



## Contaminated Frozen Poultry Products Recall Decision and Preventive Management Strategies in Retail Outlets in North Central Nigeria

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### ABSTRACT

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This study examined the contaminated frozen poultry products (FPPs) recall decision and preventive management strategies in retail outlets in North Central Nigeria. It specifically, described the socioeconomic characteristics of the FPPs retail outlets in the study area, identified the existing management strategies employed by retailers in preventing FPPs recalls in the outlets in the study area, examined the factors influencing product recall decisions in FPPs retail outlets in the study area, and identified the challenges hindering FPPs retail outlets from implementing effective meat safety measures to prevent product recalls in the study area. A multistage sampling method was utilized to select 202 FPP retailers. To address the specific objectives, both descriptive statistics and logit regression analysis were applied. The findings revealed that most FPP retail outlets in the study area were operated by married men, aged between 21 and 40 years, with an average of around 11 years of retailing experience. The findings also indicated that packaging poultry products before freezing is the most commonly used management strategy by retailers to prevent FPP recalls in the study area. The analysis showed that the source of FPPs ( $P < 0.01$ ) and the total number of FPPs purchased per month ( $P > 0.05$ ) had a positive impact on product recall decisions in frozen poultry retail outlets. Consequently, the study concludes that there is a significant relationship between the management strategies of FPP retailers and product recall occurrences. It recommends that the government and relevant agencies provide educational resources and conduct awareness campaigns to encourage retailers to adopt effective management strategies, such as packaging poultry products before freezing, proper labeling, and fridge segmentation.

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## Introduction

The poultry sub-sector is a crucial component of the Nigerian agricultural economy, significantly contributing to job creation, food security, and economic growth (Olosu et al., 2020). According to the FAO (2020), the country's poultry sector contributes an estimated 40.6 per cent of total food production, which is 337.3 million tons in 2020, with the majority of production coming from small-scale farmers who engage in semi-intensive or intensive farms. Animal protein intake in Nigeria is estimated at 10g/head/day well below the global recommendation of 35g/head/day (Sikiru, 2020). According to Connolly and Campbell (2023), poultry products are high in protein, and more recently, poultry accounts for around 13.99% of the country's overall meat consumption in 2021 (Olowa, 2021).

Poultry frozen products (FPPs) refer to numerous sorts of poultry products preserved by freezing, converting moisture to ice to stop food degradation within an optimal storage range of  $-18^{\circ}\text{C}$  to  $-20^{\circ}\text{C}$  (Fidelis, Otitoju, Idisi, Anazo & Achemu, 2024; Mercier, Villeneuve, Mondor, &

Uysal, 2017). According to Hussein, Salman, and Jawad (2020), FPPs can last up to 9 months depending on freezer conditions and packaging, whereas cooked goods only last four days and raw products just 1 to 2 days. FPPs such as frozen turkey meat, chicken meat, and chicken nuggets are popular protein sources both in Nigeria and abroad (Kayode, 2020; Oyedeji, Msagati, Williams & Benson, 2019).

The FPPs industry in Nigeria is rapidly growing, offering accessible protein sources to Sub-Saharan Africa, making them highly desired and valued exports; in fact, the Nigerian Export Promotion Council in 2021 noted that demand for Nigerian FPPs is growing in neighbouring countries, creating export opportunities for the country (Ibiroga & Ikhagh, 2022). Moreso, FPPs are in high demand among fast food providers such as hotels, restaurants, and supermarkets, and according to Foraminifera Market Research Limited (2016), almost 50 million Nigerians use imported frozen chicken, turkey, and fish daily.

While the global poultry sector was valued at \$322.55 billion in 2021, with a projected Compound Annual Growth Rate (CAGR) of 3.8%, it is expected to reach \$422.97 billion by 2025, with a CAGR of 7% (Feed Additive, 2021). However, the FPPs industry faces challenges such as inadequate storage facilities, selling products from unreliable sources, insufficient regulatory controls, and the increasing prevalence of animal diseases like avian influenza. According to the Centers for Disease Control and Prevention, [CDC] (2021), poultry products are among the primary sources of foodborne diseases. The worldwide avian influenza epidemic in 2016, notably in China, drastically impacted the global poultry supply, affecting 13.6% of output (Chatziprodromidou et al., 2018; Zhou, Li & Lei, 2019). In Nigeria, two crucial events influenced the industry: the 2003 prohibition on imported frozen chicken products, which strengthened the domestic market, and the Avian Influenza outbreak in 2007.

