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Comparative Study of the Proximate Composition of Edible Parts of *Adansonia digitata* L. obtained from Zaria, Kaduna State, Nigeria

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Abstract

The study is aimed at evaluating and comparing the proximate composition of edible parts (fruit pulp, seeds and leaves) of *Adansonia digitata*. Plant materials (dried fruits and fresh leaves) were obtained from the botanical garden and identified at the herbarium of the Department of biological Sciences, Ahmadu Bello University, Zaria, Nigeria. Dried samples of fruit pulp, seeds and leaves were pulverized and proximate analysis was carried out to determine their moisture, ash, crude lipid, crude protein, crude fibre, and carbohydrate content. Analysis of variance (ANOVA) was used to compare means of the various parameters measured and Duncan multiple Range Test (DMRT) was used to separate means where significant. The level of significance was taken at $p < 0.05$. Results revealed that: the fruit pulp had the highest significant moisture content of 18.41%; seeds had the highest significant fat, protein and fibre content of 31.42%, 14.26% and 7.87% respectively; leaves had the highest significant ash and carbohydrate content of 12.31% and 61.60% respectively. All the edible parts of *Adansonia digitata* are unique in their proximate composition and they may be used to complement each other to bring about a more balanced diet instead of been eaten singly.

Key words: *Adansonia digitata*, Edible parts, Comparative study, Proximate composition

INTRODUCTION

The use of plants as food is as old as the history of man. Plants are irreplaceable food sources for man. Synthetic chemicals and petroleum derivatives can replace other plant derivatives (e.g medicine, fibre, dye, resins etc.) but there is no alternative for plant-derived foods. Almost all human food are plants or organisms that eat plant [1].

Plant foods are excellent sources of nutrients and energy, they provide the bulk of daily calories and around 65% of the protein [1]. There are 350,000 plant species in the world, and about 80,000 are edible for humans. However, at present only about 150 species are cultivated, directly for human food or as feed for animals and, of these 30 produce 95 percent of human calories and proteins. About half of our food are derived from only four plant species: rice (*Oryza sativa*), maize (*Zea mays*), wheat (*Triticum* spp.) , and potatoes (*Solanum tuberosum*) [2]. There is therefore a need to explore the vast varieties of underutilized crops as food by man.

Adansonia digitata L. belonging to the Malvaceae family has been classified as one of the underutilized crops in Africa [3]. It is usually a large imposing tree with swollen trunk, stout and tortuous branches, scanty palmate leaves and large pendulous shaped fruits. The fruits have a characteristic velvet outer coat which ranges in colour from green to brown and causes an itch when it comes in contact with the skin.

The origin of the plant is still debated. Some reports have it that they may have originated from the savannas and savanna woodlands of Sub-saharan Africa, others have it that they may have first occurred in Madagascar , from where they spread to continental Africa and Australia [4, 5]. Its common names include: African baobab, baobab, dead rat tree, monkey bread tree, upside-down tree, cream of tartar tree [6]. In the northern part of Nigeria it is commonly referred to as “Kuka” in the Hausa language.

It has been reported that no part of the baobab tree is a waste, but amongst numerous other uses it is mainly used as food. Many parts of the tree are edible but the most used parts as food include the leaves, fruits and seeds [7, 8, 9].

The baobab fruit pulp is probably the most important foodstuff. It can be dissolved in water or milk. The liquid is then used as a drink, a sauce for food, a fermenting agent in local brewing, or as a substitute for cream of tartar in baking. Fulani herds’ men in northern Nigeria use it to adulterate cow milk [3, 10].

The leaves can be used either fresh, as a cooked vegetable, or dried and powdered as a functional ingredient (thickener) of soups and sauces [3, 9, 10]. In Northern Nigeria the dried young leaves are powdered and used to prepare a delicacy known as “Miyan Kuka” which is a soup used to eat corn or millet food called “Tuwo”.

Baobab seeds can be eaten fresh, or they may be dried and ground into a flour which can either be added to soups and stews as a thickener, or roasted and ground into a paste, or boiled for a long time, fermented and then dried for use. The seeds are also processed to extract oil which can be used for several things such as: cooking, medicine and cosmetics [3, 10]

Some earlier works on the nutritional composition of edible parts (leaves, fruit pulp and seeds) of *Adansonia digitata* have been reported from different parts of the world [3, 9], but non to the best of the researcher's knowledge has been reported from Zaria, Kaduna State, Nigeria. This research is an attempt to address that.

METHODOLOGY

Collection, identification and Preparation of Plant Materials

The plant materials (dried fruits and fresh leaves) of *Adansonia digitata* were obtained from the botanical garden of the Department of Biological Sciences, Ahmadu Bello University, Zaria, Nigeria, and were taken to the herbarium of the same department for verification and confirmation. It was allocated a herbarium voucher number of 2512. The fruits were cracked open and the pulp was separated from the seeds mechanically. The seeds were then washed properly to remove any residue of pulp on them and allowed to dry. Leaves were also washed and air dried. The pulp, seeds and leaves were pulverized separately and sieved through a pore size of 2mm after which they were stored in separate airtight plastic containers for further study.

