

**THE FOOD SAFETY KNOWLEDGE OF STREET FOOD VENDORS AND THE
ENFORCEMENT OF FOOD SAFETY POLICIES AND PROCEDURES IN OYO
STATE, NIGERIA**

By

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I declare that the above thesis is my original work and that all the sources quoted or used have been properly cited and acknowledged with full references. I further declare that I have not previously submitted this work, or part of it, for any degree or examination in any other higher education institution. I further confirm that this work, or any part of it, has not been previously submitted for any degree or examination in any other higher education institution.



SIGNATURE

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DEDICATION

This thesis is dedicated to the LORD, GOD ALMIGHTY- The owner of my life.

ABSTRACT

Inadequate food safety knowledge, insufficient enforcement and compliance with food safety regulations, and the lack of hygienic food safety regulation resources at street food vending sites may result in food contamination risk and outbreaks of foodborne diseases. This study aimed to investigate the knowledge of food safety of street food vendors and the implementation of food safety policies and procedures in Oyo State, Nigeria. This research study uses a cross-sectional survey design and a quantitative method for data analysis. A multi-stage random sampling procedure was employed, and fifteen local government areas (LGAs) were randomly selected from the three senatorial zones, with 40 street food vendors per LGA, totaling 600 respondents. The data were collected through a structured interview schedule. A quasi-experimental approach was used for the pre-and post-training assessment of 42 street food vendors on food safety knowledge. Findings revealed that 75.7% of street food vending sites had low compliance with food safety requirements, while 90% had weak enforcement. Nearly all street food vendors (96.5%) had inadequate food safety knowledge, and 80.7% had never attended any food safety training course. A significant positive correlation ($r = 0.72$, $p \leq 0.05$) existed between food safety knowledge and awareness. Additionally, no significant difference in sanitary compliance or enforcement was found between licensed and unlicensed street food vendors, and 85.7% of street food vending sites were uninspected. In the pre-and post-training assessment, street food vendors' food safety knowledge dropped from 85.7% to 14.3 %. The assessments show that food safety training programmes can enhance food safety knowledge among street food vendors.

Keywords: street food vendors, food safety knowledge, food safety compliance, food safety training, Nigeria

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CHAPTER 1: INTRODUCTION

1.1 BACKGROUND INFORMATION

Modern-day living in Nigeria has made street foods an important meal option due to their convenience and affordability. Street food has contributed to consumers' daily nutrient consumption (Sseguya et al., 2020; Abrahale et al., 2019; Leshi & Leshi, 2017). The Federal Ministry of Health in Nigeria regulates the safety considerations of street food vendors through the Department of Environmental Health (Okoruwa et al., 2022; FMHAN, 2014). The policy promotes the consumption of safe foods, discourages exposure to food, and eliminates foodborne diseases through safe water, raw materials and a clean environment (Alaka & Ogunlade, 2024). Continuous supply of healthy foods to the consumers and maintaining the hygienic vending environment to prevent diseases associated with food consumption were parts of the successes that the policy is out to achieve.

Unwholesome foods are detrimental to health, and their consumption can negatively affect the human body (Markey et al., 2023). The harmful microorganisms present in such foods, which include bacteria, fungi, viruses, parasites or chemical substances, can cause over 200 diseases such as diarrhoea and typhoid (Akinsemolu & Onyeaka, 2024; Bhalla et al., 2019). Research studies in Kumasi identified harmful microorganisms in vegetables bought at the marketplace (Ofori Ohenewa et al., 2020; Abass, Ganle & Adaborna, 2016). It shows that many people have been victims of the unwholesome foods from the markets in developing countries, especially Nigeria, which usually affects the nation's economic growth due to the cost involved in controlling the outbreak of food-related diseases (Botha et al., 2023).

Food hygiene practices prevent microbial contamination throughout the food preparation process (Kamboj et al., 2020). To prevent contamination, it is crucial for food handlers and the vending environment to maintain hygienic conditions (Letuka, Nkhebenyane & Thekiso, 2021). The food handlers with no neatness or disease may cause food infection during food preparation (Neme, Hailu & Belachew, 2017). Maintaining a hygienic and healthy environment during food preparation will produce safe food that will help human health and produce a healthy society (Garcia, Osburn & Jay-Russell, 2020). Food hygiene practice will prevent food spoilage, prevent food

adulteration and ensure accurate practices (Kamboj et al., 2020). Raji et al. (2021) indicate that constant food hygiene training for food handlers is essential to prepare healthy food for consumers.

Educating the food handlers by the authorities on the food safety knowledge (FSK) is one of the keys to producing healthy food (Al-Akash et al., 2022). Organising food safety training for the food handlers will increase their food safety knowledge and might improve their behaviour during food preparation (Akabanda, Hlortsi & Owusu-Kwarteng, 2017). Likewise, arranging revitalising training on the handlers' food safety knowledge will help them remember what they have learnt and might improve their knowledge during food preparation (Dabasso et al., 2018). A research study in Can Tho city, Vietnam, shows that a food safety training program for the street food vendors would enhance their FSK (Huynh-Van et al., 2022).

