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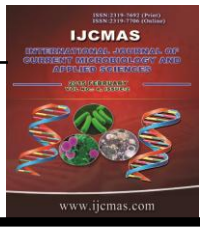

Original Research Article

Preliminary evaluation of the ecology, economic importance and nutritional potentials of *Pachira glabra* (Pasq.); a neglected fruit tree in Nigeria

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Keywords

Pachira glabra, Ecological attributes, Economic importance, Nutritional potentials

A B S T R A C T

Pachira glabra, a neglected fruit tree in Nigeria was investigated for it ecological attributes, economic importance and nutritional potentials. For the study, fruits were randomly collected from three mother trees in a location in Ibadan where the tree is a component of landscaped environment. The fruits were kept in moist bags and transported to the Central Teaching and Research Laboratory of Bells University of Technology, Ota for physico-chemical properties as well as for proximate analysis. The result of the proximate analysis on dry matter basis revealed moisture content of (8.17%), protein (7.67 %), ether extract (10.02 %), ash (7.17 %), carbohydrate (75.15), metabolizable energy (75.15 kcal/100g) while mineral constituents consisted of Iron (Fe) 128.71 mg/kg, Cu (15.98 mg/kg), Mg (600.08 mg/kg), Zn (25.88 mg/kg), and Pb (1.35 mg/kg) however Cd was not detected. The observed mineral levels and types were within the standards of dietary intakes. The seed of the plant as a traditional potential to improve both human and livestock nutrition, boost food security, promote rural development as well as play significant role in poverty alleviation The need for further research and awareness on the fruit tree potentials are implicated in the present study.

Introduction

Pachira glabra, (Pasq.,) *synonyms Bombax glabrum, Bombacopsis glabra and Bombax glabra* belongs to the family Bombacaceae (Ogunlade *et al*., 2011). It is commonly known as French peanut but often referred to Guinea peanut, money tree, lucky tree in the Anglophone countries of its range. *P. glabra* was believed to originate from Brazil but had extended sporadically to almost all parts of the tropics and subtropics while in the temperate regions it is a component urban forestry. The genus *Pachira* has 24 species, three of which have edible seeds: *Pachira glabra*, *P. aquatica* and *P. insignis. Pachira aquatica* (Guiana chestnut, Malabar chestnut, provision tree, or sabanut) (Ogunlade *et al*., 2011). It is a medium sized tree from (9-18 m) tall. The trunk is smooth and greenish gray, and often swollen at the base. The alternate leaves are 15-28 cm in

length and compound, with 5-9 leaflets. The large and showy flowers are perfect and terminal, with a long peduncle. The petals and numerous stamens are white. The fruit is a smooth, green capsule, 4-8 inches (10-20 cm), it splits open naturally on longitudinal sutures when ripe. The seeds are rounded but irregular, with about 10-25 seeds per fruit. They are about 1 inch (2.5 cm) in diameter, with a light brown testa (Montoso Gardens, 2007)

Ecology

Pachira glabra is pan-tropical, growing naturally along rivers and other bodies of water. It is well adapted to different soil types, grows well in full sun or partial shade, and is resistant to both drought and flooding. The attractive trees are easily grown in pots, and are cultured in bonsai form as "lucky trees" or "money trees". In urban forestry it planted as a shade tree in public places and in hotels landscape (Ogunlade *et al*., 2011)

Propagation

Available information indicates that deliberate cultivation had remained very low across it ranges in both tropics and subtropics because of limited information on its nutritional values as well as silvicultural requirements. However in Puerto Rico where it is frequently cultivated it is propagated from seeds, cuttings or by air layering (Montoso Gardens, 2007). The seed germinates readily quickly and is fast growing. Flowering and fruiting occur throughout the year, but principally from June to November. Trees begin to fruit at about 4-5 years, after planting, and a mature tree produces 50-80 fruits per year (Ogunlade *et al*., 2011). The fruit is dark brown and tomentose, about 8-12 inches (20-30 cm) long. Seeds are angular and large, about 1.5-2 inches (4-5 cm) long (Plate 1)

Economic importance

The seeds are d*eli*cious; it could be eating raw, boiled, fried or roasted. The flavor is similar to peanut. Roasted seeds can also be ground to make a hot drink similar to hot chocolate. Young leaves and flowers are also edible. The seeds contain 16% protein and 40-50% fat. The bark is used to treat stomach problems and headaches, and is taken to "fortify the blood" (Montoso Gardens, 2007, (Ogunlade *et al*., 2011

Study justification

P. glabra though frequently found in both tropics and subtropics with its various economic importance, limited information however exits on the nutritional characteristics especially in Nigeria where vegetable protein intakes still remains very low. The limited nutritional information is perhaps responsible for its limited cultivation as well as inclusion in various dietary formulations either in human or in livestock feed industries. Research investigation on its food values and potentials recent in literatures (Ogunlade *et al*., 2011).

