

From Knowledge to Practice: Barriers to Food Hygiene among Food Handlers at the University of Calabar, Nigeria

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Abstract

This study examined the barriers to food hygiene practices among food handlers at the University of Calabar, Nigeria. A descriptive cross-sectional research design was adopted. The study involved 236 food handlers drawn from 72 food establishments selected from 88 registered and functional food vendors within the University of Calabar. Data were collected using a structured questionnaire containing demographic items and ten potential barriers to food hygiene practices identified from the literature. Data were analysed using descriptive statistics and Chi-square analysis at a 0.05 level of significance. The findings revealed that financial constraints, inadequate equipment, inadequate supplies, time constraints, lack of enforcement of food hygiene rules and regulations, absence of established institutional standards, and lack of motivation were the major barriers to food hygiene practices. The Chi-square analysis produced a calculated value of 1,249.60, which was greater than the critical value of 40.113 at 27 degrees of freedom and a 0.05 level of significance, leading to the rejection of the null hypothesis. The study concluded that barriers to food hygiene practices among food handlers at the University of Calabar are predominantly structural, material, organisational, and regulatory rather than knowledge-based. Improving food hygiene therefore requires an enabling institutional environment characterised by adequate facilities and supplies, effective monitoring and enforcement, clear food hygiene standards, appropriate equipment, sufficient staffing and time, and mechanisms for motivating food handlers to comply with established hygiene requirements.

Keywords: Food hygiene; food handlers; barriers; food safety; institutional food service; University of Calabar; hygiene practices; food vendors.

Introduction

Food safety remains an important public health concern because unsafe food can expose consumers to biological, chemical, and physical hazards and contribute to a substantial burden of foodborne disease. The safety of food consumed outside the home is particularly important because consumers generally have limited control over the conditions under which food is sourced, prepared, stored, transported, and served. Food handlers consequently occupy a critical position in the food-safety chain, as their knowledge, attitudes, behaviours, working conditions, and access to appropriate facilities can influence the likelihood of food contamination (Ifeadike et al., 2020). Effective food hygiene therefore requires not only individual compliance with recommended

practices but also an enabling environment in which food handlers have the resources, facilities, training, supervision, and institutional support necessary to implement those practices consistently. Food hygiene practices encompass activities such as personal cleanliness, appropriate handwashing, safe food preparation, prevention of cross-contamination, adequate cooking and reheating, proper storage and temperature control, protection of food from environmental contamination, and appropriate cleaning and sanitation of utensils and food-contact surfaces (Okorie, 2024). Although food-safety knowledge is an important prerequisite for safe behaviour, knowledge alone does not necessarily translate into consistent compliance. Recent evidence indicates that food-safety practices are shaped by multiple interacting factors, including education and training, access to food-safety information, sanitation facilities, economic conditions, organisational support, and the physical environment in which food is handled. For example, Barnabas et al. (2024), in a study of food vendors participating in Nigeria's school-feeding programme, found that education and access to food-safety information were associated with food-safety knowledge, while important gaps remained in the use of protective clothing and other recommended practices. These findings suggest that improving food hygiene requires interventions that extend beyond information provision to address the conditions under which food handlers work.

The distinction between knowledge and practice is particularly important when examining barriers to food hygiene. Food handlers may understand recommended procedures but may be unable to comply consistently when appropriate facilities, equipment, water, sanitation infrastructure, time, finance, protective materials, or supervisory support are unavailable. According to Madaki and Bavorova (2021) food-safety knowledge, attitudes, economic and social constraints, and access to sanitation facilities are associated with food-safety behaviour. They argue inadequate access to sanitation facilities negatively affected food-safety behaviour. Therefore, food hygiene should not be conceptualised solely as an individual responsibility because structural and institutional conditions may either facilitate or constrain the ability of food handlers to comply with recommended practices.

The University community is important because higher-education campuses constitute concentrated food-service environments that serves large and diverse populations. Students, academic and non-academic staff, visitors, and other members of the university community may depend on restaurants, cafeterias, canteens, kiosks, mobile vendors, and other food outlets for daily meals and refreshments (Ibuo, 2023). Such environments can generate high and continuous demand for ready-to-eat foods while simultaneously creating challenges associated with crowding, workload, limited operating space, waste disposal, water availability, sanitation, food storage, and regulatory monitoring. Thus, maintaining food hygiene in university environments requires coordinated attention to both individual food-handler behaviour and the institutional conditions within which food preparation and service occur (Ibuo, 2023).

Wandolo et al. (2018) stated that several categories of barriers may influence food hygiene practices among food handlers. According to them, infrastructural barriers may include inadequate water supply, sanitation facilities, waste-disposal systems, food-storage facilities, and suitable food-preparation spaces. Material and economic barriers may include the cost or unavailability of appropriate utensils, protective clothing, cleaning materials, refrigeration equipment, and other food-safety resources. Human-resource and organisational barriers may involve inadequate staffing, workload, time pressure, insufficient training, weak supervision, and lack of motivation.

Regulatory and institutional barriers may include inadequate monitoring, inconsistent enforcement, unclear institutional standards, and limited accountability (Seidu, 2020). Individual-level barriers may also involve inadequate knowledge, attitudes, risk perception, experience, and commitment to food-safety procedures (Wandolo et al., 2018; Omari et al., 2014). These categories indicate that food hygiene is a multidimensional behaviour resulting from the interaction between individual characteristics and the environment in which food handling occurs. Mjoka & Selepe (2017), argue that improving food hygiene requires more than periodic training programmes. Training can improve knowledge and awareness, but its effectiveness may be constrained when food handlers lack the facilities, equipment, time, financial resources, supervision, or institutional support required to translate knowledge into practice. The evidence from higher institutions in Nigeria is particularly important because it demonstrates the influence of sanitation accessibility and economic and social constraints on food-safety behaviour. Consequently, interventions aimed at improving food hygiene in university environments should be informed by empirical evidence concerning the specific barriers experienced by food handlers in those environments (Diminyi & Ogoina, 2024).

