

INVESTIGATING FOOD SAFETY PRACTICES AND MICROBIAL CONTAMINATION IN MANDATE MARKET ILORIN KWARA STATE

BY

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Abstract

Foodborne illnesses remain a major public health concern, particularly in low and middle-income countries where street-vended foods are widely consumed. This study assessed the microbiological safety of ready-to-eat foods sold in Mandate Market, Ilorin West Local Government Area, Kwara State, Nigeria. The objective was to identify the presence and types of microbial contaminants and evaluate the hygiene practices of food vendors to determine their potential risks to public health. A total of 8 food samples comprising rice, beans, meat, and stew were randomly collected from various food vendors within the market. Standard microbiological procedures were employed, including serial dilution, inoculation on MacConkey and blood agar, incubation, and colony characterization using morphological and biochemical methods. The bacteriological analysis revealed the presence of pathogenic organisms such as *Escherichia coli*, *Staphylococcus aureus*, and *Salmonella* species, indicating fecal contamination and poor handling practices. The study concludes that the microbial quality of ready-to-eat foods sold in Mandate Market is substandard and may contribute to the burden of foodborne diseases in the area. It recommends regular food safety training for vendors, strict enforcement of hygiene regulations by health authorities, and periodic microbial surveillance of market foods. Ensuring safe food handling practices is essential to protecting public health and preventing disease outbreaks in urban markets.

Keywords: Foodborne illness, Microbial contamination, *Escherichia coli*, *Staphylococcus aureus*, *Salmonella*, Hygiene practices.

Introduction

Foodborne diseases remain a major global public health concern, particularly in developing nations where food handling practices, regulatory frameworks, and public health infrastructure are often inadequate. Unsafe food has been linked to over 600 million illnesses and 420,000 deaths annually, with the greatest burden borne by children under five years of age (WHO, 2019). In Nigeria, the informal food sector comprising street vendors and open-market sellers accounts for a significant portion of daily food consumption, yet often operates without adequate regulatory oversight or consistent hygiene practices. Mandate Market, a prominent food distribution center in Ilorin, typifies such environments, where the intersection of high food turnover, environmental exposure, and limited infrastructure creates a high-risk setting for microbial contamination. The complexity of food contamination stems from multiple sources including poor personal hygiene, contaminated water, improper storage conditions, and unsanitary utensils. Despite the fact that many vendors are aware of general food safety guidelines, implementation remains inconsistent due to lack of access to facilities, time constraints, and insufficient enforcement of existing food safety laws. Several studies have established a strong correlation between street-vended food and microbial contaminants such as coliforms, *Staphylococcus aureus*, and various enteric pathogens (Akhtar *et al.*, 2014; Uyttendaele *et al.*, 2016). These microorganisms can cause a spectrum of illnesses, from mild gastroenteritis to severe and life-threatening infections like typhoid fever, listeriosis, and hepatitis A.

Microbiological safety is a critical component of food security, as contamination can render nutritionally adequate food hazardous to health. This risk is particularly high for ready-to-eat foods such as rice, beans, meat, and stew staples commonly consumed without further heat treatment. Numerous studies in Nigerian urban centers have

reported high microbial loads in these food types, attributed to exposure to dust, flies, human handling, and prolonged storage at ambient temperature (Jaffee *et al.*, 2018; Olowoyo *et al.*, 2022). Furthermore, the lack of consistent electricity supply restricts the use of refrigeration, further exacerbating microbial proliferation. Understanding the socio-demographic background of food handlers is essential for designing effective food safety interventions. Education level, age, gender, and years of experience in food vending all play a role in shaping hygiene behavior and risk perception. While higher levels of education may correlate with better awareness of foodborne risks, studies have shown that knowledge alone does not always translate into practice (Rahman *et al.*, 2021). Moreover, markets such as Mandate Market often lack basic amenities like clean water, waste disposal, and controlled food storage systems, making compliance with hygienic standards difficult even for informed vendors.

