

ASSESSMENT OF KNOWLEDGE, ATTITUDE, AND PRACTICES OF MEAT HYGIENE AND MICROBIAL PROFILE OF MEAT IN TWO SELECTED LOCAL GOVERNMENT AREAS OF OYO STATE

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Abstract

Food safety remains a major public health concern, especially in developing countries like Nigeria, where informal meat markets thrive and regulatory enforcement is weak. This paper assessed the knowledge, attitudes, and practices (KAP) of meat hygiene among meat handlers including butchers, vendors, buyers and hawkers in Ibadan North and Ibadan South West Local Government Areas of Oyo State. A total of 400 respondents participated through structured questionnaires, and 20 meat samples were collected for microbial analysis to detect the presence of *Escherichia coli*, *Salmonella spp.*, *Listeria monocytogenes*, and *Staphylococcus aureus*. Quantitative data were analyzed using descriptive statistics and logistic regression to examine the correlation between KAP variables and microbial contamination. While 72.5% of respondents recognized poor handling poses contamination risk, only 18.7% could identify specific pathogens. Although general attitudes toward hygiene were positive, practical application was weak. Glove use was below 20%, and refrigeration was practiced by only 11% of abattoir workers and 2% of hawkers. Microbial results showed that 60% of hawker-sourced meat and 30% of abattoir-sourced meat were contaminated with coliforms, often exceeding international safety thresholds. Logistic regression revealed no statistically significant correlation between KAP scores and contamination levels ($p > 0.05$), indicating that external factors such as infrastructure and environmental exposure may influence contamination more than individual awareness or intent. The study identifies unsafe handling practices and the absence of cold-chain infrastructure as significant contamination risks in the meat supply chain. It recommends implementing targeted hygiene training, enforcing stricter regulations, and investing in accessible refrigeration systems to mitigate these risks. These interventions are vital for enhancing meat safety and minimizing the risk of contamination and foodborne illnesses in Oyo State and comparable settings

Keywords: Meat hygiene, microbial contamination, knowledge, attitudes, and practices

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1.0 Introduction

Food safety remains a pressing public health concern globally, particularly in developing

nations where enforcement of hygiene standards in food production and processing is often weak (WHO, 2023). Among various food items, meat is

particularly vulnerable to microbial contamination due to its rich nutrient content, high moisture levels, and complex handling and distribution processes (Reddy et al., 2022). Meat provides essential nutrients including high quality proteins, vitamin B12, iron, and zinc, which are critical for human growth and immune function (FAO, 2021). However, these same properties also make it an ideal medium for the growth of pathogenic microorganisms such as *Salmonella* spp., *Escherichia coli*, *Listeria monocytogenes*, and *Staphylococcus aureus* (Odetunde et al., 2022). Contaminated meat is a leading cause of foodborne diseases, which affect approximately 600 million people annually, causing over 420,000 deaths globally (WHO, 2023).

In Nigeria, meat is a staple food in most households and plays a central role in cultural and ceremonial diets. However, meat hygiene is often poorly regulated, especially in urban and peri-urban markets, where it is commonly displayed on open trays without refrigeration or proper sanitation measures. (Afolabi & Olugasa, 2020). Previous studies revealed alarming levels of microbial contamination in raw meat across various Nigerian markets, indicating non-compliance with hygiene protocols during slaughtering, handling, and transportation (Adeyemo et al., 2021; Fasanmi et al., 2020). Poor infrastructure, inadequate training, and the absence of standardized cold chains contribute to this reality. Although the Nigerian government introduced a “Meat Hygiene Act” to formalize abattoir operations (NAN, 2017), the act implementation and enforcement remain limited in most local government areas.

While meat is nutritionally indispensable, unsafe meat due to poor hygiene practices poses serious public health threats. In Ibadan, the capital of Oyo State and one of the largest urban centres in West Africa, meat is often hawked under unhygienic conditions, handled by individuals with limited formal education, and transported without refrigeration. These practices increase the risk of

contamination, particularly from coliforms and other enteric bacteria (Akintola et al., 2023). Moreover, while individual studies have examined either microbial contamination or unhygienic practices, there is a scarcity of integrated studies that link knowledge, attitudes, and practices (KAP) of meat handlers with microbial contamination data in a local context (Oladokun et al., 2022). This limits the ability of public health agencies to implement targeted interventions.

