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# COMPARATIVE STUDY ON PROXIMATE AND MINERAL COMPOSITION ON *PARKIA BIGLOBOSA* (AFRICAN LOCUST BEAN) FRUITS AND SEEDS

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## ABSTRACT

The proximate and minerals composition of the fruits pulp and seeds of *parkia biglobosa* (African locust bean) were evaluated and the results were compared with World Health Organization (WHO).The fruit pulp parkia biglobosa contained 33.2%, 10.6%, 2.50%, 6.30% and 47.4% moisture, Ash value, fat (ether extract), protein and carbohydrate respectively while the seeds of parkia biglobosa also contained 20.2%, 17.4%, 20%, 6.65% and 35.75% for moisture content, ash content, fat (ether extract), protein and carbohydrate respectively. The fruits and seeds of parkia biglobosa are rich in Na, K, Ca, Mg and Fe which were differed to some extents. The fruits contain 2.7 mg/100 g, 209 mg/100 g, 35.5 mg/100 g, and 27 mg/100 g, 0.556 mg/100 g Na, K, Ca, Mg and Fe respectively while the seeds contained 0.133 mg/100 g, 1.05 mg/100 g, 0.1 mg/100 g, 11.16 mg/100 g and 0.148 mg/100 g for Na, K, Mg, Ca and Fe respectively. Both the fruits and seeds are very good sources of mineral elements because the mineral composition results showed that there are very much similarities with the daily requirements of the tested elements by WHO 2011, even though the values are little bit higher than the standard. The fruits and seeds of the samples contain certain amount of energy given food and health preserving ones.

**Keywords:** Proximate and mineral compositions, *parkia biglobosa Fruits,* seeds, Protein

## INTRODUCTION

Many decades past, there has been a growing awareness of the importance of non-timber forest products (NTFPs), for the role they play in the economy of many forest – dependent households and also for their potential and importance to the economies of many developing countries (Popoola and Maishanu, 1995). Some common examples are *Parkia biglobosa*. There is considerable interest concerning the optimal utilization of this resource base while at the same time protecting biodiversity and ensuring sustainability (Popoola and Maishanu, 1995). Knowledge of the potential utilization of these products and their transformation and commercialization would favour their promotion. Excipients are the non – therapeutic but vital components of drug delivery systems. They influence drug delivery through increased or decreased solubility, modified dissolution rates, absorption enhancement, ultimately leading to improved therapeutic activity (Malviya, *et al.*, 2011). Synthetic polymers offer a broad range of properties that can be reasonably well "built-in" by design and modified by altering polymer characteristics (Liu *et al.*, 2007). Plant products are therefore attractive alternatives to synthetic products. Excipients have also been found useful in formulating immediate and sustained release preparations (Malviya, *et al.*, 2011). The ingredients or excipients used to make compressed tablets are numerous and can be classified by their use or function as: fillers, binders, disintegrants, lubricants, glidants, wetting agents, preservatives, colouring agents and flavouring agents. It is becoming increasingly apparent that there is an important relationship between the properties of the excipients and the dosage forms containing them. The advantages of natural plant – based excipients include that they are inexpensive, natural origin, environmental 'friendliness', fairly free from side effects, bioacceptable with a renewable source, local availability, better patient tolerance, as well as public acceptance. They improve the natural economy by providing inexpensive formulation to people by using locally available material (Wade and Weller, 1994).

*Parkia biglobosa* (Mimosoideae - Leguminosae) commonly called African locust bean tree has long been widely recognized as an important indigenous fruit tree in anglophone and francophone West Africa. A matured *Parkia biglobosa* bean pod contains yellow, dry and powdery pulp (locally known as 'Dorowa' in Hausa) in which dark brown or black seeds are embedded. The pulp which is rich in carbohydrates, minerals and vitamins (FAO, 1988) is licked for its sweet taste but only to a small extent.Almost all drugs which are active orally are marketed as tablets, capsules or both. The successful formulation of a stable and effective solid dosage form depends on the careful selection of the excipients which are added to facilitate administration, promote the consistent release and bioavailability of the drug and protect it from degradation (Aulton, 1990). Today cosumers opt for the natural ingredients in food, drug and cosmetics as they believe that anything natural will be safer and devoid of side effects as compared to synthetic once.

