



Assessment of Food Safety, Knowledge and Food Handling Practices Amongst Students in the University of Abuja, Nigeria

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ABSTRACT

The study examined food safety knowledge and handling practices among undergraduate students at the University of Abuja, Nigeria, highlighting the importance of understanding students' behaviors in promoting safe food handling. A descriptive cross-sectional survey using a structured questionnaire was conducted among 307 students to assess the influence of socio-demographic factors, internal locus of self-control, external locus of control, and chance locus of control on food safety knowledge, food handling practices, and food preservation behaviors. Findings revealed gaps between students' theoretical understanding of food safety and their practical application, particularly in areas such as proper food storage, prevention of cross-contamination, and sanitation. While students generally possessed basic food safety knowledge, many engaged in risky practices, exacerbated by external challenges such as unreliable electricity for refrigeration. Gender differences were observed, with female students demonstrating better food handling practices compared to males. The findings contribute to public health efforts aimed at enhancing food safety in university environments and offer recommendations for improving food safety education.

Keywords: Food Safety, Nigeria, Students, Survey.

INTRODUCTION

Food safety is defined by the Codex Alimentarius as the assurance that food will not cause harm when prepared or consumed according to intended use [1]. It could also be considered as the level of assurance that food produced, prepared and consumed will evoke no illness or injury to consumers [2,3]. Food safety is essential for public health, economic stability and international trade [4]. Food contamination can occur due to improper handling, preparation or during cooking [5]. Therefore, ensuring food safety before consumption is relevant to public health. Food-borne illnesses are a major public health concern worldwide and contribute significantly to high morbidity and mortality [6]. A food-borne disease outbreak occurs when two or more people develop similar illness after consuming the same contaminated food or drink [7]. Food-borne diseases include a wide range of gastro-intestinal disorders and are increasing globally [8]. These illnesses occur as a result of consuming food contaminated with micro-organisms, microbial endotoxins or chemicals intoxication [9]. Poor personal hygiene, improper food handling practices and inadequate time-temperature control are major contributors to food-borne disease outbreaks [10]. However, these risks can be reduced when food handlers receive adequate food safety training and where the knowledge is put in practice [11].

Training food handlers is therefore an important strategy for improving food safety [12]. University students frequently purchase ready-to-eat foods from campus vendors without knowing the sanitary conditions under which the diets were prepared [13]. Food handling involves several activities including food storage,

preparation, cooking and serving, all of which can influence food safety [14]. Improper food handling practices such as poor hand hygiene, cross-contamination and inadequate cooking temperatures can lead to food-borne illnesses [15].

According to the Centers for Disease Control and Prevention, approximately 48 million people develop food-borne illnesses each year in the United States, with about 128,000 hospitalizations and 3,000 deaths annually [16]. Common pathogens associated with food-borne diseases include *Norovirus*, *Salmonella*, *Clostridium perfringens*, *Campylobacter* and *Staphylococcus aureus* [16]. Food sources commonly associated with contamination include raw or under-cooked meat and poultry, unpasteurized milk, raw eggs, shellfish, fruits and vegetables [17]. Contamination can occur at different stages of the food chain including during production, processing and food preparation, particularly through contact with contaminated surfaces or the hands of food handlers [18]. Food borne infections may cause symptoms such as nausea, vomiting, abdominal cramps, diarrhea, fever and headache [18].

Food safety remains an important global public health issue [19]. Food-borne illnesses affect millions of people each year, resulting in significant health and economic burden worldwide [3]. Ensuring safe food from production to consumption is therefore necessary to reduce the occurrence of food-borne diseases and protect public health [20].

Students, especially those living away from home for the first time, may have limited knowledge and experience in safe food handling practices and may therefore be at higher risk of food-

borne illnesses [21]. Understanding students' knowledge, attitudes and practices regarding food safety is important for designing interventions that promote safe food handling behavior [22]. Assessing the current level of food safety knowledge among students can help identify gaps and guide the development of educational programs aimed at improving food safety practices [23]. This study therefore assessed food safety knowledge and food handling practices among students of the University of Abuja, Nigeria.