Against this backdrop, the present study was conducted to evaluate the Knowledge, Attitudes, and Practices (KAP) of meat hygiene among butchers, vendors, and consumers, and to correlate these with the microbial profile of meat sold in two selected Local Government Areas of Oyo State, Nigeria. This research is timely, given the increasing demand for safe animal products amidst recurrent outbreaks of foodborne diseases (CDC, 2023). This study combines human behavioural analysis with microbiological evidence to support the formulation of informed policies, strengthen public health responses, and enhance food safety protocols in Nigeria.

2.0 Materials and Methods

2.1 Methodology

This study adopted a mixed-methods approach, combining both quantitative and qualitative designs to provide a comprehensive understanding of meat hygiene practices and microbial profiles in two Local Government Areas of Oyo State, Nigeria. The quantitative component utilized a descriptive cross-sectional design to assess knowledge, attitudes, and practices related to meat hygiene among butchers, meat vendors, and consumers.

2.2 Study Area

The research was conducted in Ibadan North and Ibadan South West, Local Government Areas (LGAs) within Oyo State, in the south-western

region of Nigeria. Oyo State is well-known for its extensive meat markets and high meat consumption. The selected LGAs were purposively chosen due to their vibrant meat markets with a high density of meat handlers, including butchers, vendors, and consumers actively engaged in the meat supply chain.

2.3 Study Population

The study population comprised all individuals involved in the meat supply chain within the selected LGAs. These include butchers and meat vendors operating in abattoirs and local markets, as well as retail vendors who hawk meat within communities. Additionally, regular consumers of meat products from these markets were included to capture demand-side behaviours and perceptions related to meat hygiene and safety.

2.4 Sampling Technique

A multi-stage sampling technique was employed to ensure broad representation. Initially, purposive sampling was used to select Ibadan North and Ibadan South West based on the concentration of meat markets and prevalence of meat handling activities. Data collected from 400 respondents across the two LGAs. A total of 200 meat handlers from abattoirs and 200 hawkers/vendors were surveyed using structured questionnaires. Additionally, 20 meat samples were analysed for microbial contamination to determine correlations with hygiene practices. The data are presented in three major segments:

1. Descriptive statistics on respondent demographics.
2. Analysis of KAP (Knowledge, Attitudes, Practices) by handler type.
3. Microbial results and correlation with hygiene practices.

2.5 Data Collection Method

To comprehensively assess meat hygiene practices and the prevalence of microbial contamination, the study combined structured surveys, microbiological analysis, and qualitative fieldwork. Quantitative data were collected through structured questionnaires administered to meat handlers and consumers to capture their knowledge, attitudes, and daily practices related to meat hygiene. In parallel, microbiological analyses were carried out on meat samples collected from various market locations to determine the presence and types of common pathogens, including *Salmonella spp.*, *E. coli*, *Listeria monocytogenes*, and *Staphylococcus aureus*. Descriptive statistics were computed for all variables. Frequency distribution tables and charts were also used. For continuous variables, means and standard deviation (SD) were calculated. Cross-tabulations were generated for comparison of categorical data using Chi-square and t-test for continuous variables. The level of significance was set at $P < 0.05$. Variables significant at 0.05 level of significance were entered into multivariate logistic regression model to determine the correlation between KAP and microbial results.

3.0 Results and Discussions

Table 1: Demographic Characteristics of Respondents

Variable	Frequency (n=400)	Percentage (%)
Gender		
Male	346	86.5
Female	54	13.5

Variable	Frequency (n=400)	Percentage (%)
Age Group		
18–30	96	24.0
31–45	178	44.5
46–60	96	24.0
>60	30	7.5
Education Level		
No Formal Education	134	33.5
Primary Education	102	25.5
Secondary Education	106	26.5
Tertiary Education	58	14.5
Years of Experience		
<5 years	82	20.5
5–10 years	126	31.5
>10 years	192	48.0

The demographic profile of the 400 respondents revealed a clear gender imbalance, with 86.5% male and only 13.5% female participants. This reflects a long-standing trend in Nigeria and other parts of West Africa, where meat handling, slaughtering, and vending are traditionally male-dominated occupations (Babatunde et al., 2023). Most participants (44.5%) were aged between 31 and 45 years, indicating that meat processing is predominantly carried out by individuals in their economically active years. The relatively small percentage of respondents aged above 60 suggests that the physically demanding nature of the job may discourage older individuals from prolonged participation. In terms of education, the findings highlighted significant literacy challenges: 33.5% of respondents had no formal education, and only 14.5% had tertiary education. This pattern aligns with earlier findings, which showed that limited formal education restricts meat handlers' ability to understand and implement technical hygiene protocols, particularly those involving microbial risk and cold-chain management (Obadina et al., 2021; Sani et al., 2023). Educational deficiencies have also been linked to poor compliance with

hygiene standards, and raining efforts must therefore consider visual tools, local languages, and community-focused approaches.

