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Research Article

Food Safety Practices among Vendors in State Secondary Schools in Ibadan Metropolis, Oyo State

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Abstract: Unsafe food consumption may hinder Nigeria's efforts to achieve Sustainable Development Goal 3 (SDG 3). As a result, efforts have been made to increase food safety; yet, despite the intended objectives of food safety policies, implementing proper hygiene practices remains challenging. Hence, this paper investigates food safety practices among secondary school food vendors in the Ibadan metropolis of Oyo state. Data was collected from a sample of 120 participants. The data collected were analysed using descriptive and inferential statistical tools such as frequency count, percentages, and chi-square at a significance level of 5%. The majority of respondents were young (75.0%), female (80.8%), married (56.6%), with a basic educational level (61.6%), and at least 10 years (51.7%) of vending experience. The food safety techniques implemented include using clean equipment (49.1%), separating raw food from cooked food (50.0%), keeping food at safe temperatures (62.5%), using clean water (80.0%), and verifying the expiration date of condiments before use (63.3%). However, challenges such as (inadequate infrastructure) poor power supply (65.0%), access to regular food safety information (44.2%), and access to a consistent supply of clean water (80.0%) hampered participants' food hygiene practices. There was a significant relationship ($X^2 = 98$, $p < 0.05$) between participants' knowledge regarding food safety and the food safety practices adopted. Depending on their socioeconomic status, all participants implemented food safety measures. However, additional efforts need to be made; a continual food safety education campaign and the supply of basic infrastructure by Non-Governmental Organizations (NGOs) and health practitioners will improve participants' food safety practices to meet Sustainable Development Goal 3 by 2030.

Keywords: food safety, food vendors, secondary schools, socio-economic

1. Introduction

Food safety is vital to accomplishing the Sustainable Development Goals (SDGs) and is also a public health concern. Massive investment in SDG progress can be retarded without an effective food safety control system. SDG 2 seeks to eliminate hunger and promote food security, emphasising the importance of food safety in achieving sustainable development. Consumption of safe food is necessary for human growth and development; but, if food is not adequately processed for consumption, it can cause food poisoning.

Food safety is one of the most difficult social issues to address in low- and middle-income countries [1] in order to prevent certain diseases. Every year, millions of people are affected by diseases caused by the consumption of contaminated food, particularly in poor countries such as Nigeria [2-3]. Food safety is a key concern in Nigeria today, with outbreaks of food-borne illness resulting in significant costs to individuals, the food sector, community health

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systems, and the economy as a whole [4].

Food poisoning causes more than 200,000 fatalities in Nigeria each year [2], and numerous initiatives have been implemented to combat the problem and improve hygiene practices. However, excellent hygienic implementations, adhering to food safety guidelines, and checking food quality can dramatically lower the incidence of food-borne illness [5]. According to Barnabas [6], the World Health Organisation (WHO) recognised five key principles for improving food safety: ensuring that all equipment is clean, separating raw food from cooked food, completely cooking food, keeping food at safe temperatures, and using clean water and raw materials.

Poor adherence to various food safety practices has resulted in food illness [7]. Barnabas et al. [6] identified unsafe food production, a lack of hygienic education, contaminated waters, a lack of cleaning or inappropriate food storage conditions, pesticide residue, and poor personal hygiene as causes of food poisoning in northern Nigeria, with limited empirical data on the causes of food poisoning among food vendors in southern Nigeria. Furthermore, college students are one of the most vulnerable populations due to their dangerous food consumption habits [8-9]. It is also believed that young adults, particularly those in schools, lack knowledge about the steps required to prevent food-borne illnesses [10] and have become victims of food poisoning [11] because they are unable to purchase food from outside sources during the six hours they are at school.

