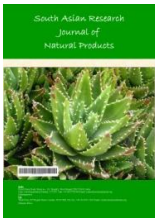

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Determination of Nutritional, Health and Medical Value of *Adansonia digitata* Leaves in Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author HAA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors AMD and KA managed the analyses of the study and managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

African Baobab (*Adansonia digitata L.*, Malvaceae) is an important indigenous food tree species for food security, nutrition, income generation and medicine for rural people in Africa. This research was aimed to examine medicinal and nutritional value of Adansonia *digitata's* leaves (Baobab). Baobab leaves were grinded and transferred into dilute ethanol solution and allowed to soak for 10 minutes. The extract was collected using Whitman No 1 filter paper under aseptic condition. The proximate analysis of *Adansonia digitata* (Baobab) leaves revealed the presence of ash, moisture, crude fiber and crude protein contents all present in the extract, in 1.94%, 2.5%, 0.81% and 8.0% respectively. The study proves that baobab leaves provide nutrient that are required by the human body when consumed and that the leaves are a form of herbal medicine that has the potential of curing several diseases.

Keywords: Adansonia digitata; baobab; phytochemical screening; proximate analysis; nutritional value cholera and typhoid.

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1. INTRODUCTION

Baobab (*Adansonia digitata L.*) is an important multipurpose food tree of the semi-arid and sub humid zones of sub-Saharan Africa. The plant is widespread throughout the hot and drier regions of tropical Africa [1]. The remarkable, long lived baobab tree has a short, swollen trunk with a girth of about 28 m, ending in thick, wide-spreading branches that carry a large, round canopy reaching a height of up to 25 m. It has large palmate leaves and showy whitish flowers that open at night and are pollinated by bats and nocturnal moths [2]. African baobab is a very long-lived tree with multipurpose uses. It is known in Africa as the tree of life because there are many traditional uses for every part of the tree, from the leaves to the roots [3].

African Baobab (*Adansonia digitata L.*, Malvaceae) is an important indigenous food tree species for food security nutrition income generation and medicine for rural generation in Africa [4] and [5]. The acceptability and optimal utilization of baobab parts as nutrient source is limited by the presence of anti-nutrients such as protease inhibitors, tannins and phytates.

The edible parts of Baobab (leaves, seeds and fruit pulp) are consumed by rural communities and sold in markets, whereas non-food part (timber, fodder and fibers) are mainly for income generation in sub-Saharan Africa [6]. The fruit is said to have high vitamin C content, almost 10 times than that of an orange [7] and [8]. While leaves are high in mineral content and pro-vitamin A. the oils extracted from the seeds are said to be edible due to the fatty acid composition [3]. The pulp is usually used in the preparation of fruit juice, snacks and sweets as fermenting agent in local brews [9] porridge herbal medicines and in food recipes [5].

In many African countries, rural people rely on a variety of nutritional and medicinal products provided by the baobab. The leaves have been known to cure Diarrhea, dysentery, wounds, malaria etc. [10], [5] and [11]. Several research have been conducted on nutritional and medicinal values of Baobab fruit pulp as done by [12,13,14] among others. Researches have also conducted research on the leaves in Benin by [15,16,17] etc. while on the Baobab seeds [18,19] among other researches.

Phytochemicals are non-nutritive plant chemicals that have protective or disease preventing properties [20]. [20] Further stated that they are chemical compounds that occur naturally in plants and are responsible for color and organoleptic properties such as the deep purple of blueberries and smell in garlic. Secondary compounds have also been shown to serve as an attraction for pollination and seed dispersing animals and as agent of plant competition [21].

Though, Baobab trees has multi-purpose uses and every part of the plant is reported to be useful [22], the study aim to examine medicinal and nutritional value of Adansonia *digitata's* leaves.

