

Research Article

Proximate, Mineral and Phytochemical Composition of *Dacryode Edulis*

Joy Enogbe Emmanuel* , Onyenze Ugochukwu , Daniel Enajeme Agbaghare 

Department of Pure and Applied Chemistry, Veritas University, Abuja, Nigeria

Abstract

Background: The differences in time and geographical locations has significant effect on the mineral and phytochemical compositions of plants. *Dacryodes Edulis* obtained in June at Idu market, Abuja, FCT Nigeria, is a plant wildy grown in Nigeria especially in the tropical and semi tropical region and humid climate. The proximate, mineral, and phytochemical components of *Dacryodes Edulis* was examined in this study. **Methods:** The proximate constituent analysis was carried out using the Association of Official Analytical Chemist method. The mineral and phytochemical analyses were carried out using Flame Atomic Adsorption Spectroscopy and standard procedures respectively. **Results:** The result of proximate analysis showed that *Dacryodes Edulis* consists of $1.96 \pm 0.01\%$ moisture, $4.22 \pm 0.27\%$ crude protein, $33.74 \pm 0.66\%$ for crude fat, $9.67 \pm 0.29\%$ ash and $50.41 \pm 0.61\%$ carbohydrate. The mineral constituents showed that *Dacryodes Edulis* contains $272.0 \pm 3.00\text{mg/g}$ Iron, $10072.45 \pm 1.00\text{mg/g}$ Potassium, $8.40 \pm 0.20\text{mg/g}$ Copper, $4461.95 \pm 1.01\text{mg/g}$ Calcium and $756.67 \pm 0.90\text{mg/g}$ Magnesium. **Conclusion:** The results of African pear pericarp showed favorable comparisons in terms of moisture content, crude fat, crude protein, ash content, and carbohydrate content with the African pear seed. The findings indicated that eating enough African pear fruit pericarp could significantly help meet human nutritional needs for healthy growth and sufficient defense against diseases brought on by malnutrition.

Keywords

Proximate Composition, Minerals, Phytochemical Screening, Leaf, Fruit

1. Introduction

The impact of plants and their products to human nourishment cannot be exaggerated. Fruits are in great demand in Africa because of their complementary role in nutrition, which helps foods achieve the status of a balanced diet. [1] In every facet of human life, plants have served as a crucial starting point for the creation of pharmaceuticals. [2] Pharmaceutical plants naturally contain physiologically active ingredients that have long been utilized in traditional medicine to treat a variety of ailments. A relatively tiny percentage

of less than 10% of all plants worldwide are thought to serve as basis of therapy, as several academics have demonstrated in their research on medicinal plants. [1-4].

The most important of these plant bioactive components include alkaloids, glycosides, tannins, carotenoids, flavanoids, terpenoids, and steroids [2]. In all facets of life, plants have served as a valuable basis for the development of novel pharmaceuticals. These days, the medicinal value of plants in aromatherapy, herbal medicine, homoeopathy, and allopathy

*Corresponding author: emmanuelj@veritas.edu.ng (Joy Enogbe Emmanuel)

Received: 21 June 2025; **Accepted:** 3 July 2025; **Published:** 23 July 2025



Copyright: © The Author(s), 2025. Published by Science Publishing Group. This is an **Open Access** article, distributed under the terms of the Creative Commons Attribution 4.0 License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited.

greatly depends on their geographic location. Many of the most common medications used today are derived from medicinal plants; many of these indigenous plants are also used as spices and food plants, and some are even added to dishes intended for pregnant women for therapeutic purposes. [5].

One fruit in the *Burseraceae* family, *Dacryodes edulis*, has the potential to be both a food source for people and, if combined properly, a raw material for the production of industrial drugs. The fruit is widely consumed in Nigeria, particularly in the southeast region of the nation. Results from other regions of the nation also indicated that while the seeds are typically thrown away, the fruit pulp is consumed. Seed oil from *D. edulis* has the potential to be used as both industrial and home oil [4]. Traditionally, the fruit is eaten grilled, boiled, or uncooked. The pulp can be consumed on its own, with roasted corn, or with tapioca, a traditional dish. When the pulp is spread on bread like butter, it might just as easily be consumed with bread. The phytochemical, proximate, and mineral composition of *D. edulis*, which was acquired in June at Idu market in Abuja, Federal Capital Territory (FCT), Nigeria, was examined in this study since it is thought to have numerous medicinal and health benefits.