With implied cases of food poisoning resulting in deaths and hospitalisations in Nigeria, for example, food poisoning among three families in Kano due to yam flour consumption was reported, and investigations revealed that the use of certain lethal preservatives for yam flour processing may have been responsible [12]. Another food poisoning case was linked to yam flour consumption in five families in Ilorin, central Nigeria [13]. The deaths were ascribed to the intake of contaminated meals as a result of faulty processing, preservation, and servicing, as well as street vendors' failure to follow food safety regulations. As previously stated, there are few research findings on food safety practices among food vendors in secondary schools in Ibadan city. Oyo state is one of the states in Southwest Nigeria with the cases of food poisoning. As a result, this study focuses on the food safety practices of food vendors in secondary schools in Ibadan Metropolis, Oyo State, Nigeria, with the purpose of providing health education workshops on food safety to participants while also accomplishing sustainable goal 3.

1.1 *Objective of the study*

The general objective of this study is to determine the socioeconomic characteristics of food vendors, identify food safety practices among food vendors, assess participants' knowledge of food safety practices, and determine challenges to food safety practices among food vendors in the study area.

2. Material and method

2.1 *Study area*

The study was conducted in Ibadan Metropolis, Oyo State, Nigeria. Oyo State was established in 1976. It is located between latitude 8.196° N and longitude 3.4196° N (Figure 1).

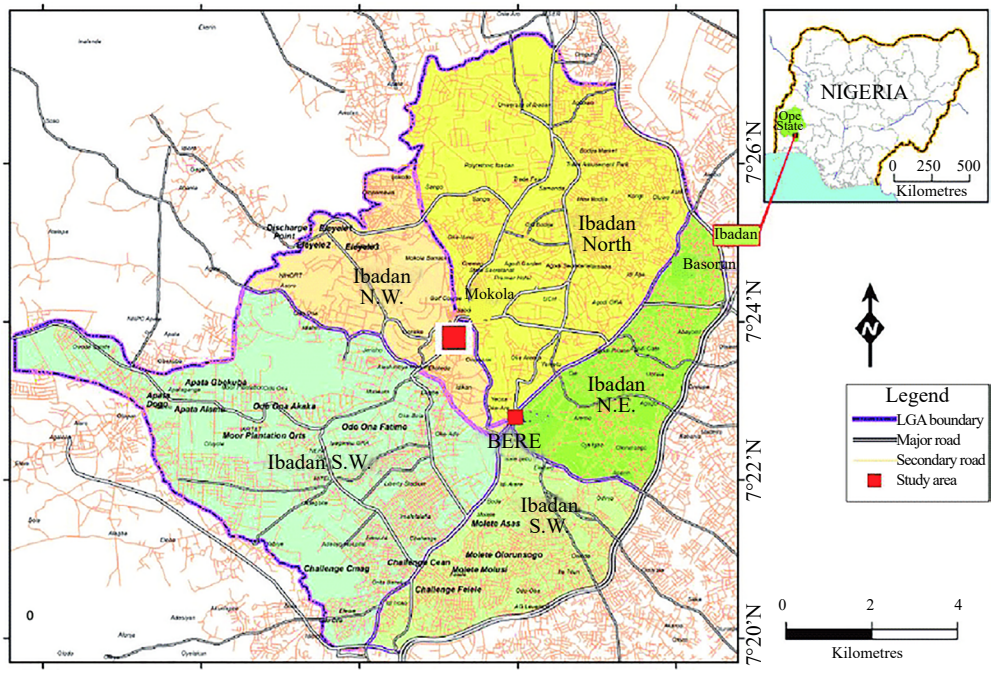

Figure 1. Map showing Ibadan Metropolis

2.2 *Sample size and method of data collection*

A multistage sampling technique was used to select the respondents. Ibadan metropolis has four local government areas: Ibadan-north, Ibadan-northeast, Ibadan-northwest, and Ibadan-southwest. Each local government has the following food vendors registered: 402 (Ibadan-north), 340 (Ibadan-northeast), 281 (Ibadan-northwest), and 180 (Ibadan south-west). A proportionate selection of ten percent of the vendors resulted in 120 participants.