Regulatory bodies, like the National Agency for Food and Drug Administration and Control (NAFDAC) and the Standards Organization of Nigeria (SON), uphold food safety standards to prevent Nigeria from being a dumping ground for expired imported frozen meat. The NAFDAC Act governs imports, exports, manufacturing, sales, and usage of numerous items in Nigeria. It oversees facilities, implements quality procedures, and certifies sites and goods. NAFDAC recently criticized the use of formalin for poultry and beef preservation (Onyesi, 2021). Hence, businesses like Chi Farms and Amo Farm invest in advanced training programmes to encourage the best chicken storage practices (Onyesi, 2021).

Product recall is a response to a product-harm crisis, and it is described as an action taken by a manufacturer or distributors to withdraw a product from the market because it may cause health and safety issues, as well as perhaps death, to customers (Astvansh, 2020). Food safety has long been a source of public concern across the world. NAFDAC recalled a chicken sausage sandwich on July 9th, 2019, due to a possible Norovirus infection from China. Retailers are vital in product recalls due to their proximity to customers (Hall & Johnson-Hall, 2021). Products are often returned to their purchase point, which, in most cases, is a store outlet (Chatzoglou, Chatzoudes, Savvidou, Fotiadis & Delias, 2022). Widayanti, Santoso and Mubarakah (2024) noted that retailers play a crucial role in ensuring suitable storage conditions, handling methods, and quality control systems are in place to reduce the potential of contamination and maintain the freshness and safety of FPPs. Effectively managing FPPs at retail outlets is crucial to guaranteeing food safety and reducing the potential of product recalls.

Hallman and Cuite (2019) observed that outlets require a series of management strategies to avert recalls. These recall prevention management tactics safeguard money, brand, and consumer loyalty in the long run (Liu et al., 2017; Schniederjans & Khalajhedayati, 2020). Preventing FPP recalls due to hazards requires a holistic approach that encompasses quality control, employee training, and strict adherence to food safety protocols. By prioritizing food safety and implementing these preventive measures, retail outlets can reduce the hazards of recalls and protect their customers and brand reputation (Fidelis et al., 2024; Schniederjans & Khalajhedayati, 2020).

A robust anticipatory risk management assessment plan, including frequent quality inspections, customer complaint tracking, and product testing, can help identify potential safety risks. Early detection and prompt action can prevent the spread of contaminated products, reduce the costs associated with product recalls, and highlight the factors that lead to retailers' decisions to recall contaminated FPPs, thereby promoting consumer confidence in FPPs in Nigeria. Concerns about food safety and contamination due to improper industrial handling, storage, and processing procedures have led to recalls aimed at protecting public health (Onyeaka, Jalata & Mekonnen, 2023). Tack et al. (2020) argued that FPPs management monitoring systems are essential for recognizing and avoiding foodborne disease clusters. Prevention is essential in reducing the possibility of product recalls in retail outlets. According to current studies in the restaurant and product industries, introducing preventative measures substantially surpasses recall costs (Anaso, Olafadehan & Fidelis, 2024; Anaso, Olafadehan, Shoyombo & Fidelis, 2024; Bartsch, Asti, Nyathi, Spiker, & Lee, 2018).

While there have also been studies like that of Li and Wang (2017) on chilled food retail chain, Mou, Robb and DeHoratius (2018) on retail store operations; Marsuki, Syah, Indradewa, and Pusaka (2019) on frozen duck nugget; Rodprayoon and Chanasit (2019) on frozen food business; Okpo and Ubi (2020) on fast food vendors; Huang et al. (2021) on retailers' business practices; which were conducted on the management strategies employed by retail products outlets globally, there is a notable research gap in understanding the specific management strategies employed by FPPs retail outlets in Nigeria. The existing literature primarily focused on general food safety practices and management strategies in the broader food retail industry, without a specific emphasis on FPPs retail outlets.

Studies like Mayounga (2018) and Ketchen, Wowak, and Craighead (2014) investigated different product recall, supply chain network, and supply chain management cases. Given that these studies were conducted mainly in Western nations and the growing number of product recalls worldwide, particularly the recall of food items, there is need for a study to assess how food retail outlets management preventive strategies in countries like Nigeria, would react to different recall scenarios. This is critical because managerial behaviours are culturally or normatively bound. Given the limitations of existing literature, there is need for a study that specifically provides insights into the management preventive strategies and the factors that could result to a recall decision.