In most locations where they are found in Nigeria they exist as a component aesthetics (ornamentals) and in most cases the fruits are rarely harvested for any economic purpose possibly due to lack of information on utilization potentials. One area to add value to the fruits utilization is the initial evaluation of the nutritional constituents of the fruit so as harness its full economic potentials. The present study was hence carried out to further characterize the nutritional potentials of the fruits therefore adding values on its utility and possibly this will promote its inclusion in both human nutrition and livestock feeds in various industries in Nigeria

Materials and Methods

Several mature fruits of *P. glabra* were harvested by hand from three fruiting mother trees in front of a Hotel in Ibadan (07^0 24'N, 3^0 54'E). The fruits were immediately kept in moist paper bags and subsequently taken to the Central Teaching and Research and Laboratory of Bells University of Technology Ota, for various physico-chemical properties and for proximate and some mineral analysis.

Samples preparation

The pods of *P. glabra* were decorticated and the seeds collected. The seeds were mashed with mortar and pestle and dried at 105^0C till constant weight. The representative samples selected were used for the analysis of the following parameters.

Proximate and Mineral analysis

Determination of protein content

The crude protein was determined using micro Kjedhal method as described by AOAC (2000). Approximately 1g of the sample was weighed into the digestion tube of Kjeltec 2200 FOSS Tector Digestion unit (Foss Tecator Analytical AB Hoganas, Sweden). Two tablets of catalyst (containing 5g of K_2SO_4 and 5mg of Se) were added and also 12ml of concentrated H_2SO_4 added. Digestion was done for one hour at 420^0C.

The distillation was done using 2200 FOSS distillation unit with addition of 80mls of water, 40mls NaOH (40%). The distillate was collected in 4% Boric acid prepared with bromocresol green and melthyl red indicators. The distillate was titrated with 0.1 M HCl..

Nitrogen

$$(\%) = \frac{(\text{Titre} - \text{Blank}) \times 14.007 \times 0.1 \times 100}{1000 \times \text{sample weight(mg)}}$$

Crude Protein, % = %N multiplied by 6.25

Determination of ether extract

The fat contents were determined using the method described by AOAC (2000). The principle of Soxhlet fat extraction method was used but with a modern fat extractor with automated control unit (Foss Soxtec 2055, Foss Tecator Analytical AB Hoganas, Sweden). The equipment has the advantage of analyzing the fat contents of six samples in 1hr: 15min compared to the conventional Soxhlet which takes up to 8hrs.The equipment has six extraction units with each unit having thimble for loading the samples and aluminum cups where the extracted fat are collected. The differences in the weight of the pre-weighed cups and after extraction were estimated as the percentage of fat in the samples. One gram of the samples was weighed into the thimble and the mouth of the thimble plugged with defatted cotton wool, and inserted into the extraction unit.

The extraction cups were cleaned, dried, weighed and 80ml of petroleum ether were measured into each cups and the heating temperature adjusted to 135°C which is the extraction temperature for fat using petroleum ether as stated in the manual. The cups were set into the Soxtec unit with each cup aligning with its respective thimble.

There are three stages involved; the boiling/extraction, rinsing and the drying. The extraction stage was for 30minutes in 'boiling' position and 30minutess in 'rinsing' position after which it was aerated for 15 minutes. The cups were removed, cooled in desiccators and weighed. Equation 8 was used for the calculation of crude fat.

Fat,

$$(\%) = \frac{W3 - W2}{W1} x100$$

Weight of the cup with the extracted oil = W_3

Weight of the empty cup = W_2

Weight of sample =W_1

Determination of ash content

The ash content was determined using the method described by AOAC (2000). Crucibles were washed and dried in the laboratory hot air oven (Surgifriend Medicals, England. SM9053) maintained at 105^0C for 30 minutes. It was allowed to cool in desiccators and weighed. 2.5 g of the samples were then weighed into the crucible and charred on a heater inside a fume cupboard to drive off most of the smoke. The samples were transferred into a pre-heated muffle furnace (Surgifriend Medicals, England. SM9080) maintained at 550^0C until a light grey ash was observed. The crucibles were transferred directly into a dessiccator, cooled and weighed immediately. The ash content was calculated using equation 9.

Ash content (%) =

$$\frac{(\text{weight of crucible+ash}) - (\text{weight of empty crucible}}{\text{weight of sample}} \quad x \quad 100$$

Determination of mineral element

Mineral analysis (Fe, Mg, Cu, Zn, Pb and Ca) were determined using Atomic Absorption Spectrophotometer (Foss 210). One gram of samples was ashed in muffle furnace at 550ºC for 6h. The ashed samples were dissolved in 0.1M H2SO4 and filtered into 100 ml volumetric flask and filled to the mark with deionised. De-ionised water was used as a blank to zero the equipment for the analysis. Atomic Absorption Spectrophotometer Buck Scientific Model 210A with air/acetylene was used for the analysis of metals. Standards for each element under investigation was prepared in part per million (ppm) and the limit standard concentration for each element was adhered to according to the BUCK Scientific instruction. The standard solutions were aspirated and the graph obtained. The samples concentrations of various metals were read and calculated using equation 13.

