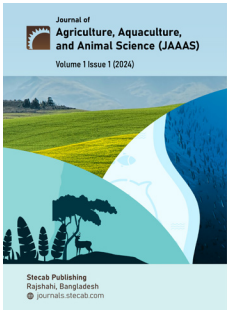

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Review Article

The Role of Post-Harvest Technologies in the Handling and Preservation of Fish and Fish Products in Nigeria: A Mini-Review

*[1]Ibrahim Muhammad Abdul, [2]Musa Kamilu, [2]Ibrahim Elisha Maiyanga, [2]Ibrahim Lukman Yaji, [3]Ahmed Kyari Yerima, [3]Abdullahi Tafida Ibrahim

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About Author

[1] Nigerian Stored Products Research Institute Kano, Nigeria

[2] Research Outreach Department, Nigerian Stored Products Research Institute Kano, Nigeria

[3] Perishable Crop Research Department, Nigerian Stored Products Research Institute Kano, Nigeria

Contact @ Ibrahim Muhammad Abdul
m.ib2010@yahoo.com

ABSTRACT

Nigeria's thriving fisheries sector suffers from significant post-harvest losses, impacting income, food security, and product quality. This review examines the application of diverse technologies, from traditional sun drying and smoking to modern chilling and modified atmosphere packaging, in preserving and handling fish and fish products. Effective post-harvest technologies offer substantial benefits by minimizing losses, enhancing hygiene and quality, adding value, and diversifying markets. However, challenges like affordability, skills gap, and weak infrastructure impede wider adoption. Hence, there is a need to develop low-cost affordable, and accessible technologies such as improved kilns and solar-powered cold storage; enhance capacity building, transportation networks, cold chain facilities, and market linkages and lastly strengthen policy and institutions for quality standards, facilitate access to finance, and provide extension services. By addressing these challenges, Nigeria can unlock the full potential of its fisheries sector, boosting food security, income generation, and overall economic development.

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1. INTRODUCTION

The fisheries sector plays a crucial role in Nigeria's economy, providing a significant source of employment and nutrition (World Bank, 2019; FAO, 2015). However, challenges persist in the post-harvest stage, where inefficiencies in handling and preservation contribute to substantial losses and diminished product quality. The specific issues surrounding the adoption, implementation, and effectiveness of post-harvest technologies in the fisheries sector remain inadequately explored. This knowledge gap impedes the sustainable development of the industry and hinders efforts to enhance food security, economic growth, and the overall well-being of communities reliant on fish and fish products in Nigeria (Akintola *et al.*, 2017; Nnorom, 2018).

Nigeria's fisheries sector is characterized by a diverse array of fish species, reflecting the ecological richness of its water bodies (Federal Ministry of Agriculture & Rural Development, 2017). The sector encompasses both artisanal and industrial fisheries, catering to the varying needs of a population heavily reliant on fish as a primary source of animal protein (FAO, 2015). As the demand for fish and fish products continues to rise with population growth, urbanization, and changing dietary preferences (World Bank, 2013), it becomes imperative to address the inefficiencies in post-harvest handling and preservation to ensure sustainability, reduce post-harvest losses, and meet the nutritional needs of the burgeoning population (Adeyeye, 2020). Hence, Effective post-harvest technology plays a crucial role in minimizing these losses, extending shelf life, improving hygiene, and adding value to fish and fish products. This mini-review delves into the multifaceted role of post-harvest technologies in addressing challenges related to the handling and preservation of fish and fish products in Nigeria. Through a concise examination of existing literature, this review aims to shed light on the current state of post-harvest technologies in the Nigerian fisheries sector and their impact on the industry's sustainability and growth.

1.1 Objectives of the Mini-Review

This mini-review seeks to address the aforementioned knowledge gaps by:

i. Providing an overview of the current state of post-harvest technologies in the Nigerian fisheries sector;

ii. Evaluating the impact of these technologies on reducing post-harvest losses and improving the quality of fish and fish products and;

iii. Identifying challenges and barriers to the widespread adoption of post-harvest technologies.

2. LITERATURE REVIEW

Although Nigeria possesses abundant fish resources, the persistent challenge of post-harvest losses (PHL) resulting from inadequate handling and preservation methods remains a significant issue. These losses not only diminish food security but also decrease the income of fishers and hinder the sector's overall economic potential (Akinremi, 2009). According to the Freshness Retention Theory, the key to minimizing quality deterioration and prolonging the shelf life of highly perishable products like fish lies in rapid post-harvest cooling and controlled storage (Rahman, 2007). The implementation of this theory through modern technologies has the potential to greatly enhance fish handling and preservation practices in Nigeria.

3. METHODOLOGY

The review adopted a systematic approach, examining peer-reviewed articles, reports, and relevant literature from databases such as PubMed, ScienceDirect, and Google Scholar. The inclusion criteria focused on studies conducted in Nigeria within the last decade, emphasizing technological interventions in post-harvest handling and preservation of fish and fish products. Data extraction involves identifying key technologies, assessing their effectiveness, and analyzing socioeconomic impacts.