The broad objective of this study was to examine the contaminated FPPs recall decision and preventive management strategies in retail outlets in North Central Nigeria. It specifically, described the socioeconomic characteristics of the FPPs retail outlets in the study area, identified the existing management strategies employed by retailers in preventing FPP recalls in the outlets in the study area, examined the factors influencing product recall decisions in FPPs retail outlets in the study area, and identified the challenges hindering FPPs retail outlets from implementing effective meat safety measures to prevent

product recalls in the study area. The null hypotheses that there is no significant relationship between the FPPs retailers' management strategies and product recall in outlets in the study area was tested in the study.

## Materials and Methods

### Ethical Approval

Ethical approval was obtained after presenting the proposal seminar (UA/FA/AEC/POS/Vol. 5/0015) on the 13<sup>th</sup> of September, 2023 at the University of Abuja, Nigeria. The university granted approval as part of a dissertation. The research conduct was carefully reviewed to ensure it adhered to international standards for food-related research.

### Study Area

This study was conducted in the North-Central region of Nigeria (Abuja and Nasarawa). Abuja, Benue, Kwara, Kogi, Nasarawa, Niger, and Plateau are the seven states that comprise this region. Abuja the Federal Capital Territory (FCT) is between Longitude: 7°23.9144' E and Latitude: 9°4.5887' N and is bounded on the east by Nasarawa, north by Kaduna, west by Niger, and south by Kogi. It is 476 meters above sea, with a population of 3,840,000 (Microtrend, 2022). Nasarawa state is located at Latitude 8°32'20.22" N and Longitude 7°42'29.56" E and bordered by Kaduna State in the north, Plateau State in the east, Benue State in the east, and Kogi State in the west (Fidelis et al., 2024). According to Madu and Abdulkadir, (2019), Abuja grew by 139.7% between 2000 and 2010, making it one of the world's fastest-growing cities. The elevated urban activities within Abuja, coupled with the strategic positioning of outlets in Nasarawa state proximate to its border with Abuja, effectively serving as a feeder to the Abuja metropolis, render Abuja and Nasarawa a compelling scenario for the conducted study.

### Sampling Procedures and method of Data Collection

The study used the multi-stage sampling technique. In the first stage, three (3) markets known for their high relative intensity of frozen poultry products retailing outlets were selected purposively from within Abuja and Nasarawa state; this was done to ensure that these three markets capture the full range of frozen meats retailing activities as it relates to poultry products, including direct selling, refrigerating/freezing, cold chain logistics, and retailing activities. Thus, Wuse, Garki, and Kado markets were selected in Abuja, while Masaka, New Nyanya, and Mararaba international markets were selected in Nasarawa state. In the second stage, the list of active FPPs retail outlets within the last 12 months was compiled from the various market associations. The compilation of the lists constitutes the sample frame for the study. Thus, a total of 110 and 92 FPPs retail outlets was obtained in Abuja and Nasarawa state markets respectively. A census approach was adopted as the sampling technique to survey all 202 FPP retailers in the market for comprehensive representation and in-depth analysis of the entire sampled population. Thus, the study's sample size was 202 FPP retailers in Nasarawa state and Abuja. The data for this study was gathered from primary sources through personal interviews using a well-structured questionnaire.

### Methods of Data Analysis

Descriptive statistics such as frequency, percentages, mean, standard deviation (SD) and the Logit model was applied to realise the various objectives of the study.

### Logit Model

The Logit model was used to analyze the factors influencing product recall decisions in frozen poultry retail outlets in the study area. This model describes the association between a binary variable defined as one of the FPPs retail stores have opted to recall items and 0 if not. The logistic model's explicit function, as specified by Agresti (2013) and Hosmer, Lemeshow, and Sturdivant (2013), is mathematically expressed as follows:

$$\ln\left(\frac{P(Y = 1|X)}{1-P(Y = 1|X)}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_{15} X_{15} + u_i \quad (1)$$

Where;

$P(Y=1|X)$  represents the probability of the binary decision to recall FPPs in retail outlets or otherwise.  $\ln$  denotes the natural logarithm.

$\beta_0, \beta_1, \beta_2, \dots, \beta_{15}$  are the coefficients of the logistic regression model.

$Y$  = is a binary variable defined as one of the outlets decides to recall any FPPs and 0 if otherwise.

$X_1$  = FPPs retailing experience (number of years in the FPPs business).