MATERIALS AND METHODS

Study Area

This study was conducted at the University of Abuja, Nigeria. The university hosts a large student population and numerous food outlets including cafeterias, canteens and street food vendors that are frequently patronized by students. These food outlets provide a variety of meals for diverse dietary preferences of students. The frequent consumption of food prepared outside the home exposes students to potential risks associated with food-borne illnesses. Therefore, the university environment provides an appropriate setting for assessing food safety knowledge and food handling practices among undergraduate students.

Study Design

A descriptive cross-sectional study design was used to assess food safety knowledge and food handling practices among undergraduate students of the University of Abuja.

Study Population

The study population consisted of undergradu-

ate students of the University of Abuja. The inclusion criteria were registered undergraduate students who were willing to participate in the study. Postgraduate students and non-students on campus were excluded from the study.

Sample Size Determination

In this study, the sample size was determined using the formula provided by Thrusfield (2017), which is commonly used for calculating sample sizes in prevalence studies. The formula accounts for the desired confidence level, the estimated prevalence of the outcome, and the acceptable margin of error.

Thrusfield's Formula:

Where:

n = required sample size

Z = Z-value (the number of standard deviations corresponding to the desired confidence level)

P = estimated prevalence of the characteristic being studied

d = margin of error (precision):

Z-value: For a 95% confidence level, the Z-value is 1.96.

Estimated Prevalence (P): Since there is no prior data on the exact prevalence of food safety knowledge and practices among students at the University of Abuja, an estimated prevalence of 50% (0.5) is used. This is a conservative estimate that maximizes the sample size, ensuring that the study is adequately powered

Margin of Error (d): A margin of error of 5% (0.05) is considered acceptable for this study.

Using these values, the sample size is calcu-

lated as follows:

$n =$

$n =$

$n = 384.16$.

Final Sample Size: The calculated sample size is approximately 384. But for precision reasons, the sample size was rounded up to 400. Thus, a sample size of 400 students was determined to be adequate for this study, allowing for a 95% confidence level with a 5% margin of error, using Thrusfield's formula.

Sampling Technique

A multi-stage sampling technique was used in selecting the participants. Five faculties were randomly selected from the university. These included the Faculty of Science, Faculty of Veterinary Medicine, Faculty of Management Sciences and the College of Health Sciences. Departments within these faculties were further selected, including Microbiology, Statistics, Accounting, Banking and Finance, Medicine and Surgery, and Veterinary Medicine. Students from these departments were then recruited to participate in the study.

Data Collection Instrument

Data were collected using a structured semi-structured questionnaire developed using Google Forms. The questionnaire was designed to obtain information on students' demographic characteristics, food safety knowledge, food handling practices and food preservation behaviours.

The questionnaire consisted of several sections including:

- socio-demographic characteristics of respondents
- internal locus of control related to food safety behaviour
- external locus of control related to food safety
- chance locus of control
- food handling practices
- food preservation practices
- food safety knowledge

Data Collection Procedure

The questionnaire link was distributed electronically through university e-mail lists, student WhatsApp groups and other social media platforms used by students. This approach ensured that students across different faculties and levels of study participated.

The questionnaire was designed to be mobile-friendly so that respondents could complete it using smartphones, tablets or computers. The estimated completion time was approximately 10–15 minutes.

Data collection was conducted over a two-week period. Reminder messages were periodically sent to encourage participation and improve the response rate.

Ethical Considerations

Ethical approval for the study was obtained from the Research Ethics Committee of the Faculty of Veterinary Medicine, University of Abuja prior to data collection.

Participation in the study was voluntary. Informed consent was obtained from all respondents through a consent statement provided at the beginning of the Google Form. Participants were assured that their responses would remain confidential and anonymous. No personal identifiers were collected, and all data were stored securely and accessed only by the research team.

