



Food safety and hygiene practices among students at the University of Calabar, Nigeria

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Abstract

Background: Food safety is a critical public health concern due to the health and economic burden of foodborne diseases. Given the high population of young adults in universities, assessing students' knowledge, attitudes, and practices is essential to identify gaps and inform targeted interventions to improve food hygiene and reduce risks.

Objectives: This study assessed the knowledge, attitudes, and practices related to food safety and hygiene among undergraduate students at the University of Calabar, Nigeria.

Materials and Methods: A descriptive cross-sectional survey design was adopted, and data were collected from 165 students selected through stratified random sampling. A semi-structured questionnaire was used for data collection; this was analyzed using SPSS version 25.

Results: Among the participants, 73.3% demonstrated good knowledge of food safety, 26.7% had poor knowledge, 60% exhibited positive attitudes, while 40% recorded negative attitudes regarding food safety and hygiene. In terms of practices, 67.9% of respondents reported good food handling and hygiene practices, while 32.1% demonstrated poor practices. Specific behaviors included washing hands before cooking (71.5%), washing fruits and vegetables before use (78.2%), keeping cooking surfaces and utensils clean (85.5%), and always separating raw and cooked foods (75.2%). Despite generally good knowledge and practices, gaps were observed in areas such as reheating leftovers (69.7%) and proper storage of cooked food (72.1%).

Conclusion: The participants generally demonstrated good knowledge, positive attitudes, and moderate food hygiene practices, but gaps remain in specific behaviors. Targeted food safety education, practical training, and improved access to hygiene facilities are needed to reinforce safe practices and reduce the risk of foodborne illnesses.

Keywords: Food safety, Hygiene, Students, Foodborne illness, KAP

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DOI: 10.61386/imj.v19i3.1178

Introduction

Food is essential for human survival and wellbeing, making its safety a critical public health concern. Food safety refers to the guarantee that food will not pose any risk to consumers when it is prepared and consumed according to its intended purpose, and it is the responsibility of food manufacturers to protect consumers from foodborne hazards¹. It involves the conditions and practices applied during

food production, processing, storage, preparation, and consumption to prevent contamination and protect individuals from foodborne diseases². Despite global efforts to improve food safety systems, unsafe food remains a significant public health threat, particularly in low- and middle-income countries where weak regulatory systems, poor infrastructure, and low public awareness persist, alongside factors such as poor hygiene, inadequate sanitation, and contaminated food and drinking water, which contribute to infections and higher fatality rates in impoverished communities lacking proper healthcare and nutrition^{3,4,5}.

Foodborne diseases arise from biological and chemical hazards such as bacteria, viruses, parasites, fungi, and toxic substances present in contaminated food or water. These illnesses range from mild gastrointestinal infections to severe and long-term health conditions, including cancers and neurological disorders⁶. Common foodborne pathogens, including *Clostridium botulinum*, are often associated with improperly handled or contaminated foods such as meat, dairy products, vegetables, seafood, and inadequately stored cooked meals, with botulism specifically linked to the consumption of poorly prepared, stored, or cooked homemade pork and canned foods^{7,8}.

In Nigeria, food safety challenges are intensified by rapid urbanization and the widespread presence of informal food vending systems⁹. University environments are often characterized by large student populations and frequent patronage of unregulated food vendors, where poor hygiene, improper food storage, and limited awareness of food safety practices are common^{10,11}. Although food safety is crucial for maintaining students' health and academic performance, there is limited empirical information on the knowledge, attitudes, and practices of undergraduate students regarding food hygiene¹². Incidents of foodborne illness in academic settings further highlight the vulnerability of students and the need for improved food safety measures. However, the true extent of these illnesses remains uncertain due to underreporting and weak surveillance systems. Evidence from similar settings suggests that even when students possess some level of knowledge about food safety, this does not always translate into safe practices. Factors such as age, gender, and level of education

may also influence food hygiene behaviors^{13,14}.

