



## Proximate and Phytochemical Constituents of *Parkia biglobosa* (Jacq.) Fruit

<sup>1</sup>Karaye I. U., <sup>4</sup>Ladan, M.U., <sup>3</sup>Shehu A., <sup>3</sup>Adili I. S., <sup>3</sup>Lawal, H. M., and <sup>1</sup>Abdulqadir, H.

<sup>1</sup>Department of Biological Sciences, Usmanu Danfodiyo University, Sokoto-Nigeria

<sup>2</sup>Department of Biological Sciences, Usmanu Danfodiyo University, Sokoto-Nigeria

<sup>3</sup>Department of Biology, Shehu Shagari College of Education, Sokoto-Nigeria

<sup>4</sup>Department of Biological Sciences, Federal University Gusau, Gusau-Nigeria

### ABSTRACT

The most logical approach towards the improvement and efficient use of indigenous fruits to supply nutritional requirement for human diet is through the investigation of their nutritional values. This study was carried out to investigate the nutritional value of African locust bean (*Parkia biglobosa*) powdered fruit pulp and seeds purchased at Sokoto central market, Sokoto State Nigeria. The seeds and fruit pulp were analyzed for proximate, Phytochemical, antinutritional and mineral contents. Results of the qualitative phytochemical analysis showed the presence of saponin, glycosides, flavonoid, steroids, volatile oils and cardiac glycosides in both extracts. Result of the proximate analysis showed protein with the highest percentage dry weight (62.56%) followed by crude lipid (23.59%), moisture (9.33%), ash (2.33%) and carbohydrate (2.19) in seeds of *P. biglobosa*. Carbohydrate had the highest percentage (69.9%) followed by moisture (16.33%), Crude protein (6.56%), crude lipid (3.81%) and then ash (3.33%) in the analyzed fruit pulp, thus indicating that locust bean fruit pulp had higher Carbohydrate content, thus a better source of energy. Result of mineral test indicated both the seeds and fruit pulp were rich sources of Potassium 2850 mg/kg and 750 mg/kg respectively followed by sodium with 142.50 mg/kg and 62.50 mg/kg respectively. Results of antinutritional test showed that the seeds contained Nitrate (18.71 mg/dl), Tannin (9.18 mg/dl) and Cyanide (6.51 mg/dl) while the analyzed Fruit pulp contains Nitrate (22.65 mg/dl), Tannin (17.10 mg/dl) and Cyanides (7.13 mg/dl), indicating higher amounts of Nitrates, Tannin and Cyanides in the pulp compared to the analyzed seeds. Taking into considerations the Crude Protein, Crude lipid, Carbohydrate as well as the Mineral composition of both the seeds and fruit pulp of the analyzed samples, it could be suggested that harnessing the plant's products in our diet preparations could enhance nutrition especially in the wake of high cost of normal food materials and could also reduce malnutrition especially amongst low income earners.

**Keywords:** *Parkia biglobosa*, Fruit pulp, Seed, Minerals, Anti-nutritional, Phytochemical

### INTRODUCTION

*Parkia biglobosa* (Jacq.) is a perennial tropical plant that belongs to the family Leguminosae (Order Fabaceae) and the subfamily Mimosoideae. *Parkia biglobosa* also known as "Dorowa" in Hausa, "African Locust Beans" in English (Udobi and Onaolapo, 2009), is a native of Africa and important multipurpose tree of West African Savannah land that grows up to about 10-15m in height. It has a rounded or umbrella shaped spreading crown, and a drooping leaf without spines. The thick bark is grey with a scaly texture, and has an orange coloured slash. The dark green leaves are alternate, bi-pinnate and 20-40 cm in length, with 8-30 pairs of alternate pinnae, and 14-65 pairs of leaflets per pinnate. They are 4-5 cm in diameter, and composed of 1500-2000 flowers. The tree is thought to be able to grow as old as 250 years. The locust bean fruit is a slightly curved indehiscent pod of 30-40 cm long and 2-3 cm wide. Each pod contains up to 20 seeds, which are embedded in a sweet, yellow, floury pulp (Salim *et al.*, 2002).

