



## Original Paper

## Acceptability of Fibreboard Carton Boxes for Tomato Packaging in Nigerian Retail Markets: A Case Study of Mile 12 Market, Lagos

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Received: 17 May 2025; Revised: 26 September 2025; Accepted: 29 September 2025

DOI: <https://doi.org/10.46676/ij-fanres.v6i3.539>

**Abstract**—Nigeria, one of Africa's leading tomato producers, faces substantial postharvest losses due to inadequate packaging methods, with losses estimated at 20% to 50% of total production. Traditional packaging methods, such as raffia baskets and nylon sacks, are prevalent due to their low cost but offer insufficient protection against mechanical damage and spoilage. This study investigates the acceptability of fibreboard carton boxes as a sustainable and efficient packaging alternative among tomato retailers at Mile 12 Market, Lagos, Nigeria. Using a structured questionnaire, data were collected from 80 retailers on their demographic profiles, current packaging practices, and perceptions of fibreboard carton boxes. Descriptive statistical analysis revealed that while 55.6% of respondents were aware of fibreboard carton boxes, traditional packaging methods were prevalent. All respondents (100%) recognised the need for improved packaging to minimise losses, with 55.6% viewing fibreboard carton boxes as viable. Key barriers to adoption included scepticism about cost and durability, though preferences for varied box sizes and distribution channels indicated flexibility in implementation. Adoption will require targeted awareness campaigns, stakeholder engagement, and alignment with existing market structures. Future research should focus on cost-benefit analysis and scalability of fibreboard carton boxes in Nigeria's agricultural value chain.

**Keywords**— acceptability, carton box, packaging, postharvest

## I. INTRODUCTION

Tomatoes (*Solanum lycopersicum*) are a vital component of Nigeria's agricultural sector, serving as both a staple in local diets and a significant source of income for farmers. Despite being one of Africa's leading tomato producers, Nigeria grapples with substantial postharvest losses, estimated between 20% and 50% of total production [1, 2, 3]. These losses are largely attributed to inadequate postharvest handling and suboptimal packaging methods, which compromise the quality and shelf life of tomatoes during transportation and marketing [4,5].

In Nigeria, traditional packaging methods like raffia baskets, wooden crates, and nylon sacks are prevalent due to

their low cost and availability [6]. However, these methods have significant drawbacks, including inadequate protection against mechanical damage and environmental factors, which contribute to high postharvest losses [7]. For instance, raffia baskets and wooden crates have rough inner surfaces that bruise tomatoes, while nylon sacks trap heat and moisture, accelerating spoilage [8, 9]. These limitations highlight the need for alternative packaging solutions that enhance the safety and quality of tomatoes during transportation.

Fibreboard carton boxes offer a sustainable and efficient packaging alternative due to their lightweight, durable, and recyclable nature [6]. Designed with features like vent holes to improve airflow and reduce moisture, these boxes help minimise spoilage during transportation. Made from renewable resources and agricultural waste, they are environmentally friendly [10]. Their structural integrity provides superior protection against damage, while their cost-effectiveness through reduced loss and increased sales makes them an attractive option for farmers and retailers [6]. Additionally, their alignment with consumer preferences for sustainable packaging enhances market appeal. Also, the high cost of some packaging options, such as plastic crates, poses a financial challenge in utilisation [11]; therefore, there is a need for a more cost-effective alternative.

Studies have demonstrated their effectiveness in reducing postharvest losses. For example, research in India showed that corrugated fibreboard cartons designed for long-distance tomato transport reduced mechanical damage and extended shelf life [12]. Similarly, a simulation study revealed that fibreboard cartons significantly decrease losses compared to traditional methods, even in cases of prolonged transit delays [6].

Despite these benefits, the adoption of fibreboard carton boxes among Nigerian tomato retailers remains limited. Hence, this study seeks to evaluate the acceptability of fibreboard carton boxes among Nigerian tomato retailers, focusing on their potential to reduce postharvest losses.

## II. MATERIALS AND METHODS

### A. Study Location

The study was conducted at the Mile 12 Market, Lagos, Nigeria, the largest fruit and vegetable market in the country [13]. This market serves as a major hub for the distribution of fresh produce, including tomatoes, to both local and regional retailers. Mile 12 Market was selected due to its extensive network of tomato retailers and its central role in Nigeria's fresh produce supply chain.

### B. Data Collection

A total of 80 retailers were randomly selected for this study using a stratified sampling method to ensure representation across different scales of operation at Mile 12 Market. A structured questionnaire consisted of sections assessing the demographic profile of respondents, current packaging practices, awareness of fibreboard carton boxes, and willingness to adopt the packaging for tomato sales. Open-ended and closed-ended questions were included to capture both quantitative and qualitative data.

