Variability in proximate and anti-nutrient contents of Baobab (*Adansonia digitata* L.) provenances across Nigeria

***[1]Etukudo, O. O., [1]Olajide, K., [2]Onwudiwe, N., [3]Badaru, S.T.,[4]Onwudiwe, O.E. and [5]Uwabor, S.C.**
[1]College of Agriculture, Division of Agricultural Colleges, Ahmadu Bello University, Kabba, Kogi State, Nigeria.

[2]Department of Crop Science and Management, Dennis Osadebay University, Asaba, Delta State, Nigeria

[3]Department of Crop Science, University of Nigeria, Nsukka, Enugu State, Nigeria

[4]Department of Agricultural Education, College of Education (T), Asaba, Delta State, Nigeria

[5]Department of Soil and Land Resource Management, Dennis Osadebay University, Asaba, Delta State, Nigeria
*Corresponding author's email: omololaetuk@gmail.com

ABSTRACT
Pulp and seed of baobab fruit across Nigeria were investigated for proximate and anti-nutrient contents using standard analytical procedures. The experiment was a 10 x 2 factorial in completely randomized design (CRD) with three replicates. Analysis of variance results showed significant ($P < 0.05$) main effect of accession on all the proximate traits evaluated. Egbeda exhibited highest ash value (7.625 %). Carbohydrate was more (64.555 %) in Bado. More accumulation of fat (6.900 %) was found in Igbaruku. Protein content (14.161 %) was highest in Nok accession. Crude fibre was more in Fadanka Goma. Tilden Fulani had more moisture content (17.000 %). Fruit component showed significant ($P < 0.05$) differences in all the proximate contents assayed. The seed gave higher concentrations of ash (7.193 %), fat (8.953 %) and protein (16.644 %). The pulp yielded more carbohydrate, crude fibre and moisture contents of 66.488, 9.960 and 16.490 %, respectively. All the anti-nutrient traits tested showed significant ($P < 0.05$) response to accession. Bado had the highest oxalate (1.559 mg/100g) and steroid (46.772 mg/100g). Phenol was highest (3.807 mg/100g) in Sarkin Kudu. More phytate concentration (1.249 mg/100g) was found in Fadanka Goma. Terpenoid was more deposited in Sohwa with 22.708 mg/100g. Fruit part significantly ($P < 0.05$) influenced all the anti-nutrients evaluated. Oxalate (2.479 mg/100g), phenol (5.495 mg/100g), phytate (1.862 mg/100g), steroids (54.510 mg/100g) and terpenoids (38.418 mg/100g) were higher in the pulp. The biplot graphs indicated that variability existed among the accessions with respect to proximate and anti-nutrient contents determined. The results obtained in this study could guide the utility of the crop and suggest possibility for genetic improvement.
Keywords: Baobab, accession, seed and pulp, anti-nutrient, proximate

INTRODUCTION
Food insecurity and under-nourishment remain the major challenges in many countries. Nutritional deficiencies are the cause of acute malnutrition affecting most people (Enzonga *et al.,* 2019). According to Stephenson *et al.* (2000), malnutrition is the most important cause of mortality in the global human population. FAO (2017a) noted that the world population is expected to increase from 7.8 billion in 2020 to 10 billion in 2050. This implies that food production needs to be doubled to ensure food security. Unfortunately, climate change has exacerbated the food crisis, resulting in low harvests and livestock losses (Ofori *et al.,* 2023). Indigenous fruits that contain significant levels of essential nutrients including fibre, protein and minerals could address the problem of malnutrition. Baobab could address global under-nourishment problems especially those confronting the developing countries. Owing to its nutritional potential, baobab has been recommended as a priority species for domestication and commercialization (Darr*et al.,* 2020). Baobab tree is a multi-purpose plant and every part of the plant is reported to be useful, the trees are extensively propagated in Africa (Ibrahim *et al.,* 2014; Mamman *et al.,* 2021).