Despite the growing body of literature on food-safety knowledge, attitudes, and practices among food handlers in Nigeria, comparatively limited attention has been given to the specific barriers that constrain food handlers from practising recommended food hygiene procedures within individual university environments. Existing research (Okon et al., 2022; Nyawo et al., 2021; Ifeadike et al., 2020; Ojide et al., 2020 & Faremi et al., 2018), has provided useful evidence on food-safety knowledge, attitudes, training, sanitation facilities, and reported practices, including studies conducted in higher institutions and in Calabar. However, there is need to move beyond measuring knowledge and practices to identify the practical, infrastructural, economic, organisational, and regulatory obstacles that food handlers encounter in their daily operations. Addressing this gap is important because interventions designed without understanding the underlying barriers may fail to produce sustained improvements in food hygiene. The University of Calabar provides an appropriate setting for examining these issues because its food-service environment serves a large and diverse university population through different categories of food vendors and handlers. Recognising the challenges faced by food handlers can yield valuable insights for reinforcing institutional food-safety policies, improving sanitation and food-service infrastructure, designing targeted training programmes, enhancing monitoring and supervision, and promoting safer food-handling practices on campus. The study is therefore guided by the premise that food hygiene is not solely a function of individual knowledge or willingness to comply but is also shaped by the physical, economic, organisational, and regulatory environment in which food handlers operate.

Accordingly, this study investigates the barriers to food hygiene practices among food handlers at the University of Calabar, Nigeria. Specifically, the study seeks to identify and examine the major factors that hinder food handlers from consistently implementing recommended food hygiene practices within the university environment. The study is guided by the following research question: What are the major barriers to food hygiene practices among food handlers at the University of Calabar, Nigeria?

Literature Review

Food hygiene practices are influenced by a combination of individual, organisational, environmental, and institutional factors. Although food-safety knowledge and training are widely recognised as important prerequisites for safe food handling, evidence increasingly suggests that knowledge alone does not guarantee consistent compliance with recommended practices. Food handlers may understand appropriate procedures but fail to implement them when they encounter inadequate facilities, limited resources, time pressure, insufficient supervision, weak organisational commitment, or unfavourable workplace conditions. Consequently, barriers to food hygiene should be understood as multidimensional constraints that affect the ability and willingness of food handlers to translate food-safety knowledge into routine behaviour.

Sinha and Sandhu (2023) conducted a cross-sectional comparative study to evaluate the impact of an educational intervention on the knowledge, attitudes, and practices (KAP) of food handlers regarding food safety. The study identified manpower management and the absence of basic amenities for hand washing as the most common barriers to implementing food safety measures in food handling establishments. In contrast, Howells et al. (2008) explored restaurant employees' perceptions of barriers to three specific food safety practices. The barriers identified included time constraints, inconvenience, inadequate training, and lack of resources, which hindered the proper implementation of food safety protocols in restaurant settings. Some specific challenges highlighted in the study included lack of space and competing tasks when cleaning work surfaces, inconvenient placement of sinks leading to dry skin from handwashing, and absence of working thermometers or their inconvenient locations. Additionally, the lack of incentives for employees to adhere to food safety practices and the failure of managers to monitor cleaning and thermometer usage were also noted as significant barriers to ensuring food safety in restaurant environments.

One important barrier is inadequate knowledge and insufficient training. Training is expected to improve food handlers' understanding of contamination risks and appropriate preventive measures; however, the effectiveness of training depends partly on whether knowledge can be translated into actual workplace behaviour. Recent evidence from Nigeria demonstrates this relationship. Madaki and Bavorova (2021), in their study of food vendors operating in higher institutions of learning in Bauchi State, found that food-safety knowledge and attitudes were associated with food-safety behaviour. However, their findings also showed that knowledge was not sufficient in isolation, as economic and social constraints and access to sanitation facilities influenced the ability of vendors to practise food safety. This finding is particularly relevant to university food environments because it demonstrates that improving knowledge without addressing structural constraints may have limited effects on food hygiene.

Wandolo et al. (2018) investigated the challenges faced by food handlers in implementing food safety and hygiene principles in TVET and university hospitality schools in Kenya. Using inferential statistics and content analysis, findings indicate that 31% of the respondents acknowledged the presence of barriers. These barriers included a lack of knowledge (32%), absence of set standards (31%), negative attitudes (31%), limited time (28%), lack of motivation (27%), insufficient experience (26%), inadequate facilities (23%), and a shortage of equipment (23%). Arendt et al. (2015) identified six obstacles to practicing food hygiene, including forgetfulness or lack of habit, being too busy, lack of knowledge, the consequences of following safe food handling practices, availability and use of resources, and the workplace culture. Recent evidence from Nigeria's school-feeding programme similarly indicates that favourable knowledge

and attitudes do not necessarily translate into consistent application of all recommended food-safety practices. Barnabas et al. (2024) reported generally positive food-safety knowledge, attitudes, and practices among food vendors, but observed weaknesses in specific protective practices, particularly the use of gloves and protective clothing. This suggests that training interventions need to be accompanied by practical support, monitoring, and access to the materials required to implement recommended procedures. Thus, lack of knowledge and inadequate training remain relevant barriers, but they should be considered alongside the environmental and organisational conditions in which food handlers operate.