Dawadawa is a typical condiment for flavouring of meals such as stew, and soup made from soybean by the Hausa tribe in Nigeria that is similar to fermented locust beans (*Parkia biglobosa*). These nutrients are essential for the physiological functions of human body. Such nutrients like carbohydrates, fats and proteins play an important role in satisfying human needs for energy and other life

processes (Latif *et al.*, 2003). The African locust bean (*Parkia biglobosa*) is medicinal plant used by marginal communities either in the form of extract or decoction to cure various diseases (Adnan and Holscher, 2010; Trease and Evans, 1989). There is the need for more plentiful output on nutrients composition of any potential plant materials with the view to unravelling the nutrients composition available in the plants such as *Parkia biglobosa*. This is to provide succour to problem of food scarcity being faced by sizeable segment of the teeming populace especially the rural dwellers. This study evaluated the proximate, minerals and phytochemical composition of the seeds and fruit pulp of *Parkia biglobosa* (Jacq.).

### MATERIALS AND METHODS

*Parkia biglobosa* seeds and powdered fruit pulp were purchased from retailers in Sokoto central market, Sokoto state. The seeds were dehulled manually and blended into fine powder, the powdered fruit pulp was sieved into fine powder using 0.2 um sieve. Both powdered plant materials were labelled and stored in an air tight container for laboratory analysis. The extracts were evaluated qualitatively for the presence of phytochemicals tests for saponin, tannins, alkaloids, glycosides, cardiac glycosides, balsams, steroids anthraquinone and test for volatile oil were all

\*Corresponding author. E-mail: inaguraguri@gmail.com

Author(s) agree that this article remain permanently open access under the terms of the Creative Commons Attribution License 4.0 International license

determined in accordance with the methods of Amin *et al.* (2013); Trease and Evans, 1989; Harbone (1998). Proximate analysis carried out of seeds and fruit pulp of *P. biglobosa* in the current study was carried out using the methods of the AOAC (2000). Analyses of crude proteins, crude lipid, percentage moisture and ash, crude fibre, as well as crude carbohydrate were determined in accordance with the standard protocols of AOAC (2000). The minerals analyzed were phosphorus, calcium, magnesium, calcium and potassium were determined using the protocols of AOAC (1995) and AOAC (2000). The presence of antinutritional factors namely; oxalate, phytate, nitrate, tannin and cyanide were detected quantitatively using standard biochemical methods as described by Bhargam *et al.* (2012). Treatments were replicated three times and the data obtained has been presented as means  $\pm$  S.D. of the means. Results obtained were subjected to one way Analysis of Variance (ANOVA). Same superscripts means there was no significant difference ( $P \leq 0.05$ ) and where the

superscripts differ, it means that there was a significant difference ( $P \leq 0.05$ ).

## RESULTS AND DISCUSSION

Phytochemical screening on seeds and fruit pulp and of *P. biglobosa* extracts revealed the presence of various secondary metabolites as shown in Table 1. From the results, saponin were identified to be present in the seeds but in trace in the fruit pulp. Alkaloids were equally identified to be present in the seeds but never detected in fruit pulp while volatile oils were detected to be more in the seeds than in the fruit pulp. A good number of antinutritional compositions such as balsams and anthraquinone were not detected in both the seeds and the fruit pulp. Table 1 shows the presence of saponin, glycosides, flavonoid, steroid, volatile oils and cardiac glycosides in both extracts with tannin and saponin glycoside only present in the fruit pulp and alkaloids only in the seeds. This result was in agreement with results reported by Gernah *et al.* (2015).

**Table 1:** Qualitative Phytochemical Constituents of *Parkia biglobosa* seeds and fruit pulp

Parameters	Seed	Fruit Pulp
Alkaloid	++	N.D
Glycosides	+	+
Cardiac glycoside	+	++
Saponin glycoside	N.D	+
Tannins	N.D	+
Saponin	+++	+
Flavonoid	+	++
Steroid	+	++
Balsam	N.D	N.D
Anthraquinones	N.D	N.D
Volatile Oils	++	+