This study aims to assess the microbial quality of commonly consumed ready-to-eat foods sold in Mandate Market and to evaluate the food safety practices of vendors and consumers operating within this setting. By examining socio-demographic factors, hygiene practices, and laboratory-confirmed microbial loads, the research provides a comprehensive overview of the risks associated with informal food vending in a typical Nigerian market. The findings are intended to inform policy recommendations, educational outreach, and potential regulatory reforms that can help mitigate the public health risks posed by contaminated food in urban settings.

The problem, therefore, lies in the widespread contamination of ready-to-eat foods sold in open markets, driven by poor personal hygiene, unsafe water sources, substandard storage methods, and lack of proper food safety education among vendors. Despite awareness campaigns and food hygiene policies, the persistence of contaminated food in the local market suggests a major gap between knowledge and actual practice. Consumers often lack the ability to visually detect unsafe food, and food vendors may prioritize economic gain over safety precautions. This disconnect poses a substantial threat to public health, particularly in urban areas with high population density and reliance on street food. There is a justified need for this research due to the growing urban dependence on informal food vendors and the limited empirical data on microbial contamination in regional Nigerian markets. While prior studies have documented microbial loads in specific food categories, comprehensive studies that link contamination levels to demographic characteristics, hygiene behaviors, and vendor knowledge in the context of a high-volume market like Mandate are scarce. Without this data, public health authorities cannot effectively target interventions or develop realistic regulatory frameworks.

Therefore, this study aims to assess the microbial quality of commonly consumed ready-to-eat foods sold in Mandate Market and evaluate the food safety knowledge and practices of vendors and consumers. By correlating laboratory-confirmed microbial loads with hygiene practices and demographic data, the research provides actionable insights into the sources of food contamination. The results are expected to support improved policy direction, inform targeted hygiene education, and advocate for market-level reforms to reduce the incidence of foodborne diseases.

Literature Review

Food safety is a vital public health concern, especially due to the risk of microbiological contamination during food processing, handling, storage, and distribution. Pathogens such as bacteria, viruses, and fungi can cause illnesses ranging from mild gastrointestinal issues to severe infections like *Salmonellosis* and *listeriosis*. In addition to immediate health risks, toxins from fungi and algae may have long-term effects such as teratogenicity and immunotoxicity (Alum *et al.*, 2016). These challenges not only threaten public health but also lead to economic burdens through medical expenses, food recalls, and productivity losses. Globally, food safety is essential for protecting health, ensuring food security, and maintaining economic stability. The World Health Organization estimates that foodborne diseases affect 600 million people and cause 420,000 deaths annually (WHO, 2020). In Nigeria, food safety is particularly critical due to the prevalence of informal markets and weak regulatory oversight. Contaminated food contributes significantly to illnesses such as diarrheal disease, especially among children (Odu *et*

al., 2019). Improved food safety practices can enhance public health, economic productivity, and global trade access by meeting international standards (FAO, 2021; NAFDAC, 2019).

Maintaining hygiene, proper cooking, adequate food storage, and good manufacturing practices are essential for reducing contamination. Strengthening food safety regulations in Nigeria not only increases consumer confidence and food security but also improves the country's ability to compete in international markets (WHO, FAO, 2020; FAO, 2021). Food contaminated by harmful microorganisms and chemicals can lead to a broad spectrum of health problems, ranging from mild gastrointestinal symptoms to severe, life-threatening illnesses. Over 200 diseases, including diarrhea, cholera, *E. coli* infections, typhoid fever, and even certain cancers, have been linked to foodborne pathogens. In many cases, these infections manifest as brief episodes of vomiting, nausea, or diarrhea, but they can also lead to more serious symptoms such as fever, neurological impairments, and long-term complications like reactive arthritis or kidney failure (Pattabhiramaiah *et al.*, 2023; Lindsay, 2002). The burden of foodborne diseases is comparable to that of major infectious diseases globally. According to the World Health Organization, 600 million cases of foodborne illness result in 420,000 deaths annually, with the African Region experiencing the highest per capita burden 91 million illnesses and approximately 137,000 deaths each year (WHO, 2019; WHO, 2022). In Nigeria and other low- and middle-income countries, these high rates are often attributed to poor food handling, inadequate sanitation, limited regulatory oversight, and insufficient awareness among food handlers (Arienzo *et al.*, 2022).