This investigation was carried out using primary data. The interview was scheduled for 2021 and included a well-structured questionnaire. Questions were asked on the respondents' socioeconomic characteristics, the food safety practices they utilised, their knowledge of food safety practices, and the challenges they faced. Data were collected and analysed using the Statistical Package for Social Science (SPSS).

Data was collected on participants' socioeconomic factors (e.g., age, gender, level of education, experience selling food, etc.), food safety practices, knowledge of food safety practices, and challenges to food safety practices. Respondents were asked to rank challenges to food safety practice as follows: severe challenge = 2, medium challenge = 1, and not a challenge = 0. Similarly, the participants' knowledge of food safety was grouped into three as follows: high knowledge (3), moderate knowledge (2), and low knowledge (1). Data was analysed using descriptive and inferential statistical tools with a 5% level of significance. The chi-square test was carried out to determine the relationship between participants' knowledge and food safety practices.

2.3 *The chi-square formula*

The Pearson's chi-square test uses the same formula to calculate the test statistic, X^2

$$X^2 = \sum \frac{(O-E)^2}{E}$$

Where:

- X^2 is the chi-square test statistic
- Σ is the summation operator (it means "take the sum of")
- O is the observed frequency

• *E* is the expected frequency

The larger the difference between the observations and the expectations (*O*-*E* in the equation), the bigger the chi-square will be. To decide whether the difference is big enough to be statistically significant, we compare the chi-square value to a critical value.

3. Result and discussion

Table 1. Distribution of respondents based on their socio-economic characteristics (N = 120)

Socio-economic characteristics		Frequency	%
Age	18-25	41	34.2
	26-30	49	40.8
	31-60	22	18.3
	61 and above	8	6.7
Gender	Male	23	19.2
	Female	97	80.8
Marital Status	Single	43	43.4
	Married	68	56.6
Educational Qualification	Primary School	74	61.6
	Secondary Education	27	22.5
	Tertiary Education	8	6.7
	Certificate Course	11	9.2
Religion	Christianity	55	45.8
	Islam	63	52.6
	Traditional	2	1.6
Educational Qualification	1-5 years	45	37.5
	5-10 years	62	51.7
	11 years above	13	10.8

Source: Field Survey 2021

Table 1 shows that the majority of food vendors (75.0%) were young, with 25.0% respondents being middle-aged or older. This finding was confirmed by Bantie [14], who observed that the majority of food vendors were aged 25 to 34 years. Anderson et al. [15], on the other hand, hypothesised that elderly persons are more likely than younger people to adhere to food safety recommendations. This could be because the immune system of the elderly weakens with age, so eating healthy foods is an option. Vulnerable populations, such as small children and those over the age of 50 years, are substantially more likely to contract serious food-borne diseases than the general population [16].

Different age groups, both male and female, participated in food sales; the results suggest that around 80.8% were female and 19.2% were male. This finding is congruent with Banties [14], who discovered that the majority of food vendors (72.0%) were female. This implies that females dominated the food vendor business in the studied area. The

rationale for female domination could be related to our cultural practice of assigning cooking as a more female job at home, particularly among married couples.

The distribution of respondents by marital status shows that the majority (56.6%) were married, while 43.4% were single. This illustrates that selling food in the study area improves family welfare, as married people in the study area sell food to support their families' needs. Education also helps to produce hygienic food; according to the findings, 61.6% of the participants had a primary school education certificate, which is the basic level of education in Nigeria; a small percentage also had some degree of food preparation training certificate (9.2%). This means that the vast majority of responders have received some level of basic schooling. Berglund et al. [17] found that online food-safety educational programmes are becoming increasingly important in educating various populations as technology and culture advance. This finding emphasises the importance of education in promoting food safety practices and the tools required to achieve that goal. Furthermore, another technique for promoting food safety procedures among vendors is through their religious groups, as the majority of respondents belong to religious organisations dominated by Christianity and Islam.

Table 1 shows that more than half of the respondents (51.7%) had worked as food vendors for at least ten years. Long experience in food processing may have exposed them to different food safety practices among food vendors in Oyo state secondary schools.