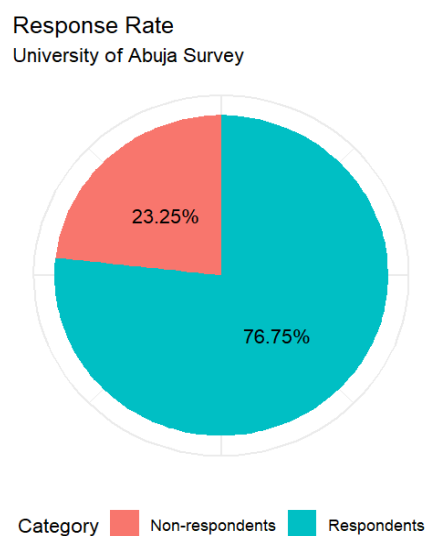
Data Analysis

Data obtained from the questionnaire were analyzed using descriptive statistical methods. Frequencies and percentages were used to summarize respondents' socio-demographic characteristics, locus of control factors, food handling practices, food preservation behaviour and food safety knowledge. The results were presented using tables, bar charts and pie charts.

RESULTS

Participant Response Rate

This study aimed to determine food safety knowledge and food handling practices among students and the demographic characteristics of university students. A total of 400 questionnaires were administered, yielding a response rate of 76.75% (307 respondents). while 23.25% did not receive



responses.

Figure 1: Characteristics of the Respondents

Socio-demographic Characteristics of the Respondents

The survey collected data from 307 respondents. The majority of respondents (53.4%) fell within the 21-27 age range, with a mean age of 22.2 years. Furthermore, females comprised 64.5% of the respondents, while males made up 35.5%. Additionally, the respondents represented various academic departments, with Microbiology, Veterinary Medicine, and Medicine and Surgery being the top three. Demographically, most respondents (93.5%) were single, and 92.5% had no children. Interestingly, 51.6% of respondents reported cooking sometimes.

Table 1 showing the Socio-demographic Characteristics of the Respondents

Socio-demographic Characteristics	Number of respondents	Percentage (%)
Age distribution	306	100
21-27 years	161	53.4%
≤ 21 years	129	42.9%
≥28 years	16	5.3%
Mean Ages	22.2	NA
Gender Distribution	307	100
Female	198	64.5%
Male	109	35.5%
Department of study	307	100
Microbiology	70	22.8%
Veterinary Medicine	65	21.2%
Medicine and Surgery	45	14.7%
Statistics	30	9.8%
Law	25	8.1%
Accounting	20	6.5%
Banking and Finance	52	16.9%
Level of Study	301	100
400 Level	73	23.8%
200 Level	69	22.5%
100 Level	59	19.2%
300 Level	41	13.4%

500 Level	22	7.2%
600 Level	37	12.1%
Marital Status	307	100
Single	290	93.5%
Married	16	5.1%
Divorced	1	0.3%
Parental Status	304	100
No Children	284	92.5%
Parents	22	7.2%
Cooking Habits	306	100
Sometimes	157	51.6%
All the time	110	36.1%
Rarely	39	12.8%
Never	1	0.3%

Internal Locus of Control

The figure shows intriguing insights into respondents' perceptions of food poisoning prevention and responsibility. 96.4% of respondents (Yes=296, No=11) believe they can prevent food poisoning by being careful about their food choices. However, when asked if they would be to blame if they got food poisoning, only 34.7% agreed, while 65.3% disagreed (Yes=106, No=199)

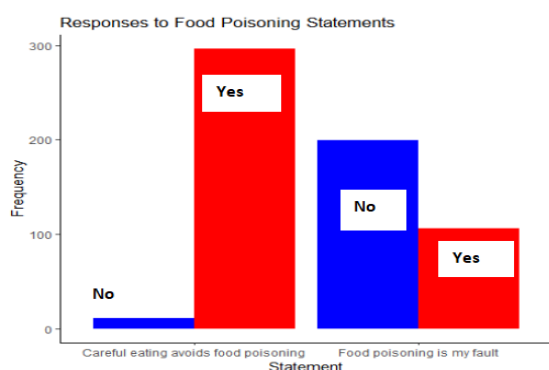


Figure 2: Internal locus of control responses by respondents

External Locus of Control

114 respondents (37%) agreed that consulting health professionals is important for maintaining health, 192 (63%) disagreed. 185 respondents (60%) agreed that care from others is important in recovering from illnesses such as food poisoning, 122 (40%) disagreed.