2. MATERIALS AND METHODS

2.1 Sample Collection

Adansonia digitata (Baobab) leaves was purchased from Sokoto State Central Market in Nigeria on 8th of April 2017. The leaves was gotten from the same plant and was allowed to air dry completely for eight days (16th of April, 2017) at a room temperature before using them for this study. The study began on 17th of April, 2017 and lasted for a period of three days. The study was carried out in triplicates and the average was taken.

2.2 Sample Preparations and Extraction

The plant sample was grinded using an electric blender into powder form. Seven gram of the sample was weighed using an electronic weighing balance, 100 ml of distilled water was added into 98.7% ethanol. The sample was transferred into the dilute ethanol solution and allowed to soak for 10 minutes. Then the extract was collected using Whitman No 1 filter paper under aseptic condition.

2.3 Phytochemical Screening

The photochemical screening of the bioactive ingredients of the plant extract was determined according to the protocol described by [23].

2.4 Qualitative Analysis of the Constituents

2.4.1 Test for Phenols (Ferric chloride test)

A fraction of the extracts was treated with aqueous 5% ferric chloride and observed for formation of deep blue or black colour.

2.4.2 Test for Tannins (Braymer's test)

2 mls of extract was treated with 10% alcoholic ferric chloride solution and observed for formation of blue or greenish colour solution.

2.4.3 Test for saponins (Foam test)

To 2 mls of extract was added 6 ml of water in a test tube. The mixture was shaken vigorously and observed for the formation of persistent foam that confirms the presence of saponins.

2.4.4 Test for flavonoids (Alkaline reagent test)

2 ml of extracts was treated with few drops of 20% sodium hydroxide solution. Formation of intense yellow colour, which becomes colourless on addition of dilute hydrochloric acid, indicates the presence of flavonoids.

2.4.5 Test for cardiac glycosides (Keller Kelliani's test)

5 ml of each extract was treated with 2 ml of glacial acetic acid in a test tube and a drop of ferric chloride solution was added to it. This was carefully underlayed with 1 ml concentrated sulphuric acid. A brown ring at the interface indicated the presence of deoxysugar characteristic of cardenolides. A violet ring may appear below the ring while in the acetic acid layer, a greenish ring may form.

2.4.6 Test for glycosides

2.5 ml of 50% H_2SO_4 was added to 5cm^3 of the extracts in a test tube. The mixture was heated in boiling water for 15 minutes. Cooled and neutralized with 10% NaOH, 5 ml of Fehling's solution was added to the mixture and allowed to boil. A brick-red precipitate indicates the presence of glycosides.

2.4.7 Test for alkaloids (Wagner's reagent)

A fraction of extract was treated with 3-5drops of Wagner's reagent [1.27 g of iodine and 2 g of potassium iodide in 100 ml of water] and observed for the formation of reddish brown precipitate (or colouration).

2.4.8 Test for terpenoids (Salkowki's test)

1 ml of chloroform was added to 2 ml of each extract followed by a few drops of concentrated sulphuric acid. A reddish brown precipitate produced immediately indicated the presence of terpenoids.

2.5 Proximate Analysis

The proximate compositions of *Adansonia digitata* (Baobab) leaves were determined using standard analytical methods. All measurements were done in triplicate and values presented in percentage.

2.5.1 Moisture content

This is a measure of the percentage moisture lost to drying at oven temperature of about 105°C [24]. 2 g of the sample A was oven-dried in a crucible at 105°C overnight. The dried sample was then cooled in desiccator for 1 h and weighed to a constant weight. The percentage loss in weight was expressed as percentage moisture content.

2.5.2 Ash content

The residue remaining was weighed after the ashing of 2 g dried grounded seed in a crucible. The ashing were done in a muffle furnace of temperature 550°C for 6 h. The ashed sample was left cooled in a desiccator and weighed. The percentage residual weighed is expressed as ash content [24].

2.5.3 Crude protein content

[25] Method used to determined total protein. 1 g of the sample was put into a filter paper and put into a Kjedahl flask, 10 cm^3 of concentrated H_2SO_4 was added and digested in a fume cupboard until the solution becomes colorless. The distillation was carried out with 15 mL of 50% of NaOH. The tip of the condenser was dipped into a conical flash containing 6cm^3 of 4% boric acid in a mixed indicator until a green coloration is observed. Titration was done in the receiver flask with 0.01 M HCl until the solution turned red.