Table 2. Description of food vendors based on their knowledge of food safety practice

S/N	Knowledge Statement	Right		Wrong	
		F	%	F	%
1	Is it good to look at the expiry date of products to understand if they are safe before using them to prepare meals?	72	60.0	48	40.0
2	Is it safe to clean and sanitize the environment before cooking activities?	55	45.8	65	54.2
3	The safest way to control if meat has been cooked well is to check its internal temperature with a food thermometer.	46	38.3	74	61.7
4	The internal temperature of the chicken must be high for safe cooking.	37	30.8	83	69.2
5	Pasteurized milk can be stored at refrigerator temperature for a maximum of 3 days in its unopened box.	23	19.1	97	80.9
6	The most suitable temperature (4-7 ^{o}C) at which bacteria grows is the temperature of the refrigerator.	52	43.3	68	56.7
7	If a cutting board will be used to cut different types of food such as vegetables and meat, you should clean the board with a clean towel to prevent bacterial growth.	79	65.8	41	34.2
8	Raw chicken, fish, and meat should not contact each other?	56	46.7	64	53.3
9	Bacteria transmitted from hands to food can result in the growth of harmful microorganisms in food?	98	81.7	22	18.3
10	Is good to wash your hands with water before touching food to get rid of bacteria?	57	47.5	63	52.5
11	Use of an apron is good when cooking?	56	46.7	64	53.3

Source: Field Survey 2021
*F = Frequency

Table 2 illustrates items from the questions that measure the respondents' knowledge of food safety practices. Approximately 60.0% of respondents correctly identified the importance of checking the expiry date of products before purchasing them as condiments for meal preparation, although some respondents (40.0%) were not conscious of checking the expiry date. This implies that the majority of respondents check the expiry date on items used in food production; however, we must not overlook the remaining vendors who were not conscious of the product's expiry date as well as water safety to promote food safety practices and achieve the sustainable development goals 1 and 6 (SDG 1 & 6). Goal 6 of the Sustainable Development Goals emphasises the need of providing "clean water and sanitation

for all". It is one of the 17 Sustainable Development Goals set by the United Nations General Assembly to replace the previous Millennium Development Goals. Also it securely managed drinking water entails employing an enhanced sanitation facility that is not shared with other homes and in which excreta are either securely disposed of in situ or collected and processed offsite. Access to clean water is critical to food safety.

The majority (81.7%) of food vendors have some basic knowledge of food hygiene preparation. Vendors (81.7%) also agreed that bacteria carried from hands to food could lead to the proliferation of harmful microorganisms in food, resulting in food poisoning; therefore, most foods, particularly meat, poultry, fish, and eggs, should be fully prepared to kill the majority of food poisoning bacteria. Food should be prepared to at least 75 °C or higher [18].

Food vendors must have knowledge of food safety, which includes frequently washing their hands and surfaces, separating or not cross-contaminating raw food, cooking at the appropriate temperature, and rapidly cooling food in the refrigerator.

Table 3. Distribution of respondents on constraints to food safety practices (N = 120)

S/N	Constraints Statement	Mild Constraint		Severe constraint		Not a constraint	
		F	%	F	%	F	%
1	Lack of regular food hygiene information	53	44.2	39	32.5	28	23.3
2	Poor power supply	78	65.0	34	28.3	8	6.7
3	Poor water supply	96	80.0	21	17.5	3	2.5
4	Poor equipment eg malfunction of refrigerator	60	50.0	45	37.5	15	12.5
5	Delay in handling of food due to poor transportation	47	39.1	56	46.7	17	14.2
6	Poor sanitary services (Unavailability of cleaning equipment)	68	56.7	34	28.3	18	15
7	Lack of apron	76	63.3	32	26.7	12	10
8	Lack of dean board for cutting	65	54.2	30	25	25	20.8
9	Poor access to workshop	36	30	71	59.2	13	10.8