While the *Parkia biglobosa* bean seed has been extensively studied (Addy *et al*., 1995), the yellow dry fruit pulp has not attracted much attention (Odunfa, 1986). As such little or no information is available concerning the use of the *Parkia biglobosa* fruit pulp as pharmaceutical excipients.

The most significant product from *Parkia biglobosa* is food. The food products collected from *Parkia biglobosa* are especially important due to the seasonality of fruit maturation and food availability. Between February and March every year, young green whole pods are roasted and eaten by men. Between March and April every year the beginning of 'hunger season' when other foods are becoming scarce mature pods are collected for food.

The seeds are used in preparation of *dawadawa*; a protein and fat rich food (Hall *et al*., 1997) surveyed families in Burkina Faso on vegetable consumption and seasonality and found that in two villages, *dawadawa* was consumed in 78% and 85% of all meals and in northern Nigeria Dawdawa is consumed in miyar kuwa, miyar kubewa and many others. *Dobulong* the yellow starchy pulp that surrounds the seed is an important food supplement rich in Vitamin C and carbohydrates. The dried powder is often mixed with water to produce a drink called *dozim* by the Dagbani tribe and *bololo* in Hausa (Hall *et al*., 1997).

The yellow dried powder is also cook and eats as a food called Gaskami in Hausa (part of Katsina State). The young pods of locust bean are cooked as a vegetable. The pods are also used as livestock feed. The young leaves are eaten as vegetable. The seeds are made into a condiment known as *dawadawa* in West Africa (Ajuebor *et al*., 2004). *Dawadawa* serves as source of protein. This condiment forms an important article of commerce in some towns and villages in Nigeria (Ibrahim and Antai, 1986) and Ghana. Progress has been made in research studies to optimize production of *dawadawa* (Ouoba *et al*., 2003). The organisms involve in the fermentation were mostly, species of the *bacillus subitilis* spectrum such as *Bacillus subtilis*, *Bacillus licheniforms* and *Bacillus pundus* and coagulase-negative *staphylococcus* species (Ogbedu and Okagbue, 1988). Drink can be made from both the seeds and leaves (FAO, 1988).

Fig. 1: Pods Image of *Parkia biglobosa* (West African plant)

Fig. 2: Fruit Image of *Parkia biglobosa* (Joan Baxter)

Fig. 3: Image of Seeds of *Parkia biglobosa* (Feedpedia).

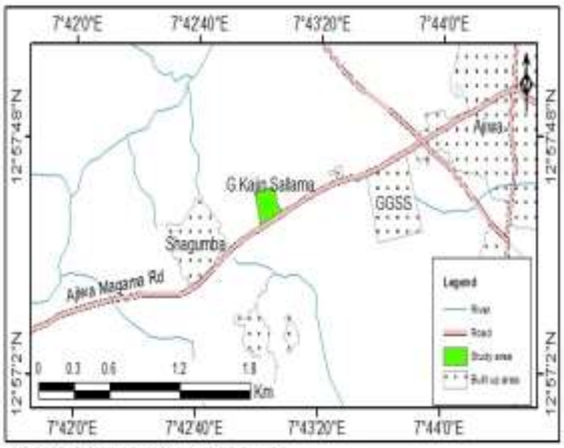


Fig. 3: Research Area Map

## MATERIAL AND METHODS

### SAMPLING AND SAMPLE LOCATIONS

The fruits and seeds of *parkia biglobosa* were obtained from Shagumba village, Batagarawa Local Government Area. The fruits and seeds were peel off and dried. The dried samples packed in a polyethylene bag and stored in the laboratory until used. The *parkia biglobosa* fruits pods were sorted, cleaned and split open manually .The yellow pulp of *Parkia biglobosa* along with attached seeds were removed, air dried for three (3) days and pounded lightly in a mortar with a pestle. The pulp was separated from the seeds and pounded thoroughly and sieved through mesh sieve. The seeds were brought out by mechanical means. Both the fruits and seeds samples (50 g each) were packed in high density polyethylene bags.

All the reagents in the research were used as purchased without further purification

**Moisture Content Determination**

Two grams (2 g each) of *parkia biglobosa* fruits pulp powder and seed powder were weighed accurately into two previously ignited and weighed crucibles .the crucibles were placed in an oven thermostatically controlled at 105$^0$C for 4 hours after which they were removed and placed in desiccators to cool. The crucibles were each weighed and the moisture content determined (AOAC, 1990).