2.5.4 Crude fibre content

Estimation of the crude fibre was done by acid and alkaline digestion methods 2.00 g of each sample was used with 20% H_2SO_4 and NaOH solution.

3. RESULTS AND DISCUSSION

The proximate analysis of *Adansonia digitata* (Baobab) leaves revealed the presence of ash,

moisture, crude fibre, crude protein and carbohydrate contents all present in the extract (Table 1). However, the phytochemical screening revealed the presence of phenols, glycosides, terpenes and flavonoids while saponins, tannins and alkaloids were absent (Table 2).

Table 1. Result showing the proximate analysis of *Adansonia digitata* (Baobab) leaves

Parameters analyzed	Percentage (%)
Moisture content	2.5
Ash content	1.94
Protein content	8.0
Crude fiber	0.81

Table 2. Results showing the phytochemical screening of *Adansonia digitata* (Baobab) leaves

Phytochemicals	Results
Phenols	+
Alkaloids	-
Saponins	-
Tannins	-
Flavonoids	++
Glycoside	+
Terpenoids	++

Note + represents the presents of the constituents, - represents the absent of the constituents

The percentage of moisture content reported for this sample was 2.5, this value is lower compared to moisture content ranges of 7.31 to 66.45 reported for some Nigerian vegetables by [26]. The moisture content is also lower than that of Baobab fresh leaves which is 77% as reported by [27]. However higher proportion of moisture in food lowers the storage duration. But high moisture in food influences the rate of food digestion and Peristaltic movement on consumption. Crude fiber concentration value was 0.81 the value is much different with 1.6 reported for cancer *Amaranthus hybridus* by [28]. Fibre in food independently lowers blood pressure and reduces the risk of cardio vascular diseases. The crude protein content is 8.0, this values is lower than that of fresh baobab leaves which is 10 g/ 100 g dw [29,30] to 14.9 g/ 100 g dw [31] and 8.23 reported for *Indigofera astragalina* leaves and 4.6 reported for *Mormodica foecide* leaves consumed in Switzerland [32]. This indicates that *Telfairia occidentalis* leaf concentrate are good sources of daily proteins. The ash content of the sample was 1.94. The value was higher compared to 1.8% reported for sweet potatoes leaves [33], but lower than 19.61 in *Amarathus hybrids* leaves. The ash content indicates the sample should be rich in mineral elements.

Phenols, flavonoids, glycosides and terpenes were present in the leaves of *Adansonia digitata* (Baobab) after phytochemical analysis. Baobab is known to have several medicinal values.

In a research by [34], using on shelf herbal medicines in Mbale, some of the herbal medicines that contain similar secondary metabolites, were found to cure cholera and typhoid and the end users were satisfied with those herbal medicines. Flavonoids were detected after phytochemical analysis of baobab, similar secondary metabolites were also found in extracts from Acacia nilotica which were effective in the cure of typhoid by [35]. Flavonoids was found In baobab which in another study by [36] aqueous extract of fruit peel of *Citrus sinensis* (L.), was found to contain flavonoids, saponins and alkaloids which was found to inhibit the growth of *S. Typhi*, a virus that causes typhoid. In another study by [37], using extracts of Spondias mombin, Senna occidentalis and Musa sapientum, tannins, flavonoids, saponins and alkaloids were found in the extracts which were found to cure cholera.

4. CONCLUSION

The conclusion drawn from this research is that phytochemical screening of *Adansonia digitata* (Baobab) leaves revealed the presence of phenols, glycosides, terpenes and flavonoids which are similar to the findings that cure typhoid and cholera. This shows that Baobab have the tendency to cure typhoid and cholera. While the proximate analysis revealed the presence of ash, moisture, crude fiber and crude protein, this proves that baobab has high nutritional value.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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