NUTRITIONAL EVALUATION OF BAOBAB SEED

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ABSTRACT

Investigations were carried out on the nutritional composition and some mineral contents of Adansonia digitata seeds for domestic consumption and industrial utilization. The fats and protein contents were determined by extraction and micro Kjeldahl method respectively while Sodium, Potassium and Calcium were determined using flame photometer. The results obtained showed that the seeds contained high protein (20.13%), carbohydrate (39.90%), fat (24.72%), Ash (7.36%), crude fiber (7.89%) and moisture content (5.37%). The concentration of some minerals in milligram per hundred gram (mg/100g) as present in the ash of baobab seeds are Na (260), K (2500) and Ca (1.2). The results showed that baobab seeds could serve as a supplementary source of carbohydrate and fiber.

Keywords nutritional composition baobab seed flame photometry mineral analysis

INTRODUCTION

Nigeria is blessed with abundant domestic trees, fruits, tubers, vegetables, and other plant foods which are of great economic importance and are excellent sources of essential nutrients required by the body for growth and prevention of diseases. Their values cannot be said to be lower than processed or imported items which are said to contain known amount of essential body nutrients. (Akiniyi and Waziri 2011). Baobab or Adansonia digitata L. belongs to the Malvaceae family (Bremer et al., 2003). The Baobab tree is one of the most intriguing trees growing on the African continent and is often referred to as monkey bread tree, Senegal Calash (fruit), bottle tree or upside down tree which can have a life span of up to 6,000 years. (Magaji, 2010). The baobab tree is tolerant to high temperature and drought, and is mostly found in the northern part of Nigeria. Every part of the baobab tree is reported to be useful (Owen (1970) cited in Igboeli et al., 1997 and Gebauer et al., 2002). The bark and roots are cut and used as traditional medicine. (Sidibe & Williams, 2002; Shukla et al., 2001). The fruit consists of large seeds embedded in a sour acidic pulp and shell. The pulp can be dissolved in water or milk and 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 (Sidibe & Williams, 2002; Obizoba, 1983). Fermented seeds are used as flavouring for soup, and the roasted seeds are used as a side dish, substituting peanut. [Addy and Etshola, 1984] The seeds are also pressed for oil but the by-product, baobab seed cake is typically underutilized (Osman 2004). The leaves are used to make soup [Yazzie et al., 1994]. The plant also provides forage for wildlife and domestic animals (Nkafamiya et al 2007). The consumption of baobab seeds in different forms has therefore been going on for quite a long time with little or no knowledge about the composition and nutritional value of the seeds, hence the need to investigate the mineral and nutritional content of the seed. A number of studies on the proximate values and mineral composition of baobab seeds and other indigenous plants have been carried out several times in different geographical locations because plants nutrient and mineral contents do vary with soil type, as well as with climate type. The aim of this study is therefore to carry out the proximate and some selected mineral analysis of baobab seeds obtained from the baobab plants, which are among the conserved plants in Gombe State University, Nigeria.

EXPERIMENTAL

Samples Collection and Preparation

The fruits were plucked from the trees in different locations in Gombe State University using long sticks. The fruits were cracked using stones, and placed in water for 24 hours to soften the pulp. The soaked fruits were washed and the
seeds were separated from the pulp and rinsed with clean water. The seeds were dried under the sun for three days and were pulverized using a grinding machine.

Determination of Fat Content
About 200g of the samples were crushed into fine particles in a mortar and pestle. 50g of the samples were placed in the filter paper thimble and was inserted in the soxhlet extractor. The solvent was added and the fat was extracted at 60-70°C into a pre-weighed round bottom flask for 6 hours. The flask and its content was detached from the extractor and the solvent distilled off at 80°C for 2 hour and was kept in a fume cupboard until the next day when it was weighed. The cake was also removed from the extractor and allowed to dry for 24 hours. The dried cake was weighed and the percentage composition of the crude fat was determined. The procedure was repeated three times and the average weights were used to deduce the weight of fat.

\[
% \text{ crude fat} = \frac{(\text{initial weight of the sample} - \text{final weight of the sample}) \times 100}{\text{initial weight of the sample}}
\]

Determination of Moisture Content
This was done according to Udo and Ogunwele’s (1986) method with modification where by three sets of filter papers were weighed and one (1g) of the samples was placed onto each of the filter papers which were then placed inside an oven and allowed to dry at 105°C until a constant weight was reached. Therefore

\[
% \text{ Moisture Content} = \frac{(W_1 - W_2)}{1g} \times 100
\]