Inadequate infrastructure, facilities, and equipment have also been identified as a major barrier to food hygiene practices (Okwuanaso et al., 2024). Safe food handling requires access to potable water, functional handwashing facilities, appropriate food-storage equipment, suitable utensils, cleaning materials, waste-disposal facilities, and adequate food-preparation spaces (Ogutu et al., 2022). Where such facilities are unavailable or inconveniently located, food handlers may find it difficult to comply with recommended hygiene procedures. Madaki and Bavorova (2021) provide particularly strong evidence in this regard, reporting that inaccessibility to sanitation facilities negatively affected food-safety behaviour among food vendors in Nigerian higher institutions. Their findings demonstrate that the physical environment can constrain food-safety behaviour even where vendors possess some knowledge of appropriate practices. The importance of resources is also evident in contemporary food-safety culture research. The U.S. Centers for Disease Control and Prevention (CDC, 2024), based on research involving restaurant workers, identified adequate food-safety supplies as one of the important components of a strong food-safety culture. The study also identified lack of space and resources as obstacles to maintaining effective food-safety practices. These findings reinforce the argument that food hygiene is partly dependent on whether organisations provide the physical and material resources necessary for employees to comply with food-safety requirements. In university environments, inadequate water supply, insufficient waste-disposal infrastructure, poor food-storage facilities, and limited access to appropriate cleaning materials may therefore constitute important barriers to food hygiene.

Okorie (2024) identified time constraints, workload, and competing work demands. Food handlers often work in environments characterised by high customer volumes, peak service periods, staff shortages, and pressure to serve customers quickly. Under such conditions, hygiene activities such as frequent handwashing (Ogutu et al., 2022), cleaning work surfaces, changing protective clothing, separating raw and cooked foods, and maintaining appropriate storage conditions may be perceived as time-consuming or secondary to immediate service demands. Arendt et al. (2015) identified being too busy, forgetfulness or lack of habit, and the perceived consequences of following safe food-handling practices among barriers affecting hygiene behaviour. Although these findings are older, they remain relevant because more recent research continues to identify staffing and operational pressures as important organisational constraints. Evidence from the CDC's (2024) recent food-safety culture research further supports this argument. The agency identified short staffing as one of the obstacles to developing a strong food-safety culture in restaurants. Where staffing levels are inadequate, individual food handlers may have to perform multiple tasks simultaneously, increasing the likelihood that hygiene procedures will be overlooked. Time pressure should therefore not be interpreted simply as an individual failure to comply but as a potential consequence of how food-service operations are organised and managed.

Another important barrier is management commitment and organisational food-safety culture. Food hygiene does not occur in isolation from the values, priorities, expectations, and practices of the organisation. A workplace in which managers consistently communicate the importance of food safety, provide adequate resources, monitor compliance, and model appropriate behaviour is more likely to encourage employees to maintain safe practices. Conversely, where management prioritises speed, sales, or cost reduction over hygiene, employees may perceive food-safety procedures as less important. The concept of food-safety culture has therefore become increasingly important in understanding food-handler behaviour. The U.S. Food and Drug Administration's (FDA, 2022) systematic review of food-safety culture literature identified food-safety culture as an important component of effective food-safety management and emphasised that beliefs, attitudes, behaviours, and organisational actions influence food-safety outcomes. The review

Evidence from Nigerian higher-education settings reinforces the importance of this issue. Madaki and Bavorova (2021) demonstrated that sanitation accessibility and economic and social constraints were important determinants of food-safety behaviour among vendors in higher institutions. More recent Nigerian evidence also indicates that food-safety outcomes are associated with access to information and training. Barnabas et al. (2024) reported that education and access to information from food inspection institutions and other sources were positively associated with food-safety knowledge among food vendors, while the study also identified shortcomings in some protective food-handling practices. Similarly, recent research (Diminyi, 2024) in Cross River State found that food-safety training was significantly associated with improved food-safety practices among food handlers in selected hotels in Ikom Local Government Area, although important gaps in environmental hygiene and food-safety knowledge remained. These findings collectively suggest that training is important but should be considered alongside the physical, organisational, and institutional conditions that influence food handlers' capacity to practice what they have learned. The Nigerian regulatory environment also recognises the importance of maintaining appropriate conditions throughout food handling and service. The National Agency for Food and Drug Administration and Control (NAFDAC) has regulatory responsibility relating to food safety, and the NAFDAC Food Hygiene Regulations 2025 provide a regulatory framework applicable to establishments involved in the preparation, processing, packaging, transportation, distribution, handling, storage, and sale of food. The existence of regulatory provisions, however, does not automatically guarantee compliance at individual food-service locations. The effectiveness of food-safety regulation depends partly on the availability of facilities and resources, awareness of requirements, monitoring, enforcement, institutional commitment, and the willingness and capacity of food handlers and food-service operators to comply (Diminyi, 2024).

The situation is particularly relevant in Calabar, Cross River State, where food hygiene has received some empirical attention. Okon et al. (2022), in a study of 156 food handlers in Calabar Municipal, reported generally high levels of food-safety knowledge and food-hygiene practices and recommended health education, continuous monitoring, and periodic training for food handlers. Although this evidence provides an important local foundation, it primarily emphasises food-hygiene knowledge, attitudes, and practices rather than systematically examining the barriers that prevent food handlers from consistently implementing recommended practices. The distinction is important because relatively favourable reported knowledge or practice levels do not necessarily indicate that food handlers operate in environments free from infrastructural, financial, organisational, regulatory, or behavioural constraints. Recent evidence from other Nigerian food-service contexts similarly demonstrates that food-safety practices can remain inconsistent despite

generally favourable levels of knowledge. Okwuanaso et al. (2024), for example, examined food-safety knowledge and hygiene practices among food handlers in Nnewi metropolis and highlighted the continuing importance of food hygiene for consumer protection. Evidence from Nigerian school-feeding vendors also demonstrates that some recommended protective practices, including the use of gloves and protective clothing, may remain poorly implemented even where vendors report generally positive attitudes toward food safety. These findings strengthen the argument that understanding why food handlers fail to adopt or consistently maintain recommended practices is as important as measuring their knowledge and reported behaviour.