Source: Field Survey 2021
*F = Frequency

According to Table 3, infrastructure constraints such as a lack of storage facilities, sanitary services, and electrical access were major challenges. Some (44.2%) of respondents lack enough food hygiene information due to their inability to attend workshops or conferences that might refresh their food safety expertise, poor power supply to preserve food, and limited access to water supply as challenges to food hygiene practices. Factors, such as lack of vendor knowledge or training, poor communication between health practitioners and vendors, and complacency or ignorance among food vendors can all lead to foodborne infections, hindering the achievement of sustainable development goals for food safety. To meet Sustainable Development Goals 1 and 6, policymakers must invest in power and water supplies. Providing these social facilities will encourage food safety practices among vendors.

Table 4. Description of respondents on their food safety practices (N = 120)

S/N	Food safety practices	Always		Occasionally		Never used	
		F	%	F	%	F	%
1	Reheating leftover food before serving	23	19.1	45	37.5	52	43.3
2	Putting on clean overall while cooking	53	44.1	42	35.0	25	20.8
3	Proper cooking of food at the appropriate temperature	75	62.5	23	19.1	22	18.3
4	Keeping raw food separate from cooked food	60	50.0	29	24.1	31	25.8
5	Regular washing of hands and use of clean water for cooking	96	80.0	16	13.3	8	6.6
6	Hand washing facility available (clean equipment)	59	49.1	39	32.5	23	19.1
7	Checking the expiring date of condiments before usage	76	63.3	25	20.8	19	15.8
8	Careful use of pesticides to control insect vectors e.g. cockroaches, houseflies.	47	39.1	52	43.3	21	17.5
9	Adequate ventilation	65	54.2	30	25.0	25	20.8
10	Solid waste storage receptacle is properly secured	36	30	71	59.2	13	10.8

Source: Field Survey 2021

Table 4 shows hygiene practices across food vendors; some vendors routinely reheat leftover food before serving to eliminate hazardous bacteria. The most often accepted food practices include wearing a clean overall (apron), using clean equipment (49.1%), separating raw food from cooked food (50.0%), keeping food at safe temperatures (62.5%), using clean water (80.0%), and checking the expiration date of condiments before use (63.3%). Some of the food safety practices mentioned by Barnabas et al. [6] include keeping everything clean, separating raw and cooked foods, completely cooking foods, keeping food at safe temperatures, and utilising clean water and raw materials.

Regular cleaning of kitchen surfaces is an important part of food safety measures. These kitchen surfaces include worktops, sinks, faucets, stovetops, refrigerators, dishwashers, floors, cupboards, utensils, and equipment. The kitchen surface cleaning methods vary according to surface types. Some cleaning methods may include the use of water solution and sanitizing agents such as bleach or quaternary ammonium to kill bacteria and microorganisms. Some respondents suggested using light detergent and warm water to remove dirt, grime, and food residues. In order to protect food from rodents, entry points are blocked by covering holes or gaps in walls, floors, and ceilings, storing food in rodent-proof containers such as glass jars or metal cans, and keeping them off the floor, and away from wall corners. Rodent control can also be achieved by the use of baits as well as chemical repellents such as peppermint oil or ultrasonic devices. Cooked foods are held at 63 ℃ or above using heat lamps, warmers, or insulated containers. Microwaves, ovens, and stoves are also employed to keep food temperature stable. Some cooked foods are covered and stored in refrigerators or freezers. These are the major food safety practices in Oyo state.

Generally, food safety practices in developed and developing countries somewhat differ, though not markedly. According to Unnevehr and Ronchi, Loraine [19], the focus of food safety practices in developed and developing countries shows that food safety regulations and policies in developed nations concentrate on adherence to public health values. But, for developing countries, food safety practices are emphasized as part of economic development. The failure or inability to achieve high public health standards, imposed by high-income or developed countries resulted in the exclusion of several developing countries and enterprises from markets when new health standard requirements were implemented in the 1990s. For example, the European Union (EU) prohibited the import of fishery goods from Bangladesh in 1997 [20], Kenya in 1997-2000 [21], and Malaysia in 1998 [22], and the United States prohibited the import of raspberries from Guatemala in 1997-1998 [23].