Baobab (*Adansonia digitata* L.) (Malvaceae) is a large, conspicuous tree, native to semiarid regions of Africa, Asia (China and Malaysia), Australia and the Caribbean (Wasihun *et al.,* 2023). It is an indigenous tree crop known as baobab in English, *Igi Ose* in Yoruba, *Ose* in Igbo and *Kuka* in Hausa (Olajide *et al.,*2022). The tree is highly valued by rural communities of arid and hot lowlands of sub-Saharan Africa for its fruits and edible leaves. It is an important cash crop, a source of healthy human food and nutrition with medicinally and pharmaceutically important constituents (Erku, 2018; Aluko *et al.,* 2016; Kamau *et al.,* 2016; Bosch *et al.,* 2013; De Caluw´e *et al.,* 2010). Baobab can be conserved as a genetic resource while at the same time promoting nutritional and food security as well as generating income from the harvested fruits (Kehlenbeck *et al.,* 2013). Many communities use the fruits as food, and other parts for shelter, clothing, and material for hunting and fishing (Thompson *et al.,* 2024). The fruit consists of large seeds encapsulated by a translucent, dry, acidic pulp and shell. The pulp is covered by a thin skin (Njoku *et al.,* 2016). Baobab pulp is used in preparing cool drinks or sucked in rural areas while the leaves, stem, bark and roots of the plant are used in the preparation of traditional medicine (Muthai *et al.,* 2017).

The baobab is called the chemist tree because of its nutritional and medicinal benefits (Althwab *et al.,* 2019; Braca *et al.,* 2018; Aluko *et al.,* 2016). Biochemical analyses conducted on baobab revealed that the leaves, the seeds and the pulp are rich in nutrients (Diop *et al.,* 2005; Nkafamiya *et al.,* 2007). Few years ago, the European Commission authorized the import of baobab fruit pulp as a food ingredient (Buchmann *et al.,* 2010), while in 2009, it was approved by the Food and Drug Administration in the United States of America (Cicolari *et al.,* 2020). Earlier study by Osman (2004) reported 10.40 % of moisture, 3.20 % of protein,0.30 % of fat, 4.50 % of ash, 5.4 % of crude fibre and 76.20 % of carbohydrate in pulp of baobab. Dandago *et al.*(2016) found 6.35, 0.20, 2.30, 5.20, 5.63 and 72.00 % for moisture, fat, protein, ash, crude fibre and carbohydrate in baobab fruit pulp, respectively. Adenekan *et al.* (2017) reported moisture content of 7.90 %, protein of 90.9 %, carbohydrate of 0.30 %, ash of 0.2 %, fat of 6.2 % and fibre of 0.26 % in the seed of baobab. Edogbanya *et al.* (2016) reported moisture, protein, carbohydrate, ash, fat and fibre in the seed of baobab with respective values of 5.40, 14.26 42.32, 7.25 31.40 7.87 %. Babalola *et al.* (2020) reported that baobab seed contained phytochemicals and anti-nutrient factors such as alkaloids (30.00), flavonoids (56.67), steroids (15.00), tannins (133.33), saponins (45.00) and protease Inhibitors (0.83). A study by Ogunleye *et al.* (2020) on fruit of baobab showed 16.14 mg/g flavonoids, 100.00 mg/g saponins, 351.0 mg/g tannins and 70.00 mg/g alkaloids.

There were reports of previous studies on accession and fruit part. Compaoré *et al.* (2011) did not find statistical differences in proximate and elemental nutrient content of pulps of *Parkia biglobosa* and *Adansonia digitata* across geographical regions of Burkina Faso. Yang *et al*. (2006) found only minute variation in nutrient content among 10 *Moringa oleifera* accessions they evaluated due to climatic and genetic factors. On the other hand, Jongrungruanchok *et al.* (2010) reported significant variation in nutritional content of eleven Moringa provenances in Thailand as a result of environmental and genetic factors. Previous study noted that ecological provenance of baobab does not induce variability in the nutritional concentration of its parts (Assogbadjo *et al.,* 2012).Chadare *et al.* (2009) posited that composition of the soils and the provenance of the samples could be responsible for variation in chemical composition of baobab fruit.

In spite of the numerous nutritional benefits of baobab pulp and seed, the crop is still underutilized owing to poor awareness of its nutritional and medicinal potentials. Recent research interest is geared towards the full utilization of potential medicinal and nutritious plant-based products (Fernandez, 2020). Most of the nutritional analysis previously reported in the literature concentrated on either the leaves or pulp or seed and limiting the sample collection to one location. There is dearth of information on the constituents of proximate and anti-nutrient of baobab pulp and seed across Nigeria which has aided the underutilization of the fruit pulp and seed in modern diet. There is the need to assess the proximate and anti-nutrient values of the pulp and seed of baobab across Nigeria to unravel the nutritional potentials of the crop, solve the problem of malnutrition, encourage the cultivation of the crop and prevent it from going into extinction. This study focused on the chemical compositions of baobab fruit in relation to fruit parts from different locations, in order to unravel its full utilization potential for pharmaceutical and genetic improvement.