$X_2$  = Number of Freezers in the outlet

$X_3$  = Freezer Capacity (in kilogram)

$X_4$  = Sex of the FPPs outlet retailers (1 for male, 0 for otherwise)

$X_5$  = Age of the FPPs outlet retailers (years)

$X_6$  = Level of education (Number of years in school)

$X_7$  = Cooperative membership (Dummy: 1 for membership, 0 for otherwise)

$X_8$  = Government agencies inspection (Dummy: 1 if inspected, 0 for otherwise)

$X_9$  = Retail outlet's source of FPPs (Dummy: 1 for larger cold rooms, 0 for otherwise)

$X_{10}$  = Total number of FPPs purchased per month (in kilogram)

$X_{11}$  = Packaging of poultry products before freezing (Dummy: 1 if used, 0 if otherwise)

$X_{12}$  = Labelling and fridge segmentation (Dummy: 1 if used, 0 if otherwise)

$X_{13}$  = Regular communication with suppliers (Dummy: 1 if used, 0 if otherwise)

$X_{14}$  = Encouraging customer feedback (Dummy: 1 if used, 0 if otherwise)

$X_{15}$  = Strategy of keeping up-to-date to industrial standard (Dummy: 1 if used, 0 if otherwise)

$\beta_0$  = intercept,

$\beta_1 - \beta_{10}$  = coefficients/parameter estimates.

### Test of Hypothesis

#### Chi-Square Test

The Chi-Square test ( $\chi^2$ ) of independence was used to test the hypothesis that there is no significant relationship between the FPP retailers' management strategies and product recall in outlets in the study area.

$$\chi^2 = \sum \left[ \left( \frac{\text{Observed frequency} - \text{Expected frequency}}{\text{Expected frequency}} \right)^2 \right] \quad (2)$$

The degrees of freedom (df) for the Chi-Square test were calculated using  $(r - 1) \times (c - 1)$ , where  $r$  is the number of rows and  $c$  is the number of columns in the contingency table.

## Results and Discussion

### *The Socioeconomic Characteristics of the FPPs Retail Outlets in the Study Area*

Table 1 below shows the socioeconomic characteristics of the FPP retail outlets in the study area. The table indicates that the majority of FPP retailers are married men, suggesting that FPP retail outlets in the area are predominantly operated by men. This finding aligns with Msetule, Komba, Kimera, and Mdegela (2017), who reported similar results in their study on the contamination of frozen broiler chicken meats with antimicrobial-resistant thermophilic campylobacter in Tanzania. Furthermore, Ogutu et al. (2022) noted that marriage confers a level of responsibility on individuals, such as providing food, clothing, and household care.

The mean age of the FPPs retailers is approximately 42 years, implying that the majority of them are economically active members of the population and thus constitute a reasonable labour force for the FPPs outlets capable of coping with the challenges and management strategies associated with recall event and hazard prevention activities in the study area. These findings corroborated Olutegbe, Olawoye, and Oyesola's (2021) argument that people in their forties and fifties are nimbler and more risk-taking than the old.

The mean number of years spent in school by the FPPs retailers is approximately 13 years, implying that an average retailer in the outlets had attained secondary education which takes at least 12 years to complete. This suggests that the FPPs retailers in the sampled outlets are literate. Education has been found to raise human capital levels, managerial ability and give the essential skills for profit or self-employment value chain exploration (D'Souza, 2020).

The mean number of years of FPP retailing experience was approximately 11 years. This implies that the average frozen poultry retailer in the research area has been in business for at least ten years. Experience levels, according to Ali, Li, Yang, Hussain, and Latif (2020), can impact corporate management and decision-making. Retailers with more experience may have better insights into industry trends; a knowledge that can be translated to enhanced management strategy that could prevent FPPs contamination.

The mean number of freezers in FPPs retailing outlets in the study area is approximately 5 freezers. The number of freezers affects storage capacity and, consequently, the scale of retail operations. According to Madushani and Howshigan (2020) and Yang and Tang (2023), retailers with more refrigerators may have the potential to offer a more comprehensive product range.

Additionally, Table 1 also showed that the retail outlets in the study area offer various types of FPPs, with chicken wings (19.12%), turkey wings (31.64%), and chicken laps

(30.12%) being the most common. Understanding product preferences can help retailers tailor their inventory to meet consumer demands and capitalize on popular items (Wang, Ni, & Yang, 2023). Table 1 also revealed that a significant percentage of respondents are cooperative members. Cooperative membership can influence supply chain dynamics and access to resources. Retailers who are cooperative members may have different sourcing advantages (Schulze & Spiller, 2021).