\(W_1 = \text{Weight of empty filter paper and fresh sample.}\)

\(W_2 = \text{Weight of empty filter paper and dried sample.}\)

Determination of Ash Content
This was done according to James (1995) whereby 5g of the samples were placed into each of the pre-weighed crucibles and ashed in a furnace at 600°C for about 7 hours when the ash was completely white. The crucibles were then removed from the furnace, allowed to cool in a desiccator and were reweighed

\[
% \text{ Ash of the sample} = \frac{(C_2 - C_1)}{5g} \times 100
\]

\(C_1 = \text{weight of empty crucible}\)

\(C_2 = \text{weight of crucible + sample}\)

\(C_3 = \text{Weight of crucible + ash}\)

Determination of Crude Fiber
Percentage crude fiber was determined using the method described by Udo and Ogunwele (1986) with modifications where by 3g of fat free samples were weighed (cake from extraction). Two 500ml digestion flasks were prepared one containing 200ml of dilute (1.25g/100ml) H\(_2\)SO\(_4\) and another containing 200ml dilute (1.25g/100ml) NaOH. Each was connected to a condenser, and was allowed to boil. 3g of samples were transferred to the boiling H\(_2\)SO\(_4\) solution and allowed to continue boiling for 30 minutes. The solution was filtered through Buchner set under light vacuum. It was washed with hot water until it was acid free. The residue was transferred to hot NaOH solution in the second flask. The solution was then brought to boil and left to continue boiling for 30 minutes. The flask was shaken intermittently to subdue the frothing that occurs during boiling. The digest was also filtered through Buchner funnel where by a piece of muslin cloth was placed on the Buchner funnel and over the lining of the ashless filter paper and was snugly fitted. 10% of hot solution of K\(_2\)SO\(_4\) was added to facilitate the filtration and dilute H\(_2\)SO\(_4\) was added to reduce the time for filtration. The residue was washed repeatedly with hot water to make the residue free from NaOH and the filtrate was tested with phenolphthalein indicator. The residue was dried along with the filter paper at 100°C and was reweighed. The weight of the filter paper was subtracted to obtain weight of the residue (crude fiber and some minerals). The residue was transferred along with the paper to tared silica crucible and the content was ignited at 450-500°C in a muffle for 30 minutes. The crucible was cool in a desiccator and weighed for ash.

\[
\text{Crude fibre (dry basis)} = \frac{(\text{Residue} - \text{Ash}) \times (100 - F)}{\text{Sample}}
\]

Protein Content Determination
The crude protein of the sample was determined using modified Kjeldhal method described by AOAC, (1990) whereby 2g of the samples were transferred into a clean 250ml Kjeldah digestion flask. 2g of the catalyst mixture was added and 25ml of concentrated H\(_2\)SO\(_4\) was also added. The mixture was digested for about 5 hours when the pale-blue colour appeared. The content of the
digestion flask was transferred to 100cm³ volumetric flask and adjusted to the mark. A blank was also prepared the same way. 20cm³ of 2% boric acid was transferred into a conical flask and 4 drops of a mixed indicator were added. A 50cm³ burette was filled with 0.01M HCl. The distillation assembly was turned on but the steam trap was left opened. The condenser tip was immersed into the boric acid. 10ml of blank digest was introduced from the sample introduction cork and the funnel was rinsed with 3ml of distilled water and then 25ml of 30% NaOH was introduced. The cork was closed after rinsing with 2ml of distilled water and the steam trap was also closed. When the colour of the boric acid was changed, the condenser tip was washed with distilled water and the boric acid mixture in the flask was titrated with standard 0.01M HCl until the colour disappeared. The procedure was repeated two times with the blank and two times with the sample digests and the averages of the titers were calculated.

\[
\text{Nitrogen} = \frac{(\text{sample} - \text{blank})\times N \times \text{HCl} \times 14 \times 100 \times 100\%}{\text{Aliquot x Wt. of Sample x 1000}}
\]

\[
\text{Nitrogen} = \frac{(\text{sample} - \text{blank})\times N \times \text{HCl} \times 14 \times 100 \times 100\%}{\text{Aliquot x Wt. of Sample x 1000 x dry matter}}
\]

\[
\text{Protein} = \frac{\text{Nitrogen} \times 6.25}{\text{Wt. of Sample x dry matter}}
\]

**Determination of Carbohydrate Content**

The Carbohydrate content of the seed was determined by difference.

\[
\text{Carbohydrate} = 100 - \text{Fat} - \text{Protein} - \text{Ash}
\]

**Mineral Analysis**

**Preparation of Sample Solution**

0.5g of the ashed sample was weighed and placed inside 100cm³ volumetric flask. 1ml of concentrated HNO₃ was added to the sample and the solution was made up to 100ml mark with distilled water. 1ml of the above solution was placed inside 100cm³ volumetric flask and made to the mark with distilled water and was used as the stock sample solution for minerals analysis.

