International Research Journal of Applied Sciences, Engineering and Technology
Vol.12, No. 01; January-2026;
ISSN (1573-1405);
p –ISSN 0920-5691
Impact factor: 6.52

DECIPHERING THE CHEMICAL AND MYCOFLORA PROFILE OF AFRICAN PEAR (*DACRYODES EDULIS (G. DON) H. J. LAM*)

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Abstract: The African pear (*Dacryodes edulis*), a nutrient-rich tropical fruit native to Central and West Africa, is a dietary staple valued for its high lipid, protein, vitamin, and phytochemical content, which contribute to its nutritional and therapeutic significance. This study evaluated the proximate, mineral, vitamin, phytochemical and mycoflora of African pear using standard laboratory procedures. Proximate analysis revealed a high moisture content (84.73±0.40%), moderate carbohydrates (12.22±0.01%), low protein (1.60±0.07%), minimal lipids (0.51±0.01%), and modest fiber (1.30±0.10%), consistent with characteristics of perishable fruits prone to microbial spoilage. The mineral profile showed significant phosphorus (40.00±0.00 mg/100g), potassium (13.00±0.00 mg/100g), and iron (3.10±0.10 mg/100g). Vitamins, particularly vitamin C (43.10±23.58 mg/100g) and vitamin A underscored the fruit's antioxidant potential. Phytochemical analysis identified high levels of lignans (25.47±0.08 mg/100g), flavonoids (15.63±0.66 mg/100g), and polyphenols (14.93±0.70 mg/100g), which confer antioxidant, anti-inflammatory, and antimicrobial properties and negligible presence of oxalate (0.00±0.01), saponin (0.00±0.01) and tannin (0.00±0.00). Mycoflora assessment revealed *Aspergillus flavus* (60% incidence) and *Candida* sp. (40% incidence) as dominant spoilage fungi, with *A. flavus* posing significant health risks due to aflatoxin production. These findings highlighted African pear's nutritional and economic potential while emphasizing the need for advanced preservation techniques to enhance food safety, shelf life, and marketability, aligning with Sustainable Development Goals for food security and health in sub-Saharan Africa.

Keywords: Chemical Profile, Mycoflora, African Pear, *Dacryodes edulis*

Background of Study

The African pear, scientifically known as *Dacryodes edulis* (G. Don) H. J. Lam, is a dioecious, shade-loving evergreen tree belonging to the Burseraceae family and is widely distributed across tropical regions of West and Central Africa, including Nigeria, Cameroon, Gabon, and the Democratic Republic of Congo (Kengue, 2002; Ajibesin, 2011). This species, commonly referred to as safou, ube, or atanga in local dialects, plays a significant role in agroforestry systems and rural economies, where its fruits are harvested seasonally—typically from May to September—and traded locally and internationally, thereby contributing to food security and income generation for smallholder farmers (Leakey *et al*., 2005; Nguenang *et al*., 2023).

Economically, *D. edulis* supports livelihoods through fruit commercialization, with production estimates in Cameroon alone reaching several thousand tons annually. Its multipurpose uses extend beyond fruit consumption to include timber, fuelwood, and traditional crafts, underscoring its importance for sustainable development in biodiversity-rich regions (Kengue & Tchoundjeu, 2002; Silou *et al*., 2002). Traditionally, various parts of the plant—including the fruits, leaves, bark, and resin—have been widely used in ethnomedicine for treating ailments such as malaria, fever, skin infections, anemia, and oxidative stress-related disorders including diabetes and hypertension, largely due to its diverse phytochemical constituents (Ajibesin *et al*., 2008; Omonhinmin & Osawaru, 2015).

The chemical profile of *D. edulis* further highlights its nutritional and health significance in African diets. The fruit pulp is nutrient-dense, containing appreciable levels of dietary fiber, carbohydrates, proteins, and lipids, with reported vitamin C concentrations ranging from 12 to 15 mg/100 g in crude pulp extracts (Silou et al., 2002; Nguenang *et al*., 2023). Mineral analyses have demonstrated high levels of essential elements such as iron, potassium, calcium, and zinc, although concentrations vary considerably depending on environmental factors including soil type, maturity stage, and climatic conditions (Onwuka & Achi, 2009; Kapseu *et al*., 2011). The fatty acid profile of *D. edulis* oil is dominated by palmitic acid (41–47%), oleic acid (20–34%), and linoleic acid (22–29%), conferring nutritional properties comparable to other health-promoting edible oils, including olive oil (Silou *et al*., 2002; Kapseu *et al*., 2011).