### *The Existing Management Strategies Employed by Retailers in Preventing FPP Recall in the Outlets in the Study Area*

The result of the existing management strategies employed by retailers in preventing FPPs recall in the outlets in the study area in Table 2 shows that Packaging of Poultry Products Before Freezing (20.15%) is the most practised management strategy employed by retailers in preventing FPP recall in the outlets in the study area. This implies that a significant percentage of retailers used packaging as a strategy. According to Falkovskaya and Gowen (2020), this involves properly enclosing poultry products before freezing, which can act as a barrier to prevent contamination and maintain product quality. Labelling and Fridge Segmentation (18.76%) are closely followed. Clear labels help identify products, while fridge segmentation involves organizing products in designated areas within the storage facility. Both practices aim to maintain organization, prevent cross-contamination, and consumer satisfaction while minimizing the risk of recalls (Beauvais et al., 2018)

Other management strategies are Encouraging Customer Feedback (7.36%), Regular Communication with Suppliers (6.61%), Staying Up to Date on Industry Regulations and Standards (5.97%), Establishing a Product Recall System (5.86%), Conducting Regular Inspections and Audits (5.86%), Regularly Reviewing and Revising Procedures (5.76%), Implementing Strict Quality Control Measures (5.54%) and Train Employees on Proper Handling and Storage (5.12%).

Encouraging customer feedback is a strategy used by a considerable number of retailers. Actively seeking customer feedback allows retailers to gather valuable information about product quality and safety, helping in the early detection of potential issues (Bai, Wu, Li, Zhang, Jiang & Chen, 2021). Having a product recall system in place and conducting regular inspections and audits are strategies employed by a notable percentage of retailers. This system ensures a rapid response in case of product contamination or safety concerns, allowing retailers to take quick action to protect consumers (Evangelopoulou, Kritas, Christodoulou & Burriel, 2015).

Routine checks involve assessing the safety and quality of products, facilities, and processes. According to Evangelopoulou et al. (2015), these checks can help identify and rectify safety issues or deviations from standards. A significant portion of retailers employs quality control measures, which include thorough checks and inspections to ensure that products meet safety and quality standards. Stringent quality control checks are essential for identifying and preventing contaminated products from reaching consumers (Aquad et al., 2019).

Table 1. Frequency Distribution of the Socioeconomic Characteristics of the FPPs Retailer in Outlets in the Study Area

Variable	Frequency	Percentage	Mean Value
<b>Sex</b>			
Female	76	37.62	
Male	126	62.38	
Total	202	100	
<b>Age Range (years)</b>			
21-30	33	16.34	42.30
31-40	65	32.18	
41-50	54	26.72	
51-60	45	22.28	
61-70	5	2.48	
Total	202	100	
<b>Marital Status</b>			
Married	153	75.74	
Single	28	13.86	
Divorced	10	4.95	
Widowed	11	5.45	
Total	202	100	
<b>Retailing Experience (years)</b>			
1-8	88	43.56	10.49
9-16	80	39.60	
17-24	32	15.84	
25-32	2	0.99	
Total	202	100	
<b>Number of Years in School (years)</b>			
1-5	12	5.94	12.99
6-10	29	14.36	
11-15	85	42.08	
16-19	76	37.62	
Total	202	100	
<b>Number of Freezers</b>			
1-3	39	19.31	4.92
4-6	125	61.88	
7-9	38	18.81	
Total	202	100	
<b>Type of Frozen Poultry Products Retailed</b>			
Chicken Wings	113	19.12	
Turkey Wings	187	31.64	
Chicken Laps	178	30.12	
Whole Chicken	113	19.12	
Total	591	100	
<b>Cooperative Membership</b>			
No	73	35.64	
Yes	130	64.36	
Total	202	100	

Source: Computed from Field Data, 2023

Table 2. Result of the Existing Management Strategies Employed by Retailers in Preventing FPPs Recall in the Outlets in the Study Area

Management Strategies	Frequency	Percentage %
Packaging of poultry products before freezing	189	20.15
Labelling and fridge segmentation	176	18.76
Preparation under special safety conditions	31	3.30
Implementing strict quality control measures	52	5.54
Train employees on proper handling and storage.	48	5.12
Conducting regular inspections and audits	55	5.86
Maintaining clear labelling and signs	47	5.01
Establishing a product recall system	55	5.86
Regular communication with suppliers	62	6.61
Encouraging customer feedback	69	7.36
Staying up to date on industry regulations and standards	56	5.97
Fostering a culture of safety and accountability	44	4.69
Regularly reviewing and revising procedures.	54	5.76
Total	938	100

Source: Computed from Field Data, 2023.

The management strategies that are employed less frequently include Maintaining Clear Labelling and Signs (5.01%), Fostering a Culture of Safety and Accountability (4.69%), and Preparation Under Special Safety Conditions (3.30%). Although a lower percentage of retailers employ these strategies, it signifies the importance of following safety protocols while preparing poultry products. Danikas (2018) noted that special safety conditions include wearing protective gear and maintaining cleanliness during product preparation.