Method

A descriptive cross-sectional research design was adopted to achieve the objective of the study. The design involved the collection and analysis of quantitative data from food vendors and food handlers operating within the University of Calabar. The study population comprised all registered and functional food vendors and their food handlers (employees) involved in the purchase, storage, preparation, and service of ready-to-eat foods within the University of Calabar. According to records obtained from the Director of Campus Business Operators, there were 88 registered and functional food vendors operating within the University at the time of the study. Thus, the target population comprised 88 food vendors and their employees. The sample size for the food vendors was determined using Yamane's (1967) formula for finite populations. Based on the calculation, a sample size of 72 food vendors was obtained from the target population of 88 vendors. Yamane's formula of 1967 was used to determine the sample size of 72 food vendors as follows:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n = sample size

N = population of registered and functional food vendors (88)

e = error of tolerance usually set at 5% level of significance

Therefore;

$$n = \frac{88}{1 + 88 (0.05)^2}$$

$$n = \frac{88}{1 + 88 (0.0025)}$$

$$n = \frac{88}{1 + 0.22}$$

$$n = \frac{88}{1.22}$$

$$n = 72$$

A purposive sampling technique was subsequently employed to select the 72 food establishments. Selection was based on three main criteria: high patronage, accessibility, and the willingness of the vendors to participate in the study. The food handlers working in the selected establishments constituted the sample for the study. Since the number of food handlers within the 72 selected

establishments was considered manageable, a total enumeration approach was adopted. Consequently, all 236 food handlers working in the selected food establishments were included in the study, as presented in Table 1. Data were collected using a structured questionnaire developed based on the objective of the study and relevant literature. The questionnaire was divided into two sections. Section A elicited information on the demographic characteristics of the respondents, while Section B contained ten (10) major barriers to food hygiene practices identified from the literature review. Respondents were asked to indicate the extent to which each identified barrier affected their ability to practice appropriate food hygiene. The data collected were coded and analysed using descriptive and inferential statistical techniques. Descriptive statistics, including frequencies and percentages, were used to summarise the respondents' characteristics and responses to the identified barriers. A Chi-square (χ^2) test was employed to determine whether significant differences existed in the observed responses to the identified barriers. The test was conducted at a 5% level of significance ($\alpha = 0.05$).

Table 1: List of sample food vendors and food handlers

Sn	Food vendors	No of staff	Sample	%	Sn	Food vendors	No of staff	Sample	%
1	Linda's Kitchen	3	3	100	37	Mummy Best Restaurant	2	2	100
2	Scholas' Food	5	5	100	38	Mma Uko Eatery	4	4	100
3	Sparks Restaurant	4	4	100	39	Mma Kufre Restaurant	3	3	100
4	Mama Restaurant	3	3	100	40	Pa's Restaurant	3	3	100
5	T-Boy Food	3	3	100	41	Belle Belle Food	3	3	100
6	Mma Eka Kitchen	2	2	100	42	Feel Well Restaurant	4	4	100
7	Stella Foods	3	3	100	43	Mbere Restaurant	3	3	100
8	Eatery	3	3	100	44	Malabo's Spot	5	5	100
9	Tourism Kitchen	5	5	100	45	Mfonobong Food	2	2	100
10	Domino's Kitchen	5	5	100	46	SSANU Restaurant	5	5	100
11	Madam J Restaurant	3	3	100	47	Mama Atam Kitchen	3	3	100
12	Food Hub	5	5	100	48	Kenny's Restaurant	2	2	100
13	Mummy P Restaurant	3	3	100	49	Iniobong Restaurant	4	4	100
14	Vicky's Food	4	4	100	50	Mma Nkoyo Kitchen	3	3	100
15	Kiki's Sport	3	3	100	51	Mama Aboy Restaurant	2	2	100
16	Chitis Etery	2	2	100	52	Last Spot Restaurant	3	3	100
17	Mama Gold Restaurant	3	3	100	53	Janny's Food	3	3	100
18	11:45	2	2	100	54	Mummy Comfort Eatery	4	4	100
19	Right Time Foods	3	3	100	55	Linckon Food	2	2	100
20	Ime Restaurant	4	4	100	56	Asua Adi Restaurant	3	3	100
21	Mummy Eno	5	5	100	57	Auntie Julie Restaurant	2	2	100
22	Grace Restaurant	2	2	100	58	Esther's Spot	4	4	100
23	Amazing Grace Food	3	3	100	59	Eno-Obong Restaurant	3	3	100
24	Ndifreke's Restaurant	3	3	100	60	Mama Maggi Kitchen	3	3	100
25	J. J. Spot	4	4	100	61	Etekamba's Joint	4	4	100
26	True Hope Food	3	3	100	62	Emem Restaurant	2	2	100
27	Cheapers's Food	4	4	100	63	BB Food and Drink	3	3	100
28	Madam Quantity	2	2	100	64	Madam Josephine Eatery	3	3	100
29	Divine Food	3	3	100	65	Cameroon Restaurant	4	4	100
30	Success Food	3	3	100	66	Students' Eatery	5	5	100
31	M & B Spot	5	5	100	67	Blessing Jollof	2	2	100
32	Mma Clara Restaurant	4	4	100	68	Bima's Place	3	3	100
33	Tom B's Spot	2	2	100	69	Mummy Benita food	4	4	100
34	Ini Food	3	3	100	70	Refill Spot	3	3	100
35	Favour's Eatery	4	4	100	71	Sandra Restaurant	4	4	100
36	Zero Limit Restaurant	3	3	100	72	Nice Time Eatery	3	3	100

Total food establishments = 72
Total food handlers = 236
Total sample size = 236

Source: Authors' computation, 2026

Result

A total of 236 food handlers from 72 food establishments at the University of Calabar took part in the survey, achieving a 100% response rate. While the primary focus of this study was not on the demographic characteristics of food handlers, the collected data provides valuable insights into factors related to their knowledge and practices regarding food hygiene. The survey gathered demographic information including age, gender, marital status, religion, and education level, which is presented in Table 2. The results indicated that 35.7% of the food establishments employed five food handlers, 28.6% employed four, 21.4% employed three, and 14.3% employed two. Regarding gender distribution, 93% of the respondents were female, while 7% were male. The majority of participants (83.9%) were aged between 18 and 25, with 8.5% in the 26 to 35 age range, and 3.8% in each of the 36 to 45 and 46 to 55 age groups. Additionally, 61% of participants were single, whereas 39% were married. Among the respondents, 92% identified as Christians (n=218), 5% as Muslims (n=11), and 3% as practitioners of African Traditional Religion (n=7). In terms of educational attainment, 31.4% possessed a First School Leaving Certificate, 60.2% held an SSCE certificate, 7.6% had qualifications such as B.Sc., HND, NCE, or ND, and 0.8% reported having no formal education.