Phytochemical screening has identified bioactive compounds such as terpenoids (e.g., α-pinene, sabinene, β-caryophyllene), flavonoids (e.g., quercetin, afzelin), polyphenols (e.g., ellagic acid, gallic acid), and antioxidants like vanillic acid and phytol, which contribute to its health-promoting properties (Onyema *et al*., 2024). Recent studies indicate that heat processing, such as boiling or roasting, affects these compounds; for instance, boiling reduces total phenols by 34% and flavonoids by 50%, while roasting preserves flavonoids better and increases anthocyanin content, enhancing overall bioactive potential (Onyema *et al*., 2024). These attributes support *D. edulis* as a functional food with antidiabetic, anti-inflammatory, antimicrobial, and antioxidant activities, as demonstrated in in vitro and in vivo models where extracts modulate glucose metabolism, scavenge free radicals (e.g., DPPH inhibition up to 84%), and inhibit enzymes like α-amylase (Nguenang *et al*., 2023).

Despite its nutritional benefits, *D. edulis* is susceptible to post-harvest spoilage, primarily driven by mycoflora, which poses challenges to its storage and commercialization. Fungal isolates commonly associated with fruit deterioration include *Aspergillus niger*, *Aspergillus flavus*, *Penicillium* spp., *Rhizopus* spp., *Fusarium* spp., and *Colletotrichum gloeosporioides*, often leading to rot, discoloration, and nutrient loss under humid tropical conditions (Uzoho *et al*., 2022; Ebede *et al*., 2025). Bacterial contaminants such as *Bacillus* spp., *Erwinia* spp., *Xanthomonas* spp., *Pseudomonas* spp., *Staphylococcus* spp., and *Klebsiella* spp. also contribute to spoilage, with microbial loads increasing rapidly in ambient storage (Uzoho *et al*., 2022; Ebede *et al*., 2025). These microbial interactions not only reduce the fruit's shelf life but also pose health risks through potential mycotoxin production, such as aflatoxins from *Aspergillus* species (Ebede *et al*., 2025).

While existing literature underscores the chemical richness and traditional uses of *D. edulis*, gaps persist in comprehensive profiling, particularly integrating chemical constituents with mycoflora dynamics under varying environmental conditions. Recent pharmacological evaluations highlight its therapeutic potential, yet limited in-depth studies on bioactive compound isolation, toxicological assessments, and spoilage mechanisms hinder its full exploitation (Nguenang *et al*., 2023). This research aims to decipher the chemical and mycoflora profiles of *D. edulis* to address these gaps, enhancing its nutritional, medicinal, and economic value through evidence-based insights.

Materials & Methods

Study Area

The study was conducted in Rivers State, Nigeria, within the Niger Delta region (latitudes 4°45′N–5°15′N, longitudes 6°40′E–7°05′E). This area features a humid tropical climate with annual rainfall of 2,000–4,500 mm, mean temperatures of 26–28°C, and relative humidity >80%. Soils are predominantly alluvial and hydromorphic, with sandy-loam to clay-loam textures, acidic pH (4.0–6.5), and variable organic matter content. These conditions support cultivation of tropical fruits like African pear (*Dacryodes edulis*) but promote fungal spoilage (Chukunda & Stephen, 2015).

Sample Collection

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Healthy and diseased African pear (*Dacryodes edulis*) fruits, identified by dark purple-black skin and firm texture, were collected from a vendor at Fruit Garden Market, Diobu, Port Harcourt, Nigeria. Samples were gathered in the early hours of the day to reduce heat and humidity effects, transported in perforated polyethylene bags for ventilation, and stored at 4°C in the Department of Plant Science and Biotechnology, Rivers State University, to preserve integrity prior to analyses.

Proximate Composition Determination
Proximate parameters (moisture, ash, crude fiber, lipid, protein, carbohydrate) were analyzed per AOAC (2005) standards.

Mineral Composition Determination
Mineral analysis was conducted using wet digestion with a mixture of concentrated nitric acid and concentrated tetraoxosulphate (VI) acid in a 3:1 ratio (Moreira *et al*., 2020). Powdered samples (0.2 g) were weighed into a conical flask, and 5 cm^3 of the digestion mixture was added. Digestion occurred at 150–200°C for 2 hours in a fume cupboard. After cooling, 30 cm^3 of distilled water was added, the mixture was shaken, filtered, and made up to 100 cm^3 in a volumetric flask. Sodium (Na), potassium (K), calcium (Ca), iron (Fe), magnesium (Mg), and phosphorus (P) were quantified using a flame photometer, while calcium was also determined by EDTA complexometric titration (ASTM, 2004). Mineral content was calculated as:

$$\text{MW} = \frac{\text{absorbency (ppm) x dry wt x D}}{wt\ of\ sample} \times 100$$

Where D= Digestion

Determination of Vitamin Composition
Standard Analytical Method AOAC, (2005) was used to determine the vitamin composition of the sample.