The vending environment always influences the hygienic quality of the food being prepared by the street food vendors (SFVs) (Negassa et al., 2023). The vending environment needed to be inspected by the appropriate authority to assess the equipment and quality of food being prepared and encourage the SFVs to implement FSK during food preparation to produce healthy food for the consumers (Nkosi & Tabit, 2021; Mwove et al., 2020). The research study on bacteriological quality assessment of selected street foods in Gondar Town, Northwest Ethiopia, indicates frequent inspection of food vending environment and enforcement of food safety policies by the authority on the SFVs (Adimasu et al., 2016).

Similarly, the SFVs must avoid the selling of food in open containers to protect the food from sun, rain, dust and flies to provide healthy food for the consumers (Mohammed & Shehasen, 2020). Food must also be protected from waste and pest to prevent contamination (Thompson & Darwish, 2019). Likewise, the SFVs need to protect their foods because the streets occupied by most SFVs are usually surrounded by dirty gutters, which can compromise the hygienic quality of the food being sold (Abera & Ashenafi, 2023; Nkosi & Tabit, 2021).

To realise the above objective in food preparation SFVs and municipal authorities are expected to play their roles to ensure the safety of the consumers. The practice in

Nigeria among SFVs indicates that food handlers and the authorities have low enforcement of food safety regulations in Nigeria (Ibrahim & Adeola, 2024).

1.2 PROBLEM STATEMENT

Problems often associated with implementing food safety policies are the lack of FSK, attitude and training by some SFVS, inadequate enforcement by the authorities (Teffo & Tabit, 2020). The lack of national food safety knowledge and attitude by some SFVs towards implementing the national food safety policies and procedures (NFSPPs) is attributed to inadequate training on NFSPPs (Ibrahim et al., 2024; Desye et al., 2023). Currently in Nigeria, no formal or informal training on NFSPPs is provided to SFVs (Okoruwa et al., 2022). Research studies in Bauchi State and Benin City, Edo State, Nigeria, showed inadequate FSK among SFVs (Madaki & Bavorova, 2019; Okojie & Isah, 2019). The lack of FSK by SFVs can lead to unhygienic food handling practices, which can lead to cross-contamination that occurs during food preparation, resulting in foodborne and food-related diseases in consumers (Gargiulo et al., 2022; Teffo & Tabit, 2020). Particularly among the vulnerable populations, such as children, pregnant women, the elderly, and individuals with weakened immune systems, the lack of FSK by SFVs can lead to severe health outcomes because repeated infections in children can affect growth and cognitive impairment, in pregnant women, unsafe food consumption can result in adverse birth outcomes (Njoagwuani et al., 2023; Ndem & Okon, 2023). Among the elderly and immunocompromised, even mild food contamination can progress into life-threatening conditions (Ovca, Jevšnik & Raspor, 2014).

The existence of inadequate street food vending facilities and an unhygienic environment around the street food vending sites often makes it impossible for vendors to handle food hygienically (Mwove et al., 2020; Okojie & Isah, 2019). Factors like unstable electricity supply, unavailability of potable water and toilet facilities, which are lacking by the SFVs can contribute to the preparation of foods in an unhealthy way (Ma et al., 2019). The consumption of unhealthy food by consumers through the SFVs could lead to foodborne illnesses (Mohammed & Shehasen, 2020; Verma et al., 2023). The study research conducted in Central state of northern Nigeria revealed that 60% of SFVs prepared food in an unhealthy environment (Nurudeen, Lawal & Ajayi, 2015).

Enforcement authorities are not efficient in enforcing food safety policies and regulations because some have been found not to possess the right attitude during the enforcement of the NFPPs (Enunwaonye & Olugbade, 2020). Some are corrupt and willing to solicit bribes from non-compliant SFVs, thereby compromising the enforcement of food safety and regulations for personal financial gains (Adaku et al., 2024). Thus, this attitude of the authorities during enforcement is identified as one of the causes of various foodborne diseases within Nigeria's street food vending sectors (Ezirigwe, 2018).

The consequences of foodborne disease outbreaks are absent from work, huge health costs, reduced economic growth and even death (Grace, Wu & Havelaar, 2020; Pires & Devleesschauwer, 2021). Annually, the foodborne diseases caused by six bacterial agents cost the United States US\$ 9.3 – 12.9 billion, and England and Wales spent £300 – 700 million on five foodborne diseases yearly (Bhalla et al., 2019). Globally, the intake of food from unsafe sources has resulted in the untimely deaths of millions of consumers and put many lives in danger (Founou, Founou & Essack, 2021; Bari & Yeasmin, 2018). In 2010, 420,000 deaths were recorded through the consumption of contaminated food, and 40% of foodborne diseases occurred in children under five years of age (WHO, 2019; Mohammad et al., 2018). In Nigeria, deaths recorded annually through food poisoning caused by the consumption of contaminated foods are more than 200,000 (Ezirigwe, 2018; Oladayo et al., 2022).