#### ***Factors Influencing Product Recall Decisions in FPPs Retail Outlets in the Study Area***

In examining the factors influencing product recall decisions in FPPs retail outlets in the study area, some variables: sex of the FPPs outlet retailers, age, marital status, number of years in school, FPPs retailing experience, cooperative membership, retail outlet's source of FPPs, total number of FPPs purchased per month, labelling and fridge segmentation, regular communication with suppliers, encouraging customer feedback, packaging of poultry products before freezing, number of freezers in the outlet, freezer capacity and strategy of keeping up-to-date to industrial standard were regressed against decision to recall any FPPs in Logit model.

The result of the logit model for the factors influencing product recall decisions in FPPs retail outlets in the study area is presented in Table 3. The Log-likelihood value of -65.3423 and the Chi-square value of 72.13 which is significant at a 1% level implies that the logit regression model, as a whole, is statistically significant, and the explanatory variable in the model significantly influenced product recall decisions in FPPs retail outlets in the study area.

Five (5) variables out of the eleven variables included in the logit model were statistically significant. The coefficient of experience and source of FPPs were significant at 1%; The coefficient of the total number of FPPs purchased per month is significant at 5%; The coefficient of labelling and fridge segmentation and cooperative membership are significant at 10% and statistically influencing product recall decisions in frozen poultry retail outlets in the study area.

The coefficient of experience (-0.1754) is significant at 1% and negatively influences product recall decisions in FPPs retail outlets in the study area. The negative coefficient suggests that as experience increases, the likelihood of product recall decisions decreases. This means that experienced retailers have a better grasp of product quality and safety and may be more capable of preventing issues that could lead to recalls. This aligns with the study of Ali et al. (2021) that experienced retailers often have better risk assessment and decision-making skills.

The coefficient of cooperative membership (0.8918) is significant at the 10% level and positively influences product recall decisions in FPP retail outlets in the study area. This suggests that cooperative members are more likely to initiate recall decisions than non-members. This finding contradicts conventional wisdom, which posits that cooperatives enforce stricter quality control measures (Wei, Kong, & Wang, 2022). Cooperative members might experience different market pressures or competition, leading them to be more cautious about product quality and more willing to initiate recalls to maintain customer trust

(Wei et al., 2022). The positive relationship observed may indicate that cooperatives within the studied outlets were more focused on recall-oriented actions rather than preventive measures.

The coefficient of the source of FPPs (1.6943) is significant at 1%. It positively influences product recall decisions in FPPs retail outlets in the study area, indicating that products sourced from larger cold rooms significantly influence recall decisions. This underscores the importance of supply chain management and product sourcing practices among vendors (Adesokan, Funso-Adu & Okunlade, 2020).

The coefficient of the total number of FPPs purchased per month (0.0019) is significant at 5%. It positively influences product recall decisions in FPPs retail outlets in the study area, suggesting that monthly restocking of FPPs is associated with a greater likelihood of recall decisions. This might be due to increased potentially problematic products associated with carrying a large inventory. This finding is consistent with Costanza, Faber-Langendoen, Coulston and Wear (2018) who also linked large quantity purchases to increased risk of product recalls.

The coefficient of labelling and fridge segmentation (0.9651) is significant at 10%. It positively influences product recall decisions in FPPs retail outlets in the study area, indicating that retailers who adopt certain labelling and product segmentation strategies are more likely to initiate recalls. This result may be due to the ease of identification of products created by employing labelling and product segmentation management strategies. As noted by Alsuwailem et al. (2021) by implementing effective strategies, retailers are able to categorize their products in a way that simplifies inventory management processes.

#### ***Challenges Hindering FPPs Retail Outlets from Implementing Effective Meat Safety Measures to Prevent Product Recalls in the Study Area***

The result of the challenges hindering FPPs retail outlets from implementing effective meat safety measures to prevent product recalls in the study area is presented in Table 4. The table shows that the major challenge hindering frozen poultry products retail outlets from implementing effective meat safety measures to prevent product recalls in the study area is high electricity bills, with a mean value of 3.82. This is closely followed by FPPs supply chain complexities (3.24) and international trade complexities (2.70). This cost challenge may affect the feasibility of safety investments in the business (Firdaus, Prasetyo, Sutarjo & Hermawan, 2020), and this complexity can lead to issues in transportation, storage, and distribution, increasing the risk of contamination (Cahyono, Suryantini & Mulyo, 2019).