Vitamin A
Vitamin A was extracted using 100 ml of 50% ethanol solution, followed by filtration. The extract was heated in a steam bath for 30 minutes, and 2 ml of Na_2SO_4 solution was added, then diluted to 50 ml with distilled water. A standard riboflavin solution was similarly treated. Absorbance was measured at 510 nm, and vitamin A content was calculated as:

$$\text{Vitamin A} = \frac{100}{W} \times \frac{AU}{AS} \times C \times \frac{Vf}{Va} \times D$$

Where:
W= weight of sample analyzed
AU= absorbance of the test sample
AS= absorbance of the standard solution
Vf= total volume of filtrate
Va= volume of filtrate analyzed
C= concentration of the standard
D= dilution factor where applicable

Thiamine
Thiamine was extracted by mixing 2 g of sample with 50 ml of NaOH alcohol, followed by filtration. The filtrate was mixed with 10 ml of potassium dichromate, and absorbance was measured at 430 nm. Thiamine content was calculated as:

$$\text{Thiamine} = \frac{100}{W} \times \frac{AU}{AS} \times C \times \frac{Vf}{Va} \times D$$

Where:
W= weight of sample analyzed
AU= absorbance of the test sample
AS= absorbance of the standard solution
Vf= total volume of filtrate
Va= volume of filtrate analyzed
C= concentration of the standard
D= dilution factor where applicable.

Vitamin C
Vitamin C was determined using a titration method where 1 ml of 0.01M $CuSO_4$ equals 0.88 mg of vitamin C. A 5 g sample was used, and the content was calculated as:

$$\text{Vitamin C} = \frac{\text{F} \times \text{T}}{D \times S} \times 100$$

Where: F = factor for standardization (ml of ascorbic / mil of dye); T = (ml) used dye solution; D = diluted sample for titration; S = mushroom juice (g) for dilution

Phytochemical Analysis
Antinutrients were determined using Standard Analytical Method AOAC, (2005).

Oxalate, Glycoside and Saponin

Oxalate, glycoside, and saponin were quantified using the gravimetric alkaline precipitation method (Azwanida, 2015). A 5 g powdered sample was soaked in 20 ml of 10% ethanoic acetic acid, filtered, and concentrated to one-quarter of its volume over a steam bath. Concentrated ammonia solution was added to precipitate the compounds, filtered, washed with 9% ammonia solution, dried, and weighed after cooling. Content was calculated as:

Oxalate/Glycoside/Saponin= $\frac{w2-w1}{wt\ of\ samples} \times 100$

Where:
W1 = Weight of filtrate
W2 = Weight of filter paper + alkaloid/glycoside/saponin precipitate

Flavonoid, Phenol and Tannin

Flavonoid, phenol, and tannin were extracted by mixing 5 g of powdered sample with 50 ml of distilled water and 2 ml of HCl solution in a conical flask, boiled for 30 minutes, cooled, and filtered (Azwanida, 2015). The extract was obtained in 10 ml of ethyl acetate, filtered, dried at 60°C, cooled, and weighed. Content was calculated as:

Flavonoid/phenol/tannin = $\frac{w2-w1}{wt\ of\ samples} \times 100$

Where:
W1 = weight of empty filter paper
W2 = weight of paper + flavonoid/phenol/tannin extract

Carotenoid and Lignant

Carotenoid and lignin were extracted by mixing 5 g of powdered sample in 50 ml of 20% aqueous ethanol solution, heated at 55°C for 90 minutes in a water bath, and filtered (Sasidharan *et al*., 2011). Saponin was extracted using 60 ml of normal butanol, washed with 5% aqueous sodium chloride (NaCl) solution, dried through evaporation, and weighed. Content was calculated as:

Carotenoid/Lignant = $\frac{w2-w1}{wt\ of\ samples} \times 100$

Where:
W1 = weight of evaporating dish
W2 = weight of dish + carotenoid/lignant extract

Isolation of Fungal Organisms

A three-fold serial dilution was used (Wofu & Tariah, 2024). Hence, 1g of rotted plantain root samples was transferred into the first test tube containing 9mls of normal saline. 1ml of the solution was transferred to the second test tube and finally from the second to the third. 0.1ml aliquots from the second and third dilutions was plated onto Sabourand Dextrose Agar in Petri dishes containing ampicillin to hinder the growth of bacteria and this was done in triplicate. The inoculated plates (-1, -2 and -3) was incubated for 5days at ambient temperature of 25ºC ± 3ºC (Chuku, 2009). The entire set up was observed for 7 days to ensure full grown organisms. Pure cultures of isolates were obtained after series of isolations.