Aside from the high focus on public health and food safety practices in advanced countries, there are also strict food safety regulations and high-level enforcement of rules by public officials, use of advanced food technology equipment, and infrastructure for food processing and storage, high level of public awareness and education about food safety, robust traceability and recall systems, and high compliance with international food safety standards. The Codex Alimentarius Commission is rated as the international standards measure for food safety standards.

Furthermore, according to the Canadian Institute for Food Safety [24], developed countries improve their food safety technologies through the application of artificial intelligence in food manufacturing. The concept of artificial intelligence has helped to improve the efficiency and reliability of farming practices where insects cause damage to crops, and weather events can make or break a farming season. The reliability of Artificial Intelligence (AI) technology has helped to anticipate harvests, allowing farmers to communicate with consumers and businesses in the supply chain. Light technologies have addressed food safety challenges in industrialised countries, where ultra violet (UV) procedures are tested and, in some circumstances, are already in use in the supply chain and restaurants. Improvements in UV lights can be used to disinfect food surfaces and some liquids, providing an economical and effective method of ensuring cleanliness and safety.

In terms of a national food control system, developed countries have improved their food control systems by implementing contemporary food control systems to achieve food safety and quality. In some of the industrialized countries, risk-based inspections are implemented by allowing trained food inspectors to conduct risk-based inspections of food production and processing facilities. Other stakeholders, such as consumers, farmers, and food industry workers have built a system to communicate information and create education awareness of food safety.

The food safety practices in developing countries revealed a lack of basic sanitary facilities infrastructures, poor knowledge and practice of hygiene and sanitation among food handlers in the food service industry, and a general negligence in safe food handling [25]. These constitute major problems for hazardous food safety practices in the food industry. Azanaw and Gebrehiwot [25] found that limited food safety regulations and enforcement, inadequate infrastructure for food processing and storage, low levels of public awareness and education on food safety, limited traceability and recall systems, and low compliance with international food safety standards were common factors influencing food safety practices in developing countries. The challenges that are attributed to low compliance with basic food safety principles in developing countries include insufficient financial resources and health infrastructure, lack of public awareness and education, and restricted access to potable water and sanitation.

Table 5. Relationship between the food vendor knowledge and their food safety practices

Variable	X^2	Df	Pv	Decision
Knowledge of food safety practices	98	3	0.05	Significant

Source: field survey, 2021

The chi-square value in Table 5 demonstrates a significant relationship between respondents' knowledge and their food safety practices. This means that the vendors were able to put the knowledge they gained from local public health practitioners into action. A vendor's food safety standards improve as he or she receives more training. Policymakers should keep this in mind when developing policies to achieve SDG 1.

The Sustainable Development Goals for Food Safety highlight the importance of individuals having access to safe and nutritious food all year round, as well as promoting organic agriculture. Organic agriculture refers to agricultural practices that do not use synthetic chemical pesticides in crop cultivation with the goal of achieving the highest possible yields through the use of mineral fertilisers while reducing environmental impact by avoiding the use of chemical plant products. By completely avoiding pesticides, this technique has the potential to significantly contribute to the European Union's pesticide reduction goals, as well as prevent the problems of pesticide residues in food and biodiversity loss [26].

4. Conclusion and recommendations

The majority of food vendors have a good knowledge of food safety practices. The study also found a substantial association between respondents' knowledge and their food safety practices. While food sellers have made tremendous progress toward guaranteeing food safety, there is still much space for improvement due to the challenges they confront. Challenges such as inadequate infrastructure facilities (poor electricity and water supply) impede food safety practices.