2. Materials and Methods

2.1. Sample Collection and Preparation

The African pear fruits (*D. edulis*) were purchased from the Idu market in Abuja, Nigeria's Federal Capital Territory. After carefully washing, draining, and cracking open the African pear fruits, the fleshy portion was carefully removed and dried for seven days at constant weight in a herbarium. At 50 degrees Celsius, the pulpy pericarp was oven-dried for three to four days. In accordance with Wanjiru et al.'s procedures, the dried sample was then ground into a powder using a blender and stored in an airtight container for additional research. [6].

A Soxhlet extractor with a reflux condenser attached was used to extract the mixture after 500 milliliters of ethanol were added and left for 12 hours. Following extraction, each plant extract was concentrated in a rotary evaporator and filtered using Whatman filter paper (No. 1); the semi-solid extracts were then stored at -4 °C until they were needed for further analysis and allowed to completely dry at room temperature. [7, 8].

2.2. Proximate Composition Analysis

To find the secondary metabolites (active compounds) in methanol extracts of the African pear fruit pulp, such as alkaloids, saponins, flavonoids, phenols, and glycosides, a qualitative phytochemical screening was conducted in compliance with standard operating procedures. Using standard operating techniques described by the Association of Official Analytical Chemists, the protein, fat, moisture, ash, and carbohydrate

contents of the pulpy pericarp of African pear were ascertained. [8].

2.3. Ash Content

A crucible that had been cleaned, dried, and weighed beforehand was filled with a 2-gram sample of ground *D. edulis*. After that, it was burned over a Bunsen burner until the smoke was gone, which allowed the moisture to be extracted. A muffle furnace was then used to burn the sample for five hours at 600 degrees Celsius (the end point was indicated by a grey-white color) [7, 9, 10]. The sample was removed from the furnace and allowed to cool in a desiccator after being regularly weighed. The sample's ash content, expressed as a percentage, was calculated using Equation 1.

$$\text{Ash Content (\%)} = \frac{\text{Weight of Ashed}}{\text{Weight of sample}} \times 100 \quad (1)$$

2.4. Fat Content

Similarly, to determine the fat (oil/lipid) content, 2g of the *D. edulis* sample were carefully wrapped in filter paper and put into the thimble of the Soxhlet extractor. The apparatus was heated gradually over the course of five hours using a heating mantle until the extracting solution turned clear, indicating that the extraction process was complete. The 200 milliliters of petroleum ether were contained in a clean round-bottom flask with the thimble attached, which was connected to a reflux condenser. After utilizing a distillation device to extract refluxed petroleum ether, the oil was placed in a bottle and left for five days to evaporate any remaining solvent. After the oil was weighed, the percentage oil content was determined using Equation 2.

$$\text{Fat Content (\%)} = \frac{\text{Weight of oil}}{\text{Weight of sample}} \times 100 \quad (2)$$

2.5. Moisture Content

A 2g sample of *D. edulis* was moved into a dry crucible that had been previously weighed and then weighed again. In a moisture extractor oven, the samples were dried for three hours at 105 °C. Following their removal, the samples were let to cool before being weighed several times until they reached a constant weight. We then calculated the moisture content using Equation 3, and the result was shown as a percentage.

$$\text{Moisture Content (\%)} = \frac{\text{Weight of sample} - \text{Weight of dry sample}}{\text{Weight of sample}} \times 100 \quad (3)$$

2.6. Crude Protein

A Kjeldahl apparatus was used to digest the material, and as a catalyst, 2.5g of anhydrous sodium sulphate granules, 0.01g of copper sulphate, and two grams of *D. edulis* were used.