Identification of Fungal Organisms

Microscopic examination of fungal isolates was carried out using the needle mount method (Cheesebrough, 2000). The fungal spores were properly teased apart to ensure proper visibility. The well spread spores were stained with cotton blue in lacto phenol and examined microscopically using both the low and high power objective. The fungi were identified based on their spores and colonial morphology, mycelia structure and other associated structures using the keys of (Barnett and Hunter, 1998).

Determination of Percentage Incidence of Fungal Organisms

The percentage incidence of fungal occurrence was determined following Chuku *et al*. (2019);

$$\frac{X}{Y} \times \frac{100}{1} = \%\ \text{Incidence}$$

Where;
X = total number of each organism in a sample
Y = total number of all identified organism in a sample

Results

The chemical profile of African pear revealed a high moisture content of 84.73 ± 0.40%, while ash was found to be very low at 0.06 ± 0.01%. Lipid and protein contents were recorded at 0.51 ± 0.01% and 1.60 ± 0.07% respectively. Crude fibre was present at 1.30 ± 0.10%, and carbohydrate constituted the major dry-matter fraction at 12.22 ± 0.01% (Table 1). Mineral analysis (mg/100 g) revealed that phosphorus was the most abundant element at 40.00 ± 0.00 mg/100 g, followed by potassium at 13.00

± 0.00 mg/100 g. Calcium, iron, sodium, and magnesium were detected at 4.01 ± 0.01 mg/100 g, 3.10 ± 0.10 mg/100 g, 2.30 ± 0.10 mg/100 g, and 1.60 ± 0.10 mg/100 g respectively (Table 2). Vitamin composition (mg/100 g) showed a substantial level of vitamin C at 43.10 ± 23.58 mg/100 g, together with thiamine at 5.33 ± 0.15 mg/100 g, chlorophyll at 10.63 ± 0.58 mg/100 g, and vitamin A at 2.27 ± 0.15 mg/100 g (Table 3).
The phytochemical composition (mg/100 g) was characterized by very low or undetectable levels of anti-nutritional compounds: glycoside at 0.04 ± 0.03, oxalate at 0.01 ± 0.01, saponin at 0.00 ± 0.01, and tannin at 0.00 ± 0.00 (Table 4). Conversely, beneficial bioactive compounds were present in appreciable quantities: carotenoids at 14.33 ± 0.15, polyphenols at 14.93 ± 0.70, flavonoids at 15.63 ± 0.66, and lignans at 25.47 ± 0.08.
Microbiological examination identified *candida* sp. and *Aspergillus flavus* as the predominant fungal isolates from the African pear samples as shown in Table 5 and Plate 1. *Candida* sp. accounted for 40% of the total fungal incidence, and was characterized by small, circular, convex, undulate, smooth, opaque, and creamy colonies. *Aspergillus flavus* constituted 60% of the fungal incidence and was characterized by powdery colonies that progressed in colour from white to green; microscopic observation revealed septate, hyaline hyphae with radiate conidial heads.

Table 1: Proximate Composition (%) of African Pear

S/N	Parameter	Composition
1	Moisture	84.73±0.40
2	Ash	0.06±0.01
3	Lipid	0.51±0.01
4	Fibre	1.30±0.10
5	Carbohydrate	12.22±0.01
6	Protein	1.60±0.07

Table 2: Mineral Composition (mg/100 g) of African Pear

S/N	Parameter	Composition
1	Calcium	4.01±0.01
2	Iron	3.10±0.10
3	Magnesium	1.60±0.10
4	Phosphorus	40.00±0.00

5	Potassium	13.00±0.00
6	Sodium	2.30±0.10

Table 3: Vitamin Composition (mg/100 g) of African Pear

S/N	Parameter	Composition
1	Vitamin C	43.10±23.58
2	Vitamin A	2.27±0.15
3	Thiamine	5.33±0.15
4	Chlorophyll	10.63±0.58