As a result, periodic continuing food safety educational activities, as well as the provision of basic infrastructure such as regular power supply, are required to improve these vendors' food safety practices to meet SDG 3. Furthermore, maintaining proper hygiene standards requires vendors to comply with food safety guidelines, and monitoring food quality by environmental and health officials will dramatically lower the incidence of foodborne illness.

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Conflict of interest

The authors declare there is no conflict of interest at any point with reference to research findings.

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Appendix

Questionnaire

Dear Respondent,

An Appeal to Complete Questionnaire

This questionnaire is designed to ascertain the Food Safety Practices among selected Vendors in State Secondary Schools in Ibadan Metropolis, Oyo State. The research questionnaire is strictly for academic purpose and all information given will be treated with utmost confidence.

Yours faithfully,

Section A: Socio-economic characteristics of the respondents

1. Age: Please, how old are you?_____
2.Gender: Indicate your sex
i. Male ( ) ii. Female ( )
3. Marital Status: Indicate your marital status as grouped below
i. Single ( ) ii. Married ( ) iii. Widowed ( ) iv. Divorced ( )
4. Level of Education: Indicate your level of education as grouped below
i. Primary School ( ) ii. Secondary Education ( ) iii. Tertiary Education ( ) iv. Certificate Course ( )
5. Religion: Indicate your religion as grouped below
i. Christianity ( ) ii. Islam ( ) iii. Traditional ( )
6. Working Experience: How long have you been working as food vendor? _____

Section B: Knowledge of respondents on food safety.

This section determines the knowledge of food safety practices among food vendors. A set of questions on knowledge of food safety practices have been raised to determine the level of knowledge of the food safety practices among the food vendor. Please answer the true or false question below

S/N	Knowledge statement	True	False
1	You should taste food rather than look at its expiry date to understand if it is safe or not.		
2	It is not wrong to expose food if the cover of the tin is not available?		
3	The safest way to control if meat has been cooked well is to check its internal temperature with a food thermometer.		
4	Internal temperature for cooking chicken meat must be high to ensure absence of bacteria.		
5	Food can be stored at refrigerator temperature for a maximum of 3 days in its unopened box.		
6	The most suitable temperature (4-7 °C) at which bacteria grows is the temperature of the refrigerator.		
7	If a cutting-board will be used to cut different types of food such as vegetables and meat, you should clean the board with a clean towel to prevent bacterial growth.		
8	Raw chicken, fish and meat should not be preserved together in the same container, including the refrigerator.		
9	Bacteria that are transmitted by hands to food can result in the growth of harmful microorganisms in the food.		
10	It is good to wash your hands with water before touching food in order to get rid of bacteria?		
11	Use of an apron is good when cooking food at anytime.		

Section C: Constraints to food safety practices

Please rank the information in the table below according to its impact on your ability to practise food safety.

S/N	Constraints statement	Mild constraint	Severe constraint	Not a constraint
1	Lack of adequate food hygiene information.			
2	Poor power supply electricity.			
3	Poor water supply.			
4	Poor equipment.			
5	Prolong handling of food.			
6	Incorrect application of cleaning procedures of equipments.			
7	Uncovered long hair and long fingernails of food handlers.			
8	Lack of apron.			
9	Dean board for cutting.			
10	Poor access to workshop.			
11	Other challenges, please specify.			

Section D: Food safety practice by the respondents

Please identify the food safety practices used from the alternatives listed in the table below, as well as the frequency of use.

S/N	Food safety practices	Always	Occasionally	Never used
1	Reheating leftover food before serving.			
2	Putting on clean overall while cooking.			
3	Proper cooking of food at the appropriate temperature.			
4	Keeping raw food separate from cooked food.			
5	Regular washing of hands and use of clean water for cooking.			
6	Hand washing facility available (clean equipment).			
7	Checking the expiring date of condiments before usage.			
8	Careful use of pesticides to control insect vectors e.g. cockroaches, houseflies.			
9	Adequate ventilation.			
10	Solid waste storage receptacle is properly secured.			
11	Others, please specify.			

Thank you for taking the time to fill out this questionnaire.