Animal-origin foods such as eggs, milk, pork, and poultry are common carriers of microbial contamination. Ready-to-eat (RTE) foods are also of increasing concern due to their potential to harbor antibiotic-resistant bacteria, posing a significant public health risk as they are consumed without further cooking (Zwirzitz *et al.*, 2020). Unsafe food practices including improper storage, cross-contamination, and undercooking are major contributors to foodborne disease outbreaks. Vulnerable populations such as pregnant women, the elderly, immune compromised individuals, and children are particularly at risk, with surviving children often facing developmental delays (WHO, 2022). Despite advances in food safety systems, the persistent global impact of foodborne diseases underscores the need for coordinated international action. These diseases not only affect public health but also hinder national development through economic losses and strain on healthcare systems (Alum *et al.*, 2016; Arienzo *et al.*, 2022).

Methodology

This study employs a cross-sectional descriptive design using a mixed-methods approach. Both quantitative and qualitative techniques will be utilized to provide a comprehensive understanding of microbial contamination and food safety practices in Mandate Market, Ilorin, Kwara State, Nigeria. The sample size was calculated using the standard formula for sample size determination in population proportion studies. The study was conducted in Ilorin, the capital city of Kwara State, located in Nigeria's North Central region. Ilorin has an area of 765 km² and a population of 777,667 as of the 2006 census. The city serves as the administrative headquarters of the state and is home to several local government areas, including Ilorin West, where Mandate Market is located. The market is a hub for various commercial activities, including food vending, and is selected as the study site. The target population consists of food vendors and hawkers operating in Mandate Market, Ilorin. The study focuses on vendors selling ready-to-eat meals such as rice, beans, meats, and stew, as well as an evaluation of the market's environmental characteristics, including waste disposal and sanitation infrastructure.

Data were collected using the following instruments: **Structured Questionnaire:** To assess food vendors' knowledge, attitudes, and practices regarding food safety, including water sources, food handling, and hygiene practices. **Observation Checklist:** To evaluate the market's hygienic conditions, vendors' personal hygiene, and food preparation area cleanliness. **Microbial Sampling Tools:** Sterile containers, swabs, pipettes, gloves, and sterile bags will be used to collect food samples for laboratory analysis. **Laboratory Equipment:** Standard laboratory tools such as culture media, incubators, and microscopes will be used to identify and quantify microbial contaminants like *Escherichia coli* and *Salmonella spp.*

The instrument was reviewed by the research supervisor for face and content validity. Expert suggestions will be incorporated to refine the instrument and ensure it accurately measures the intended variables. To ensure the instrument's reliability, a pilot study will be conducted with a small group of participants similar to the target population. The results will be assessed for consistency, and any identified inconsistencies will be addressed before the main study. Materials required for sample collection and analysis include: MacConkey agar, Weighing scale, Conical flask, Pistol and mortar, Glass pipette, Slide and coverslip, Culture media, Gram's reagent, Food items (rice, beans, meat, stew), Microscope, Petri dishes, Measuring cylinder, Hand gloves, Cotton wool, Distilled water, Sieve. Food samples were collected from eight different food items (rice, beans, meat, stew) from vendors in Mandate Market. Samples were obtained from two locations (Spot A and Spot B) to ensure variability. The samples were wrapped in sterile aluminum foil and transported to the public health laboratory at Al-Hikmah University for analysis. Food samples were processed by blending them in distilled water, followed by serial dilution in conical flasks. A 1:100 dilution was made followed by further dilutions of 1:10,000, 1:100,000, and 1:1,000,000. The highest dilution was plated on blood and MacConkey agar plates, incubated at 37°C for 48 hours, and examined for bacterial growth.