Table 4: Phytochemical Composition (mg/100 g) of African Pear

S/N	Parameter	Composition
1	Glycoside	0.04±0.03
2	Oxalate	0.01±0.01
3	Saponin	0.00±0.01
4	Tannin	0.00±0.00
5	Carotenoid	14.33±0.15
6	Polyphenol	14.93±0.70
7	Flavonoid	15.63±0.66
8	Lignans	25.47±0.08

Table 5: Macroscopic and Microscopic Characterisation of Fungal Isolates

Isolate Code	Macroscopic Examination	Microscopic Examination	Probable Organism	% Incidence
C1	Colonies with a small circular, convex, undulate, smooth opaque and creamy	Budding, spherical to elongated cells, forming pseudomycelium	*Candida sp.*	40
C2	Colonies are powdery with surface colour progressing from white to green.	Hyphae are septate and hyaline and conidial heads are radiate	*Apergillus flavus*	60

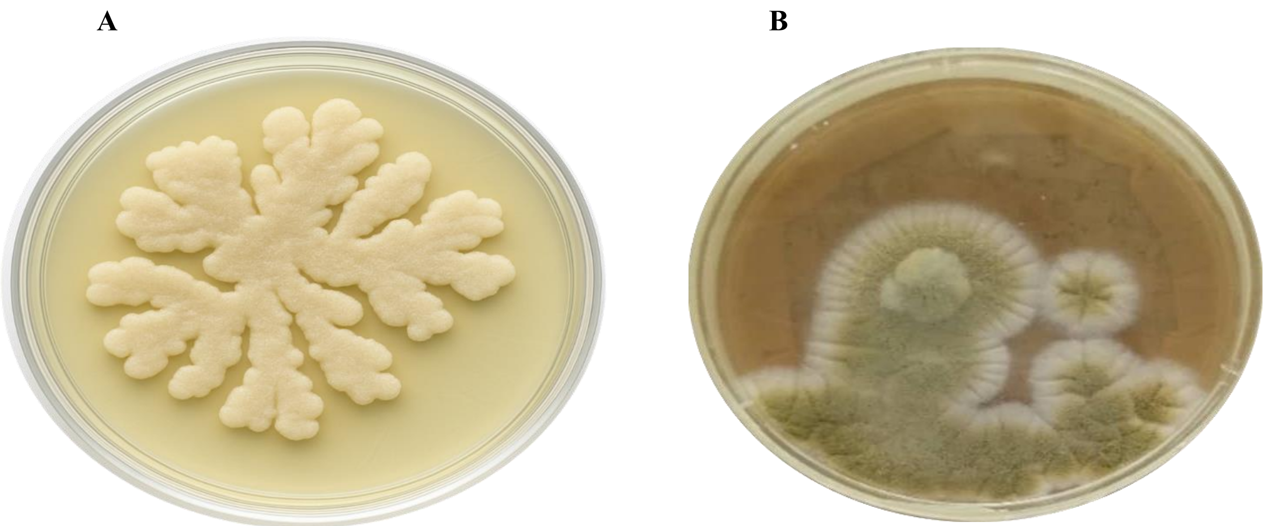

Plate 1: Morphology of *Candida* sp. (A); and *Aspergillus flavus* (B) in Macroscopic Study

Discussion

The chemical, phytochemical, and microbiological profile of the African pear (*Dacryodes edulis*) was evaluated, revealing a composition that both supports and clarifies established nutritional literature. The analysis established that the samples possessed a high moisture content of 84.73%, which is consistent with earlier reports describing the fruit as having moisture levels typically ranging from 70–85% on a fresh weight basis (Akubugwo & Ugbogu, 2007). While this significantly exceeded the 40–60% range noted by Urubu *et al*. (2014), it confirms that such elevated moisture renders the fruit highly perishable and prone to rapid post-harvest spoilage, affecting the quality of plant-derived products in tropical agro-ecosystems (Okwu & Ndu, 2006). Consequently, lipid (0.51%) and protein (1.60%) concentrations were lower than the values often reported in dried pulp analyses by authors such as Abe et al. (2012). Carbohydrates represented the major dry-matter fraction at 12.22%, suggesting the fruit could serve as a supplementary energy source in animal feeds, particularly for non-ruminants like rabbits, where inclusion supports growth performance (Ezeokoli, 2016). Additionally, the modest crude fibre level of 1.30% was found beneficial for promoting digestive health and maintaining gut microbiota balance (Oboh & Ekperigin, 2004).