**KEYS:** + = Trace or small amount, ++ = Moderate amount, +++ = large or high amount, N.D = Not detected

Results on proximate Composition of the seed and fruit pulp of *P. biglobosa* have been presented in Table 2. From the Table, moisture composition of the seeds and fruit pulp of *Parkia biglobosa* ranged from  $9.33 \pm 0.58$  and  $16.33 \pm 0.57$  for both the seeds and fruit pulp respectively. Ash content of the seeds was  $2.33 \pm 0.58$  while it was  $3.33 \pm 0.57$ . Crude fibre was however,  $1.67 \pm 0.58$  and  $2.67 \pm 0.78$  for both the seeds and fruit pulp. Similarly, an appreciable amount of crude protein obtained in the study was  $62.56 \pm 0.22$  and  $6.56 \pm 0.21$  for the seeds and fruit pulp respectively. More so, crude carbohydrates ranged from  $21.19 \pm 0.41$  to  $69.97 \pm 0.32$  in both the seeds and fruit pulp respectively. Crude lipid obtained from the study was  $23.59 \pm 1.21$  and  $3.81 \pm 0.45$  for both the seeds and fruit pulp. Finally, available energy in kilo calorie obtained was  $339.31 \pm 1.21$  and  $711.21 \pm 2.67$  for the seeds and fruit pulp respectively. Result of the proximate analysis in Table 2 shows that protein has the highest percentage (62.56%) followed by crude lipid (23.59%), moisture (9.33%), ash (2.33%) and then Carbohydrate (2.19) in the analyzed seeds of *P. biglobosa* and carbohydrate had the highest percentage (69.97%) followed by moisture (16.33%), Crude protein (6.56%), crude lipid (3.81%) and then ash (3.33%) in the analyzed fruit pulp. Carbohydrate content of the fruit pulp was found to be 69.97%, which is slightly higher than 66.39% by Gernah *et al.* (2007) and is in agreement with the findings of Aja *et al.* (2015).

Generally, there was a significant difference ( $p \leq 0.05$ ) in the compositions of crude lipid, crude carbohydrate, crude proteins and available energy (in K/Cal.) between the seeds and the fruit pulp. This indicates that *P. biglobosa* fruit pulp is a good source of energy compared to the seeds due to high content of Carbohydrate in the fruit pulp. With this content of carbohydrate, the African locust bean fruit pulp is a potential source of energy given the recommended daily energy intake. Crude fibre was found of the fruit pulp was found to be 2.67%, which is much lower than that ( $7.7 \pm 0.18$ ) and  $5.51 \pm 0.64$ ) as reported by Obasi *et al.* (2012). The proximate values of the seeds were; 9.33% Moisture, 2.33% Ash, 1.67% crude fibre, 62.56% Crude protein mg/dl, 2.19% Carbohydrate and 23.59% Crude lipid. This is not in agreement with the values reported as 30% by Lucas *et al.* (1989), with 4.81% Moisture, 4.81% Ash, and 4.66% crude fibre, 33.50% Crude protein and 49.2% Crude lipid. Also, reported range of protein from the seed of 32.74-34.64% for *Lagenaria siceraria* by Mercy *et al.* (2015). Less carbohydrates and proteins were reported by Uzuazokaro *et al.* (2018) on *Cucumis sativus*, as well as the report of Stanley *et al.* (2020), who reported lower protein contents of 37.50% on *Citrullus lanatus*. Such differences could be attributed to species variability.

**Table 2:** Proximate Composition of *P. biglobosa* seeds and fruit pulp. Percentage (%) dry weight.

Nutritional Composition	Seed (%)	Fruit Pulp (%)
Moisture	9.33 ± 0.58 <sup>a</sup>	16.33 ± 0.57 <sup>b</sup>
Ash	2.33 ± 0.58 <sup>a</sup>	3.33 ± 0.58 <sup>a</sup>
Crude Fibre	1.67 ± 0.58 <sup>a</sup>	2.67 ± 0.78 <sup>a</sup>
Crude Protein	62.56 ± 2.22 <sup>a</sup>	6.56 ± 0.21 <sup>b</sup>
Carbohydrate	21.19 ± 1.41 <sup>a</sup>	69.97 ± 0.32 <sup>b</sup>
Crude Lipid	23.59 ± 1.24 <sup>a</sup>	3.81 ± 0.45 <sup>b</sup>
Available Energy k/cal.	339.31 ± 1.13 <sup>a</sup>	711.21 ± 2.67 <sup>b</sup>

Results are presented as means ± Standard Deviation (means of three replications). \*indicates significant difference in means at  $p \leq 0.05$ .