Other serious challenges hindering FPPs retail outlets from implementing effective meat safety measures to prevent product recalls in the study area include limited traceability (2.64), which makes it challenging to track the origin and handling of products (Jones & Comparin, 2020). compliance issues (2.61), which could lead to product recalls and legal consequences; rapidly evolving threats (2.59), rapidly evolving threats highlight the dynamic nature of risks in the frozen poultry industry; consumer's trust and perception (2.58), this emphasizes the importance

of maintaining consumer trust and a positive perception (Aksoy & Özsönmez, 2019). Negative perceptions can lead to reduced sales and reputation damage. The result also revealed that limited resources (2.40), inadequate regulatory framework (2.33), lack of awareness (2.21), and fragmented communication and coordination (2.50) are “somewhat serious” challenges hindering FPPs retail outlets from implementing effective meat safety measures to prevent product recalls in the study area.

The challenges indicate that many retail outlets face resource constraints. Limited finances, personnel, or infrastructure can hinder the implementation of comprehensive safety measures. Poor communication and coordination among stakeholders in the supply chain can also lead to inefficiencies and mismanagement. According to Patricia et al. (2017), insufficient knowledge could lead to improper handling and storage of poultry products, increasing the risk of contamination.

### Test of Hypotheses

The null hypothesis of the study that there is no significant relationship between the FPPs retailers’ management strategies and product recall in outlets in the study area was tested using the chi-square test of independence. The result is represented in Table 5 below.

The chi-square test of independence results for each management strategy. Overall, 5 of the 10 management strategies tested showed a significant relation to product recall at different significance levels. The chi-square value of packaging of poultry products before freezing (9.667), labelling and fridge segmentation (12.333), fostering a culture of safety and accountability (2.974), implementing strict quality control measures (2.023) and establishing a product recall system (2.273) shows that they significantly relate to product recall at different levels of significance. Hence, there is a significant relationship between management strategies and product recall.

Table 3. Result of the Factors Influencing Product Recall Decisions in FPPs Retail Outlets

Explanatory variables		Coefficients	S.E.	P> z	Marginal Effect
Constant	$\beta_0$	-3.2146		0.050	
Experience (X <sub>1</sub> )	$\beta_1$	-0.1754***	0.0560	0.002	-0.0181
Number of Freezers in the outlet (X <sub>2</sub> )	$\beta_2$	0.3767	0.3060	0.218	0.0388
Freezer Capacity (X <sub>3</sub> )	$\beta_3$	-0.0369	0.0032	0.247	-0.0004
Sex (X <sub>4</sub> )	$\beta_4$	0.4271	0.4895	0.383	0.0440
Age (X <sub>5</sub> )	$\beta_5$	0.0322	0.0278	0.246	0.0033
Number of years in school (X <sub>6</sub> )	$\beta_6$	-0.0181	0.0447	0.686	-0.0019
Cooperative membership (X <sub>7</sub> )	$\beta_7$	0.8918*	0.5011	0.075	0.0919
Government agencies inspection (X <sub>8</sub> )	$\beta_8$	0.6617	0.5837	0.257	0.0682
Source of FPPs (X <sub>9</sub> )	$\beta_9$	1.6943***	0.4925	0.001	0.1745
Total number of FPPs purchased per month (X <sub>10</sub> )	$\beta_{10}$	0.0019**	0.0008	0.024	0.0002
Packaging of poultry products before freezing (X <sub>11</sub> )	$\beta_{11}$	0.8081	0.7748	0.297	0.0832
Labelling and fridge segmentation (X <sub>12</sub> )	$\beta_{12}$	0.9651*	0.5626	0.086	0.0994
Communication Strategy (X <sub>13</sub> )	$\beta_{13}$	-0.1415	0.5706	0.804	-0.0148
Encouraging customer feedback (X <sub>14</sub> )	$\beta_{14}$	0.2310	0.5222	0.658	0.0238
Up-to-date industry standard (X <sub>15</sub> )	$\beta_{15}$	0.0673	0.5521	0.903	0.0069
LR Chi-Square (15)		72.13***			
Pseudo R <sup>2</sup>		0.3588			
Log-likelihood		-65.3423			
Number of Observations		202			

\*\*\* is Significant at a 1% level of Significance, \*\* is Significant at a 5% level of Significance and \* is Significant at a 10% level of Significance. S.E. stands for Standard Error, Source: Computed from Field Data, 2023

Table 4. Result of the Challenges Hindering FPPs Retail Outlets from Implementing Effective Meat Safety Measures to Prevent Product Recalls in the Study Area