Data were collected through both primary and secondary methods to gather relevant information on microbial contamination and food safety in Mandate Market. Data will be analyzed using statistical methods, including IBM SPSS and chi-square tests, to meet the research objectives. Permission will be obtained from the relevant authorities at Mandate Market before data collection. Participation is voluntary, and informed consent will be obtained from all participants. Confidentiality and anonymity will be maintained throughout the study.

Results and Discussion

Table 1: Socio-demographic data of respondents

Variable	Category	Frequency	Percentage (%)
Gender	Male	54	36.0
	Female	96	64.0
Age	Below 20 years	12	8.0
	20–29 years	60	40.0
	30–39 years	49	32.7
	40 years and above	29	19.3
Education Level	No formal education	8	5.3
	Primary education	17	11.3
	Secondary education	62	41.3
	Higher education	63	42.0
Role in the Market	Consumer	51	34.0
	Market official	33	22.0
	Vendor	66	44.0
Market Duration	1–5 years	24	16.0
	6–10 years	67	44.7
	More than 10 years	39	26.0
	4 years* (special category)	20	13.3
Goods Sold/Purchased	Fresh produce	18	12.0
	Fruit and vegetable	24	16.0
	Meat and poultry	16	10.7
	Fish and seafood	13	8.7
	Packaged food	36	24.0
	Others	43	28.7

The socio-demographic data show that the majority of respondents were female (64%), suggesting that women predominantly engage in market activities. The largest age group was 20–29 years (40%), followed by 30–39 years (32.7%), indicating a youthful population actively involved in the market system. Educationally, 41.3% had secondary education and 42% had tertiary education, while only 5.3% had no formal education, pointing to a generally literate population. In terms of roles within the market, vendors formed the largest group (44%), followed by consumers (34%) and market officials (22%). Most participants had been in the market for between 6 to 10 years (44.7%), reflecting a population with considerable experience. The types of goods traded varied, with the highest proportion being unspecified "others" (28.7%), followed by packaged food (24%), fruits and vegetables (16%), and fresh produce (12%).

Hygienic measures practiced and their impact on food safety

Table 2: *Hygiene Practices among Vendors*

Practice	Frequency	Percent (%)
Always wash hands before handling food	135	90.0
Sometimes	12	8.0
Rarely	3	2.0
Food Storage Methods		
Method	Frequency	Percent (%)
Refrigerator/Freezer	42	28.0
Tight-Fitted Container	54	36.0
Warmer	53	35.3
Other	1	0.7

Hygiene practices among vendors were generally positive, with 90% of respondents stating that they always washed their hands before handling food. However, 8% only did so sometimes and 2% rarely, indicating some inconsistency in adherence to good hygiene. Food storage practices varied, with 36% using tight-fitted containers, 35.3% relying on warmers, and 28% using refrigeration. While these figures suggest an awareness of hygienic storage methods, they also indicate that a significant portion may lack access to optimal storage facilities, such as refrigeration.

Major causes of microbial contamination in mandate market

Table 4.3: *Reported Causes of Contamination*

Cause	Frequency	Percent (%)
Dirty utensils	33	22.0
Poor personal hygiene	45	30.0
Contaminated water	27	18.0
Improper food storage	31	20.7
Others	13	8.7

The most frequently reported cause of food contamination was poor personal hygiene (30%), followed by dirty utensils (22%) and improper storage (20.7%). Contaminated water accounted for 18%, while 8.7% identified other unspecified causes. These findings underscore the multifaceted nature of contamination sources, with both human behavior and environmental conditions playing significant roles.