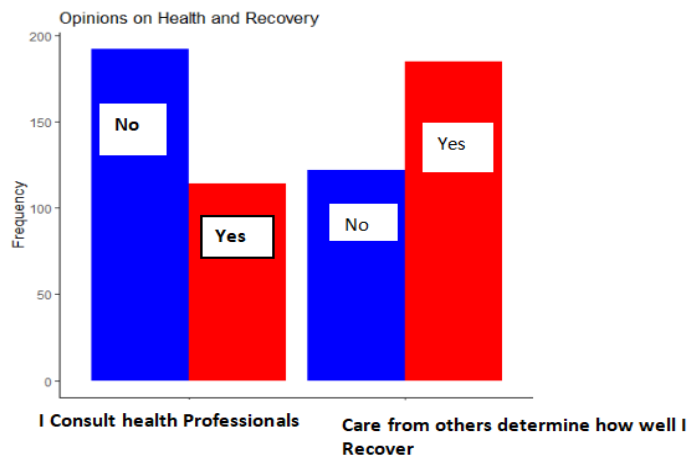


Figure 3: External locus of control responses by respondents

Chance Locus of Control

This section reports on the respondents' perceptions of chance control, as gathered through the questionnaire. The results are presented in three Figures(4A-C)

Figure 4A: 65.5% agreed and 34.5% disagreed with "If it is meant to be, I will stay healthy". Figure 4B: 37.3% agreed and 62.7% disagreed with "When I stay healthy, I am just plain lucky." Figure 4C: 78.5% agreed and 21.5% disagreed with "Most things that affect my health such as food poisoning happen by accident."

If it's meant to be,I will stay healthy
304 responses

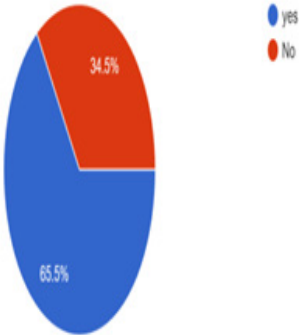


Figure 4A

Most things that affect my health like food poisoning,happen to me by accident
303 responses

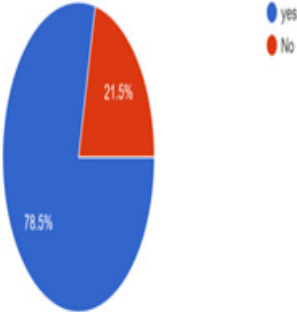


Figure 4B

When I stay healthy,I am just plain lucky
306 responses

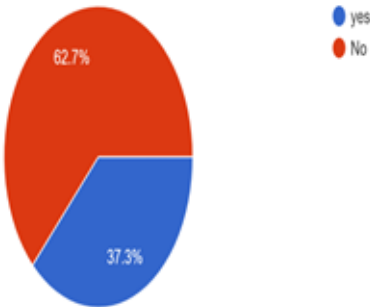


Figure 4C

Food Handling Practices

Figure 5D: 95.7% soap and water, 3% hand sanitizer, 1% water only, 0.3% do not wash hands. Figure 5E: 72.4% remove jewellery when preparing food, 14.5% do not, 12.8% not applicable, 0.3% depends on food being prepared, 0.3% depends on jewellery. Figure 5F: 43.6% wash hands after touching all listed items,29.8% after touching face, 6.6% after touching utensils, 3.3% after touching clean pots and counters, 15.4% none, 1% avoid touching other items, 0.3% sometimes wash hands.

