AASCIT Journal of Chemistry
2015; 2(4): 93-96
Published online July 30, 2015 (http://www.aascit.org/journal/chemistry)

AASCIT American Association for Science and Technology

Keywords
Dialium guineese,
Phytochemical Analysis,
Proximate Analysis,
Elemental Analysis,
Vitamin A and Vitamin C

Received: July 1, 2015
Revised: July 9, 2015
Accepted: July 10, 2015

Assessment of the Phytochemicals Proximate and Elemental Composition of the Fruits of *Dialium guineese* (Icheku)

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Citation

I. O. Okerulu, C. T. Onyema, F. C. Agunabu. Assessment of the Phytochemicals Proximate and Elemental Composition of the Fruits of *Dialium guineese* (Icheku). *AASCIT Journal of Chemistry.* Vol. 2, No. 4, 2015, pp. 93-96.

Abstract

Phytochemical, proximate and elemental analyses of the fruits (pulp) of *Dialium guineese* were carried out using standard analytical techniques. Phytochemical analysis of the water, methanol and ethyl acetate extracts showed the presence of alkaloids, tannins, saponins and flavonoids in various concentrations while glycoside and phenol were conspicuously absent. Proximate analysis of the fruits indicated the presence of protein (8.4%), carbohydrates (78.69%), Moisture (4.1%), crude fibre (0.8%), fat (4.8%) and ash (3.2%). The results of the selected vitamin analysis showed the presence of vitamin C (7.1%) and Vitamin A (0.03%) while the results of the trace mineral elements showed the presence of Ca (45.0g/100g), Zn (0.7g/100g), Cr (1.5g/100g), Fe (4.1g/100g) while Pb was impressively and notably absent, showing the overall safety and health benefit of this plant part.

1. Introduction

There are wide varieties of trees and plants whose seeds, roots and leaves are widely used by all humans throughout the world because of their nutritional or medicinal values (Abayomi, 1986). Using CO_2, water and other elements from the soil, plants are able to produce glucose, starch, fatty acids termed the primary metabolites which serve as precursors to secondary metabolites such as alkaloids, steroids, flavonoids, saponins, tannins, sapogenins etc which are of various medicinal values (Burkill, 1985, Adeniyi, 2004, Idu et al., 2010, Reid, 2005, Sonibare, 2009). It has been proved that natural products serve as the major source of drug, providing about half of pharmaceutical ingredients in use today. In China, species are held in high esteem from time immemorial due to their medicinal and economic uses (Alinor, 2007).

Dialium guineense commonly called velvet tamanind belongs to the family of *leguminosae – caesapinioteae.* It is a tree of nearly 20m high, low branching, rarely straight, bearing a compact densely leafy crown. The leaves are hairy and the flowers are usually white while the fruits are circular and chewed by some women to improve lactation. The bark of the plant is used in medicine for naso-pharyngeal infection, stomach troubles while the leaves are used for eye and heart treatment, malnutrition, pulmonary troubles, debility etc.

Given its overall acclaimed medicinal values and consumption, there is the need for the safety of this plant part to be ascertained hence the aim of this work.

2. Experimental

2.1. Plant Collection Identification and Preparation

The ripe fruits of *Dialium guineese* were collected from St Anthony Parish, Ifite, Awka, Anambra State, Nigeria and were identified by Mr Maxwell Nwatu of the Department of Botany, Nnamdi Azikiwe University, Awka, Nigeria. The fruits were peeled and the fleshy part (pulp) stored in a sterilized air tight container in the refrigerator for further use.

2.2. Phytochemical Screening

Three solvents (Water, Methanol, Ethylacetate) were used in the plant extraction for comparative study. The sample (20g) was weighed into three different conical flasks followed by 100ml of each solvent. The flasks were stirred, covered and allowed to stand for about 1hour 30minutes under normal room temperature. The mixtures were subsequently filtered using whatmann no 1 filter paper and the filterate concentrated to one tenth of its original volume using a rotary evaporator. The extracts were subsequently tested for the presence of alkaloids, glycoside, tannin, phenol, saponin and flavonoids using standard analytical procedure (Harbone, 1998). Results are shown in table 1.

2.2.1. Test for Alkaloid Using Meyer's Reagent Test

1cm^3 of 1% HCl was added to 3cm^3 of the various extracts in a test tube. The mixture was heated for 2minutes, cooled and filtered. Two drops of meyer's reagent were added to 1cm^3 of the filterate. A creamy precipitate was observed which showed the presence of alkaloids in the extract.

2.2.2. Test for Glycosides

1ml of ethylacetate extract was mixed with 1ml of 2% solution of 3,5-dinitrosalicilic acid (3,5-DNS) and 1ml of 5% aqueous NaOH and the mixture was boiled. No bright yellow colouration showed the absence of glycosides.

2.2.3. Test for Tannins

0.5ml of 5% ferric chloride ($FeCl_3$) was added to 1ml of the various extracts. A greenish precipitate showed the presence of tannins.

2.2.4. Test for Phenols

3 drops of 5% NaOH was added to 1ml of the various extracts. Absence of an orange colour indicated the absence of phenol.

2.2.5. Test for Saponins (Emulsion Test)

3 drops of olive oil were added to 1ml of the various extracts and shook vigorously. A stable emulsion when shook indicated the presence of saponin.

2.2.6. Test for Flavonoids

2 drops of 10% NaOH solution was added to 1ml of various extracts. A yellow colouration observed showed the presence of flavonoids.

