
RESEARCH ARTICLE**Bacteria Associated With Spoilage of African Pear (*Dacryodes Edulis*) From Selected Market in Port Harcourt, Rivers State, Nigeria****Okorite George-West¹✉, Anele B.C² and Oyadiran H.A³**¹ Department of Science Laboratory Technology, Captain Elechi Amadi Polytechnic, Rumuola, Port Harcourt, Rivers State, Nigeria² Department of Microbiology, Madonna University, Nigeria, Elele, Rivers State³ Department of Environmental Petroleum Management/Industrial Chemistry, Madonna University, Nigeria, Elele, Rivers State**Corresponding Author:** Okorite, George-West, **E-mail:** okorite.george-west@portharcourtpolytechnic.com OR brightanele76@gmail.com**ABSTRACT**

This study investigated the bacteria associated with the spoilage of African pear (*Dacryodes edulis*) sold in selected markets in Port Harcourt, Rivers State, Nigeria. A total of fifteen (15) spoiled African pear samples were randomly collected from Rumuola Market, Mile 3 Market, and Rumuokoro Market. Standard microbiological methods, including serial dilution, spread plate technique, Gram staining, and biochemical tests, were used for the isolation and identification of bacterial isolates. The total bacterial counts ranged from 5.35×10^6 CFU/g to 7.3×10^6 CFU/g, indicating heavy bacterial contamination of the spoiled fruits. The highest bacterial count was recorded in sample Rk1 from Rumuokoro Market, while the lowest count was observed in sample M3 from Mile 3 Market. Four bacterial genera were identified from the spoiled African pear samples: *Staphylococcus* species, *Bacillus* species, *Escherichia coli*, and *Klebsiella* species. *Staphylococcus* species had the highest frequency of occurrence (34.8%), followed by *Bacillus* species (26.1%), *Escherichia coli* (21.7%), and *Klebsiella* species (17.4%). The presence of these bacteria suggests poor hygienic handling, inadequate storage conditions, and environmental contamination during transportation and marketing. The study revealed that spoiled African pear sold in local markets may serve as a source of potentially pathogenic bacteria and could pose public health risks to consumers. Proper hygiene, improved storage conditions, and routine microbial monitoring are therefore recommended to reduce contamination and improve fruit safety.

KEYWORDSAfrican pear, *Dacryodes edulis*, bacterial spoilage, microbial contamination, public health, Port Harcourt**ARTICLE INFORMATION****ACCEPTED:** 04 April 2026**PUBLISHED:** 10 May 2026

1. Introduction

Fruits are important components of the human diet because they provide essential nutrients required for growth, energy production, and maintenance of good health. They are rich sources of vitamins, minerals, dietary fiber, antioxidants, and other bioactive compounds that help in disease prevention and improvement of body functions. Regular consumption of fruits has been associated with reduced risks of cardiovascular diseases, diabetes, malnutrition, and certain forms of cancer (Adebayo et al., 2020). Due to their high moisture and nutrient content, fruits are highly perishable and are easily attacked by microorganisms during harvesting, transportation, storage, and marketing.

Fruit spoilage is a major public health and economic problem in many developing countries, including Nigeria. Spoilage microorganisms reduce the quality, nutritional value, marketability, and shelf life of fruits. Post-harvest losses caused by microbial contamination have continued to increase due to poor handling practices, inadequate storage facilities, and

unfavorable environmental conditions. Studies have shown that approximately 20–25% of harvested fruits are lost annually to microbial spoilage caused mainly by bacteria and fungi during post-harvest handling and distribution (FAO, 2021). These microorganisms invade fruit tissues through wounds, bruises, or natural openings and cause deterioration characterized by softening, discoloration, foul odor, and tissue breakdown.

African pear, scientifically known as *Dacryodes edulis*, is an important tropical fruit tree belonging to the family Burseraceae. The fruit is commonly known as African pear, bush pear, or “ube” in southeastern Nigeria. It is widely cultivated and consumed in many parts of West and Central Africa because of its nutritional, medicinal, and economic importance. The fruit contains high amounts of lipids, proteins, vitamins, essential fatty acids, minerals, and antioxidants that contribute significantly to human nutrition (Okafor et al., 2019). African pear is commonly eaten roasted, boiled, or raw and is often consumed with maize or bread as a local delicacy.