MATERIALS AND METHODS

Plant Collection, Identification and Authentication

Ten mature fruits of baobab without defects were collected randomly from different positions in the crown and put in labeled plastic bags. Fruits were collected from 10 locations (Table 1)in February 2024 and taken to the Herbarium Unit, Department of Plant Science and Biotechnology, Faculty of Biological Sciences, University of Nigeria, Nsukka, Enugu State for identification. Voucher number UNN/11802 was obtained. The total number of fruits sampled was 100 from different locations. The pulp was separated from the pods and seed manually. The pulp obtained was kept for further analysis while the seeds were sun dried for two weeks, ground, passed through a 2mm sieve and stored in air tight bags ready for further analysis. The pulp and the seed were named according to location of collection and the triplicate samples were packed in paper envelopes and transported to Crop Science Laboratory, University of Nigeria, Nsukka for proximate and anti-nutrient analysis. The study was carried out as 10 x 2 factorial experiment in completely randomized design (CRD).

Table 1: List of accessions showing States, Local Government Areas and collection centers of baobab fruits in Nigeria

S/N	State	LGA	Specific location
1	Kaduna	Jema'a	Fadanka Goma
2	Kogi	Yagba West	Igbaruku
3	Ekiti	Ikole	Irele
4	Plateau	Pankshin	Dilla
5	Kogi	Kabba/Bunu	Egbeda
6	Taraba	Ibi	Sarkin Kudu
7	Bauchi	Toro	Tilden Fulani
8	Taraba	Wukari	Sohwa
9	Kaduna	Jaba	Nok
10	Sokoto	Wamako	Bado

Proximate analysis

Proximate were analyzed as recommended by AOAC (2005). Ash was determined by weighing 2g of sample into a silica dish and placed in a muffle furnace set at 600^0C for 3hours till a white greyish matter was obtained. The amount of residual white greyish matter was obtained by difference. The crude fat content was determined by Soxhlet extraction with petroleum ether as solvent and crude fibre content by the acid and alkaline digestive methods. Five grams of the ground samples were dried to a constant weight at 600^0C in a hot air circulating oven and the moisture content was determined by calculating the difference in weight after drying. Crude protein in the samples was determined by the routine micro Kjeldahl procedure. The carbohydrate content was estimated by differences, subtracting the sum of moisture, protein, fat, crude fibre and ash percentages from one hundred.

Determination of phytochemicals

Phytochemicals were analyzed as recommended by Harborne (1973). Oxalate, phenols, phytate, steroids and terpeniods were determined using a spectrophotometer (752P) at wavelengths of 490, 425, 520, 780 and 538nm, respectively.

Data analysis

Data collected were subjected to the analysis of variance (ANOVA) in completely randomized design (CRD) using GENSTAT Discovery edition 3 Release 7.22 DE (Genstat (2008). Significant treatment means were compared using least significant difference (LSD) at 5% level of probability. Genotype plus genotype by environment interaction (GGE) biplot was used to illustrate the combined effect of accession and fruit part on proximate and anti-nutrient compositions of baobab fruit.

Results

Table 2 presents the main effect of accession and fruit part on the proximate composition of *Adansonia digitata.* Accession significantly ($P < 0.05$) influenced ash, carbohydrate, fat, protein, crude fibre and moisture. Egbeda gave the highest ash value of 7.625 % while the least (5.625 %) was obtained from Tilden Fulani accession. Carbohydrate was more concentrated (64.555 %) in Bado accession. Regarding fat, more accumulation (6.900 %) was recorded in accession from Igbaruku. However, Nok had the least carbohydrate and fat with respective values of 50.603 and 3.388 %. On the other hand, protein content (14.161 %) was more pronounced in Nok accession while the least of 2.752 % was obtained in Fadanka Goma. Contrarily, crude fibre was highest in Fadanka Goma. The least was recorded in Dilla with 7.000 %. Tilden Fulani had more moisture content (17.000 %) than others while accession from Bado gave the least of 11.743 %.