The best way to wash vegetables and fresh fruits is using?
305 responses

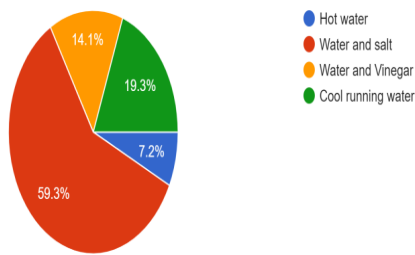


Figure 5A

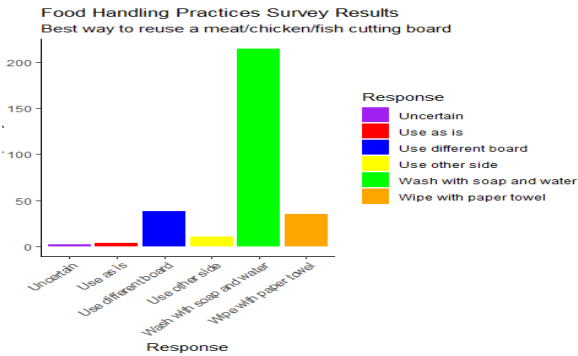


Figure 5B

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Figure 5C

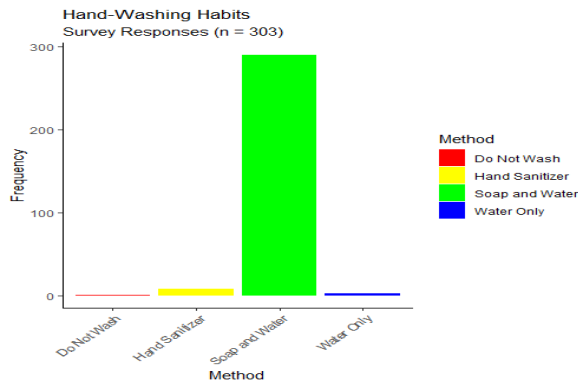


Figure 5D

2

Removing Jewelry When Preparing Food
Survey Responses (n = 304)

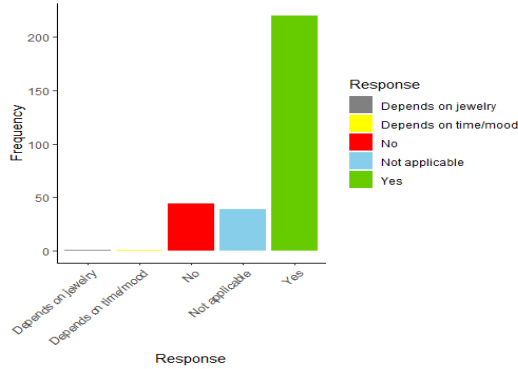


Figure 5E

Hand-Washing Habits During Cooking
Survey Responses (n = 305)

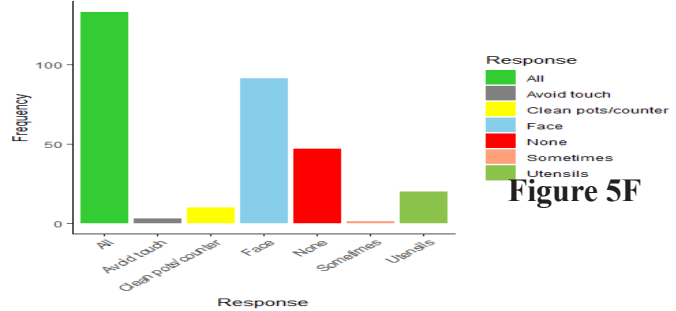


Figure 5F

Food Preservation

Figure 6A: 41.4% top shelf, 39.1% lowest shelf, 15.9% middle shelf, 3.3% freezer, 0.3% anywhere. Figure 6B: 48% defrost outside the freezer, 26% soak in water, 17% thaw in the fridge, 9% microwave. Figure 6C: 86% poor electricity supply, 6% lack of time, 6% lack of space, 2% no challenges. Figure 6D: 64% take refrigerated items at the end of shopping, 11% at the beginning, 10% any time suitable, 6% in the middle, 8% at the counter. Figure 6E: 52% store hot meals in a warm oven, 26% in the fridge, 19% in a cool oven, 3% allow meals to cool before refrigeration. Figure 6F: 87% freezing, 7.7% drying, 3% canning, 1% salting, 1% vacuum packing.

Ideal Way to Defrost Frozen Meat
Survey Responses (n = 301)

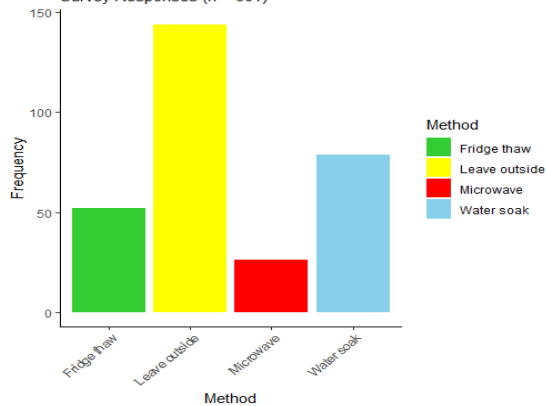


Figure 6A

Best Place to Store Raw Meat in the Fridge
Survey Responses (n = 302)