Results of mineral constituents in *P. biglobosa* Seeds and Fruit pulp have been shown in Table 3. As could be seen, high amounts of potassium has been identified in the seeds and fruit pulp of *P. biglobosa* studied with 2850.00±7.37 in the seeds while relatively high amounts were identified in the fruit pulp with 750.00±8.85 with significant difference ( $p \leq 0.05$ ) between the samples species. More so, the samples analyzed were rich in sodium with 142.50±7.37 62.50±1.73 with significant difference ( $p \leq 0.05$ ) between the samples species. Other valuable elements identified in the samples (phosphorus) were moderately present while magnesium and calcium

were identified in minute quantities. Table 3 indicates both the seeds and fruit pulp are great sources of Potassium 2850 mg/kg and 750 mg/kg respectively followed by sodium with 142.50 mg/kg and 62.50 mg/kg respectively, with magnesium and calcium present in trace quantities (0.5 mg/dl and 0.35 mg/dl for seeds and 0.65 mg/dl and 0.35 mg/dl for the fruit pulp respectively). Significant difference ( $p \leq 0.05$ ) in the contents of potassium and sodium was observed. However, there was no significant difference ( $p \leq 0.05$ ) in the contents of phosphorus, magnesium and calcium between the seeds and the fruit pulp.

**Table 3:** Mineral Constituents of *P. biglobosa* seeds and fruit pulp.

Minerals	Seeds (mg/kg)	Fruit Pulp (mg/kg)
Potassium	2850.00 ± 7.37 <sup>a</sup>	750.00 ± 8.35 <sup>b</sup>
Sodium	142.50 ± 3.61 <sup>a</sup>	62.50 ± 1.73 <sup>b</sup>
Phosphorus	2.39 ± 0.35 <sup>a</sup>	2.81 ± 0.17 <sup>a</sup>
Magnesium	0.50 ± 0.1 <sup>a</sup>	0.65 ± 0.05 <sup>a</sup>
Calcium	0.35 ± 0.05 <sup>a</sup>	0.35 ± 0.05 <sup>a</sup>

Results are presented as means ± Standard Deviation (means of three replications). Different superscripts indicate significant difference at  $p \leq 0.05$ .

Antinutritional factors present in the seeds and fruit pulp of *P. biglobosa* analyzed have been shown in Table 4. From the results obtained, high amounts of nitrates were found to be present in the samples with 18.71±0.43<sup>a</sup> and 22.65±0.45<sup>b</sup> with significant difference ( $p \leq 0.05$ ) between the species. Other antinutrient components identified to be in appreciable quantities in the samples include tannins, phytate and cyanide while oxalate was found in both the seeds and fruit pulp in trace. Table 4 indicates that the fruit pulp contained higher amounts of nitrate (22.65 mg/dl), tannin (17.10 mg/dl) and cyanides (7.13 mg/dl) compared to seeds (having nitrate, tannin and cyanide of 18.71, 9.18 and 6.51 mg/dl respectively). There was significant difference ( $p \leq 0.05$ ) only in the amount of phytate.

Results of anti-nutritional factors have been shown in Table 4. Phytate content was found to be 5.49 mg/dl and 1.27 mg/dl for the seeds and fruit pulp respectively, lower than 858.95±13.14 and 242.91±8.62 as reported by Karaye *et al.* (2020) for the seeds and fruit pulp of desert date (*Balanites aegyptiaca* L.) respectively. Tannin content was found to be 9.18 mg/dl and 17.10 mg/dl, and much lower than the everyday consumed legumes like lima beans (140.00 mg/100 g) and pigeon pea (100.00 mg/100 g). Nitrates were also found to be 18.71 mg/dl and 22.65 mg/dl, which is lower than 12,160.00 mg/100 g for lima beans as reported by Aja *et al.* (2015) and could be considered to be acceptable and safe.

**Table 4:** Antinutritional Composition of *P. biglobosa* Seeds and Fruit pulp.

Parameters	Seeds (mg/dl)	Fruit Pulp (mg/dl)
Nitrate	18.71 ± 0.43 <sup>a</sup>	22.65 ± 0.45 <sup>a</sup>
Tannin	9.18 ± 0.07 <sup>a</sup>	17.10 ± 0.18 <sup>a</sup>
Phytate	5.49 ± 2.42 <sup>a</sup>	1.27 ± 0.42 <sup>b</sup>
Cyanide	6.51 ± 0.21 <sup>a</sup>	7.13 ± 0.23 <sup>a</sup>
Oxalate	0.54 ± 0.09 <sup>a</sup>	0.09 ± 0.20 <sup>a</sup>

Results are presented as means ± SD (means of three replications). Different superscripts indicate significant difference in means at  $p \leq 0.05$ .

## CONCLUSION

This work has shown that both the African locust bean seeds and fruit pulp are a potentially good source of food which can compete favourably with most cereals and legumes. The chemical composition indicates that it is a good source of macro and micro-nutrients that if exploited could help the low income earners immensely. Thus, exploring the sampled plant parts could help greatly towards fighting malnutrition and hunger among the teeming populace.