Fruit component indicated significant ($P < 0.05$) differences in all the proximate contents assayed. The seed had higher concentrations of ash (7.193 %), fat (8.953 %) and protein (16.644 %) relative to the pulp. Carbohydrate, crude fibre and moisture contents were more pronounced in the pulp with respective values of 66.488, 9.960 and 16.490 %.

Figure 1 shows the combined effects of accession and fruit part on the proximate composition of *Adansonia digitata*. The biplot revealed that variability existed among the accessions. Fat and protein were more pronounced in seeds from Igbaruku. Seeds from Egbeda had more ash content. Carbohydrate and moisture were more concentrated in pulp from Tilden Fulani. Crude fibre was more deposited in pulp sourced from Fadanka Goma. The biplot analysis of the proximate contents explained 81.9 % of the total variation among the accessions.

Table 2: Main effect of accession and fruit part on the proximate composition (%) of *Adansonia digitata*

Accession	Ash	Carbohydrate	Fat	Protein	Crude Fibre	Mositure
Dilla	6.975	61.182	4.050	8.216	7.000	12.675
Irele	6.737	54.805	5.017	10.447	9.200	13.892
Egbeda	7.625	57.580	4.850	7.732	8.200	14.075
Sohwa	6.775	61.110	4.302	8.133	7.050	12.567
Igbaruku	6.350	51.220	6.900	9.646	10.650	14.225
Sarkin Kudu	6.050	58.435	4.950	9.440	8.200	12.850
Tilden Fulani	5.625	51.980	5.250	11.719	8.100	17.000
Fadanka Goma	6.450	59.770	3.900	2.752	11.900	14.125
Nok	5.675	50.603	3.388	14.161	10.600	14.933
Bado	6.175	64.555	3.900	3.635	9.800	11.743
LSD (0.05)	0.648	0.649	0.118	0.039	0.533	0.540
Fruit part						
Pulp	5.694	66.488	0.348	0.532	9.960	16.490
Seed	7.193	47.760	8.953	16.644	8.180	11.127
LSD (0.05)	0.290	0.290	0.053	0.017	0.238	0.242