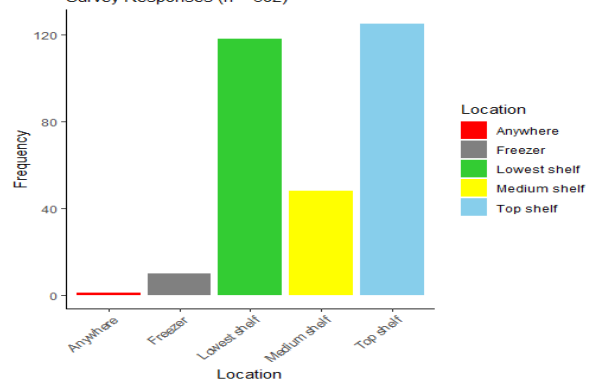


Figure 6B

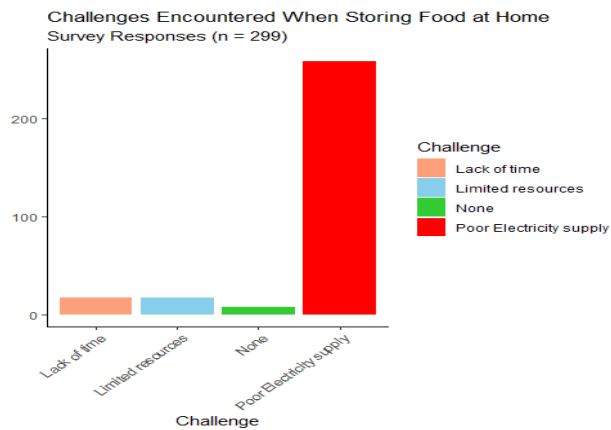


Figure 6C

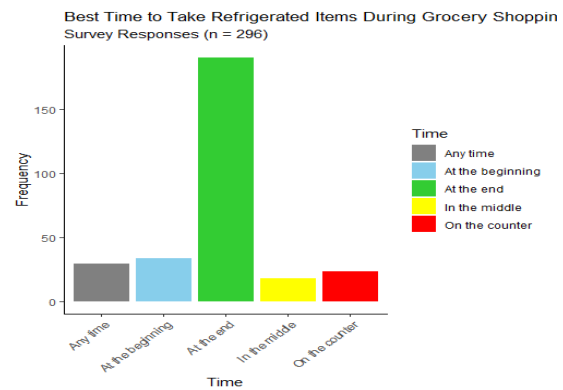


Figure 6D

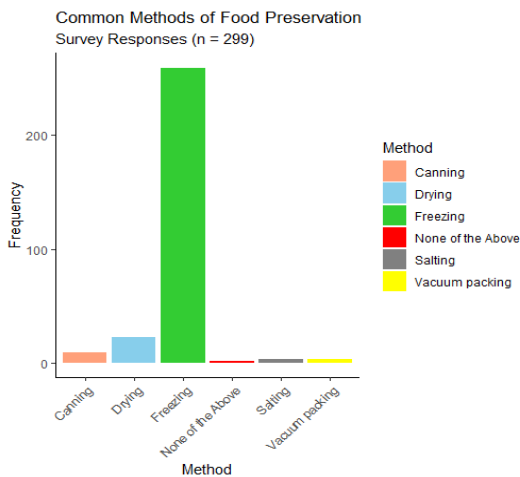


Figure 6E

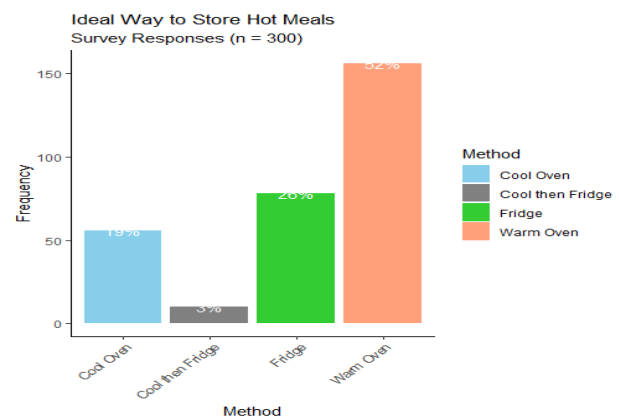


Figure 6F

Food Safety

In 7A; "What group of individuals should not prepare food for other people?" 95% chose a person with diarrhea, 1% chose a person with headache and 4% chose a person with malaria. 7B; "Which microorganisms are responsible for most food borne diseases?"

86% chose Bacteria, fungi 11%, and viruses 3%. 7C; "How can we protect ourselves from salmonella bacteria in food? 81.7% consider proper cooking of food as the most effective method Refrigerating food is 17.3%, Adding seasonings is 1% .