Despite its nutritional and commercial importance, African pear has a very short shelf life due to its high moisture and oil content, making it highly susceptible to microbial spoilage. Spoilage usually occurs during transportation, storage, and marketing, especially under poor sanitary conditions commonly observed in open markets. Bacterial contamination of African pear may originate from soil, contaminated water, handling by vendors and consumers, dirty containers, insects, and exposure to dust and environmental pollutants. Some spoilage bacteria associated with fruits include *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas* species, *Bacillus* species, and *Salmonella* species, many of which are capable of causing foodborne infections in humans (Nwachukwu & Akobundu, 2022).

Rumuola, Mile 3, and Rumukwota Markets in Port Harcourt are the major markets where African pear is sold in large quantities. However, inadequate preservation methods, poor hygiene practices, and prolonged exposure of fruits to environmental contamination may increase the rate of spoilage and microbial growth. The presence of spoilage bacteria on African pear not only reduces its quality and shelf life but may also pose serious health risks to consumers.

Therefore, this study was carried out to assess the bacteria associated with the spoilage of African pear (*Dacryodes edulis*) sold at selected market in Port Harcourt, Rivers State, Nigeria. The study aims to isolate and identify the bacterial organisms associated with spoiled African pear and to determine their possible public health implications

2. Materials and Methods

2.1 Study Area

This study was carried out at Rumuola, Mile 3, and Rumokwuta Markets respectively. The markets were characterized by high commercial activities involving the sale of fresh agricultural produce, including African pear (*Dacryodes edulis*). The warm and humid environmental conditions of the area favor microbial growth and fruit spoilage.

2.2 Study Design

A laboratory-based cross-sectional study was conducted to isolate and identify bacteria associated with the spoilage of African pear sold at Rumuola, Mile 3, and Rumokwuta markets. The study focused on determining the bacterial organisms responsible for spoilage and their possible public health significance.

2.3 Sample Collection

A total of Fifteen (15) spoiled African pear fruits were randomly purchased from different vendors from the markets. The samples were collected aseptically into sterile polyethylene bags, properly labeled, and transported immediately to the microbiology laboratory for analysis. Care was taken to avoid external contamination during sample collection and transportation (Nwachukwu & Akobundu, 2022).

2.4 Preparation of Samples

The spoiled portions of the African pear fruits were cut using sterile scalpels and forceps. About 1 g of each spoiled sample was weighed and homogenized in 9 mL of sterile distilled water to obtain the stock solution. Serial dilution was carried out up to 10^{-5} dilution using sterile test tubes containing distilled water.

2.5 Isolation of Bacteria

Aliquots (0.1 mL) of the diluted samples were inoculated onto prepared Nutrient Agar, MacConkey Agar, and Mannitol Salt Agar plates using the spread plate technique. The inoculated plates were incubated aerobically at 37°C for 24–48 hours for bacterial growth (Adebayo et al., 2020).

2.6 Enumeration of Bacterial Isolates

After incubation, visible colonies on the culture plates were counted and recorded as colony-forming units per gram (CFU/g). Distinct colonies were subcultured repeatedly on fresh media to obtain pure bacterial isolates for identification.

2.7 Identification of Bacterial Isolates

Bacterial isolates were identified based on colonial morphology, Gram staining characteristics, and standard biochemical tests, including catalase test, coagulase test, citrate utilization test, oxidase test, indole test, motility test, and sugar fermentation reactions. Identification procedures were carried out according to standard microbiological methods described by Cheesbrough (2021).

2.8 Data Analysis

The data obtained from bacterial counts and identification of isolates were analyzed descriptively using frequencies, percentages, and tables. The occurrence of each bacterial isolate associated with the spoilage of African pear was calculated and presented appropriately.