Given the health and economic consequences of foodborne diseases and the concentration of young adults in university settings, there is a need to assess food safety knowledge, attitudes, and practices among students. Such assessment will help identify gaps and inform the development of targeted interventions aimed at improving food hygiene and reducing the risk of foodborne illnesses. Therefore, this study focuses on assessing the knowledge, attitudes, and practices of undergraduate students at the University of Calabar regarding food safety and hygiene.

Materials and Methods

Study Design and Study Area: A descriptive cross-sectional study design was adopted using a quantitative approach to assess food safety and hygiene practices among students residing in the University of Calabar hostels and off-campus accommodations. The study was conducted at the University of Calabar, located in Calabar, the capital of Cross River State in Nigeria's South-South region. The study population included students living in both university-owned hostels and nearby off-campus residences in student-populated areas such as Etta Agbor, Goldie, and Atimbo roads.

Study Population, Sample Size Determination and Sampling Technique: The study population consisted of undergraduate students of the University of Calabar residing in both on-campus hostels and off-campus accommodations. These students consumed meals prepared by themselves, at local eateries, or through food vendors. The sample size was determined using Yamane's formula (1967):

$$n = N / 1 + N(e)^2$$

A total of 150 respondents was calculated, and an additional 10% was added to account for non-response rate, bringing the final sample size to 165. A purposive random sampling technique was employed, where students were first divided into on-campus and off-campus residents. From each group, about 10 departments were randomly selected, after which students were randomly chosen based on availability, consent, hostel registers, and from those residing off-campus within

the study area.

Data Collection: A semi-structured self-administered questionnaire was used to collect data from 165 respondents. The reliability and validity of the data collection instrument were ensured through expert review for content and face validity, to guarantee accurate and consistent measurement of food safety knowledge, attitudes, and practices among the study population. The questionnaire was pre-tested among students outside the study area, and necessary modifications were made to improve clarity and relevance. The instrument demonstrated acceptable internal consistency, with a Cronbach's alpha of 0.75.

Statistical Analysis: Data was collected into Microsoft Excel for sorting and cleaning. Subsequently, Statistical Package for the Social Sciences (SPSS), Version 25.0 was used to analyze the data. For the purpose of data analysis, respondents' scores on knowledge, attitude, and practice were categorized based on their respective means. Knowledge scores ≥ 5.13 were classified as good knowledge, while scores < 5.13 were classified as poor knowledge. Similarly, attitude scores ≥ 16.81 were classified as positive attitude, and scores < 16.81 as negative attitude. Practice scores ≥ 32.19 were classified as good practice, while scores < 32.19 were classified as bad practice.

Results

Socio-demographic data of respondents

Table 1 shows that females constituted the majority of respondents (57.0%), while males accounted for 43.0%. Most respondents were aged 18–22 years (63.6%), followed by those aged 23–27 years (15.2%). The largest proportion of respondents were in 100 Level (43.0%), followed by those in 300 Level (26.7%). Most respondents lived off campus (81.2%), and the majority reported that they prepare their own meals (84.2%). Regarding faculty distribution, the highest proportion of respondents were from the Faculty of Arts (40.5%), followed by Social Sciences (17.0%) and Medical Laboratory Science (15.2%). Smaller proportions were from Basic Medical Sciences (7.3%), Allied Medical Sciences (6.7%), and Education (6.1%). Very few respondents were from Clinical Sciences (3.6%), Management Sciences (1.8%), Biological Sciences (1.2%), and Engineering (0.6%).