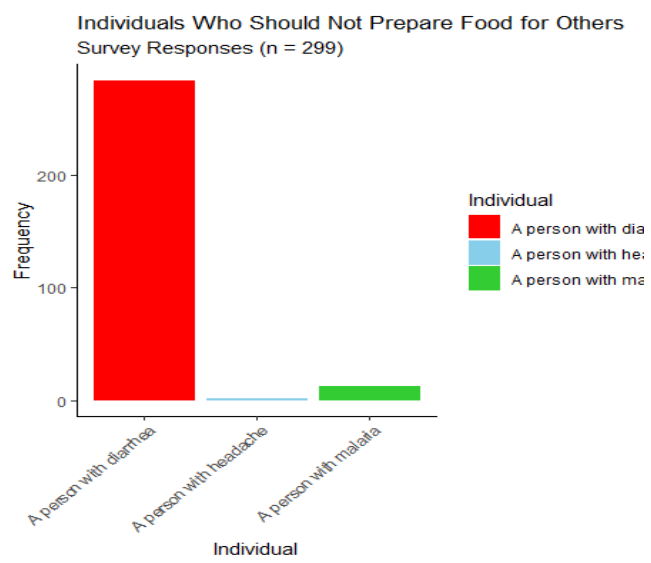


Figure 7A

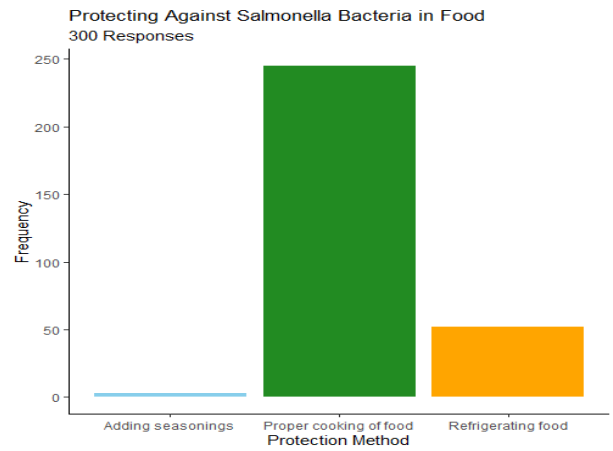


Figure 7B

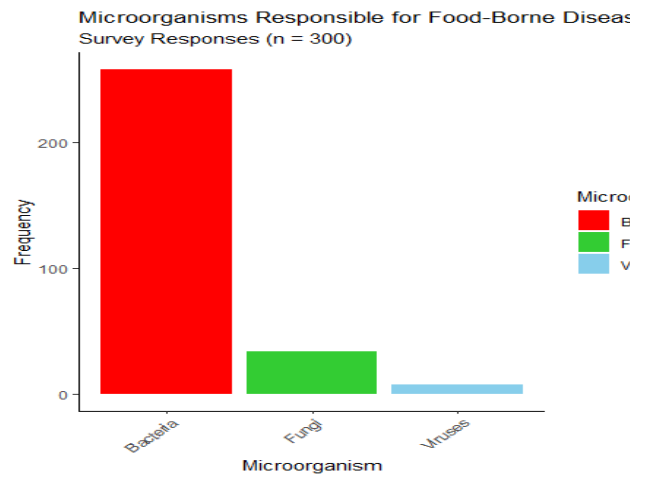


Figure 7C

DISCUSSIONS

The findings of this study revealed notable discrepancies between food safety knowledge and actual food handling practices among undergraduate students in the University of Abuja. Although many respondents demonstrated awareness of general food safety principles, several gaps were observed in the practical application of these practices. This difference between knowledge and behaviour has been reported in previous studies, which indicates that awareness of food safety does not necessarily translate into consistent safe food handling practices [25,26].