## REFERENCES

- Adnan, M. and Holscher, D. (2010). Medicinal plant abundance on degraded and reforested sites in Northwest Pakistan. *Journal of Material Research and Development*, **1**:09-17.
- Aja, P.M., Offor, C.E. and Orji, O.U. (2015). Proximate and Antinutrient Compositions of *Parkia biglobosa* Fruits in Abakaliki, Ebonyi state, Nigeria. *International Journal of Current Microbiology and Applied Sciences*, **4**(2): 394-398.
- Amin, M., M., Jawwhney, S.S. and Jassal, M.M.S. (2013). Quantitative and qualitative phytochemicals of *Taraxacum officinale*, *Journal of Pharmacy and Pharmacology*, **2**(1):3-
- AOAC (1980). *Official Methods of Analysis*, 13th Edition. Association of Official Analytical Chemist, Washington D.C. USA.
- AOAC (1995). *Official Methods of Analysis of AOAC International*, 16th edition. Association of Official Analytical Chemist, Washington D.C. USA.
- AOAC (2000). *Official Methods of Analysis of AOAC International* 17th edition; Gaithersburg, MD, USA Association of Analytical Chemists.
- Bhargava S., Dhabbai K., Batra A., Sharma A. and Malhotra, B. (2012). *Zingiber officinale*: Chemical and Phytochemical Screening and Evaluation of its Antimicrobial activities. *Journal of Chemistry Pharmaceutical Research*, **4**(1):360-354.
- Gernah, D. I., Atolagbe, M.O. and Echegwo, C.C. (2007). Nutritional composition of the African locust bean (*Parkia biglobosa*) fruit pulp. *Nigerian Food Journal*, **25** (1): 190-196.
- Harbone, J. B. (1998). *Phytochemical Methods a Guide to Modern Techniques of Plant Analysis*. 3rd Edition, Chapman and Hall Limited, London, UK. ISBN-13: 9780412572708, pp: 302-305.
- Karaye, I.U., Ladan, M.U., Adili, I.S., Shehu, A. Lawal H. M. and Sahabi, M. H. (2020). Photochemistry and Proximate Composition of Fruit pulp and Seeds of Desert date (*Balanites aegyptiaca* Del.). *International Journal of Science for Global Sustainability*, **6** (2):109-117.
- Latif, A. Ahmad, H. Begum, S. Adnan, M. Hussian, S. and Waseem, M. (2003). *Medicinal and Other Economic Plants as Substitute to Forest Logging in Miandam and Sulatanr valleys*, Swat. Proceedings of International Workshop on Conservation and Sustainable use of Medicinal and Aromatic Plants in Pakistan. WWF-Pak. pp: 101-105.
- Lucas, E.O. (1998). The Potential of leaf Vegetable in Nigeria. *Outlook Agronomy*, **17**; 163-168.
- Mercy, B. A., Elie, F., Clerge, T. Martin, F. and Feilicite, M.T. (2005). Nutritive value of some Cucurbitaceae oilseeds from different regions in Cameroon. *African Journal of Biotechnology*, **4** (11):1329-1334.
- Obasi, N.A., JOY, U., Ebrechukwu, E., Akubugwo, E.I. and Okorie, U.C. (2012). Proximate Composition, Extraction, Characterization and Comparative Assessment of Coconut (*Cocos nucifera*) and Melon (*Colocynthis Citrullus*) Seeds and Seed Oils. *Pakistan Journal of Biological Sciences*, **15**(1):1-9.
- Salim, A.S., Simeon, A.J., Waruhiu, A., Orwa, C and Anyanjo, C. (2002). *Agroforest tree Database: A tree species Reference and Selection guide*. Available online at <http://www.icraf.org>.
- Stanley, K. N., Kingsley, I.U., Uchehukwu, C.O. Victor, H.A.E. and Adebayo, A.O. (2020). Comparative Study on the Nutritional and Antioxidant Components of Fruit Parts of *Citrullus lanatus*. *European Journal of Nutrition Food Safety*, **12**(1): 39-51.
- Trease, G.E. and Evans, W.C. (1989). *A Textbook of Pharmacognosy*. 12th Edition, Bailliere Tindall Ltd., London, pp: 388 400.
- Udobi, C.E. and Onaolapo, J. A. (2009). Phytochemical analysis and antibacterial evaluation of the leaf stem bark and root of the African locust bean (*Parkia biglobosa*). *Journal of Medicinal Plant Research*, **3** (5): 338-344.