3. Results

3.1 Bacterial Counts of spoiled African Pear (*Dacryodes edulis*)

Table 1 shows that spoiled African pear (*Dacryodes edulis*) samples obtained from different markets had high bacterial counts ranging from 5.35×10^6 CFU/g to 7.3×10^6 CFU/g. The highest bacterial count was recorded in sample Rk1 from Rumuokoro Market, while the lowest count was observed in sample M3 from Mile 3 Market. The high microbial load indicates significant bacterial contamination of the spoiled fruits, likely due to poor handling and storage conditions.

Table 1: Total Bacterial counts of spoiled African pear (*Dacryodes edulis*)

Sample code	Total Bacterial Count (CFU/g)
R1	6.3×10^6
R2	6.35×10^6
R3	6.5×10^6
M1	6.3×10^6
M2	6.35×10^6
M3	5.35×10^6
Rk1	7.3×10^6
Rk2	6.5×10^6
Rk3	6.4×10^6

Key: R=Rumuola Market, M=Mile 3 market, RK=Rumuokoro market, CFU/g= Colony Forming Unit per gram

3.2 frequency of occurrence of bacterial isolates recovered from spoiled African pear samples.

Table 2 presents the frequency of occurrence of bacterial isolates recovered from spoiled African pear samples. *Staphylococcus* species had the highest occurrence with 34.8%, followed by *Bacillus* species (26.1%), *Escherichia coli* (21.7%), and *Klebsiella* species (17.4%). The predominance of these bacteria suggests that spoiled African pear fruits may serve as reservoirs of spoilage and potentially pathogenic microorganisms.

Table 2: Frequency of Occurrence of Bacterial Isolates from Spoiled African pear

Bacterial Isolates	Frequency	Percentage (%)
<i>Staphylococcus</i>	8	34.8
<i>Escherichia coli</i>	5	21.7
<i>Bacillus</i>	6	26.1
<i>Klebsiella</i>	4	17.4

4. Discussion

The present study revealed high bacterial contamination in spoiled African pear (*Dacryodes edulis*) obtained from selected markets in Port Harcourt, Rivers State, Nigeria. The total bacterial counts ranged from 5.35×10^6 CFU/g to 7.3×10^6 CFU/g, indicating that spoiled African pear provides a suitable environment for the growth and multiplication of bacteria. The high microbial load observed in this study may be attributed to the rich nutrient composition and high moisture content of African pear, which support rapid microbial activity during storage and marketing.

Among the samples analyzed, the highest bacterial count was recorded in sample Rk1 obtained from Rumuokoro Market, while the lowest count was observed in sample M3 from Mile 3 Market. The variation in bacterial counts among the samples may be associated with differences in storage conditions, handling practices, duration of exposure, environmental sanitation, and level of fruit deterioration. Fruits that are bruised or damaged are more vulnerable to microbial invasion because damaged tissues provide nutrients and entry points for microorganisms.

The high bacterial counts recorded in this study agree with earlier reports by Wogu and Ofuase (2018), who reported heavy microbial contamination in spoiled avocado pear fruits sold in Nigerian markets. The similarity between both studies may be linked to comparable tropical environmental conditions, open market systems, poor sanitary practices, and inadequate post-harvest handling methods commonly observed in many local markets.

The elevated microbial load observed in fruits from Rumuola Market, Mile 3 Market, and Rumuokoro Market may also be connected to poor hygienic handling during transportation and marketing. In many open markets, fruits are displayed without adequate protection, thereby exposing them to dust, flies, contaminated water, and repeated human contact. These factors increase the risk of bacterial contamination and accelerate spoilage.

The study further identified *Staphylococcus* species as the most predominant bacterial isolate, accounting for 34.8% of the total isolates recovered. The high occurrence of *Staphylococcus* species may be related to contamination from human skin, hands, and respiratory secretions during handling and sale of the fruits. This finding agrees with the report of Aliero et al. (2022), who also identified *Staphylococcus aureus* as one of the major bacterial contaminants associated with spoiled avocado fruits in Nigeria. The agreement between the studies suggests that poor personal hygiene and unsanitary market conditions play significant roles in fruit contamination.