Proximate Analysis

The proximate analysis (moisture, ash, crude lipid, crude protein, crude fibre, and carbohydrate) of fruit pulp, seeds and leaves of *Adansonia digitata* were determined using AOAC (1990) [11] methods. The moisture was determined using weight difference after oven drying at 100°C to a constant weight. Ash was determined using weight difference after been calcined in a furnance at 550°C for 8 hours. Crude lipid content of samples was done using soxhlet apparatus of the direct solvent extraction method. The nitrogen value which is the precursor for protein of a substance was determined by micro – kjeldahl method. The nitrogen value was converted to protein by multiplying to a factor of 6.25. The solvent used was petroleum ether (boiling range 40 – 60 °C). For crude fibre, samples were digested in sulphuric acid and sodium hydroxide solutions and the residue calcined. The difference in weight after calcination indicates the quantity of fibre present. Carbohydrate was determined by difference method by adding the proximate values of all the other parameters and subtracting it from 100 [12, 13].

Statistical Analysis

Analysis of Variance (ANOVA) was used to compare the means of the various parameters measured. Duncan Multiple Range Test (DMRT) was used to separate means where significant. Means were presented as Mean ± Standard Deviation and the level of significance was taken as $p < 0.05$. The analysis was ran using SPSS software (Version 20).

RESULTS AND DISCUSSION

The proximate composition of fruit pulp, seeds and leaves of *Adansonia digitata* are presented in table 1.

The results revealed that there was a significant difference ($p < 0.05$) in the Moisture content of the different samples. The fruit pulp had the highest significant moisture content of 18.41% while the leaves had the lowest moisture content of 2.16%. The high moisture

content of the fruit pulp may be due to the fact that it contains simple sugars (that gives it sweet taste) [9], this may be responsible for it been hygroscopic in nature, causing it to absorb water from the environment [14]. The high moisture content of the fruit pulp indicates that it has a reduced shelf-life; hence it cannot be kept in storage for as long as seeds and leaves can be kept [15]. In northern Nigeria the powdered dried leaves are usually kept in storage for a very long time and used in making soup.

There was a significant difference ($p < 0.05$) in the Ash content between the different samples. Leaves had the highest significant ash content of 12.31% while pulp had the lowest ash content of 5.20%. The high ash content of leaves may be due to its mineral content [16].

There was a significant difference ($p < 0.05$) in the Fat content between the different samples. Seeds had the highest significant fat content of 31.42% while Pulp had the lowest fat content of 14.00%. The high fat content of seeds makes it a good source of vegetable oil which can be used for cooking, medicine cosmetics etc. [17]. High fat content of seeds also indicates that they could serve as high source of energy when eaten [18].

There was a significant difference ($p < 0.05$) in the Protein content between the different samples. Seeds had the highest significant protein content of 14.26% while Pulp had the lowest of 6.32%. The high protein content of seeds makes it a good body building food for growth and repair of worn out cells and tissues (in children most especially) [19].

There was a significant difference ($p < 0.05$) in the Fibre content of the different samples. Seed had the highest significant fibre content of 7.87% while Pulp had the lowest of 3.54%. The high fibre in the seeds adds to the bulk of diet and this enhances normal bowel function. It may also be useful in preventing diseases like cancer of the colon [13]

There was a significant difference ($p < 0.05$) in the Carbohydrate content in the different samples. The Leaves had the highest significant carbohydrate content of 61.60% while seeds had the lowest of 42.32%. The high carbohydrate content of seeds indicates that it is a good source of energy [3].

SAMPLE	PROXIMATE COMPOSITION (%)					
	Moisture	**Ash**	**Fat**	**Protein**	**Fibre**	**CHO**
Pulp	18.41 ± 0.21[c]	5.20 ± 0.02[a]	14.00 ± 0.43[a]	6.32 ± 0.21[a]	3.54 ± 0.16[a]	56.03 ± 0.83[b]
Seeds	5.40 ± 0.33[b]	7.25 ± 0.07[b]	31.42 ± 0.56[c]	14.26 ± 0.45[c]	7.87 ± 0.18[c]	42.32 ± 0.42[a]
Leaves	2.16 ± 0.06[a]	12.31 ± 0.84[c]	15.93 ± 0.62[b]	8.00 ± 0.90[b]	5.70 ± 0.00[b]	61.60 ± 0.69[c]

TABLE 1. PROXIMATE COMPOSITION OF EDIBLE PARTS OF *ADANSONIA DIGITATA*

n = 3; Mean ± Standard deviation; Values with different superscript within a Column indicate a significant difference between the groups ($p < 0.05$)

CONCLUSION

The results indicate that the edible parts of *Adansonia digitata* are rich sources of dietary nutrients. Every part is unique in its own composition and none is left out in usefulness: the fruit pulp is rich in carbohydrate; Seeds are rich in protein, fibre and lipid; leaves are rich in minerals and carbohydrate. The various edible parts could be complemented with each other to bring about a more balanced diet instead of consuming them singly. The use of *Adansonia digitata* as food should be further explored to harness its enormous benefits.

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