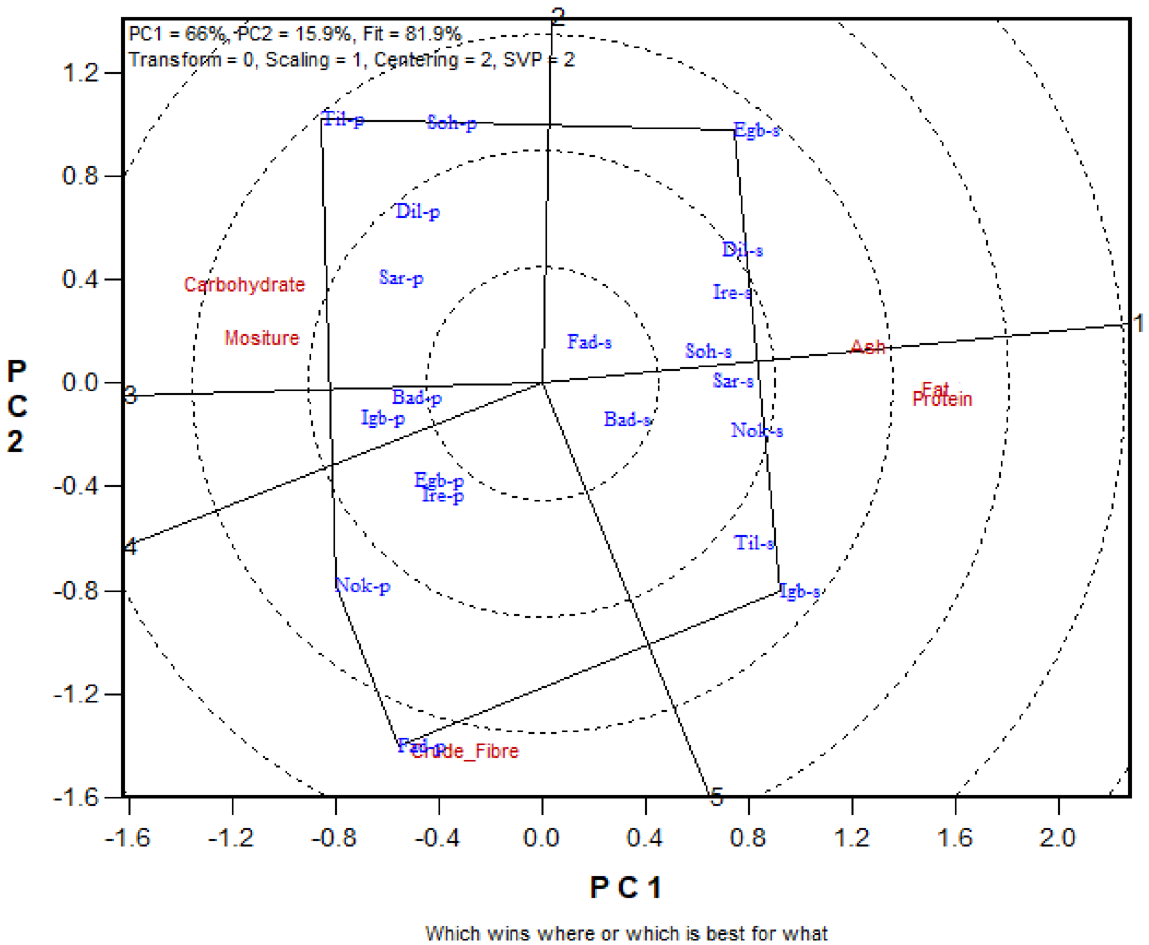

Fig 1: Interaction of accession x fruit part on the proximate constituents (mg/100g) of *Adansonia digitata*
P-pulp of baobab fruit. S-seed of baobab fruit. Proximate contents in the pulp and seed of baobab (Ash, carbohydrate, fat, protein, crude fiber and moisture). Location of collection- Dil-Dilla, Ire-Irele, Egb-Egbeda, Soh-Sohwa, Igb-Igbaruku, Sar-Sarkin Kudu, Til-Tilden Fulani, Fad-Fadanka Goma, Nok-Nok and Bad- Bado.

Main effect of accession and fruit part on the phytochemical constituents of *Adansonia digitata* is shown in Table 3. Accession significantly (P<0.05) affected all the anti-nutrient traits evaluated. Bado had the highest oxalate and steroid of 1.559 and46.772 mg/100g, respectively. The least oxalate (1.105 mg/100g) and steroids (7.095 mg/100g) were recorded in Dilla and Sohwa, respectively. Phenol content (3.807 mg/100g) was highest in sample from Sarkin Kudu while Dilla had the least of 1.182 mg/100g. Fadanka Goma took the lead (1.249 mg/100g) with respect to phytate concentration in the samples. Terpenoids was more deposited in Sohwa with 22.708 mg/100g than others. Igbaruku had the least phytate (0.951 mg/100g) and terpenoids (20.463mg/100g).

Oxalate, phenol, phytate, steroid and terpenoid were significantly ($p \leq 0.05$) influenced by fruit part. The pulp consistently had higher oxalate (2.479 mg/100g), phenol (5.495 mg/100g), phytate (1.862 mg/100g), steroids (54.510 mg/100g) and terpenoids (38.418 mg/100g) when compared with the seed.

Interaction of accession and fruit part on the anti-nutrient contents of *Adansonia digitata* is presented in Figure 2. Bado pulp had the highest steroids, phytate, terpenoids and oxalate concentrations. Highest phenol content was linked with pulp sourced from Sarkin Kudu. The biplot analysis of the anti-nutrient contents explained 97.6 % of the total variation among the accessions.

Table 3: Main effect of accession and fruit part on the anti-nutrient constituents (mg/100g) of *Adansonia digitata*

Accession	Oxalate	Phenol	Phytate	Steroids	Terpenoids
Dilla	1.105	1.182	1.031	40.373	21.688
Irele	1.490	2.755	0.987	21.952	22.352
Egbeda	1.371	1.971	1.036	40.349	21.022
Sohwa	1.435	2.495	1.007	7.095	22.708
Igbaruku	1.529	3.445	0.951	41.507	20.463
Sarkin Kudu	1.540	3.807	1.037	28.037	22.316
Tilden Fulani	1.264	2.757	1.001	15.325	21.464
Fadanka Goma	1.334	3.156	1.249	28.375	21.375
Nok	1.554	2.244	1.002	38.223	21.530
Bado	1.559	3.679	1.026	46.772	22.646
LSD (0.05)	0.005	0.703	0.005	0.582	0.747
Fruit part					
Pulp	2.479	5.495	1.862	54.510	38.418
Seed	0.357	0.003	0.204	7.092	5.094
LSD (0.05)	0.002	0.314	0.002	0.260	0.334