. Despite the low literacy levels, many respondents demonstrated positive attitudes toward hygiene, which presents an opportunity for behavior-change campaigns if properly structured.

Notably, nearly 48% of respondents had over 10 years of experience in meat handling, which indicates that this profession is largely composed of long-serving, informal experts. While experience should ideally correlate with improved hygiene, this study like others (Oladokun *et al.*, 2022) found that knowledge and practice gaps persist despite many years in the trade. This suggests that informal knowledge acquisition alone is insufficient to ensure food safety, especially in settings lacking structured regulatory oversight. However, the depth of experience offers a unique opportunity to engage senior meat handlers as peer educators or community role models, reinforcing hygiene messages from within the industry.

Table 2: Respondents' Knowledge of Meat Hygiene

Knowledge Statement	Correct Response (%)
Meat can be contaminated by poor handling	72.5%
Importance of personal hygiene (hand-washing, gloves, etc.)	66.8%
Meat requires refrigeration to prevent microbial growth	55.2%
Identification of <i>E. coli</i> , <i>Salmonella</i> , or pathogens by name	18.7%
Knowledge of Meat Inspection Stamp	47.0%

The study revealed that while 72.5% of respondents correctly understood that improper handling leads to contamination, only 18.7% could identify specific pathogens like *E. coli* or *Salmonella*. This aligns with findings by Obadina *et al.* (2021), who noted that knowledge of general hygiene is often superficial among meat vendors in Nigeria, lacking depth on microbial risk factors. Similarly, Akinyemi *et al.* (2022) reported that although meat handlers demonstrated familiarity with cleanliness practices, their understanding of microbial

hazards and cross-contamination remained poor, especially in informal markets. Comparative studies across sub-Saharan Africa also highlight these gaps. In Ghana, Boakye *et al.* (2020) found that fewer than 30% of meat vendors could identify major foodborne pathogens despite undergoing food safety training. These trends suggest that conventional hygiene education programs may need redesigning to include practical demonstrations, local-language delivery, and microbial awareness campaigns.

Table 3: Respondents' Attitude towards Meat Hygiene

Attitude Statement	Agree (%)
Meat hygiene is essential to prevent disease.	85.0%
Covering meat during transport is necessary.	78.4%
Government inspections are important and should be enforced.	70.5%
Using gloves and clean water should be mandatory during processing.	60.2%
Cooking kills all microorganisms, so hygiene is less important.	22.3%

Despite the knowledge gaps, the study recorded relatively positive attitudes among respondents, with 85% agreeing that hygiene is critical to disease prevention. This is consistent with research by Sani et al. (2023), who found that positive attitudes toward hygiene were high among Nigerian abattoir workers but did not always translate into safe behaviours. A recent Kenyan study by Mwangi and Njiru (2021) also found that while attitudes toward hygiene were overwhelmingly positive, actual hygiene

practices were substandard due to structural and economic limitations. This divergence between attitudes and practices has been interpreted using behavioural theories such as the Health Belief Model, which posits that perceived severity and self-efficacy determine action (Champion & Skinner, 2022). In the present study, many respondents expressed willingness to comply with government inspections but lacked the capacity (e.g., gloves, refrigeration) to implement such measures consistently.

Table 4: Respondents' Attitude towards Hygiene Practices (Observed & Reported)

Practice Variable	Abattoir (%)	Hawkers (%)
Wash meat with clean water	88.5%	67.0%
Use of gloves	19.5%	7.0%
Cleaning surfaces before and after slaughter	84.0%	44.5%
Refrigerated storage or display	11.0%	2.0%
Covering meat during transportation	64.5%	22.0%

The disparity in practices between abattoir workers and hawkers was significant. While 88.5% of abattoir respondents reported washing meat with potable water, only 67.0% of hawkers did the same. More concerning was the very low rate of glove usage (<20% overall) and the near absence of refrigeration among hawkers. These findings are corroborated by Oladokun et al. (2022), who reported that street meat vendors in Ibadan largely lacked cold-chain facilities, resulting in higher meat spoilage rates. Similarly, Yusuf et al. (2023) in Kaduna State found that 68% of meat vendors did not use any protective clothing or sterilization equipment.