**Calculation:**

$$\textbf{Moisture content (\%)} = \frac{W_2-W_3}{W_2-W_1} \times 100$$

$W_1$=Weight of empty crucible

$W_2$=Weight of empty crucible + sample before heating

$W_3$=Weight of empty crucible + sample after heating

**Ash value**

Two gram (2 g each) *parkia biglobosa* fruits pulp powder and seed powder were weighed accurately into two (2) previously ignited and weighed crucibles and placed in a muffle furnace (pre-heated at 450$^0$C) for 2 hours to incinerate after which the crucibles were removed and transferred directly into desiccators and allowed to cool. They were each weighed and the percentage ash determined (AOAC, 1990).

**Calculation**

$$\textbf{Ash content (\%)} = \frac{W2-W_3}{W_2-W_1} \times 100$$

$W_1$=Weight of empty crucible

$W_2$=Weight of empty crucible + sample before ashing

$W_3$=Weight of empty crucible + sample after ashing

**Fat content**

Two grams (2 g each) *parkia biglobosa* fruits pulp powder and seed powder were weighed accurately into two boiling tubes. 10 ml concentrated HCl and distilled water were added and put in a boiling water bath for complete hydrolysis of the solid particles until the mixture becomes brown in color. They were then taken off cooled and transferred into two separating funnel. In the first extraction 10ml of ethanol and 30 ml diethyl ether were added, shaken and allowed to stand for clear separation. In the second and third extraction only 25 ml of diethyl ether was added to each of the separating funnel, shacked and allowed to stand for separation. The solvents were then evaporated in a water bath .The fat obtained was dried in an oven at 100$^0$C, cooled and weighed.

**Calculation**

$$\textbf{Fat content (\%)} = \frac{W_3-W_2}{W_S} \times 100\%$$

$W_S$= weight of the sample

$W_2$ = weight of the sample + conical flask + reagents before extraction

W3= weight of the sample + conical flask + reagents after extraction

**Protein content**

This was determined by kjedahal method by Chang; 2003. The total nitrogen was determined and multiplied with factor 6.25 to obtain protein content. 0.5 g of each of *parkia biglobosa* fruits pulp powder and seed powder were mixed with 20 ml of concentrated $H_2SO_4$ in digestion flask. A tablet of selenium catalyst was added to each of the flask before they were heated under a fume cup board until a clear solution was obtained (the digest).The digest were diluted to 100ml in a conical flask and used for the analysis. The 10 ml of the digest of each sample was mixed with 20 ml of 40% NaOH solution in a kjedahal distillation apparatus. The mixture was distilled into 20 ml of 20% boric acid containing 4-5 drops of mixed indicator(methyl blue).As total of 50ml distillates was collected and titrated against 0.01M $H_2SO_4$ from green to a pink end point .A reagent blank were distilled and titrated. Hence protein content was determined.

**Carbohydrate**

Carbohydrate content *parkia biglobosa* fruits pulp powder and seed powder were obtained by difference using the derived data and the following equation.

**Calculation**

**Carbohydrate (%) =100-(%moisture+%ash+%fat+%protein).**

**Mineral Composition**

**Digestion for AAS (Atomic Absorption Spectroscopy) Analysis**

0.5 g ash each of *parkia biglobosa* fruits pulp powder and seed powder were weighed into a clean and dried conical flask, to each of the conical flask 5 ml of nitric acid and 15 ml of Hydrochloric acid were added. The conical flasks were then placed on a hot plate at 105$^0$C for 3 hours. The samples were then removed and allowed to cool. The digested solutions were then filtered using a whatman filter paper the solutions were transferred into 100 ml volumetric flask and distilled water was added to the mark and then transferred into a 2 different sample bottles for AAS analysis.

**Results and Discussion**

The table below shows the results obtained from the proximate analysis of the two samples (Fruits and seeds). It can be seen that the moisture contents are different; the fruits have the higher value (33.2%) compared to the seeds (20.2%) and this indicate one very important quality of the samples in terms of their storage, thus the seeds can be store for a longer period without spoilage compared to the fruits, this is because moisture content of any food is an index of its water activity, it is used as a measure of stability and susceptibility to microbial contamination. Their moisture contents are within the range of required value as safe storage limit for plant food materials (Olutiola *et al.,* 1991, Pearson, 1994, Uraih *et al.*, 1990 and Umar *et al*., 2007).