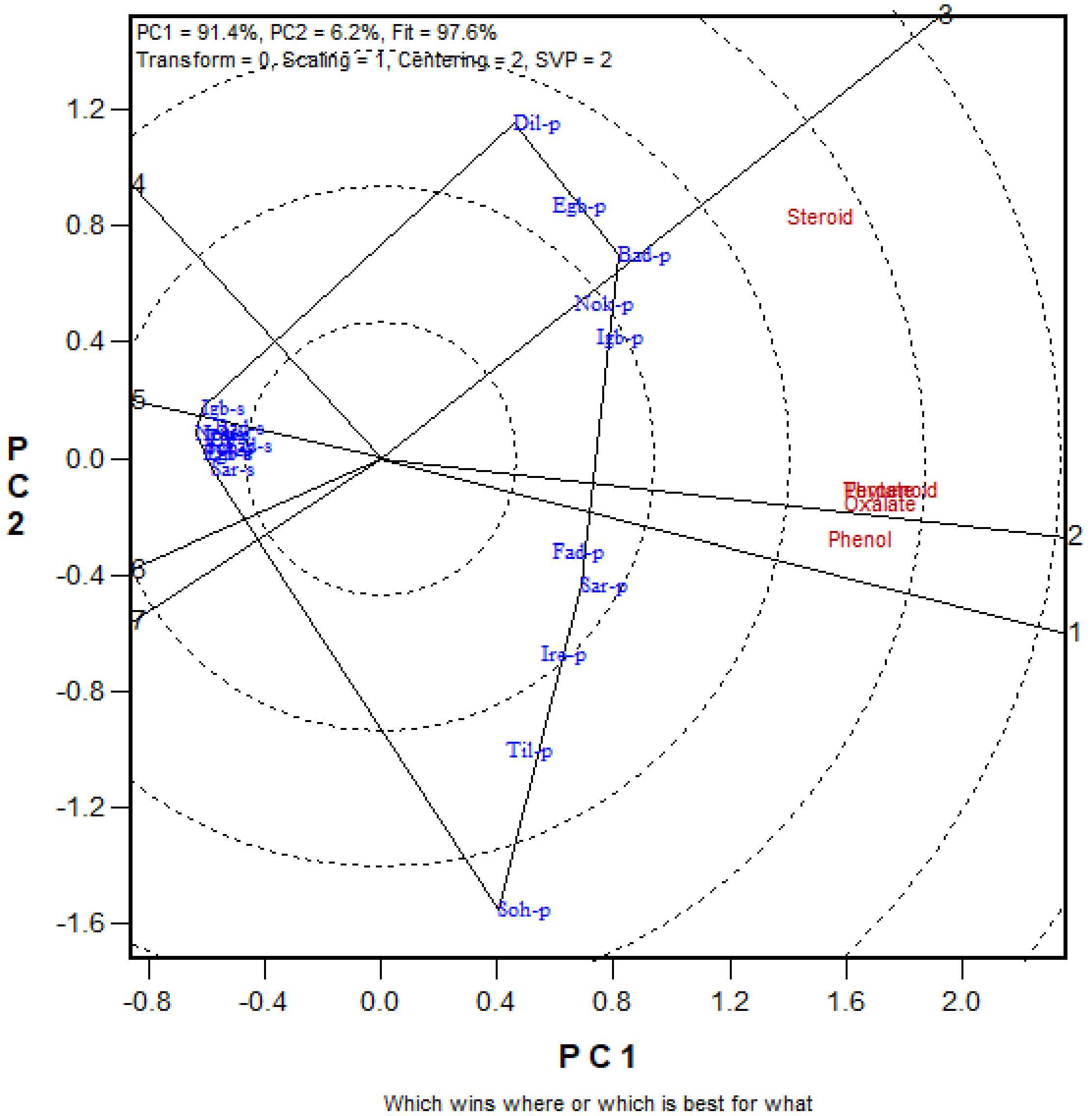

Fig 2: Interaction of accession x fruit part on the anti-nutrient contents (mg/100g) of *Adansonia digitata*
P-pulp of baobab fruit. S-seed of baobab fruit. anti-nutrient contents in the pulp and seed of baobab (Oxalate, phenol, phytate, steroid and terpenoid. Location of collection- Dil-Dilla, Ire-Irele, Egb-Egbeda, Soh-Sohwa, Igb-Igbaruku, Sar-Sarkin Kudu, Til-Tilden Fulani, Fad-Fadanka Goma, Nok-Nok and Bad- Bado.