The present study found that hawkers had significantly higher microbial contamination (60%) in meat samples compared to abattoirs (30%). This validates earlier findings by Kang et al. (2020) and Riley et al. (2022), who documented a strong correlation between informal meat markets and increased presence of coliform bacteria, including multidrug-resistant *E. coli*. Their work emphasized how contamination often occurs post-slaughter during transportation or hawking, especially when meat is exposed to flies, dust, or unrefrigerated storage

Table 5: Microbial Analysis of Meat Samples

Sample Source	Coliform Presence	Average CFU/g
Abattoir (n=10)	3 Positive (30%)	1.1×10^5
Hawker (n=10)	6 Positive (60%)	3.2×10^5

Laboratory results showed coliform presence in 9 of 20 samples, with hawkers' meat accounting for two-thirds of the positive tests. This is consistent with Huang et al. (2021), who reported that meat contamination in informal supply chains often results from cross-contamination with equipment, handlers' hands, and unclean display surfaces. Moreover, the CFU/g readings for hawkers' meat exceeded safe limits set by international guidelines (FAO/WHO, 2020), this poses a potential risk of gastrointestinal infections if the meat is consumed undercooked. Interestingly, although abattoirs had better physical facilities, contamination still occurred, suggesting that

environmental cleanliness alone does not guarantee microbial safety. This is in agreement with Mensah et al. (2020), who argued that hygiene during processing encompassing the handling of meat during bleeding, skinning, evisceration, and packaging is a more critical determinant of meat safety than visible or environmental sanitation alone

Furthermore, Babatunde et al. (2023) emphasized that even in urban Nigerian abattoirs, contamination risks remain unless staff undergo proper training and microbial testing becomes routine.

Table 6: Correlation between KAP and Microbial Results

Variable	Coefficient (β)	Std. Error	z-value	p-value	95% CI
Intercept	-2.566	1.246	-2.06	0.039	[-5.01, -0.12]
Knowledge Score	+0.018	0.0105	+1.71	0.087	[-0.003, +0.039]
Attitude Score	+0.008	0.0127	+0.65	0.515	[-0.017, +0.033]
Practice Score	+0.008	0.0072	+1.08	0.278	[-0.006, +0.022]

The intercept is significant ($p = 0.039$), indicating a meaningful baseline log-odds of contamination. Knowledge Score shows a borderline effect ($p = 0.087$), suggesting that higher knowledge may slightly increase the odds of contamination. This is counterintuitive, possibly due to over-reporting of knowledge not reflected in actual behaviour. Practice Score has a positive coefficient, though non-significant ($p = 0.278$), which contradicts expectations. This may indicate: Either misreporting in self-assessed practice or that environmental factors outside individual practices (e.g., equipment, market conditions) have stronger effects. Overall, the model suggests that self-reported KAP variables alone may not fully explain contamination risk underscoring the importance of combining observational and microbial data in hygiene research (Obadina et al., 2021; Riley et al., 2022).

This study has revealed critical insights into the knowledge, attitudes, and practices (KAP) of meat hygiene among butchers, vendors, and consumers in Ibadan North and Ibadan South West LGAs of Oyo State. While most respondents demonstrated positive attitudes towards hygiene and disease prevention, there were significant gaps in both knowledge and actual practices especially among hawkers. The microbial analysis confirmed high levels of contamination in meat, particularly from hawker sources, underscoring the public health risks posed by poor handling, lack of refrigeration, and limited protective gears. Importantly, the data showed that years of experience do not necessarily equate to safe practices, and that formal training remains a weak point across the sector.

To improve meat hygiene and reduce contamination risks, multi-level interventions are necessary. Firstly, targeted education and training programmes should be developed using visual

4.0 Conclusion and Recommendations

aids and local languages, focusing on microbial risks and practical hygiene behaviours. These should include the promotion of the usage of protective clothings such as hand gloves, mouth mask, headgears and aprons, proper surface cleaning, and refrigeration techniques. Secondly, Local Government Authorities should strengthen enforcement of hygiene regulations in informal markets and abattoirs by instituting regular inspections and penalties for non-compliance. Additionally, public-private partnerships could be leveraged to provide low-cost cold storage facilities or hygiene kits to meat vendors, particularly hawkers. Engaging experienced meat handlers as community educators may also enhance peer-led compliance and cultural acceptance of safer practices.

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