Bacillus species were the second most frequently isolated organisms in this study, with an occurrence of 26.1%. The presence of *Bacillus* species may be due to their ability to form resistant spores that survive under harsh environmental conditions. These organisms are naturally found in soil, dust, water, and air, making contamination during harvesting, transportation, and storage highly possible. Similar findings were reported by Wogu and Ofuase (2018), who isolated *Bacillus* species from spoiled fruit samples.

The isolation of *Escherichia coli* from the spoiled African pear samples indicates possible fecal contamination and poor sanitary handling of the fruits. *E. coli* is commonly regarded as an indicator organism for food contamination and poor hygiene. The presence of this organism in the fruits suggests exposure to contaminated water, dirty handling materials, or poor personal hygiene among fruit handlers. This observation agrees with the findings of Okeh et al. (2022), who also reported the occurrence of *E. coli* in spoiled avocado pear fruits sold in Nigerian markets.

However, the percentage occurrence of *E. coli* recorded in the present study was lower than those reported in some previous studies. This variation may be due to differences in geographical location, environmental sanitation, climatic conditions, sample handling, and methods of storage adopted in different markets.

Klebsiella species recorded the lowest frequency of occurrence among the isolates identified in this study. Despite the lower occurrence, the presence of *Klebsiella* species remains important because some strains are opportunistic pathogens capable of causing infections in humans. Their occurrence may be associated with environmental contamination, poor storage conditions, contaminated packaging materials, and prolonged exposure of fruits to humid environments.

Overall, the findings of this study confirm that spoiled African pear sold in open markets contains high levels of bacterial contamination, including potentially pathogenic organisms. This poses a possible public health risk, especially when contaminated fruits are consumed without proper washing or processing. The study therefore emphasizes the importance of good hygiene practices, proper storage facilities, and effective post-harvest handling techniques in reducing microbial contamination and improving the safety and shelf life of African pear fruits sold in local markets.

Regular microbial quality assessment, public health education for fruit vendors, and improved environmental sanitation should also be encouraged to minimize bacterial contamination and reduce the risk of foodborne diseases associated with spoiled fruits.

5. Conclusion

This study revealed that spoiled African pear (*Dacryodes edulis*) sold in selected markets in Port Harcourt, Rivers State, harbored high bacterial loads and diverse bacterial contaminants. The total bacterial counts obtained from the samples indicated significant microbial contamination, suggesting that African pear provides a favorable environment for bacterial growth due to its high moisture and nutrient content. The bacterial isolates identified in this study included *Staphylococcus* species, *Bacillus* species, *Escherichia coli*, and *Klebsiella* species, with *Staphylococcus* species showing the highest frequency of occurrence. The presence of these organisms indicates poor hygienic handling, improper storage conditions, and environmental contamination during harvesting, transportation, and marketing of the fruits. The isolation of potentially pathogenic bacteria such as *Escherichia coli* and *Klebsiella* species suggests possible public health risks associated with the consumption of contaminated African pear fruits. The findings of this study therefore emphasize the need for improved sanitation, proper storage practices, and effective post-harvest handling methods to reduce microbial spoilage and ensure consumer safety.

6. Recommendations

We therefore recommend the following important strategies:

1. Proper hygienic practices should be maintained during the harvesting, transportation, storage, and marketing of African pear fruits to reduce bacterial contamination and spoilage.
2. Fruit vendors should avoid displaying fruits in dirty or open environments exposed to dust, flies, contaminated water, and excessive human handling.
3. Adequate storage facilities, including clean storage containers and refrigeration, should be provided to extend the shelf life and improve the safety of African pear fruits.
4. Regular public health education and routine microbiological monitoring of fruits sold in local markets should be encouraged to promote food safety and reduce the risk of foodborne infections.

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Bacteria Associated With Spoilage of African Pear (Dacryodes Edulis) From Selected Market in Port Harcourt, Rivers State, Nigeria

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