Table 2: Demographic characteristics of respondents

		N=236	
Characteristics		Frequency	Percentage
Number of employees			
	5	9	35.7
	4	16	28.6
	3	33	21.4
	2	24	14.3
Gender			
	Male	16	7
	Female	220	93
Age			
	18-25	198	83.9
	26-35	20	8.5
	36-45	9	3.8
	46-55	9	3.8
	55-	0	0
Marital status			
	Married	92	39
	Single	144	61
Religion			
	Christianity	218	92
	Islam	11	5
	African Traditional Religion	7	3

Education

FSLC	74	31.4
SSCE	142	60.2
Tertiary	18	7.6
No formal education	2	0.8

Source: Authors' computation, 2026

Barriers to Food Hygiene Practices

Consistent with the conceptual framework underpinning the study, Table 8 presents the perceived barriers that hinder food handlers from maintaining appropriate food hygiene practices at the University of Calabar. Ten potential barriers were assessed, covering financial, material, organisational, knowledge-related, attitudinal, and individual factors. The findings indicate that the most prominent barriers were financial constraints, inadequate equipment and supplies, time limitations, weak enforcement of food hygiene rules and regulations, absence of established institutional standards, and lack of motivation. In contrast, lack of knowledge, negative attitudes, and illiteracy were perceived as relatively less important barriers by the respondents.

Financial constraints emerged as one of the most prominent barriers to effective food hygiene practices. Specifically, 56.3% of respondents indicated that financial limitations constituted a barrier to a very large extent, while 42.4% reported that they constituted a barrier to a large extent. Only 1.3% considered financial constraints to be a barrier to a small extent. This finding suggests that the ability of food handlers to maintain appropriate hygiene standards may be strongly influenced by their capacity to obtain the financial resources required for hygienic operations, including cleaning materials, personal protective items, safe storage facilities, and other essential hygiene inputs.

Inadequate equipment was similarly identified as a substantial barrier. More than half of the respondents (52%) reported that inadequate equipment hindered food hygiene practices to a very large extent, while 46% indicated a large extent. Only 2% considered inadequate equipment to be a barrier to a small extent. This result indicates that the availability and adequacy of appropriate food-handling and sanitation equipment are important conditions for translating food safety knowledge into actual hygienic practices. Even when food handlers are aware of appropriate procedures, inadequate or unsuitable equipment may constrain their ability to implement those procedures effectively.

Inadequate supplies also constituted a major constraint. A majority of respondents (58%) reported that inadequate supplies hindered their hygiene practices to a very large extent, while 37% indicated a large extent and only 5% reported a small extent. The high proportion of respondents identifying inadequate supplies as a barrier suggests that the consistent availability of essential consumables may be critical to maintaining hygiene standards. Items such as soap, disinfectants, cleaning materials, protective clothing, water, and other sanitation supplies are necessary for the routine implementation of food hygiene procedures.

Time constraints were another prominent barrier identified by the respondents. Approximately 54% indicated that lack of sufficient time constituted a barrier to a very large extent, while 42% reported a large extent and only 4% reported a small extent. This finding suggests that the pressure associated with food preparation, customer service, and other competing work responsibilities may

limit the time available for proper cleaning, handwashing, equipment sanitation, and other preventive hygiene activities. Thus, the challenge may not necessarily be a lack of awareness of appropriate hygiene procedures but the practical difficulty of consistently implementing them within a demanding work environment.

The enforcement of food hygiene rules and regulations was also perceived as a major institutional barrier. Sixty percent of respondents indicated that lack of enforcement constituted a barrier to a very large extent, while 37% reported a large extent. Only 2% and 1% identified it as a barrier to a small extent and no extent, respectively. This finding points to the importance of institutional monitoring, supervision, and enforcement in sustaining food hygiene practices. The existence of rules and regulations may have limited practical impact if food handlers are not regularly monitored or if non-compliance does not attract appropriate corrective measures.

The absence of established institutional standards was another important barrier. Fifty-seven percent of respondents reported that the absence of established standards constituted a barrier to a very large extent, while 33% indicated a large extent. A further 7% reported a small extent and 3% indicated no extent. The finding suggests that clearly defined institutional standards may provide food handlers with specific expectations regarding food preparation, personal hygiene, sanitation, storage, waste management, and other aspects of food safety. Where such standards are absent or poorly communicated, food handlers may rely on inconsistent practices and individual interpretations of acceptable hygiene behaviour.

Lack of motivation was also identified as a substantial barrier to food hygiene practices. More than half of the respondents (53%) indicated that lack of motivation constituted a barrier to a very large extent, while 36% reported a large extent. Only 9% considered it a barrier to a small extent, and 2% indicated that it was not a barrier. This result highlights the potential influence of organisational and motivational conditions on food hygiene behaviour. Food handlers may be less likely to consistently comply with hygiene requirements where good practices are not recognised, supervised, encouraged, or supported by management.

In contrast to the preceding barriers, lack of knowledge appeared to be a relatively less significant constraint. Only 18% of respondents indicated that lack of knowledge constituted a barrier to a very large extent and 21% reported a large extent. However, 22% identified it as a barrier to a small extent, while 39% indicated that it was not a barrier at all. This distribution suggests that most respondents did not perceive insufficient knowledge as the principal obstacle to maintaining food hygiene practices. The finding may imply that other structural and organisational factors, rather than knowledge alone, play a more decisive role in determining whether food handlers are able to implement appropriate hygiene practices.