Vendor compliance deficiencies in food safety

Table 4: *Frequency of Following Safety Measures*

Practice Frequency	Frequency	Percent (%)
Yes, frequently	82	54.7
Yes, rarely	42	28.0
No, never	14	9.3
Not sure	12	8.0

Only 54.7% of respondents reported frequently complying with food safety standards. A significant proportion (28%) admitted to rarely following them, 9.3% stated they never complied, and 8% were unsure of their level of compliance. These figures highlight a notable gap between awareness of safety standards and their consistent application, pointing to the need for ongoing monitoring, education, and enforcement.

Knowledge of food safety and microbial risk

Table 5: *Familiarity with Microbial Risk and Food Safety*

Familiarity Level	Frequency	Percent (%)
Very familiar	99	66.0
Somewhat familiar	28	18.7
Not familiar	23	15.3

Awareness of microbial contamination varied among respondents. While 66% claimed to be very familiar with the concept, 34% had either limited or no familiarity. When asked to identify spoiled food, 72.7% relied on visible or sensory indicators, suggesting a reliance on observable signs rather than scientific knowledge of microbial contamination. This implies a knowledge gap that could be addressed through targeted training.

Isolate and examination of counts

Table 6: *Distinctive properties of isolates on each food items*

Food items	Distinctive properties of isolates					
	GSR	CATALASE	COAGULASE	LACTOSE	MOTILITY	YEAST CELL
Rice A	GNB	—	—	+	+	
Rice B	GNB	—	—	+	+	
Bean A	GNB	—	—	+	+	
Beans B	GNB	—	—	+	+	
Meat A	GPC	—	+	+	+	+
Meat B	GNB	—	—	+	+	
Stew A		—	—	—	+	
Stew B	GPC	—	+	+	+	
	GNB		—			

GSR- Gram Staining Reaction

GNB- Gram Negative *Bacilli*

GPC- Gram Positive *Bacilli*

+ = Presence
- = Absent

Laboratory investigations revealed significant microbial contamination in commonly sold foods. Rice and bean samples contained Gram-negative bacilli (GNB), indicating the presence of coliforms, which are often associated with fecal contamination due to poor hygiene or contaminated water. Meat samples contained yeast cells and motile organisms, with some also showing coagulase-positive gram-positive cocci, indicating possible staphylococcal contamination. These findings suggest that contamination may result from inadequate storage, prolonged exposure to air, or improper reheating practices.

Statistical analysis of food samples from vendors in mandate market

Table 7: *Isolate from food vendors of Rice Isolates*

MEDIA	MARKET SPOT A	MARKET SPOT B	TOTAL
Blood Agar	60	40	100
MaConkey Agar	55	35	90
Total	115	75	190

The chi-square test for rice contamination between Market A and Market B yielded a value of **2.1** ($\chi^2 = 2.1$), which was **not statistically significant**. This suggests that microbial contamination levels in rice were relatively similar across both markets. The absence of a significant difference may be attributed to common food handling, preparation methods, or environmental exposure shared by vendors.

Table 8: *Isolate from food vendors of Beans Isolates*

MEDIA	MARKET SPOT A	MARKET SPOT B	TOTAL
Blood Agar	20	15	35
MaConkey Agar	25	10	35
Total	45	25	70

For beans, the chi-square value was **156** ($\chi^2 = 156$), indicating a **highly significant difference** in microbial loads between Market A and Market B. This suggests notable disparities in how beans were processed or stored. The result points to the possibility that vendors in one market may follow less stringent hygiene practices or use less safe water and storage methods than those in the other.

Table 9: *Isolate from food vendors of Stew Isolates*

MEDIA	MARKET SPOT A	MARKET SPOT B	TOTAL
Blood Agar	16	26	42
MaConkey Agar	3	4	7
Total	19	30	49

The chi-square test for stew resulted in a value of **0.062** ($\chi^2 = 0.062$), which was **not statistically significant**. This implies that contamination levels in stew were consistent between the two markets. The uniformity may result from standardized preparation and reheating routines that reduce microbial variability.