	Challenges	VS	S	SS	NS	TV	MV	R
1	Lack of awareness	9(5.08)	56(31.64)	76(42.94)	36(20.34)	392	2.21	SS
2	Inadequate regulatory framework	4(2.21)	79(43.65)	70(38.67)	28(15.47)	421	2.33	SS
3	Limited resources	13(8.23)	62(39.24)	58(36.71)	25(15.82)	379	2.40	SS
4	FPPs supply chain complexities	112(58.64)	30(15.71)	32(16.75)	17(8.90)	619	3.24	S
5	Fragmented communication and coordination	15(8.82)	74(43.53)	62(36.47)	19(11.18)	425	2.50	SS
6	Rapidly evolving threats	26(15.38)	61(36.09)	68(40.24)	14(8.28)	437	2.59	S
7	Compliance issues	28(15.73)	68(38.20)	67(37.64)	15(8.43)	465	2.61	S
8	Consumer’s trust and perception	18(10.71)	78(46.43)	56(33.33)	16(9.52)	434	2.58	S
9	Limited traceability	21(12.07)	84(48.28)	54(31.03)	15(8.62)	459	2.64	S
10	International trade complexities	25(14.29)	87(49.71)	49(28.00)	14(8.00)	473	2.70	S
11	Cost of implementing preventive strategies	18(13.53)	57(42.86)	47(35.34)	11(8.27)	348	2.62	S
12	High electricity bill	168(84.00)	28(14.00)	4(2.00)	0(0.00)	764	3.82	VS
13	Cost of freezer maintenance	21(13.13)	73(45.63)	55(34.38)	11(6.88)	424	2.65	S

VS: Very Serious; S: Serious; SS: Somewhat Serious; NS: Not Serious; TV: Total Value; MV: mean value, R: Remark; Percentages (%) in bracket; Source: Computed from Field Data, 2023.

Table 5. Result of the Chi-square Test of Independence

Management Strategies	Recall		
	Pearson Chi-Square	df	Asymptotic Significance (2-sided)
Preparation under special safety conditions	0.687 <sup>a</sup>	1	0.407
Packaging of poultry products before freezing	9.667 <sup>a</sup>	1	0.002***
Labelling and fridge segmentation	12.333 <sup>a</sup>	1	0.000***
Fostering a culture of safety and accountability	2.974 <sup>a</sup>	1	0.005***
Train employees on proper handling and storage.	0.861 <sup>a</sup>	1	0.354
Implementing strict quality control measures	2.023 <sup>a</sup>	1	0.015**
Establishing a product recall system	2.273 <sup>a</sup>	1	0.001***
Encouraging customer feedback	0.000 <sup>a</sup>	1	0.999
Regular communication with suppliers	0.288 <sup>a</sup>	1	0.591
Conducting regular inspections and audits	0.209 <sup>a</sup>	1	0.648

\*\*\* is Significant at a 1% level of Significance, \*\* is Significant at a 5% level of Significance and \* is Significant at a 10% level of Significance; Source: Computed from Field Data, 2023.

This suggests that certain management strategies are more critical in preventing product recalls in FPPs retail outlets. Thus, the null hypothesis (H<sub>0</sub>) that there is no significant relationship between frozen poultry retailers' management strategies and product recall in outlets in the study area is rejected.

### Conclusions

This study examined the contaminated FPPs recall decision and preventive management strategies in retail outlets in North Central Nigeria and found that packaging of poultry products before freezing and labelling and fridge segmentation are retailers' most practised management strategies in preventing FPPs recall in the study area.

Experience and source of FPPs, the total number of FPPs purchased per month, labelling and fridge segmentation, communication strategy and cooperative membership were the factors that influenced product recall decisions in FPPs retail outlets in the study area. High electricity bills, FPPs supply chain complexities, and international trade complexities were the major challenges hindering FPPs retail outlets from implementing effective meat safety measures to prevent product recalls in the study area.

The FPP retailers' management strategies in outlets in the study area, such as packaging poultry products before freezing, labeling, fridge segmentation, fostering a culture of safety and accountability, implementing strict quality control measures, and establishing a product recall system, showed a significant relationship to product recall. Therefore, the null hypothesis of the study—that there is no significant relationship between FPP retailers' management strategies and product recall in outlets in the study area—is rejected, and the alternative hypothesis is accepted. The study concludes that there is a significant relationship between frozen poultry retailers' management strategies and product recall in outlets in the study area. It recommends that the government and its agencies provide educational resources and conduct awareness campaigns to encourage retailers to adopt and prioritize effective management strategies, such as packaging poultry products before freezing, proper labeling, and fridge segmentation.

### Declarations

The author declares no conflict of interest in the design, collection, writing of manuscript and decision to publish this work

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