4. RESULTS AND DISCUSSION

4.1. The Current State of Post-harvest Technologies

Recognizing the need to address post-harvest challenges, various stakeholders have explored and implemented post-harvest technologies (Akaneme, 2019; World Bank, 2019) to enhance the handling and preservation of fish and fish products in Nigeria. These technologies encompass a broad spectrum, ranging from innovations in storage facilities and transportation to advancements in processing methods (Akinneye & Sagoe, 2012; FAO, 2015).

In recent years, there has been a notable increase in the adoption of cold chain technologies, including refrigeration and insulated transportation, to maintain the quality of fish from the point of harvest to the end consumer (Akintola *et al.*, 2017; Ezenwa, 2012). The development and deployment of solar-powered refrigeration units, mobile cold storage, and improved transportation infrastructure have played a pivotal role in extending the shelf life of fish products and reducing losses during transit (Ogbonna, 2018; World Bank, 2019).

Furthermore, innovations in processing technologies have aimed to enhance the quality and safety of fish products. Improved smoke-drying techniques, vacuum packaging, and the utilization of food preservatives are among the technological interventions that seek to address traditional limitations in preservation methods (Adedeji *et al.*, 2018; Nnorom *et al.*, 2018). These advancements not only contribute to the reduction of post-harvest losses but also elevate the standards of fish products in terms of hygiene, nutritional value, and market acceptability (Adeyeye *et al.*, 2020; Federal Ministry of Agriculture & Rural Development, 2017).

4.2. Traditional and Modern Technologies

4.2.1. Traditional Technologies

Sun drying: The most prevalent traditional method, practiced especially in rural areas due to its simplicity and low cost (Akinneye *et al.*, 2012). However, it suffers from slow drying times, inconsistent quality, and susceptibility to insects and contamination (FAO, 2015).

Smoking: Commonly used for oily fish species, the smoke inhibits microbial growth and adds flavor (Adedeji *et al.*, 2018).

Improved smoking kilns like the Chorkor oven offer better efficiency and product quality (FAO, 2015).

Salting: A simple and effective method for dry fish preservation, especially in coastal areas (Olagunju *et al.*, 2019). However, excessive salt usage can affect taste and nutritional value (Ojo *et al.*, 2014).

4.2.2. Modern Technologies

Chilling and icing: Essential for preserving fresh fish quality during transportation and marketing (Akande *et al.*, 2017). However, limited access to electricity and ice infrastructure creates challenges (World Bank, 2019).

Freezing: Offers extended shelf life but requires high investment in freezers and reliable power supply (Ezenwa *et al.*, 2012). Small-scale solar-powered freezers hold promising potential for rural areas (Akaneme *et al.*, 2019a).

Modified atmosphere packaging (MAP): Uses controlled gas mixtures to prolong shelf life and maintain freshness (Nnorom *et al.*, 2018). Requires specific packaging materials and technical expertise, limiting its adoption by small-scale processors (Adeyeye *et al.*, 2020).

4.3. Impact on Fish and Fish Products Value Chain

Reduced post-harvest losses: Technology adoption can significantly reduce losses, enhancing food availability and income for fishers and processors (Akintola *et al.*, 2017).

Improved product quality and safety: Hygienic handling practices and proper preservation techniques increase product shelf life and reduce spoilage and contamination risks (Ogbonna *et al.*, 2018).

Value addition and market diversification: Processing technologies like canning, smoking, and filleting create value added products, fetching higher prices and expanding market reach (Ezenwa *et al.*, 2012).

4.4. Challenges in Technology Adoption

Despite the benefits, several challenges hinder wider technology adoption in Nigeria. These include:

Limited access to finance and infrastructure: High initial investment costs for modern technologies like cold storage and processing equipment pose a barrier for small-scale actors (FAO, 2015a).

Lack of technical knowledge and skills: Inadequate training and awareness about proper equipment operation and maintenance lead to inefficient utilization and failures (Akaneme *et al.*, 2019b).

Poor market infrastructure and logistics: Inefficient distribution networks and limited access to cold chain facilities hamper the effective utilization of preserved fish products (World Bank, 2019).

Policy and institutional gaps: Weak enforcement of quality standards and limited access to credit and extension services further constrain technology adoption (Akinneye *et al.*, 2012).

4.5. Policy Implication

Promote affordable and accessible technologies: Develop low cost, locally adaptable technologies like improved smoking kilns and solar-powered cold storage solutions (FAO, 2015b). Others include the NSPRI Iced Fish box.

Enhance capacity building and skills development: Provide training programs on proper fish handling, processing techniques, and equipment maintenance for fishers and processors (Akaneme *et al.*, 2019).

Invest in market infrastructure and logistics: Improve transportation networks, develop cold chain facilities, and strengthen market linkages to connect producers with consumers (World Bank, 2019).

Strengthen policy and institutional frameworks: Implement stricter quality standards for fish products, facilitate access to finance, and provide extension services to support technology adoption (Akinneye *et al.*, 2012).

5. CONCLUSIONS

Effective post-harvest technologies have the potential to revolutionize the Nigerian fisheries sector by minimizing losses, enhancing product quality, and adding value to fish products. However, addressing the challenges of affordability skills gap, and weak infrastructure enable Nigeria to unlock the full potential of its fisheries sector, boosting food security income generation, and overall economic development.

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