When the digest (content) in the flask transformed from green to colorless after two hours, the heating was stopped. Following this, the flasks were placed inside the chamber, covered with cotton wool, and allowed to cool. The digests were then transferred into the 100 ml volumetric flask, and the volume was increased to 100 ml by adding distilled water. Utilizing the micro-Kjedahl distillation apparatus, the digest was subsequently further concentrated.

Twenty milliliters of a 2% boric acid solution were added to a 100 ml conical flask, to which four drops of methyl red indicator were added; twenty milliliters of a 50% NaOH solution and distilled water were added to 25 milliliters of the sample that needed to be distilled; the conical flask was then secured beneath the condenser of the distillation apparatus; the titre value was determined by distilling the sample into separate conical flasks and titrating the distillate with 0.1 NH_3Cl until the colorless solution turned pink; a blank was also identified to aid in the calculation given in equations 4 and 5;

$$\% \text{ Total Nitrogen} = \frac{[(\text{Titre Value} \times \text{Blank}) \times 14 \times 0.1N]}{\text{Weight of sample}} \quad (4)$$

$$\% \text{ Crude Protein} = \text{Total Nitrogen} \times 6.25 \times 100 \quad (5)$$

2.7. Total Carbohydrates Content

The carbohydrate value of *D. edulis* was determined by difference and this involves, subtracting from 100, the total (in percentage) of all the other components (moisture, protein, fats, and ash) that were present in the work.

The above experimental procedures for proximate analysis were repeated using the African pear powder sample. All values were recorded.

3. Mineral Analysis

Weighing 2.0g of each powdered sample into 100ml Kjeldahl flasks with a solution of nitric acid, perchloric acid (60%) and hydrochloric acid (10:4:1) allowed us to perform the wet digestion process in triplicate for each sample. [11, 12] After being placed under a fume hood, the solution was heated progressively for 35 minutes to a temperature of about 120 °C. Dense reddish-orange fumes were present at the start of the digestion process, but as a result of continuous heating, these were eventually replaced by white fumes, which finally produced a clear solution that indicated the process was over.

The digest was diluted with 10 milliliters of distilled water, and the resulting solution was filtered into a 100-milliliter volumetric flask. Once it cooled, it was diluted with the same amount of distilled water. A Flame Atomic Absorption Spectrometer was used to evaluate the digested *D. edulis* sample and determine its mineral composition.

4. Phytochemical Screening

Qualitative phytochemical studies were carried out following standard operating procedures to determine the secondary metabolites (active chemicals) such as alkaloid, Saponin, flavonoids, phenols, and glycosides in methanol extracts of African pear fruit pulp.

4.1. Test for Alkaloids (Wagner Reagent Test)

About 4 - 6 drops of Wagner's reagents (1.27 grams of iodine and 2 grams of potassium iodide in 100 milliliters of water) were added to 1 mL of each extract. The formation of a radish-brown precipitate shows the presence of alkaloids. [13].

4.2. Test for Saponin (Foam Test)

3ml distilled water was added to 1ml of each extract and thoroughly shook for 5 min in a falcon tube and the formation of 1cm foam for 5-10 minutes indicated the presence of Saponin. [14] After thoroughly shaking 1ml of each extract with 3 ml of distilled water for five minutes in a falcon tube, the presence of saponin was shown by the formation of one centimeter of foam for about 5 - 10 minutes. [14].

4.3. Test for Flavonoid

For flavonoid screening, in 2ml of each extract, 3-4 drops of 20% NaOH solution were added and a strong yellow-colored solution was formed and turned colorless when 4-5 drops of diluted HCl were added. This indicates the presence of Flavonoids. [13].

4.4. Test for Phenol (Ferric Chloride Test)

In 1ml of each sample extract was added 1ml of ethanol followed by 6-7 drops of 1% ferric chloride solution was added in the solution. According to Akther et al. [15], the formation of green, blue, and purple colors showed the presence of phenol.