Discussion

The study indicated that proximate contents varied among the 10 accessions of baobab. Muthai *et al.* (2017) reported significant variation in proximate composition of 5 accessions of baobab evaluated across Africa. Ikani *et al.* (2024) reported significant differences in proximate and elemental nutrient contents of 33 accessions of *Phaseolus species* from Nigeria. Conversely, Gurashi *et al.* (2016) found slight significant difference in chemical composition of baobab from North Kordofan and Blue Nile State in Sudan. Similarly, Stevens *et al.* (2021) reported minute variation in nutrient contents of 10 *Moringa* accessions assayed in Nigeria. The study confirmed the presence of ash, fat, carbohydrate, crude fibre, moisture and protein both in the seed and pulp of baobab. The pulp contained more carbohydrate, crude fibre and moisture content while ash, fat and protein were more deposited in the seeds. In comparing the proximate values obtained in this study with those reported in the literature, some similarities and discrepancies were noted. Carbohydrate, crude fibre and moisture contents were higher than the values (63.6, 6.1 and 11.00%, respectively) reported by

Asimi *et al.* (2016) in baobab pulp from Osun State, Nigeria. Mamman *et al.* (2021) found higher value for carbohydrate (76.78%) but lower crude fibre (3.85%) and moisture (10.16%) contents in baobab pulp from Nasarawa State, Nigeria. Oyeleke *et al.* (2012) reported higher carbohydrate of 74.3% in baobab pulp from Osun State, Nigeria but found crude fibre (6.1%) and moisture (11.2%) to be lower than those obtained in this work. The values obtained for carbohydrate in this study was lower than 70.17% reported by Thompson *et al.* (2024) in fruit pulp of baobab from Ghana but crude fiber was higher than their value (6.69%). Their moisture content; was however, comparable (16.26%) to what was obtained in this work. The ash and protein contents of the seed sample were higher than those in baobab seed from Sudan (4.49 and 12.97%, respectively) but fat content from this work was lower than 14.3% as reported by Mohammed *et al.* (2018). Assogbadjoa *et al.* (2012) found higher protein of 33.89 and fat of 28.30 in baobab seed from Sudano-Guinean zone, Benin. The ash content from this study was found to be higher than 4.93% reported by Adam *et al*. (2019) in baobab seed from Sudan. Ash content detected in this study was relatively higher than 0.57% reported by Babalola *et al.* (2021) in baobab seed from Oyo State, Nigeria but this present study indicated fat and protein were lower than their values of 30.43% and 32.13%, respectively. The high amount of ash detected in the pulp and seed of baobab implies that they both have high level of inorganic matter; thus, possessing high amount of minerals. The considerable amount of crude fiber in the pulp (9.960 %) indicated that baobab pulp is an excellent source of dietary fiber. According to Babalola *et al.* (2021) any plant food that provides more than 12% of its calorific value from protein is considered good source of protein. This indicated that baobab seed is an excellent source of protein that could meet the recommended daily requirements for humans (FND, 2002). Protein is crucial for children's healthy growth and development, the preservation and repair of damaged tissues, the generation of immunoglobulin for the body's defense, the production of metabolic enzymes, and the growth of lean muscle mass (Ilenowa *et al.,* 2024). Dietary fiber is essential for good bowel movement and could help in preventing obesity, diabetes, cancer of the colon and other ailments of the gastrointestinal tract of humans. More concentration of carbohydrate in the pulp implies that it could be a good source of energy and thus, a useful supplement in animal feed formulation and human diet. The lower moisture content of the seeds implies that the seeds could have prolonged shelf life which is very useful in storage of food (Babalola e*t al.,* 2021). More crude fat in the seed could give the seed an extra advantage over some seeds and could serve as a good source of fat which provide energy. The differences in proximate compositions as reported by different authors may be attributed to climatic factors. Similar finding was reported by Gurashi *et al.* (2016).