The demographic analysis showed differences in food safety behaviour among respondents. Female students demonstrated better adherence to recommended food safety practices than male students. Similar findings have been reported in earlier studies where female respondents were more likely to adopt safer food handling behaviours [27,28]. This pattern may be influenced by gender roles and social expectations related to food preparation, as well as greater exposure to domestic food preparation activities. Previous research suggests that individuals who frequently engage in food preparation activities tend to develop better food safety practices through routine exposure and experience [29]. These findings indicate that targeted educational interventions may be necessary to improve food safety practices among male students.

One important observation from this study was that 41.4% of respondents believed that raw meat should be stored on the top shelf of the refrigerator, which increases the risk of cross-contamination with ready-to-eat foods. Similar mis-

conceptions have been reported in other studies assessing food storage practices among students and household consumers [30]. Proper food safety guidelines recommend storing raw meat on the lowest shelf of the refrigerator to prevent juices from contaminating other foods and spreading harmful microorganisms [31].

Although 81.7% of respondents correctly identified proper cooking as the most effective method for preventing *Salmonella* infection, gaps in knowledge regarding food preservation and storage practices were still evident. This finding is consistent with previous research indicating that while basic food safety awareness may be common, more detailed knowledge regarding temperature control, refrigeration, and food storage practices is often limited among students [32]. These knowledge gaps highlight the need for more comprehensive food safety education programs within university settings.

Hygiene practices among respondents showed both positive and concerning patterns. Encouragingly, 95.7% of respondents reported washing their hands with soap and water before food preparation, which is a key preventive measure in reducing food-borne disease transmission. However, some respondents reported inadequate sanitation practices, such as merely wiping cutting boards before re-use. Studies have shown that improper cleaning of food contact surfaces can significantly increase the risk of cross-contamination and the transmission of food-borne pathogens [33,34].

External environmental factors also appeared to influence students' food safety practices. A significant proportion of respondents (86%) identi-

fied poor electricity supply as a major challenge affecting food preservation. Reliable electricity is essential for maintaining refrigeration and preventing food spoilage. In many developing countries, infrastructural challenges such as unstable electricity supply have been identified as important contributors to food spoilage and increased risk of food-borne illnesses [35].

This study also has several limitations. The use of self-reported data may introduce social desirability bias, as respondents may over report desirable behaviour such as proper hygiene practices. Previous research has demonstrated that self-reported food safety practices often differ from observed behavior [36]. Additionally, socioeconomic factors were not assessed in this study, despite evidence that financial constraints and limited access to cooking facilities may influence food handling behaviour among students [31]. Future studies should incorporate observational methods and socioeconomic variables to provide a more comprehensive understanding of the factors influencing food safety practices

CONCLUSIONS

This study assessed food safety knowledge and food handling practices among undergraduate students at the University of Abuja and identified both strengths and gaps in students' food safety behavior. While many students demonstrated awareness of common food-borne pathogens and the importance of proper cooking, several deficiencies were observed in areas such as food storage, cross-contamination prevention, and sanitation practices. These findings suggest that although basic food safety knowledge exists among students, consistent application of safe

food handling practices remains limited. Environmental constraints such as unreliable electricity supply and limited access to proper food storage facilities further complicate the ability of students to maintain safe food handling practices.

Based on these findings, there is a need for targeted food safety education programs, particularly those that emphasize practical food handling behavior and correct food storage practices. Universities can play an important role by integrating food safety education into student health programs and awareness campaigns. Gender-sensitive interventions may also be beneficial in addressing behavioral differences observed among students.

Overall, the findings contribute to ongoing public health efforts aimed at improving food safety awareness and practices within university communities and highlight the importance of continuous food safety education among young adults.

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