Similarly, respondents generally did not perceive negative attitudes towards food hygiene as a major barrier. Only 7.2% reported that attitudes constituted a barrier to a very large extent, while 14.4% indicated a large extent. Conversely, 25.0% reported a small extent and 53.4% indicated that attitudes were not a barrier at all. This finding suggests that food handlers generally recognise the importance of hygiene practices and that unwillingness or negative attitudes may not be the principal explanation for inadequate hygiene practices within the study setting.

Illiteracy was the least prominent barrier among the factors examined. Only 10% of respondents reported that illiteracy constituted a barrier to a very large extent, while 16% indicated a large extent. A further 6% reported a small extent, whereas 68% stated that illiteracy was not a barrier at all. The finding indicates that the educational limitations of food handlers may have relatively little influence on their ability to practise food hygiene within the University of Calabar environment. This may also suggest that practical knowledge, workplace instructions, supervision, and access to appropriate facilities may be more important determinants of hygiene behaviour than formal literacy alone.

Overall, the findings demonstrate that the barriers to food hygiene practices among food handlers at the University of Calabar are predominantly structural, material, and organisational rather than knowledge-based. Financial constraints, inadequate equipment and supplies, time pressure, weak enforcement, absence of institutional standards, and lack of motivation were perceived as the most substantial obstacles, whereas lack of knowledge, negative attitudes, and illiteracy were comparatively less significant. This pattern suggests that improving food hygiene within the university environment requires more than conventional food safety education. Sustainable improvement would also require adequate provision of hygiene facilities and supplies, appropriate equipment, clearly defined institutional standards, regular monitoring and enforcement, and mechanisms for motivating food handlers to consistently comply with established hygiene requirements.

Table 3: Barriers to food hygiene practices in University of Calabar

Barriers to Food Hygiene Practices	Very large extent	Large extent	Small extent	No extent
Lack of finances	133(56.3)	100(42.4)	3(1.3)	0(0)
Inadequate equipment	123(52)	109(46)	4(2)	0(0)
Inadequate supplies	137(58)	88(37)	11(5)	0(0)
Lack of time	127(54)	100(42)	9(4)	0(0)
Lack of enforcement	141(60)	88(37)	4(2)	3(1)
Lack of knowledge	43(18)	49(21)	51(22)	93(39)
Attitude	17(7.2)	34(14.4)	59(25)	126(53.4)
Lack of set standards in the Institution	135(57)	77(33)	16(7)	8(3)
Lack of Motivation	125(53)	86(36)	21(9)	4(2)
Illiteracy	24(10)	38(16)	14(6)	160(68)
Total	1005(43%)	769(33%)	192(8%)	394(16%)

Source: Authors' computation, 2026

Test of hypothesis

Tables 4 and 5 present the chi-square analysis conducted to determine whether food handlers at the University of Calabar experience significant barriers to food hygiene practices. Table 16 presents the expected frequencies for the four response categories across the ten barrier items. Based on the aggregate responses, the expected frequencies were 105.5 for "very large extent," 90.5 for "large extent," 15.9 for "small extent," and 24.1 for "no extent." These expected frequencies provide the basis for comparing the observed responses with the frequencies that would be expected if there were no significant pattern in the perceived barriers. Table 5 presents the computation of the chi-square statistic for Hypothesis Four. The table contains the observed frequencies (O), expected frequencies (E), the differences between the observed and expected

frequencies $(O - E)$, the squared differences $[(O - E)^2]$, and the resulting chi-square components $[(O - E)^2/E]$. The total number of observed responses across the ten barrier items was 2,360. The analysis produced a calculated chi-square (χ^2) value of 1,249.60.

At 27 degrees of freedom and a 0.05 level of significance, the critical chi-square value was 40.113. Since the calculated chi-square value of 1,249.60 is substantially greater than the critical value of 40.113, the result is statistically significant at the 5% level. Consequently, the null hypothesis is rejected and the alternative hypothesis is accepted. The finding indicates that the barriers identified by the respondents are not randomly distributed across the response categories. Rather, the observed pattern provides statistically significant evidence that food handlers at the University of Calabar experience identifiable barriers to effective food hygiene practices. The result therefore supports the study's proposition that factors such as financial constraints, inadequate equipment and supplies, time limitations, weak enforcement of food hygiene regulations, absence of established institutional standards, and inadequate motivation constitute important constraints to the consistent implementation of appropriate food hygiene practices among food handlers in the university environment.

Table 4: Computation of expected frequencies

Barrier items to food hygiene practices	Responses								
	Very large extent		Large extent		Small extent		No extent		Total
	O	E	O	E	O	E	O	E	
Lack of finance	133	105.5	100	90.5	3	15.9	0	24.1	236
Inadequate equipment	123	105.5	109	90.5	4	15.9	0	24.1	236
Lack of facilities	137	105.5	88	90.5	11	15.9	0	24.1	236
Lack of time	127	105.5	100	90.5	9	15.9	0	24.1	236
Lack of experience	141	105.5	88	90.5	4	15.9	3	24.1	236
lack of knowledge	51	105.5	93	90.5	43	15.9	49	24.1	236
Attitude	59	105.5	126	90.5	34	15.9	17	24.1	236
Lack of institution set standard	135	105.5	77	90.5	16	15.9	8	24.1	236
Lack of motivation	125	105.5	86	90.5	21	15.9	4	24.1	236
Illiteracy	24	105.5	38	90.5	14	15.9	160	24.1	236
Total	1055		905		159		241		2360