Table 10: *Isolate from food vendors of Meat Isolates*

MEDIA	MARKET SPOT A	MARKET SPOT B	TOTAL
Blood agar	10	11	21
MaConkey agar	22	23	45
Total	32	34	66

For meat, the chi-square value was **0.012** ($\chi^2 = 0.012$), also indicating **no statistically significant difference** in contamination levels between Market A and Market B. This consistency may reflect similar sourcing, cooking, and storage methods used by vendors in both locations.

Discussion

The socio-demographic characteristics of the respondents provide essential context for understanding food safety practices within Mandate Market. A majority of participants were female (64%), suggesting that women predominantly engage in food vending and related activities. The most represented age group was 20–29 years (40%), followed by 30–39 years (32.7%), indicating a relatively young and active workforce. Most respondents had at least a secondary education (41.3%) or tertiary education (42%), while a minority (5.3%) reported having no formal education. This relatively high level of education among respondents could have implications for their awareness of food hygiene, though, as the findings show, knowledge alone does not always translate into safe practices. Regarding market roles, vendors accounted for 44% of respondents, consumers for 34%, and market officials for 22%. Most respondents had been active in the market for between 6 and 10 years (44.7%), reflecting a population with substantial experience in food handling and sales. The most frequently sold or purchased items were categorized as “others” (28.7%) and packaged foods (24%), followed by fruits and vegetables (16%) and fresh produce (12%), indicating a broad diversity in food types handled.

In terms of hygiene practices, 90% of vendors reported always washing their hands before food handling, yet 8% only did so sometimes and 2% rarely. Food storage methods were moderately hygienic, with 36% using tight-fitted containers, 35.3% using warmers, and 28% relying on refrigeration. Although these figures suggest a basic understanding of safe food handling, the significant proportion of vendors not using optimal storage methods reflects gaps in consistent practice or access to infrastructure. Respondents identified poor personal hygiene (30%), dirty utensils (22%), and improper storage (20.7%) as the most common causes of food contamination. Contaminated water (18%) and other factors (8.7%) were also reported. These results point to multiple, often overlapping, contamination sources, emphasizing the need for comprehensive hygiene interventions across food handling processes.

Compliance with food safety standards was moderate, with 54.7% of respondents claiming frequent adherence. However, 28% admitted to rarely following these standards, 9.3% reported never doing so, and 8% were unsure. This highlights a significant implementation gap that undermines the effectiveness of food safety awareness campaigns. While 66% of respondents claimed to be familiar with microbial risks, a notable 34% had limited or no knowledge. Furthermore, only 72.7% could identify spoiled food based on sensory evaluation, indicating that food safety assessments were largely superficial and reactive. Laboratory analyses confirmed the presence of microbial contamination in all examined food samples. Rice and beans harbored Gram-negative bacilli (GNB), consistent with coliform bacteria, often linked to fecal contamination through poor hygiene or unsafe water use. Meat samples revealed yeast cells, motile organisms, and coagulase-positive Gram-positive cocci, indicating contamination possibly due to improper reheating, prolonged exposure to air, or contact with contaminated surfaces or human skin flora.

A chi-square statistical test was applied to compare microbial loads between Market A and Market B for each food type. Only beans showed a statistically significant difference in microbial contamination levels ($\chi^2 = 156$), indicating major variability in food handling or storage practices between market sections. This is likely because beans require longer preparation, are often held at room temperature, and may be exposed to varying hygiene conditions depending on the vendor. For the remaining food items, rice ($\chi^2 = 2.1$), stew ($\chi^2 = 0.062$), and meat ($\chi^2 = 0.012$) showed no statistically significant differences, suggesting uniform contamination across vendors. This may reflect shared contamination sources, such as communal water, utensils, or general market hygiene conditions, and underscores the systemic nature of the contamination problem rather than isolated vendor behavior.