Specific mineral (i.e Zn, Fe) ppm

$$= \frac{\text{Machine reading(ppm)}}{\text{Weight of sample}} x \text{ dilution factor}(100)$$

Result and Discussion

The results of proximate and mineral composition of *Pachira glabra* were presented in Tables 1 and 2 respectively.

The results of proximate and mineral composition (dry basis) of *P. glabra* were as shown in Tables 1 and 2 respectively. The protein content observed for *P. glabra* seed was relatively lower compared to the findings of Ogunlade *et al*. (2011) in which 10.38 % was recorded while the same trend was also recorded for crude fat value (15.29 %) compared with 10.02 % ether extract revealed in this experiment. The ash content was high, an indication of high mineral contents. The present findings have shown that several million people, particularly in the developing countries may relatively derive their protein and calorie (11.1g and 342 kcal/day) requirement from *P. glabra* (Gopalan *et al*., 1997). The values obtained in this study differed slightly from the work of study on chemical composition of maize

in Industrial area of Ogun State (Malomo *et al*., 2012).

The result observed for the mineral and ash concentrations showed that *P. glabra* is rich in several essential minerals; Fe, Cu, Mg, and Zn, while Lead (Pb) and Cadmium (Cd) observed were heavy metals. The concentration of copper in the seed was below the recommended safe limit of WHO/FAO, Codex alimentary commission (1984) of 40.00 mg/kg and maximum safe level given by Standard Organization of Nigeria (SON) (20mg/kg). The Recommended Dietary Allowance (RDA) for copper is given as between 0.9-2.0 (Alasalvar *et al*., 2009). Zinc is a ubiquitous essential trace element necessary for normal growth of animals and is present in a host enzyme in the human body and foods vary in their Zinc content.

The result also showed that the seed is a good source of Zn and is capable of supplying the Recommended Dietary Allowance for Zn which is put at 11 mg. Nkansah and Amoako (2010) reported 100 mg/kg as WHO limit for spices. Unsafe levels of Zn can lead to respiratory system damage, stress and inhibition of normal growth and maturation (Weatherley *et al*., 1988). Iron concentration was high above safety limit coated by Nkansah and Amoako (2010) (300mg/kg). The Recommended Dietary Allowance for Fe is in the range of 8-15 mg. The recommended micronutrient fortification guidelines for iron in cereal range between 40.7- 34.6 mg/kg (Ogunmoyela *et al*., 2013). From the present study *P. glabra* could be utilized in enriching flour deficient in iron. Excess Fe is toxic and has been reported to inhibit the absorption of Zn (Malomo *et al*., 2012). The magnesium concentration was also high and adequate to supply daily requirement in diets.

The lead accumulation in the seed was found to be low and almost fall within the limits of WHO/FAO (1984), 5ppm but exceeded the maximum limit of 1ppm recommended by Standard Organisation of Nigeria (SON). Lead has also been known not to be essential in normal functioning in human and is a known metal that damages the liver, kidneys, brain, central nervous and reproductive systems of man (Lovei and Ley, 2000). According to the Agency for Toxic Substances and Disease Registry (USA), it has been identified that fruits and grains are major mean of exposure of lead to the general populace (McNamara, 2008). Cadmium was not detected; however, presence of heavy metals could possibly be due to environmental and soil factors.

From the present investigation *P. glabra* is a traditional seed plant reputable for its high nutrient diversities based on proximate analysis as well as containing several mineral elements. The nutritional potentials observed for the species provides additional research information capable of being exploited in human and livestock diets formulation. The species traditionally exhibits potential to improve nutrition, boost food security, alleviate rural poverty and promotes rural development as well as income diversity to farmers involve in its cultivation. The need for further research and development studies are implicated in the study

Table.1 Proximate composition *of P. glabra* seeds

Parameters	Values
Moisture, %	8.17±0.56
Protein, %(db)	7.67±0.82
Carbohydrate, %	75.15±2.7
Ether extract, %	10.02±1.06
Ash content, %	7.17±0.71
Metabolizable energy, kcal/100g	42.34±1.03kcal/100g

Table.2 Mineral contents of *P. glabra*

Parameters	Average values
Fe, ppm	128.71±8.34
Cu,ppm	15.98±4.31
Mg,ppm	600.08±2.94
Zn, ppm	25.88±o.97
Cd,ppm	ND
Pb, 100	1.35±0.26

Plate.1 Mature *Pachira glabra* fruit split open with seeds and the leaves

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