4.5. Test for Glycosides (Glacial Acetic Acid Test)

In 1ml of each of the sample extract, 1ml of glacial acetic acid was added and 5 - 6 drops of 1% ferric chloride solution were added to the mixture. The presence of glycoside was revealed by the brown color ring formed at the top. [15].

5. Results

Table 1. Percentage (%) Proximate composition of African-pear samples.

SAMPLE	Moisture	Crude Protein	Crude Fat	Ash	Carbohydrate
African-Pear	1.96±0.01	4.22±0.27	33.74±0.66	9.67±0.29	50.41±0.61

Values are presented as means ±SD. A value with different superscript within the same column is significantly different compared to each other (p<0.05).

Table 2. Mineral contents in African-pear samples.

SAMPLE (mg/g)	Iron (Fe)	Potassium (K)	Copper (Cu)	Calcium (Ca)	Magnesium
African-Pear	3.28±0.38 ^b	14554.00±3.00 ^a	24.77±0.95 ^a	5379.75±0.03 ^a	12.06±1.70 ^b

Values are presented as mean ±SD. A value with different superscript within the same column is significantly different compared to each other (p<0.05).

Table 3. Qualitative Phytochemical composition of African-pear Samples.

Phytochemical	African-pear
Saponin	+
Alkaloid	-
Flavonoid	+
Phenol	+
Glycoside	-

Key: [+] Imply the phytocompound is Present while [-] not present

6. Discussion

The result of proximate composition of *Dacryodes edulis* (African pear) fruit pulpy pericarp is as presented in Table 1 in percentages and the result showed that the plant samples contained 1.96±0.01% moisture content, 4.22±0.27% crude protein, 33.74±0.66% crude fat, 9.67±0.29% ash and 50.41±0.61% carbohydrate contents at different levels. The percentage value of moisture content showed that the African pear sample had an insignificant (p>0.05) lower moisture content (1.96±0.01) compared to 9.55±0.66% in *D. edulis* seed reported by Okoro et al. [16]. Notably, the moisture content is however relatively small compared to other literatures [16, 17]. This implies that African pear pericarp will likely have longer time without spoiling due to the low

moisture content than the seed. This is because a higher water activity could increase microbial action that causes spoilage.

The percentage crude protein value for the African pear pericarp is 3.50±0.07% and it is found to be higher than 1.22±4.04% obtained by Otache et al. [12] and lower than 3.81±0.40% for the African pear seed reported by Okoro et al. [16] It is known that high level of protein content contributes significantly to human health. [18] It has also been reported that some nutritional and bioactive amino acids are present in African pear pericarp and seed and they are capable of regulating blood sugar, promotes growth, repairs muscles and bones and also responsible for wound healing. [19, 20].

The 33.74±0.66% fat content in African pear sample help maintain a healthy heart and prevent cardiovascular diseases and the total ash content is lower than the value 3.88-4.03 reported by Otache et al. [12] The 50.41±0.61 percentage carbohydrate in the African pear pericarp is found to be higher than 39.03±1.16% African pear seed reported by Okoro et al. [16].

The elemental composition results for the African pear pericarp samples are presented in Table 2. The result showed that the Iron values obtained for African pear is 3.28±0.38mg/g lower than the values (0.07±0.013) mg/100g reported by Otache et al. [12] Iron is known to be relevant for the formation of hemoglobin, the proper operation of the central nervous system and the oxidation of carbohydrates, proteins, and fats, iron is a necessary trace element.

The 12.06±1.70mg/g concentration of magnesium in African pear sample. The potassium content in African pear pericarp (14554.00±3.00) can be responsible for nerve function and some osmoregulation in the body fluid. [12] The

values of copper and calcium in African pear pericarp sample can also help strong bones and teeth development.

