's overdose. Although, medicinal plants are natural products of nature, as a result, they have little or no side effects when consumed for therapeutic purposes. However, consuming medicinal plants could also results to adverse medical conditions among consumers, therefore, cautions and international standards should be employed while using them. The adverse conditions could arise.

References

1. Okegbile EO, Taiwo EA. Nutritional potential of velvet tamarind (*Dialium guineense* wild). Niger, *F.A.O. J*,1990:8:115-121.
2. Szolnok TW. Food and fruit trees of Gambia, Hamburg. Federal Republic of Germany, 1985.
3. Hong TD, Linington S, Ellis RH. Seed storage behavior: A compendium handbook for gene banks, 1996, 4.
4. Adame L. Leaf absorption of mineral nutrients in carnivorous plants stimulates root nutrient uptake, New Phytologist,2012:155:89-100.
5. Ngoci SN, Mwendia CM, Mwaniki CG. Phytochemical and cytotoxicity testing of Indigofera lupatana Baker F. Journal of Animal & Plant Sciences,2011:11(1):1364-1373.
6. Sharma A, Meena A, Meena R, Kumar A. Isolation of phytosterols from static culture of *Ocimum tenuiflorum* L. The Journal of Bioprocess Technology. Photon,2012:96:125-129.
7. Suffredini BI, Paciencia MLB, Nepomuceno DC, Younes RN, Varella AD. Antibacterial and cytotoxic activity of Brazilian plant extracts- Clusiaceae. Memórias do Instituto Oswaldo Cruz,2006:101:1590-1598.
8. Gideon IO, Raphael A. Phytochemical analysis and *in vivo* anti-diarrheal potentials of *Dialium guineense* (wild) stem bark extract. J intercult Ethnopharmacol.2012:1(2):105-110.
9. Gideon IO, Joachim E, John ME. Antioxidant and antimicrobial activities of *Dialium guineense* (wild) leaf extract. Pharm. Pharmacol. Res,2013:1(1):1-7.
10. Ogu GI, Amiebenemo R. Phytochemical analysis and *in vivo* antidiarrheal potentials of *Dialium guineense* wild stem bark extract. J. Intercult Ethnopharmacol,2012:1(2):105-110.
11. David David David David AA, Olaniye AT, Mayowa AO, Olayinka AA, Anthony OI. Antivibrio and preliminary phytochemical characteristics of crude methanolic extract of the leaves of *Dialium guineense* (wild). J. Med Plants Res,2011:5(11):2398-2404.
12. Orji JO, Alo MN, Anyim C, Okonkwo EC. Antibacterial activities of crude leaf and bark extracts of "icheku" *Dialium guineense* on bacterial isolates from bronchitis patients. J. pharm. Biol. Sciences,2012:1:22-25.
13. Odukoya OA, Houghton PJ, Adelusi A, Omogbai EKI, Sanderson L, Whitfield PJ. Molluscicidal triterpenoid glycosides of *Dialium guineense*. J. Nat Prod,1996:59:632-634.
14. OdukoyaOdukoya OA, Sofidiya MO, Ilori OO, Gbedelo MO, Ajadotuigwe JO, Olaleye OO. Hemorrhoid therapy with medicinal plants: Astringency and Inhibition of Lipid Peroxidation as Key Factors. Int. J. Biol. Chem,2009:3:111-118.

15. Ruba AA, Nishanthini A, Mohan VR. *In vitro* Antioxidant and Free Radical Scavenging Activities of Leaf of *Arthocnemum fruticosum* Moq (Chenopodiaceae). The Journal of Free Radicals and Antioxidants. Photon,2013:139:166-174.
16. Ogungbenle HN. Sugar, physicochemical properties and fatty acid composition of velvet tamarind *(Dialium guineense)* pulp and oil. European Journal of Biotechnology and Bioscience,2014:2(3):33-37.
17. Ogungbenle HN, Ebadan P. Nutritional qualities and amino acid profile of velvet tamarind (*dalium guineense)* pulp. British Biomedical Bulletin,2014:2(1):006-016.
18. Ogunwenmo KO, Idowu OA, Innocent C, Esan EB, Oyelana OA. Cultivars of *Codiaeum variegatum* (L.) Blume (Euphorbiaceae) show variability in phytochemical and cytological characteristics. *Journal of. Biotechnology*,2007:20:2400-2405.
19. Ewédjè EBK, Tandjiékpon A. *Dialium guineense*, velvet tamarind. Conservation and sustainable use of genetic resources of priority food tree species in sub-saharan Africa. Bioversity International, 2011, 1-8.
20. Ekikeme CM, Ezeonu CS, Eboatu AN. "Determination of physical and phytochemical constituents of some tropical timbers indigenous to Niger Delta Area of Nigeria", European Scientific Journals,2014:10(8):247-270.
21. AOAC. Official methods of analysis, Association of official and analytical chemists, Washington, D.C. USA,1990:(15):807-928.