2.3. Proximate Analysis

Standard methods of the Association of Official Analytical Chemists (AOAC, 1998) were used to determine the proximate analysis which is the partitioning of the samples into different categories; Moisture content, Ash Content, Crude protein (kjedahl protein), Crude fibre and Carbohydrates (Nitrogen free extracts). Results are shown in table 2.

2.4. Trace Metal Determination

Selected trace and essential metals (Ca, Fe, Zn, Cr and Pb) concentrations was determined using Atomic absorption spectrophotometer. Results are shown in table 3.

3. Results and Discussion

Table 1. *Phytochemical Composition of the fruits of Dialium guineese.*

Test/Extracts	Distilled water	Methanol	Ethylacetate
Alkaloids	+++	+++	+++
Glycosides	-	-	-
Tannin	++	++	+++
Phenol	-	-	-
Saponin	+	+++	++
Flavonoids	+	+	+

Note: - = absent + = low concentration ++ = moderate concentration +++ = high concentration

The results of the phytochemical analysis of the fruits extracts of *Dialium guineese* (table 1) showed the presence of alkaloids, tannins, saponins and flavonoids in the three .extracts with varving concentrations. The above phytochemicals are the backbone for the plant's medicinal properties as they are starting materials for the synthesis of new drugs in our pharmaceutical world today.

The presence of tannin showed the antibacterial properties of the plant part (Sonibare, 2009; Reid, 2005). Tannins are vital metabolites which help in toning of vital organs such as kidney and liver. The very high presence of alkaloids highlighted the possession of antimicrobial activity, cyto toxicity and sometimes neutralization ability of poisons within the herb. Alkaloids have been reported to exert inhibiting activity against most bacteria (Camacho-Corona et al., 2008; Al-Bayati, and Sulaiman, 2008). Flavonoids which are however present in low concentration are known to help in reinforcing of capillary walls, improve the exchange of nutrients and oxygen between blood and tissues (Harbone, 1998). The conspicuous absence of glycosides in all the three extracts was also noted. As a class, drugs that contain cyanogenic glycosides do not have wide applications in pharmacy or medicine. They are potentially very dangerous because of the highly poisonous properties of hydrocyanic acid. The cyanide poisoning in livestock resulting from eating

the vegetative parts of plants containing cyanogenic glycosides is a practical problem of some relevance. So the absence of this in the plant examined contributes positively to its safety for human consumption.

Flavonoids are powerful anti-oxidants and scavangers of free radicals which cause cellular and DNA damage hence inducing age related diseases such as dementia (Verril, 1937). Increased intake of flavonoids has also been associated with reduced ovarian cancer risks (Verill, 1937). Flavonoids are known to have hypoglycemic activity also used in the treatment of diabetes, exhibit anti-allergic , anti-inflammatory, anti-microbial and anti-cancer properties (Ghamba *et al.,* 2012; Harbone and Williams, 2000).

Table 2. *Results of the proximate analysis of the fruits of Dialium guineese.*

Parameter	Protein	Carbohydrate	Moisture content	Crude fibre	Fat content	Ash content	Vit.C	Vit. A
Percent (%)	8.40	78.69	4.10	0.80	4.80	3.21	7.10	0.036

The high protein content as opined by Adepoju (2010) showed that the fruit is high in nitrogenous compounds and could be as well useful in animal diets. The high percentage of carbohydrate indicated that the fruit is of high calorific value and hence if incorporated into animal feed formulation of man, it could help in the supply of the required energy for daily activities. The low moisture content suggested that the fruit will not mould easily on storage and hence would have a long shelf life. Presence of crude fibre although in low content suggested that the consumption of the fruit could help in the bowel movement (Kirschenbraver, 1975) while the percentage of Vitamin A and Vitamin C suggested that the fruit can act as an antioxidant by protecting the body against oxidative stress and other diseases like scurvy inherent with the lack of vitamin C. Its low ash content suggested that it contains low quantity of micro elements, a fact confirmed by the results of the elemental analysis as shown in table 3

Table 3. *Results of the mineral elements in the fruits of Dialium guineese.*

Element	Ca	Cr	Fe	Pb	Zn
g/100g	45.0	1.5	4.1	0.0	0.7

The values of the mineral elements found in the plant fruits suggested the safety and usefulness of this plant parts as the heavy metal (Pb) was totally absent.

Calcium an essential trace element used majorly for the formation and mineralization of bones and shells was in high amount as well as iron which is required for the production of Adenosine Tri Phosphate (ATP). Presence of zinc a useful element in the treatment of diarrhoea in children also showed the medicinal and curative properties of this plant as acclaimed by ethnomedicinal practitioners and nutritionists.

4. Conclusion

The extracts of the fruits of *Dialium guineese* have shown to contain some useful secondary metabolities (Table 1) as a result the fruits could be used for compounding drugs for the treatment of age related diseases, heart diseases, cancer, malaria etc. Its proximate and elemental analyses results as in Tables 2 and 3 respectively showed that the fruit of the plant can serve as essential nutrients for human body, act as building blocks, improve digestion and prevent numerous health problems especially those associated with availability of free radicals a problem mitigated by the activities of flavonoids found in this plant part.

Recommendations

It is recommended that other parts of this plant such as the leaves, stem or roots should be examined to discover more of its medicinal values.

Also, the toxicity and dosage of the plant part should be fully determined as well as the formulation of the active isolates into drugs to help in the prevention, treatment and control of susceptible diseases.

Finally, it is recommended that structural elucidation of the isolated active fractions should be done.

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