Significant variation in the anti-nutrient contents of baobab seed and pulp was noticed in this study. Babalola *et al*. (2021) reported significant variations in anti-nutrient contents of baobab seed evaluated, with the exception of steroid content. Previous work of Olajide and Baiyeri (2022) reported significant effect of accession on anti-nutrient contents of baobab leaves in Nsukka. All the anti-nutrient traits evaluated were more pronounced in baobab fruit pulp. Ndubuisi *et al.* (2022) found lower oxalate (1.14 mg/100g) and phytate (0.28%) in fruit pulp of baobab from Zaria, Kaduna State, Nigeria when compared with the findings of this present study. The value for phenol (5.545 mg GAE/g) in baobab fruit pulp as reported by Thompson *et al*. (2024) from Ghana was comparable to the value obtained in this work. The phenol and terpenoids values in the test sample were higher than those in baobab fruit pulp from Ethiopia (0.0440 and 0.0440%) (Wasihun *et al.,* 2023).Ilenowa *et al.* (2024) reported higher oxalate (75.95 mg/g) and phytate (140 mg/g) in *Picralima nitida* fruit pulp from Edo state, Nigeria. The oxalate and phytate found in this study were higher than the values (11.04% and 5.21 mg/100g, respectively) reported by Njoku *et al.* (2016) in S*ynsepalum dulcificum* berry pulp from Imo State, Nigeria but the steroids (1.56 mg/100g) was relatively low compared to ours. The value obtained for steroid was relatively higher than that in baobab seed (15.00%) (Babalola *et al.,* 2021). The pulp oxalate, phenol, steroids and terpenoids were higher compared to 1.32mg/100g, 4.73 mg/100g, 5.4 mg/g and 8.67 mg/100g, respectively as reported by Aja *et al.* (2017) for *Phoenix dactylifera* fruits from Ebonyi State, Nigeria. On the other hand, their phytate level (1.32 mg/100g) was comparable to ours. Oxalate and phytate contents detected in the test sample were within the tolerable limits of 5 % (Caser, 2003) and 5.72 - 9.22 % (Okon and Akpanyung, 2005) but phenol was above the accepted level of human consumption of 2 % (Michałowicz and Duda, 2007). The anti-nutrient content may be significantly reduced by heat during the cooking process. Boiling of plant parts in water reduced the poisonous effect of anti-nutrients and assists to increase their consumption (Dei *et al.,* 2007; Zafar *et al.,* 2015).The high level of phenol (5.495 mg/100g) in baobab fruit pulp cannot be neglected as phenols exhibit several properties beneficial to humans and its antioxidant properties are important in determining their role as protective agent against free radical mediated diseases processes (Dai and Mumper, 2010). Phytate chelate metal ions such as calcium, magnesium, zinc, copper, iron and molybdenum to form insoluble complexes that are not readily absorbed from gastrointestinal (Aja *et al.,* 2015). The steroidal compounds are of importance in pharmacy because of their relationship with such compounds as sex hormone (Okwu, 2001). It has reported that flavonoids and steroids are free radical scavengers that prevent oxidative cell damage, and have strong anticancer activities (Pourmorad *et al.,* 2006; Ugwu *et al.,* 2013) and thought induce mechanism that affect cancer cells and inhibit tumor invasion (Rafat *et al.,* 2008). Eating plant foods high in sterol is known to help lower the cholesterol level in the blood (Piironen *et al.,* 2002). Hence, consumption of baobab pulp could help to check the level of cholesterol in the blood. Terpenoids are commercially important because of their use as flavours and frangrances in food fruits and cosmetics industries (Aja *et al.,* 2017). The differences in the concentration of anti-nutrient contents in this study may probably be as the result of the climatic conditions prevalent in the different locations. Variation in climatic conditions could affect the availability of anti-nutrient contents in plant sample (Olajide *et al.,* 2021).

CONCLUSION

This study indicated significant variability in the proximate and anti-nutrient traits of baobab across the locations. Proximate traits and anti-nutrient contents were significantly influenced by plant part. Carbohydrate, crude fibre and moisture contents were more deposited in the fruit pulp while ash, fat and protein were more concentrated in the seed. Concentration of oxalate, phenol, phytate, steroids and terpenoids were more in baobab seed. The variation could guide the utility of baobab fruit and pulp in feed formulation and pharmaceutical industry. This information could also be explored during germplasm collection for use in conservation, breeding programmes, and domestication of baobab. Further studies should focus on preservation of the pulp to increasing the pulp storage time while maintaining its nutritive value.

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