Source: Authors' computation, 2026

Table 5: Chi-square computation

O	E	(O-E)	(O-E) ²	$\Sigma(O-E)^2/E$
133	105.5	27.5	756.25	7.2
100	90.5	9.5	90.25	1.0
3	15.9	-12.9	166.41	10.5
0	24.1	-24.1	580.81	24.1
123	105.5	17.5	306.25	2.9
109	90.5	18.5	342.25	3.8
4	15.9	-11.9	141.61	8.9
0	24.1	-24.1	580.81	24.1
137	105.5	31.5	992.25	9.4
88	90.5	-2.5	6.25	0.1
11	15.9	-4.9	24.01	1.5
0	24.1	-24.1	580.81	24.1
127	105.5	21.5	462.25	4.4
100	90.5	9.5	90.25	1.0

9	15.9	-6.9	47.61	3.0
0	24.1	-24.1	580.81	24.1
141	105.5	35.5	1260.25	11.9
88	90.5	-2.5	6.25	0.1
4	15.9	-11.9	141.61	8.9
3	24.1	-21.1	445.21	18.5
51	105.5	-54.5	2970.25	28.2
93	90.5	2.5	6.25	0.1
43	15.9	27.1	734.41	46.2
49	24.1	24.9	620.01	25.7
59	105.5	-46.5	2162.25	20.5
126	90.5	35.5	1260.25	13.9
34	15.9	18.1	327.61	20.6
17	24.1	-7.1	50.41	2.1
135	105.5	29.5	870.25	8.2
77	90.5	-13.5	182.25	2.0
16	15.9	0.1	0.01	0.0
8	24.1	-16.1	259.21	10.8
125	105.5	19.5	380.25	3.6
86	90.5	-4.5	20.25	0.25.1
21	15.9	5.1	26.01	1.6
4	24.1	-20.1	404.01	16.8
24	105.5	-81.5	6642.25	63
38	90.5	-52.5	2756.25	30.5
14	15.9	-1.9	3.61	0.2
160	24.1	135.9	18468.81	766.3
2360				1249.6

df = 27 p = 0.05; t = 40.113

Discussion

The findings of this study demonstrate that food handlers at the University of Calabar encounter several structural, organisational, and operational barriers that constrain the consistent implementation of appropriate food hygiene practices. Of the ten barrier factors examined, seven were identified by respondents as major obstacles, namely lack of enforcement of food hygiene rules and regulations, inadequate supplies, absence of established standards, financial constraints, inadequate equipment, lack of motivation, and time constraints. In contrast, lack of food safety knowledge, negative attitudes, and illiteracy were not perceived as major barriers. This pattern is important because it suggests that inadequate food hygiene practices within the study setting may be driven less by what food handlers know and more by whether they have the resources, institutional support, time, supervision, and organisational conditions necessary to translate knowledge into practice.

Lack of enforcement of food hygiene rules and regulations emerged as the most prominent barrier identified by respondents. This finding suggests that the existence of food safety requirements may not necessarily result in compliance when monitoring and enforcement mechanisms are weak. The finding is consistent with Arendt et al. (2015), who reported that food handlers may fail to comply with established food safety requirements when workplace monitoring is inadequate and employees perceive that compliance is not being actively checked. Similarly, Seidu (2020) found that inadequate enforcement contributed to poor food hygiene practices among food handlers in the Tamale Metropolis of Ghana. Omari et al. (2014) also identified weak enforcement of food safety and environmental regulations as an important obstacle to the adoption of safer food

practices. Taken together, these findings emphasise that food hygiene is not sustained by regulations alone; effective implementation requires continuous supervision, monitoring, feedback, and appropriate corrective action.

Within the University of Calabar context, the prominence of enforcement as a barrier may indicate weaknesses in institutional monitoring of food vending operations. Where food handlers perceive that hygiene requirements are not routinely inspected or that non-compliance does not attract consequences, adherence to prescribed practices may become inconsistent. The finding therefore highlights the need for a clearly defined institutional food safety monitoring system involving routine inspection of food preparation areas, personal hygiene, equipment sanitation, water availability, food storage, waste disposal, and other critical hygiene practices. Such monitoring should be supportive as well as regulatory, with identified deficiencies followed by corrective measures and appropriate follow-up.

Inadequate supplies emerged as the second major barrier to food hygiene practices. Respondents particularly identified the lack of essential materials and resources required for routine hygiene activities as a significant constraint. This finding agrees with Seidu (2020), Wandolo et al. (2018), and Arendt et al. (2015), who identified inadequate supplies and resources, including soap, sanitisers, cleaning agents, disinfectants, water, and appropriate sanitation facilities, as important barriers to effective food hygiene practices. Ogutu et al. (2022) similarly reported resource-related barriers, including inadequate access to basic supplies, as important constraints on hygiene practices. Sinha and Sandhu (2023) also identified the absence of basic handwashing amenities as a recurrent barrier among food handlers.

The implication is that food hygiene practices cannot be sustained through training and awareness alone when food handlers lack the materials required to perform the recommended practices. For example, frequent handwashing requires reliable access to clean water, soap, appropriate handwashing facilities, and adequate time to use them. Similarly, effective cleaning and sanitation require appropriate detergents, disinfectants, cleaning equipment, and suitable storage facilities. Consequently, university management and operators of food establishments should ensure that essential hygiene supplies are consistently available and accessible at points where food is prepared, stored, and served.

The absence of established institutional standards was identified as another important barrier. This finding indicates that food handlers may experience difficulty maintaining consistent hygiene practices where specific institutional requirements, procedures, and performance expectations are unclear or inadequately communicated. The finding is consistent with Wandolo et al. (2018), who identified the absence of established standards as a significant barrier to food hygiene practices among hospitality students and food handlers in Kenya. Although earlier literature has emphasised the importance of appropriate hygiene standards in food service establishments, the present finding extends this argument to the university environment, where institutional food vendors operate within a complex setting involving management, students, staff, visitors, and external regulatory authorities. Clearly documented and communicated food hygiene standards could therefore provide a common basis for practice, monitoring, and accountability among food handlers.