Mineral analysis identified phosphorus (40.00 mg/100 g) and potassium (13.00 mg/100 g) as the most abundant elements, followed by calcium (4.01 mg/100 g), iron (3.10 mg/100 g), sodium (2.30 mg/100 g), and magnesium (1.60 mg/100 g). This hierarchy aligns with the mineral profiles documented by Edem *et al*. (2009) and Uhegbu *et al*. (2015), positioning the fruit as a moderate source of minerals essential for bone mineralization, energy metabolism, and cardiovascular function in poultry and rabbit rations. The presence of iron specifically supports hemoglobin synthesis and prevents anemia in consuming animals (Okwu, 2005). Within the plant, while adequate mineral nutrition facilitated nutrient uptake and tree vigor, fungal infections were observed to potentially interfere with mineral assimilation and overall plant health (Omokaro, 1999).

The vitamin composition revealed a notable vitamin C content of 43.10 mg/100 g, which aligns with findings by Ibe and Owutadua (2005) and Ajibade *et al*. (2004), reinforcing its role as a potent antioxidant that supports immune competence under tropical stress. Other detected vitamins, including thiamine (5.33 mg/100 g) and vitamin A (2.27 mg/100 g), along with chlorophyll (10.63 mg/100 g), contribute to metabolic efficiency and protective effects against nutritional deficiencies (Ezeama & Akobundu, 2005). However, the high incidence of spoilage fungi was noted to compromise vitamin stability post-harvest.

Phytochemical screening showed very low or undetectable levels of anti-nutritional factors such as glycosides (0.04 mg/100 g), oxalates (0.01 mg/100 g), and tannins (0.00 mg/100 g). These negligible levels indicate minimal risk of nutrient interference, supporting the safe use of the fruit in animal feeds (Uhegbu *et al*., 2015; Omokaro, 1999). Conversely, beneficial bioactives were abundant: lignans (25.47 mg/100 g), flavonoids (15.63 mg/100 g), polyphenols (14.93 mg/100 g), and carotenoids (14.33 mg/100 g). These levels are consistent with Okwu and Nnamdi (2008) and Atawodi *et al*. (2010), who highlighted their roles in scavenging free radicals and offering anti-inflammatory protection. Furthermore, lignans and carotenoids provide cellular protective effects and provitamin A for immune support (Tee *et al*., 2014; Ajibade *et al*., 2004), while also enhancing the plant's own defense against pathogens (Obame *et al*., 2008).

Microbiological examination identified *Candida sp.* (40% incidence) and *Aspergillus flavus* (60% incidence) as the predominant fungal isolates. *Candida sp.* was characterized by creamy colonies and pseudomycelium, while *A. flavus* exhibited powdery green colonies and radiate conidial heads, matching standard mycological descriptions and the research of Nwufo (1994). The predominance of *A. flavus* reflects its opportunistic behavior in humid environments, where it accelerates fruit rot and reduces yield (Ameh *et al*., 2010). Spoilage by these organisms not only degrades macronutrients but introduces risks of aflatoxin contamination, which causes hepatotoxicity and growth impairment in livestock (Egwim *et al*., 2013). *Candida sp.* may further alter gut microbiota balance in animals consuming contaminated material (Okafor *et al*., 2009). Ultimately, while the African pear offers valuable nutritional benefits, its high susceptibility to fungal spoilage poses substantial risks, highlighting the critical need for effective post-harvest handling in tropical settings (Ndon, 2012).

Conclusion

African pear (*Dacryodes edulis*) exhibits a strong nutritional and phytochemical profile with valuable bioactive compounds, essential vitamins and minerals, and negligible anti-nutritional factors, making it a promising,

low-risk resource for supporting animal health, antioxidant protection, and plant resilience in tropical settings.
However, its high moisture content and significant vulnerability to fungal spoilage (especially *Aspergillus flavus* and *Candida* sp.) limit post-harvest quality, introduce mycotoxin risks, and threaten safe utilization in animal nutrition as well as sustainable plant production. Effective post-harvest management is therefore essential to preserve its benefits and unlock its full potential for nutrition, food security, and agro-ecological value.

References

Abe, P. N., Onwuka, F. C., & Onyenekwe, P. C. (2012). The effect of *Dacryodes edulis* (African Pear) pulp oil extract on serum lipid parameters in male Albino Wistar rats. *Journal of Applied Life Sciences International*, 1(1), 1–10.

Akubugwo, I. E., & Ugbogu, A. E. (2007). Physicochemical studies on *Dacryodes edulis* (G. Don) Lam. seeds from Nigeria. *American Journal of Food Technology*, 2(4), 300–305.