Results of phytochemical qualitative analysis carried out on the various extract samples showed that out of the five (5) phytochemicals screened, saponin, flavonoid and phenols were found in the ethanol extract of African pear fruit pulp. In addition to giving plants their color, phenols are typically engaged in defense against UV radiation and hostility from infections, parasites, and predators, which makes the African pear pericarp a bioactive and nutritious component. The samples' saponin content matched the findings published by Otache et al. [12] and Saponin is utilized in the pharmaceutical and medical fields due to its tendency to produce a frothy, foamy impact. There were flavonoids in the sample of African pears as seen the phytochemical results and flavonoids are renowned antioxidants. Reports [12, 20-22] by some researchers showed that the presence of alkaloids in *D. edulis* have certain metabolic functions. These compounds are part of the most lucrative medications and have demonstrated their effectiveness in animals.

7. Conclusion

In this study, the African pear fruit contains important chemical compositions with medicinal and nutritional value that, with more study and use, could enhance the quality of life for both people and animals. The study confirmed the herb's traditional significance, as it is believed to aid in the treatment of several illnesses. Using phytochemical screening, active pharmacological compounds were identified. Significant amounts of macro and microchemicals that are necessary for numerous body processes, such as hormone synthesis, enzyme synthesis, immune system maintenance, body development, and fluid balance maintenance, were discovered during the proximate and mineral assessment.

The findings of the African pear pericarp revealed positive comparisons with the African pear seed in terms of moisture content, crude fat, crude protein, ash content, and carbohydrate content. According to the results, consuming enough pericarp from African pear fruit could greatly contribute to meeting human nutritional needs for normal growth and adequate protection against malnutrition-related disorders.

Abbreviations

<i>D. edulis</i>	Dacryodes Edulis
FCT	Federal Capital Territory
NaOH	Sodium Hydroxide

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Wylie, M. R., & Merrell, D. S. (2022). The antimicrobial potential of the neem tree *Azadirachta indica*. *Frontiers in pharmacology*, 13, 891535.
- [2] Onyenze, U., Otuokere, I. E., & Emmanuel, J. E. (2024). Synthesis, Characterization and Anti-bacterial Screening of Fe (II) Mixed Ligand Complex of Ofloxacin with Ascorbic Acid. *European Journal of Scientific Research and Reviews*, 1(2), 112-112.
- [3] Otache, M. A., & Agbajor, G. K. (2017). Proximate and mineral composition of leaves of *Azadirachta indica*. *International Journal of Current Research in Chemistry and Pharmaceutical Sciences*, 4(11), 50-54.
- [4] Owoeye, T. F., Akinlabu, K. D., & Ajani, O. O. (2023). Proximate composition, phytochemical screening and mineral content studies of leaves extract of *Adenanthera pavonina*. *Arab Journal of Basic and Applied Sciences*, 30(1), 317-328.
- [5] Fufa, D. D., Bekele, T., Tamene, A., & Bultosa, G. (2025). Drying kinetic models, thermodynamics, physicochemical qualities, and bioactive compounds of avocado (*Persea americana* Mill. Hass variety) seeds dried using various drying methods. *Heliyon*, 11(1).
- [6] Wanjiru, S. N., Opiyo, S. A., Njoroge, P. W., & Mugendi, B. J. (2025). Elemental Composition of Pulp and Seed of Avocado Cultivars from Murang'a County.
- [7] Akpaso, M., Anani, S., Isamoh, T., Agaba, E., Oku, M., Uruakpa, K.,... & Ajang, C. (2025). Effect of Alkaloid-rich Fraction of *Dacryodes edulis* Leaves on the Cytoarchitecture of the Liver and Blood Glucose Levels in Streptozotocin-Induced Hyperglycemic Rats. *Asian Journal of Research and Reports in Hepatology*, 7(1), 41-51.
- [8] Baur, F. J., & Ensminger, L. G. (1977). The association of official analytical chemists (AOAC). *Journal of the American Oil Chemists' Society*, 54(4), 171-172.
- [9] Obianuju, O. A., Noris, E. C., Jennifer, E. A., Millicent, A. N., & Divine, O. U. (2025). Assessment of the Protective Effect of *Dacryodes edulis* Methanol Seed Extract against Glycerol Induced Acute Kidney Injury. *Journal of Applied Life Sciences International*, 28(4), 54-63.
- [10] He, P., Ye, Q., Yu, K., Wang, H., Xu, H., Yin, Q.,... & Liu, H. (2025). Growing-Season Precipitation Is a Key Driver of Plant Leaf Area to Sapwood Area Ratio at the Global Scale. *Plant, Cell & Environment*, 48(1), 746-755.
- [11] Sarkiyayi, S., & Agar, T. M. (2010). Comparative analysis on the nutritional and anti-nutritional contents of the sweet and bitter cassava varieties. *Advance journal of food science and technology*, 2(6), 328-334.
- [12] Otache, M. A., Ubwa, S. T., & Godwin, A. K. (2017). Proximate analysis and mineral composition of peels of three sweet cassava cultivars. *Asian Journal of Physical and Chemical Sciences*, 3(4), 1-10.