Table 1: Socio-Demographic Characteristics of Respondents

Variables	Frequency (n)	Percentage (%)
Gender		
Male	71	43.0
Female	94	57.0
Age		
Under 18	18	10.9
18–22	105	63.6
23–27	25	15.2
28 and above	17	10.3
Level of Study		
100 Level	71	43.0
200 Level	16	9.7
300 Level	44	26.7
400 Level	23	13.9
500 and above	11	6.7
Type of Residence		
On – Campus	31	18.8
Off – Campus	134	81.2
Prepare meal		
Yes	139	84.2
No	26	15.8
Faculty		
Arts	67	40.5
Social Science	28	17
Medical Laboratory Science	25	15.2
Basic Medical Science	12	7.3
Education	10	6.1
Allied Medical Science	11	6.7
Clinical Sciences	6	3.6
Management Sciences	3	1.8
Biological Science	2	1.2
Engineering	1	0.6
Total	165	100

Knowledge of food safety and hygiene among students

Table 2 shows that a high proportion of respondents (89.7%) correctly indicated that handwashing before handling food prevents foodborne diseases, while 85.5% reported that proper cooking kills most foodborne pathogens. Similarly, 78.8% correctly stated that raw and cooked foods should not be stored together, and 81.2% indicated that expired food products are unsafe even if they look and smell normal. In addition, 75.8% knew that unwashed fruits and vegetables can cause food poisoning, whereas 63.6% agreed that thorough reheating of certain foods reduces the risk of illness. However, only 38.2% correctly identified that leftover food should not be stored at room temperature overnight, while 44.2% provided incorrect responses. Figure 1 shows that majority of the respondents demonstrated good knowledge of food safety and hygiene (73.3%), followed by poor knowledge (26.7%), indicating a generally high level of awareness among the students.

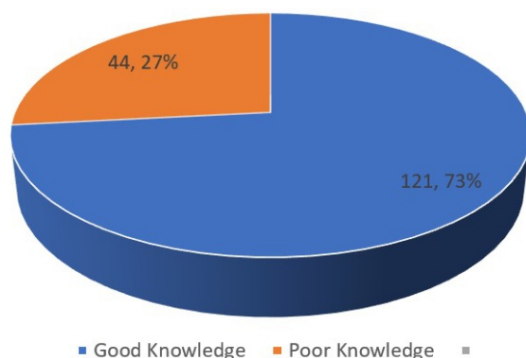
Attitudes toward food hygiene among students

Table 3 shows that respondents generally expressed

Table 2: Knowledge of food safety and hygiene among students

Variables	Frequency (n)	Percentage (%)
Handwashing before handling food prevents foodborne diseases.		
True	148	89.7
False	4	2.4
Don't Know	13	7.9
Leftover food can be safely stored at room temperature overnight		
True	73	44.2
False	63	38.2
Don't know	29	17.6
Raw and cooked foods can be stored together to save space.		
True	17	10.3
False	130	78.8
Don't know	18	10.9
Expired food products are safe if they look and smell normal.		
True	20	12.1
False	134	81.2
Don't know	11	6.7
Proper cooking kills most foodborne pathogens.		
True	141	85.5
False	14	8.5
Don't know	10	6.1
Unwashed fruits and vegetables can cause food poisoning.		
True	125	75.8
False	21	12.7
Don't know	19	11.5
Thorough reheating of certain foods reduces the risk of illness.		
True	105	63.6
False	33	20.0
Don't know	27	16.4

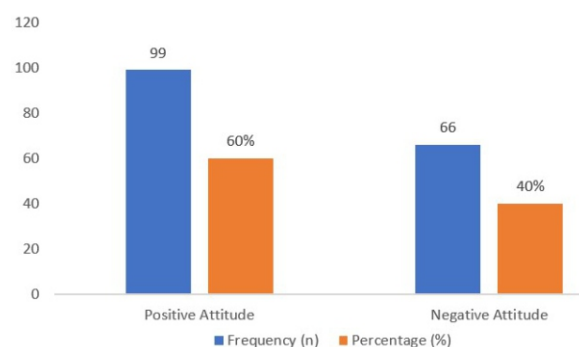
positive attitudes toward food hygiene. A large proportion strongly agreed that food hygiene is important for preventing illness (88.5%), with an additional 9.7% agreeing. Most respondents also expressed confidence in handling food safely, as 62.4% strongly agreed and 33.9% agreed. However, 71.5% (29.7% strongly agreed and 41.8% agreed) believed that food hygiene is only taken seriously when someone falls sick. Similarly, 63.0% (38.2% strongly agreed and 24.8% agreed) indicated that using soap to wash utensils is unnecessary if they appear clean. In contrast, a high proportion (92.1%) acknowledged the importance of checking expiry dates when buying food, with 84.2% strongly