### C. Data Analysis

Descriptive statistical analysis was performed using SPSS version 17. Percentages were used to summarise the data.

### D. Ethical Considerations

Participation in the survey was voluntary, and informed consent was obtained from all respondents. The confidentiality of participants' responses was maintained throughout the study, in line with ethical research guidelines [13].

## III. RESULTS AND DISCUSSIONS

The results in Table I show the socio-economic and operational characteristics of the respondents in the study area.

### A. Level of Education

The educational background of the respondents reveals a mix of formal and informal education. About 30% of the respondents had no formal education, 20% completed primary school, 40% had secondary education, and 10% attended Islamic schools. This distribution indicates that a significant proportion of the retailers lack higher formal education, which could influence their ability to quickly adapt to technological innovations like carton box packaging. According to Onyemima et al. [15], education plays a crucial role in the adoption of improved postharvest technologies, as better-educated individuals are more likely to understand and implement innovations effectively.

### B. Selling Capacity

The selling capacity ranged from 1-2 baskets for 20% of respondents to 11 or more baskets for 40% of respondents, with intermediate capacities of 3-5 baskets (30%) and 6-10 baskets (10%). The average basket sold is higher than the average of 1 and 3 baskets reported in Ibadan metropolis [16]. This variability and quantity of baskets sold reflects the diversity in scale of operations at Mile 12 Market.

TABLE I. TOMATO RETAILERS' DEMOGRAPHICS, PACKAGING PRACTICES, AND PERCEPTIONS OF CARTON BOX ADOPTION AT MILE 12 MARKET

	Variables	Percent (%)
Highest Level of Education	No Formal Education	30.0
	Primary	20.0
	Secondary	40.0
	Islamic School	10.0
Selling Capacity (Baskets)	1-2	20.0
	3-5	30.0
	6-10	10.0
	11 and Above	40.0
Years of Tomato Handling	4-10	30.0
	11-20	30.0
	21 and Above	40.0
Supply Source	Within Lagos (Mile 12)	80.0
	Outside Lagos	20.0
Role Played	Wholesale	20.0
	Retail	60.0
	Local Agent	20.0
Price of Basket of Tomato (₦)	1800	16.7
	2000	33.3
	2500	16.7
	2600	16.7
	4000	16.7

### C. Years of Experience in Tomato Handling

Experience in tomato handling was significant, with 30% of respondents having 4-10 years, another 30% with 11-20 years, and 40% with over 21 years. Extensive experience suggests a reliance on traditional practices, potentially creating resistance to new packaging methods unless their benefits are clearly demonstrated. Olayemi et al. [17] also noted that experienced handlers often prioritize established practices over innovations unless the advantages are well-articulated.

### D. Source of Tomatoes

Most retailers (80%) sourced their tomatoes from within Lagos, while 20% obtained supplies from outside Lagos. This local sourcing could facilitate the introduction of innovations like carton boxes, as supply chains are shorter and easier to influence as compared to inter-state logistics.

### E. Packaging Practices

Currently, only 20% of respondents package their tomatoes while 80% do not. Traditional methods such as stacking in woven baskets remain prevalent, as highlighted by Babarinsa et al. [18] These methods contribute significantly to physical damage during transportation, with losses estimated at 20-50% [3]. The low adoption of packaging underscores the need for awareness campaigns and practical demonstrations of improved methods.

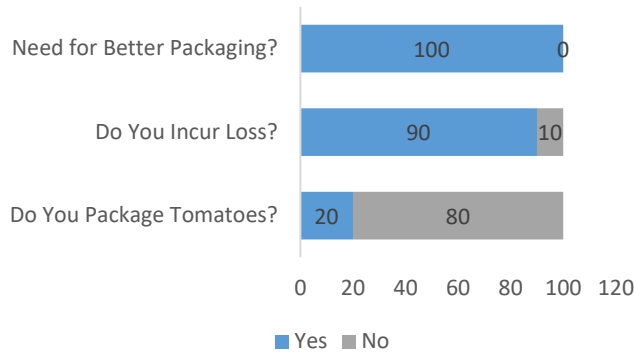


Fig. 1. Respondents packaging practices

#### F. Storage Facilities and Losses

The findings show that 62.5% of respondents store tomatoes in covered facilities, 12.5% under sheds, and 25% have no formal storage. Additionally, 90% of respondents reported experiencing losses, which highlights the vulnerability of tomatoes to spoilage and physical damage. Losses incurred can be attributed to poor handling and insufficient protection during storage and transit. As noted by Adepoju [18], postharvest losses are exacerbated by the lack of proper storage and packaging solutions.