- [13] Ugochukwu, A. E., John, D. E., Amin, A. F., Chidi, E., Nwobodo, N. N., Ogbonna, O. R.,... & Nnamdi, E. I. (2018). Bacteriostatic and bactericidal effects of ethyl acetate root bark extract of *Terminalia avicennioides* on methicillin-resistant *Staphylococcus aureus*. *African Journal of Biochemistry Research*, 12, 45-54.
- [14] Kumar, A., P, N., Kumar, M., Jose, A., Tomer, V., Oz, E.,... & Oz, F. (2023). Major phytochemicals: recent advances in health benefits and extraction method. *Molecules*, 28(2), 887.
- [15] Akther, F., Alim, M. A., Nasrin, N. A., Khan, M., Gomes, D. N., Suhan, M.,... & Begum, R. (2023). Effects of different drying methods on the proximate composition, antioxidant activity, and phytochemical content of *Hibiscus sabdariffa* L. Calyx. *Food Chemistry Advances*, 3, 100553.
- [16] Okoro, E. O., & Iyawe, H. O. T. (2024). Proximate, Mineral, and Amino Acid Compositions of *Dacryodes edulis* (African Pear) Seeds gotten From the Same Parent Tree in Ekpoma in Esan Central Local Government Area of Edo State, Nigeria. *Journal of Applied Sciences and Environmental Management*, 28(11), 3625-3630.
- [17] OYEYEMI, S., AYENI, J., & ADESINA, J. STUDY ON THE NUTRITIONAL, MINERAL AND ANTINUTRIENT COMPOSITION OF SOME UNDERUTILISED SPECIES OF FABACEAE IN ADO-EKITI, EKITI STATE, NIGERIA.
- [18] Ullah, M. R., Akhter, M., Khan, A. B. S., Yasmin, F., Hasan, M. M., Bosu, A.,... & Mahmud, Y. (2024). Nutritional composition and phenolic contents of *Gracilariopsis longissima*, *Padina tetrastromatica* and *Ulva intestinalis* from the Bay of Bengal, Bangladesh coast. *Heliyon*, 10(10).
- [19] Lekpoabari, N. P., Clement, M. A., & Joe, N. P. (2021). Phytoconstituents, Proximate Composition and Antimicrobial Studies on *Dacryodes edulis*. *J. Chem. Res*, 6(2), 87-93.
- [20] Nandan, A., Koirala, P., Tripathi, A. D., Vikranta, U., Shah, K., Gupta, A. J.,... & Nirmal, N. (2024). Nutritional and functional perspectives of pseudocereals. *Food chemistry*, 139072.
- [21] Sakthivel, R., & Devi, K. P. (2015). Evaluation of physico-chemical properties, proximate and nutritional composition of *Gracilaria edulis* collected from Palk Bay. *Food chemistry*, 174, 68-74.
- [22] Parraga, A., Gonzales, J. A. V. I. E. R., Portales, R. O. S. A. R. I. O., Ruiz, C. A. N. D. Y., & Rojas, R. (2021). Proximate analysis and aminoacid profiles of leaves, flowers, pods, and seeds of *erythrina edulis* from Peru. *Int. J. Pharm. Pharmaceut. Sci*, 13, 30-2.