**FIG 1: Level of Knowledge of food safety and hygiene among student**

agreeing and 7.9% agreeing. Figure 2 indicates that majority of the respondents demonstrated a positive attitude toward food hygiene (60%), followed by those with negative attitudes (40%).

Table 3: Attitudes toward food hygiene among students

Variables	Frequency (n)	Percentage (%)
Food hygiene is important for preventing illness		
Strongly Agree	146	88.5
Agree	16	9.7
Disagree	0	0
Strongly Disagree	3	1.8
I am confident in my ability to handle food safely		
Strongly Agree	103	62.4
Agree	56	33.9
Disagree	5	3.0
Strongly Disagree	1	.6
I take food hygiene seriously only when someone falls sick		
Strongly Agree	49	29.7
Agree	69	41.8
Disagree	23	13.9
Strongly Disagree	24	14.5
Using soap to wash utensils is unnecessary if they look clean		
Strongly Agree	63	38.2
Agree	41	24.8
Disagree	25	15.2
Strongly Disagree	36	21.8
Paying attention to expiry dates is important when buying food		
Strongly Agree	139	84.2
Agree	13	7.9
Disagree	6	3.6
Strongly Disagree	7	4.2

**FIG 2: Summary of attitudes toward food hygiene among students**

Food handling and hygiene practices among students

Tables 4a and 4b show generally good food handling and hygiene practices among the respondents. A high proportion reported that they always wash their hands before cooking (71.5%) and always wash

fruits and vegetables before eating or cooking (78.2%). Similarly, 75.2% indicated that they always store raw meat and cooked food separately, while 69.7% reported that they always reheat leftovers before eating. With respect to other practices, 74.5% stated that they always check food expiry dates before consumption, 89.1% reported always using clean water for cooking and washing,

Table 4a: Food handling and hygiene practices among students

Variables	Frequency (n)	Percentage (%)
Wash hands before cooking		
Always	118	71.5
Often	19	11.5
Sometimes	22	13.3
Rare	6	3.6
Never	0	0.0
Wash fruits/vegetables before eating or cooking		
Always	129	78.2
Often	16	9.7
Sometimes	18	10.9
Rare	0	0.0
Never	2	1.2
Store raw meat and cooked food separately		
Always	124	75.2
Often	19	11.5
Sometimes	10	6.1
Rare	5	3.0
Never	7	4.2
Reheat leftovers before eating		
Always	115	69.7
Often	20	12.1
Sometimes	20	12.1
Rare	9	5.5
Never	1	.6

Table 4b: Food handling and hygiene practices among students

Variables	Frequency (n)	Percentage (%)
Check food expiry dates before consumption		
Always	123	74.5
Often	19	11.5
Sometimes	8	4.8
Rare	8	4.8
Never	7	4.2
Use clean water for cooking and washing		
Always	147	89.1
Often	13	7.9
Sometimes	3	1.8
Rare	2	1.2
Never	0	0.0
Keep cooking surfaces and utensils clean		
Always	141	85.5
Often	13	7.9
Sometimes	8	4.8
Rare	3	1.8
Never	0	0.0
Store cooked food in a refrigerator or cool place		
Always	119	72.1
Often	15	9.1
Sometimes	18	10.9
Rare	11	6.7
Never	2	1.2