**Elemental Determination**

Three elements; sodium, potassium and calcium were determined using a flame photometer model, PFP7/REV/10-08. The preparation of standard solutions for elemental analysis was done using the method of Association of Official Analytical Chemists (AOAC) (1999).

**Results and Discussion**

The study was carried out in order to determine the nutritional value and some mineral content of baobab seed. The proximate composition was determined in percentage and the results presented on Table 1. The results for minerals analysis is presented on Table 2 as milligram of element per gram of dry sample.

**Table 1: Nutritional Composition of Baobab Seed**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>5.37%</td>
</tr>
<tr>
<td>Ash</td>
<td>7.36%</td>
</tr>
<tr>
<td>Fat</td>
<td>24.72%</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>7.89%</td>
</tr>
<tr>
<td>Crude protein</td>
<td>20.13%</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>39.90%</td>
</tr>
<tr>
<td>Energy</td>
<td>462.60</td>
</tr>
<tr>
<td>Calories/100g</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2: Mineral Composition of the baobab Seed**

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Concentration (mg/100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>260</td>
</tr>
<tr>
<td>Potassium</td>
<td>2,500</td>
</tr>
<tr>
<td>Calcium</td>
<td>1.2</td>
</tr>
</tbody>
</table>

The results of the proximate analysis show that the seed contains 20.13, 7.36 and 7.89% of protein, ash and fiber respectively. These values are similar to that of *P. africana* and *P. filicoidea* which are most commonly used for preparation of Hausawa Daddawa cake. (Eka and Isbell, 1984; Barminas et al, 1998). The Crude Fat, 24.72% is within the range obtained by Osman (2004) and Ajayi et al (2006) which are 12.25 and 33.00% respectively for the same plant. The crude fiber obtained is lower than that obtained by Lockett et al (2000) and higher than the result obtained by Nkafamiya et al (2007) which are 49.72% and 6.71% respectively. The protein content was found to be 20.13% which is much lower than 36.60% as determined by Ajayi et al (2006) and Murray et al (2001) respectively. The Carbohydrate content of the seed was found to be 39.90% which falls within the range obtained by Murray et al (2001) and Proll et al (1998) which are 11.2% and 56.75% respectively. This
shows that the carbohydrate in the baobab seed do not vary much with variation in geographical location. The total moisture content of the seed however was determined to be 5.37% which can be compared with 5.02% and 4.80% as obtained by Ajayi et al (2006) and Murray et al (2001) respectively. The ash content 7.36% can be compared with the results obtained by Ajayi et al (2006) which are 7.50% and 7.61% respectively. This is an indication that the mineral content of baobab seeds may be the same when grown in different soil and different climate. The results of the mineral analysis show that the baobab seeds contain 260, 2500 and 1.2 mg/100g of Sodium, Potassium and Calcium respectively. This shows that the seed contain high Potassium and therefore the seed can be used to supplement the intake of Potassium in the body. Potassium prevents hyperacidity in the stomach. It is also necessary for the contraction of the muscles and to keep the heart beat normal. Potassium also helps hormone secretion and aids in the kidneys detoxification of blood. The concentration of Calcium (1.2mg/ 100g) in the sample is very low compared to that obtained by Osman (2004) but the result is within the range obtained by Obizoba and Amaechi (1993).

Conclusion
In conclusion, the Proximate and Mineral Composition of the seeds of Adansonia digitata, indicates that it could be served as an alternative source of human food and could find immediate utility in mixed animal feed. The seed contain high percentage of protein and could be used as protein supplement when mixed with low protein foods such as cereals grains for both animals and human. The seeds could also serve as a good source of carbohydrate for human and all classes of livestock since it is found to contain a high percentage of carbohydrate. The energy content of this seed is high and it could be used to supplement the daily energy intake for human, livestock and birds.

References