Ajibade, S. R., Balogun, M. O., Afolabi, O. O., & Kupolati, M. D. (2004). Nutritional and anti-nutritional composition of African pear (*Dacryodes edulis*). *Journal of Food Technology*, 2(4), 261–265.

Ajibesin, K. K. (2011). *Dacryodes edulis* (G. Don) H.J. Lam. In E. M. M. Lemmens, R. H. M. J. Louppe, & A. A. Oteng-Amoako (Eds.), Plant resources of tropical Africa: Timbers 2 (pp. 211–214). PROTA Foundation.

Ajibesin, K. K., Ekpo, B. A., Bala, D. N., Essien, E. E., & Adesanya, S. A. (2008). Ethnobotanical survey of Akwa Ibom State of Nigeria. *Journal of Ethnopharmacology,* 115(3), 387–408.

Ameh, J. B., Okwori, E. E., & Onuorah, S. (2010). Fungi associated with the spoilage of African pear (*Dacryodes edulis*) in some parts of Kaduna State, Nigeria. *Journal of Biological Sciences*, *3*(2), 45–52.

Atawodi, S. E., Pfundstein, B., Haubner, R., Spiegelhalder, B., Bartsch, H., & Owen, R. W. (2010). Content of polyphenolic compounds in the Nigerian stimulants *Cola nitida* (Kola nut) and *Dacryodes edulis* (African pear). *Journal of Agricultural and Food Chemistry*, 58(2), 1251–1256.

AOAC. (2005). *Official Methods of Analysis of AOAC International* (18th ed.). Association of Official Analytical Chemists.

ASTM. (2004). *Standard Test Methods for Calcium and Magnesium in Water by EDTA Titration*. ASTM International.

Azwanida, N. N. (2015). A review on the extraction methods use in medicinal plants, principle, strength and limitation. *Medicinal & Aromatic Plants*, 4(3), 196.

Barnett, H. L., & Hunter, B. B. (1998). *Illustrated genera of imperfect fungi* (4th ed.). American Phytopathological Society Press.

Cheesebrough, M. (2000). *District laboratory practice in tropical countries part 2*. Cambridge University Press.

Chuku, E. C. (2009). Fungi responsible for the spoilage of plantain (*Musa paradisiaca*) at various ripening stages. *Acta Agronomica Nigeriana, 9*(1&2), 35–45.

Chuku, E. C., Agbagwa, S. S., & Worlu, C. (2019). Nutrient quality and associated spoilage fungi of English pear (*Pyrus communis* L.). *International Journal of Agriculture, Environment and Bioresearch, 4*(6), 317–325.

Chukunda, F. A. & Stephen, O. U. (2015). Nutritional composition and fungal spoilage of African pear (*Dacryodes edulis*) fruits sold in Port Harcourt Metropolis, Nigeria. *Journal of Research in Biology*, *5*(6), 1809-1814.

Edem, D. O., Eka, O. U., & Ifon, E. T. (2009). Chemical evaluation of the nutritive value of the African pear (*Dacryodes edulis*). *Tropical Science*, 49(1), 22–27.

Egwim, E. C., Omere, J. C., & Evans, E. C. (2013). Evaluation of mycotoxins in African pear (*Dacryodes edulis*) sold in major markets of Minna, Nigeria. *International Journal of Applied Biology and Pharmaceutical Technology*, 4(3), 224–228.

Ezeama, C. F., & Akobundu, E. N. (2005). Vitamins and phytochemical composition of African pear (*Dacryodes edulis*) during fruit development. *Journal of Sustainable Agriculture and the Environment*, 7(1), 33–40.

Ezeokoli, L. C. (2016). Effects of processed African pear (*Dacryodes edulis*) seed meal on the growth performance and carcass characteristics of weaner rabbits. *Nigerian Journal of Animal Science*, 18(2), 415–423.

Ibe, A. E., & Owutadua, J. I. (2005). Chemical and phytochemical composition of African pear (*Dacryodes edulis*). *International Journal of Food Science and Technology*, 40(2), 121–127.

Kapseu, C., Tchiegang, C., & Parmentier, M. (2011). Fatty acid composition and physicochemical properties of *Dacryodes edulis* (safou) pulp oil. *Journal of Food Lipids,* 18(2), 256–269.

Kengue, J. (2002). *Safou: Dacryodes edulis (G. Don) H.J. Lam*. International Centre for Underutilised Crops, University of Southampton.