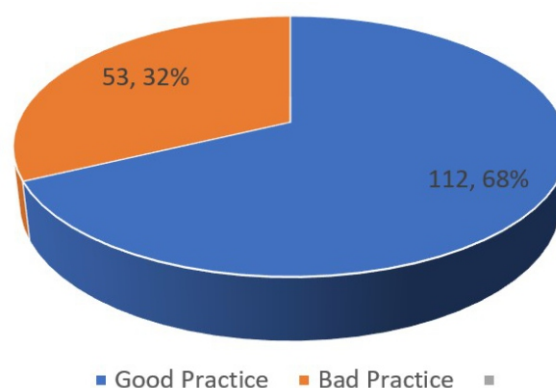


FIG 3: Level of food handling and hygiene practices

and 85.5% indicated that they always keep cooking surfaces and utensils clean. In addition, 72.1% reported that they always store cooked food in a refrigerator or cool place. As shown in Figure 3, a large majority of respondents demonstrated good food handling and hygiene practices (67.9%), then the rest (32.1%) had bad practices, indicating a generally high level of safe food handling behaviour among the students.

Discussion

This study assessed the knowledge, attitudes, and practices related to food safety and hygiene among undergraduate students at the University of Calabar, Cross River State Nigeria. The findings of this study indicate a generally high level of knowledge of food safety and hygiene among students, where 89.7% of the respondents recognized the importance of handwashing before handling food with majority understanding that proper cooking can eliminate most foodborne pathogens. This level of awareness is notably higher than reported previously¹⁰, where only 58.6% of participants demonstrated a fundamental understanding of food hygiene principles. The observed difference may be attributed to improved access to health education, increased awareness campaigns, or targeted training interventions among the current study population. In contrast, 54.4% of participants in prior research demonstrated inadequate knowledge of food safety practices¹⁶ underscoring persistent gaps in food safety awareness in other settings. With respect to understanding food poisoning risks, majority of respondents in the current study acknowledged that

consuming unwashed fruits and vegetables can lead to illness, and the importance of thorough reheating before consumption. Most of the participants were reported to have good knowledge of cross-contamination¹¹, despite the persistence of misconceptions. In addition, risky food behaviours among young adults were previously identified¹⁷, highlighting the gap between knowledge and safe practices. A higher number of respondents in this study demonstrated good knowledge of food safety, suggesting an improvement compared to earlier research where only few of the respondents exhibited adequate knowledge¹⁵.

The findings of the present study reveal that a many of respondents demonstrated a positive attitude toward food hygiene, with 60% exhibiting positive attitudes. A substantial proportion strongly agreed that food hygiene is important for preventing illness. This is consistent with previous findings¹⁶, where an overwhelming 98.7% of participants believed that food safety is important. Similarly, favorable attitudes toward food safety were reported in another study¹, where most respondents had positive perceptions, while high agreement levels across several attitude items were observed in a separate study¹¹. These comparisons suggest that positive attitudes toward food hygiene are widely reported across different populations. In addition, the present study showed that majority of the respondents expressed confidence in their food handling abilities. This aligns with previous observations¹¹, where 84% of respondents expressed willingness to change inappropriate food safety practices, reflecting a generally positive and receptive attitude toward safe food handling. Likewise, an overall positive attitude among respondents was reported previously¹⁰, agreeing on the necessity of handwashing and maintaining hygienic practices while expressing willingness to learn more about food hygiene, indicating openness to improvement. Despite these generally positive attitudes, the present study identified important inconsistencies in specific perceptions. Notably, 29.7% of respondents strongly agreed that food hygiene is only taken seriously when someone falls sick, suggesting a predominantly reactive rather than preventive attitude. This pattern is comparable to earlier findings¹⁰, where 48.6% agreed on