The ash content values are higher in the seeds (17.45) compared to the fruits (10.6%). Ash content is a measure of the total mineral content of a food (Vunchi *et al.,* 2011), thus the seeds are expected to have higher mineral content considering the value of the ash contents.

The results for the fat contents indicate high value in the seeds (20%) compared to the fruits (2.5%), this is in line with many literature that seeds always contain higher fatty acids value compared to the fruits. Fats or oils are very important in human health as it serves as sources of energy and components of biological membranes (Michelle., *et al.*, 1993).The protein contents is also higher in the seeds (6.65%) than in the fruits (6.30%) even though the difference is negligible. Both the seeds and the fruits are less in terms of protein value compared to the daily protein requirement of 23-56 g per 100 g (FAO/WHO/UNU, 1991).

The result for carbohydrate indicates that the fruit has higher value (47.45%) than the seeds (35.75%), thus the higher contents of carbohydrate by the fruits it indicates that it can serve as an important source of energy and so also the seeds even though is less compared to the fruits. The seeds can be said to have higher nutrients than the fruits considering the obtained results; fats, protein and carbohydrate

**Table 1: Result of the proximate composition of *parkia biglobosa* fruit pulp and Seeds**

| Parameters | ***Parkia biglobosa*** fruits **(%)** | ***Parkia biglobosa*** seeds **(%)** |
|---|---|---|
| Moisture content | 33.2 | 20.2 |
| Ash content | 10.6 | 17.4 |
| Fat (Ether extract) | 2.50 | 20 |
| Protein | 6.30 | 6.65 |
| Carbohydrate | 47.4 | 35.75 |

The elements checked for the two samples (fruits and seeds) are Na, K, Ca, Mg and Fe and the concentration of each element in the two samples are shown in table two (2). The fruits and seeds of *Parkia biglobosa* contained 2.7 mg/100 g and 0.133 mg/100 g of sodium (Na) respectively. Sodium (Na) is very important in maintaining the electrolyte balance in the body regulates blood volume, blood pressure, osmotic equilibrium and pH. K contents of the fruits and seeds are 209mg/100g and 1.5 mg/100 g. The ability of cells to produce electrical discharge is critical for body functions such as neurotransmission, muscle contraction, and heart function and these are controlled by potassium (K) in the body. Sodium (Na) content in combination with potassium (K) is involved in maintaining proper acid-base balance (PH) and in nerve impulse transmission in the body (Adeyeye, 2002). The *parkia biglobosa* fruits and seeds contained 35.5 mg/100 g and 0.10 gm/100 g Mg respectively; the fruits have higher value than the seeds. Magnesium is an important element in connection with circulatory diseases and calcium metabolism in bone (Ishida *et al.,* 2000). The fruits contained 27 mg/100 g while the seeds have 11.16 mg/100 g calcium (Ca). Calcium forms component of bones and teeth (Structural role) very important for blood clothing and muscle contraction (Vunchi *et al.,* 2011). The concentration of iron (Fe) in *parkia biglobosa* fruits and seeds were 0.556 mg/100 g and 0.148 mg/100 g respectively, Iron is essential micronutrient for haemoglobin formation (for oxygen transportation), functioning of central nervous system (CNS) normally and in the oxidation of foods (carbohydrate, protein and fat) (Adeyeye *et al.,* 1999). Both samples have low content of iron (Fe).

**Table 2: Mineral composition of *parkia biglobosa* powdered Fruits and seeds**

| Elements | *parkia biglobosa* fruits (mg/100 g) | *parkia biglobosa* seeds (mg/100 g) | WHO and FAO (mg/100 g), 2011 |
|---|---|---|---|
| Sodium (Na) | 2.7 | 0.133 | 5.00 |
| Potassium (K) | 209 | 1.05 | 5.02 |
| Magnesium (Mg) | 35.5 | 0.10 | 3.50 |
| Calcium (Ca) | 27 | 11.16 | 0.80 |
| Iron (Fe) | 0.556 | 0.148 | 0.443 |

## CONCLUSION

The results for proximate analysis indicate that both the samples (*Parkia biglobosa* fruits and seeds) can served as supplement for protein, carbohydrate and fat while the results of mineral composition indicate higher concentration of potassium, magnesium and calcium in *Parkia biglobosa* fruit shown that the fruit can be good source of those elements while in the seeds all the element were found in smaller quantity, the seeds are not as good as the fruits compared to the fruits

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