These findings are in line with earlier research. For example, Olowoyo *et al.* (2022) reported that a significant number of street-vended foods in Nigeria were contaminated due to inadequate sanitation and environmental exposure. Similarly, Rahman *et al.* (2021) linked high microbial counts to the use of contaminated water and poor personal hygiene among food handlers. The present study strengthens these conclusions by providing statistical backing for microbial load differences between vendor groups, particularly highlighting beans as a high-risk item. The detection of coliform bacteria, *Staphylococcus* species, and yeast cells in ready-to-eat foods is concerning, as these organisms are linked to foodborne diseases such as gastroenteritis, typhoid fever, and dysentery. The presence of coagulase-positive *Staphylococcus aureus* suggests human skin contact during food handling, likely due to the absence of gloves or frequent hand washing.

These results point to widespread violations of critical control points as defined by the Hazard Analysis and Critical Control Point (HACCP) system. The lack of significant differences in contamination for most foods implies that interventions must be applied across the entire market system, not just to individual vendors. Hygiene training, better infrastructure, and regulatory enforcement are urgently needed. This study highlights significant microbial contamination in foods sold at Mandate Market, with beans showing a statistically significant variation in contamination between vendors. Despite relatively high education levels and awareness of food safety, unsafe practices remain common, pointing to disconnect between knowledge and implementation. The findings support prior literature and underscore the urgent need for market-wide hygiene improvements, targeted vendor education, and enforcement of safety standards to mitigate the risks of foodborne disease.

Conclusion

This study investigated food safety practices and microbial contamination in Mandate Market, Ilorin, focusing on both vendor hygiene behaviors and the microbial quality of commonly sold foods. The findings highlight a significant gap between food safety awareness and its practical application among vendors. Although many vendors demonstrated basic hygiene knowledge, including hand washing and using containers, only a few adhered to essential safety protocols consistently. Laboratory analysis revealed the presence of microbial contaminants, primarily gram-negative bacilli (coliforms) and yeast cells, in food samples such as rice, beans, meat, and stew. These pathogens are commonly linked to poor hygiene, contaminated water, improper food storage, and cross-contamination. Notably, beans showed significant variation in microbial loads between vendors, suggesting differences in food handling and hygiene practices. The widespread detection of coliforms across multiple samples indicates systemic food safety issues in the market, particularly in high-risk areas like open markets where regulation is often lacking. The study concludes that food sold in Mandate Market poses a potential public health risk, especially for vulnerable populations such as children, the elderly and pregnant women.

Recommendations

To address the identified food safety gaps and reduce microbial contamination in Mandate Market, the following recommendations are proposed:

To the Government

1. Enact and enforce comprehensive food safety regulations requiring hygiene standards for open markets.
2. Introduce mandatory licensing for food vendors, renewable based on hygiene compliance and training participation.
3. Provide essential infrastructure in markets, including clean water sources, waste disposal bins, and public hand washing stations.
4. Create designated food preparation zones to separate raw and cooked food areas.

To Health and Environmental Agencies (e.g., NAFDAC, Local Environmental Health Units)

1. Conduct regular microbial testing of food and water samples in the market.
2. Carry out unannounced hygiene inspections and enforce penalties for non-compliance.
3. Organize food hygiene training workshops for food vendors and handlers.
4. Collaborate with institutions to develop accessible educational materials for low-literacy vendors.

To Food Vendors

1. Always wash hands, utensils, and surfaces before and after handling food.
2. Store food in clean, covered containers and use appropriate cooling or warming equipment.
3. Participate in food safety workshops and obtain certification to demonstrate hygiene compliance.
4. Avoid selling leftovers or spoiled food; dispose of them responsibly.

To Consumers

1. Inspect food before purchase and avoid buying from visibly unhygienic vendors.
2. Patronize vendors who wear protective gear and maintain clean stalls.
3. Report unhygienic vendors or contaminated food to market officials or health agencies.

To Market Associations and Community Stakeholders

1. Establish sanitation committees within the market to monitor vendor practices and organize regular clean-up efforts.
2. Promote peer education, where trained vendors guide others on food safety practices.
3. Reward vendors who consistently maintain high hygiene standards through recognition or market incentives.

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