Kengue, J., & Tchoundjeu, Z. (2002). Propagation and management of *Dacryodes edulis* for improved productivity. *Forest, Trees and Livelihoods,* 12(1–2), 85–98

Leakey, R. R. B., Tchoundjeu, Z., Schreckenberg, K., Shackleton, S. E., & Shackleton, C. M. (2005). Agroforestry tree products (AFTPs): Targeting poverty reduction and enhanced livelihoods. *International Journal of Agricultural Sustainability,* 3(1), 1–23

Nguenang, G. M., Mbaveng, A. T., Bonsou, I. N., Chi, G. F., & Kuete, V. (2023). The genus Dacryodes Vahl.: Ethnobotany, phytochemistry and biological activities. *Pharmaceuticals*, 16(5), Article 775.

Ndon, B. A. (2012). Post-harvest handling and storage practices for *Dacryodes edulis* in tropical settings. *Nigerian Journal of Agriculture, Food and Environment*, 8(3), 12–18.

Nwufo, M. I. (1994). Post-harvest spoilage of African pear (*Dacryodes edulis*) in southeastern Nigeria. *Journal of Tropical Agriculture*, 32(1), 150–154.

Obame, L. C., Edou, P., Zongo, C., & Traore, A. S. (2008). Antioxidant and antimicrobial activities of *Dacryodes edulis* (G. Don) H.J. Lam. essential oil from Gabon. *African Journal of Microbiology Research*, 2(7), 173–177.

Oboh, G., & Ekperigin, M. M. (2004). Nutritional evaluation of some Nigerian wild seeds. *Nahrung/Food*, 48(2), 85–87.

Okafor, N., Umeh, C., & Iheukwumere, I. (2009). Identification of spoilage fungi associated with the African pear (*Dacryodes edulis*) in Anambra State, Nigeria. *African Journal of Biotechnology*, 8(21), 5841–5845.

Okwu, D. E. (2005). Phytochemicals, vitamins and mineral contents of two Nigerian medicinal plants. *International Journal of Molecular Medicine and Advance Sciences*, 1(4), 375– 381.

Okwu, D. E., & Ndu, K. C. (2006). Evaluation of the phytonutrients, vitamins and mineral contents of indigenous spices. *Journal of Food and Nutrition Sciences*, 2(1), 1–7.

Okwu, D. E., & Nnamdi, F. U. (2008). Evaluation of the chemical composition of *Dacryodes edulis* and *Raphia hookeri* Mann and Wendl exudates used in herbal medicine in South Eastern Nigeria. *African Journal of Traditional, Complementary and Alternative Medicines*, 5(2), 194–200.

Omokaro, D. N. (1999). Mineral nutrition and fungal infestation of African pear (*Dacryodes edulis*) fruits. *Journal of Phytopathology*, 47(3), 211–215.

Omonhinmin, C. A., & Osawaru, M. E. (2015). Ethnobotanical survey of medicinal plants used in the treatment of skin diseases in Ovia North-East Local Government Area, Edo State, Nigeria. *Journal of Plant Sciences,* 3(4), 188–196.

Onwuka, G. I., & Achi, O. K. (2009). Quality characteristics of African pear (*Dacryodes edulis*) fruit pulp. *Journal of Food Science and Nutrition,* 10(2), 138–146.

Sasidharan, S., Chen, Y., Saravanan, D., Sundram, K. M., & Latha, L. Y. (2011). Extraction, isolation and characterization of bioactive compounds from plants' extracts. *African Journal of Traditional, Complementary and Alternative Medicines*, 8(1), 1-10.

Silou, T., Louembe, D., & Chalchat, J. C. (2002). Characterisation of safou (*Dacryodes edulis*) fruit oil. *Food Chemistry,* 76(2), 249–253.

Tee, E. S., Tan, S., & Siah, W. M. (2014). Bioactive compounds in tropical fruits: Their role in health and disease. *Food Reviews International*, 30(1), 15–32.

Uhegbu, F. O., Onwuchekwa, C. C., & Iweala, E. E. (2015). Effect of inclusion of *Dacryodes edulis* seed meal on the biochemical parameters of poultry birds. *International Journal of Biochemistry and Biotechnology*, 4(2), 108–114.

Urubu, T. L., Orhevba, B. A., & Agajie, M. (2014). Effect of processing on the proximate and mineral composition of African pear (*Dacryodes edulis*) pulp. *Standard Research Journal of Agricultural Sciences*, 2(5), 78–84.

Wofu, N. B. & Tariah, J. O. (2024). Evaluation of the Mineral Composition and Mycoflora of Yellow Monkey Cola (*Cola lepidota* K. Schum) Fruit Pulp. *International Journal of Agriculture & Earth Science*, 10(6), 1-8