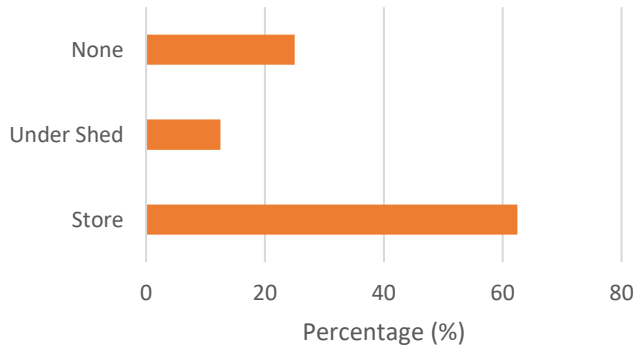


Fig. 2. Distribution of respondents on storage facilities.

#### G. Need for Improved Packaging

All respondents (100%) acknowledged the necessity of better packaging methods. This unanimous agreement indicates a readiness to explore alternative solutions to minimize losses and enhance product quality. This is in agreement with the report of Olumuyiwa et al., [19] where 100% of retailers in Mile-12 market were willing to adopt plastic crates.

#### H. Awareness and Acceptability of Carton Boxes

The survey showed that 55.6% of respondents were aware of fibreboard carton boxes, indicating moderate awareness among retailers. However, 44.4% were unaware, highlighting the need for targeted educational campaigns to increase awareness and adoption. Despite moderate awareness, 55.6% considered carton boxes a viable alternative, whereas 22.2% were sceptical, and another 22.2% were uncertain. This mixed perception underscores the importance of targeted interventions, including education on the cost-effectiveness and benefits of carton boxes. According to Adeoye et al. [3],

providing comparative studies of different packaging materials can help shift perceptions toward modern options.

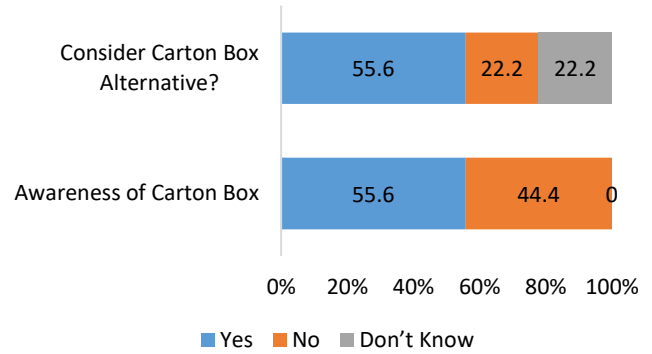


Fig. 3. Respondents' consideration and awareness and acceptability of carton boxes

#### I. Preferred Size and Distribution Channels for Carton Boxes

Respondents demonstrated varying preferences regarding box sizes, with 11.1% favouring small, 11.1% medium, 33.3% large, and 44.4% open to any size. This flexibility suggests that offering multiple size options could cater for diverse needs. Regarding distribution, 40% preferred dealers, 40% preferred associations, and 20% had no specific preference. These findings highlight the importance of leveraging existing market structures for effective dissemination of packaging innovations.

Variables		Percent (%)
Carton Box Size Preference	Small	11.1
	Medium	11.1
	Large	33.3
	Any Size	44.4
Carton Box Distribution Channel	Dealer	40
	Association	40
	Anyone	20

#### J. Perceived Challenges in using carton boxes

The perceived challenges or hindrances to the adoption of carton boxes by retailers include concerns about their durability, particularly in humid or rainy conditions where exposure to moisture can compromise their structural integrity. Additionally, the higher initial cost relative to traditional packaging methods, such as raffia baskets or wooden crates, poses a financial barrier for small-scale retailers. Handling and stacking limitations, including the potential for compression damage during transportation, also discourage adoption. Furthermore, limited awareness and insufficient training on the benefits and proper usage of carton boxes exacerbate resistance, highlighting the need for targeted educational programs to address these concerns and promote their use effectively.

#### IV. CONCLUSION

This study highlights the significant postharvest losses in Nigeria's tomato value chain, occurring due to inadequate packaging methods like raffia baskets and nylon sacks. While awareness of fibreboard carton boxes existing among retailers

at Mile 12 Market was moderate (55.6%), all respondents acknowledged the need for improved packaging to minimize losses and enhance product quality. The study found that education, years of handling experience, and packaging preferences influenced acceptance. Adoption remains limited due to scepticism about cost and durability. Targeted awareness campaigns, practical demonstrations, and stakeholders' engagement are crucial for addressing these barriers. Future studies should explore the scalability, economic viability, and long-term impact of these innovations on Nigeria's agricultural value chain.

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