Financial constraints also emerged as a significant barrier to food hygiene practices. The finding suggests that some food handlers or foodservice operators may have difficulty financing the

purchase and maintenance of essential hygiene facilities, equipment, and consumable supplies. This finding is consistent with previous evidence that financial and resource limitations can constrain the ability of food handlers and foodservice establishments to implement recommended safety measures. The relationship between financial resources and hygiene is particularly relevant in settings where food vendors operate on relatively small margins and must simultaneously meet operational costs, purchase ingredients, maintain equipment, and satisfy hygiene requirements. Adequate financial planning and institutional support may therefore be necessary to ensure that food safety is not compromised by competing business priorities.

Inadequate equipment was also identified as a major barrier. Appropriate equipment is necessary for safe food preparation, cleaning, storage, temperature control, waste management, and personal hygiene. When suitable equipment is unavailable, defective, insufficient, or poorly positioned, food handlers may be unable to implement recommended hygiene procedures consistently. This finding is consistent with Wandolo et al. (2018), Arendt et al. (2015), and Howells et al. (2008), who identified inadequate equipment and facilities as important constraints on food safety practices. The finding reinforces the argument that food safety interventions should address the physical work environment in addition to individual knowledge and behaviour.

Lack of motivation and time constraints were also identified as important barriers. The finding concerning motivation suggests that food handlers may be less inclined to consistently maintain hygiene standards where good performance is not recognised, encouraged, or reinforced by management. Organisational support, supervision, recognition, and constructive feedback may therefore play important roles in sustaining food hygiene behaviour. Similarly, time constraints may arise from high customer demand, competing work responsibilities, inadequate staffing, or pressure to complete food preparation and service quickly. The finding is consistent with Howells et al. (2008), Arendt et al. (2015), Wandolo et al. (2018), and Ogutu et al. (2022), who identified time pressure, competing responsibilities, and inadequate resources as barriers to the implementation of recommended hygiene practices. This suggests that improving food hygiene may require changes to work organisation and staffing in addition to conventional training interventions.

An important finding of the study is that lack of food safety knowledge, negative attitudes, and illiteracy were not identified as major barriers by most respondents. This result differs from some previous studies. Wandolo et al. (2018), Arendt et al. (2015), and Omari et al. (2014), for example, identified inadequate knowledge and low literacy as barriers to food safety practices in different settings. The difference may be attributable to contextual variations in the characteristics of food handlers, their previous exposure to food safety information, institutional requirements, educational backgrounds, or the availability of workplace guidance. It is also possible that food handlers at the University of Calabar possess sufficient awareness of appropriate hygiene practices but encounter practical difficulties in implementing what they know. This interpretation supports the broader knowledge-practice gap observed in food safety research, where awareness does not necessarily translate into consistent behaviour when environmental and organisational constraints remain unresolved.

The overall finding that 84% of respondents identified barriers to food hygiene practices, compared with 16% who did not, further demonstrate the substantial prevalence of perceived constraints within the study environment. The chi-square analysis provided additional statistical

evidence that the distribution of responses across the barrier categories was significantly different from what would be expected under the null hypothesis. The calculated chi-square value of 1,249.60 exceeded the critical value of 40.113 at 27 degrees of freedom and the 0.05 significance level. The null hypothesis was therefore rejected, indicating that food handlers significantly encounter barriers to effective food hygiene practices.

Taken together, the findings suggest that improving food hygiene at the University of Calabar requires a multidimensional intervention rather than an exclusive focus on food safety education. The dominance of financial, material, institutional, and organisational barriers indicates that food handlers may already possess considerable awareness of appropriate hygiene practices but lack the enabling conditions required to implement them consistently. Consequently, university management, foodservice operators, supervisors, environmental health personnel, and other relevant regulatory bodies should adopt an integrated approach that combines clear standards, regular inspection and enforcement, adequate supplies and equipment, sufficient financial support, appropriate staffing and work schedules, and motivational mechanisms. Such an approach would create an enabling food safety environment in which knowledge and positive attitudes can be translated into consistent hygiene practices.

Conclusion

The study concludes that food handlers at the University of Calabar encounter substantial barriers that constrain their ability to consistently implement recommended food hygiene practices. The findings demonstrate that these barriers are predominantly structural, material, organisational, and institutional rather than related to a lack of knowledge or negative attitudes. Financial constraints, inadequate equipment and supplies, time limitations, weak enforcement of food hygiene rules and regulations, absence of established institutional standards, and lack of motivation emerged as the most important barriers reported by the respondents. Conversely, lack of knowledge, negative attitudes, and illiteracy were perceived as relatively less important constraints. The significant Chi-square result further confirms that the barriers experienced by food handlers are not randomly distributed but represent identifiable constraints within the university food-service environment. The findings therefore highlight an important knowledge-practice gap: food handlers may possess adequate awareness of food hygiene requirements but may be unable to consistently translate such knowledge into practice when the necessary resources, facilities, supervision, institutional standards, and organisational support are inadequate.

Consequently, improving food hygiene at the University of Calabar requires a comprehensive approach that goes beyond periodic food-safety education. Sustainable improvement will depend on creating an enabling food-safety environment in which food handlers have access to appropriate equipment and supplies, clearly defined standards, adequate time and working resources, regular supervision, effective regulatory enforcement, and appropriate motivation. Addressing these barriers would strengthen compliance with food hygiene requirements and contribute to improved food safety and consumer protection within the university environment.

Recommendations

Based on the findings of the study, the authors recommended that:

1. the University management, environmental health personnel, and relevant regulatory authorities should strengthen the culture of monitoring and enforcement;

2. develop clear institutional food hygiene standards;
3. provide adequate hygiene facilities and supplies;
4. address financial constraints, introduce motivation and recognition mechanisms to encourage compliance and strengthen a positive food-safety culture within university food establishments.

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