avoiding contact between hands and potentially contaminated surfaces. Furthermore, only 47.1% believed that food should not be handled with wounded hands, highlighting gaps in the internalization of critical hygiene practices. Similarly, misconceptions were evident regarding utensil hygiene, as 38.2% strongly agreed that using soap to wash utensils is unnecessary if they appear clean. This reflects inconsistencies reported previously¹¹, where only 54% of respondents acknowledged the importance of frequent handwashing. Furthermore, the high proportion of respondents in the present study who strongly agreed on the importance of checking expiry dates demonstrates a strong preventive attitude in certain aspects of food safety. This is comparable to previous findings¹¹, where majority of the respondents emphasized ensuring the cleanliness of purchased food, and reheating leftovers before consumption, indicating awareness of preventive food safety behaviours.

In terms of food handling and hygiene practices among students, the present study indicate that respondents generally demonstrated good food handling and hygiene practices, with 67.9% exhibiting good practices. These findings suggest a relatively strong level of compliance with recommended food safety practices among the students. This level of good practice is higher than previously reported¹⁵, where the overall food handling practice score was only 34.9%, indicating generally poor practices among students. Similarly, only 46.3% of respondents demonstrated good food safety practices in another study¹⁶. The comparatively higher proportion of good practices observed in the present study may reflect improved awareness, better access to hygiene facilities, or increased exposure to food safety education among the study population. In terms of specific practices, a high proportion reported adherence to key hygiene behaviours, including washing hands before cooking, washing fruits and vegetables before use, and keeping cooking surfaces and utensils clean. Notably, 74.5% of respondents in this study indicated that they always check food expiry dates, slightly lower than the 85% reported in the same study¹¹ who consistently checked expiry dates before use. These similarities suggest some

consistency in specific safe food handling behaviours across different study populations. However, despite the generally good practices observed, some gaps remain. For example, only 69.7% of respondents reported always reheating leftovers before consumption, indicating that a notable proportion may still be at risk of foodborne illness. This is comparable to prior findings¹⁶, where 44.6% of respondents reported often leaving leftover food at room temperature, highlighting unsafe practices related to food storage and reheating. Additionally, although majority of the respondents in this study reported always storing cooked food in a refrigerator or cool place, this is contrary to the previous findings¹¹, where majority of participants did not store leftovers in a refrigerator, indicating persistent gaps in safe storage behaviours. Furthermore, while 71.5% of respondents reported always washing hands before cooking, this is slightly higher than the 69.4% reported in prior research¹⁶, suggesting some improvement but still leaving room for better compliance. However, despite these high rates, risky practices such as handling money and food simultaneously, and working while experiencing diarrhea were observed, indicating that good practices in one area do not necessarily translate into overall safe behaviour.

Conclusion and Recommendations

The importance of food safety knowledge, attitudes, and practices in preventing foodborne illnesses cannot be overemphasized. Based on the findings of this study, undergraduate students at the University of Calabar demonstrated generally good knowledge, positive attitudes, and relatively safe food handling practices; however, gaps remain, particularly in translating knowledge and awareness into consistent, safe practices. Greater efforts are therefore required to establish comprehensive food safety education and practical training programmes within universities to strengthen safe food handling behaviours among students. To this end, it is important to develop targeted intervention strategies aimed at enhancing food safety knowledge, promoting preventive attitudes, and encouraging hygienic practices. Integrating food safety education into the academic curriculum or as part of a dedicated course, coupled with practical

demonstrations and awareness campaigns, can further reinforce safe behaviours. Additionally, stakeholders including university authorities, campus food services, and student organisations, should actively support and model safe food practices, making hygienic facilities and resources readily accessible. These efforts will go a long way in ensuring that students not only learn about food safety in theory but also adopt proper practices in their daily routines, thereby reducing the risks of foodborne illnesses both during their campus days and later in life.

Declaration of conflicting interest: The authors declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding statement: No external funding was received for this research

Informed consent: This was duly obtained from the participants before commencement of the interviews.

Data availability statement: Not applicable

Acknowledgement: Nil

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