1.3 PURPOSE OF THE STUDY

Contribution to the body of knowledge

The study provides incremental contributions to the area of food safety. First, it extends the body of knowledge by exploring the factors influencing street food vendors in implementing food safety policies and procedures in Oyo State, Nigeria, using a quantitative method approach. Second, the existing study covers several issues affecting the authorities' enforcement of food safety policies on street food vendors (Teffo & Tabit, 2020). Third, the current study assesses street food vendors' food safety knowledge on food safety policies and their consequences on consumers' health (Okojie & Isah, 2019; Gargiulo et al., 2022; Njoagwuani et al., 2023). Fourth,

the existing study develops a training framework for street food vendors on food safety knowledge and national food safety policies.

Contribution to practice

This study contributes to food safety practice in several ways. First, the street vendors' food safety knowledge results will be available for the Ministry of Health (both at the local and state levels) for future intervention in implementing the NFSPPs. Second, the findings of this study will help the economic growth of the country because it will prevent consumers' job loss, massive medical bills and even death associated with food contamination and foodborne diseases. Third, the findings from the current study will add to the knowledge about NFSPPs for the SFVs and the authorities.

This study aims to investigate the food safety knowledge of street food vendors and the implementation of food safety policies and procedures in Oyo State, Nigeria. Food safety knowledge is essential for street food vendors to understand the appropriate food handling, hygiene and storage practices to prevent food contamination and foodborne diseases, which can cause serious health problems (Barnabas et al, 2024; Putri & Susanna, 2021). Implementing food safety policies is crucial for street food vendors to adhere to safe ingredients, maintain adequate hygiene and practice hygienic food preparation methods (Adaku et al, 2024). Street food vendors implementing food safety policies will further reduce the risk of foodborne diseases, promote a safer food environment and contribute to the consumers' overall health (Ma et al., 2019; Imathlu, 2017). Additionally, the health authorities conduct inspections of food vending sites to ensure street food vendors' compliance with guidelines on food sanitation and safety standards (Mazi et al., 2023). Furthermore, identifying street food vendors' food safety knowledge and the level of implementation of food safety policies and procedures can help improve street food safety for consumers. Also, street food vendors' deficiency areas can be determined, and strategies can be developed to improve street food vendors' food handling practices. The findings from this research can be used to improve the existing food safety policies and procedures.

1.4 SIGNIFICANCE OF THE STUDY

This research study will benefit street food consumers, the Ministry of Health (both at the local and state levels) and the street food vendors implementing the NFSPPs. The data of this study will be added to the existing body of knowledge about the NFSPPs, street food vendors' food safety knowledge and attitudes toward implementing NFSPPs to ensure the safety of street food for consumers. Presently, there is limited research on street food vendors' food safety knowledge and their NFSPPs implementation in Oyo State, Nigeria.

1.5 AIM

This research aims to investigate the food safety knowledge of street food vendors and the implementation of food safety policies and procedures in Oyo State, Nigeria.

1.6 OBJECTIVES

The objectives of the study were to:

1. Investigate the enforcement of national food safety policies and procedures by street food vendors in Oyo State, Nigeria.
2. Assess the knowledge of street food vendors on national food safety policies and procedures.
3. Assess the effectiveness and attitudes of authorities towards the enforcement of national food safety policies and procedures.
4. Develop a training framework for street food vendors on food safety knowledge and national food safety policies and procedures.

1.7 THE RESEARCH QUESTIONS

1. What is the level of implementation of the national food safety policies and procedures by street food vendors?
2. What is the level of food safety knowledge of street food vendors on national food safety policies and procedures? Moreover, what attitudes do they have towards food safety knowledge on the national food safety policies and procedures?
3. What are the effectiveness and attitudes of the authorities in enforcing national food safety policies and procedures?

1.8 ASSUMPTIONS OF THE STUDY

The validity and reliability of the research questionnaire instruments were tested in a pilot study with 30 street food vendors. This exercise was done to ensure that the instrument's content is appropriate and valuable for the purpose and goals of the research study and that the contents are appropriate for measuring what it is supposed to measure (Kusi Amponsah et al., 2020; Machin et al, 2018).

1.9 LIMITATIONS OF THE STUDY

The sample of street food vendors was limited to those who had been operating a food vending business for more than a year in Oyo State, Nigeria, and who were supposed to implement the NFSPs. Street food vendors in this sample are represented in three senatorial zones of Oyo State. The response rate from the cross-sectional survey reflects the sampled street food vendors that were sampled. Likewise, the lack of street food vendors' cooperation with the NFSPs and accuracy in self-reporting information were additional limitations. All questionnaires were completed using face-to-face interviews with the respondents.

1.10 LAYOUT OF THE THESIS

This research study has four chapters, which are arranged as follows:

CHAPTER 1 (INTRODUCTION): Serves as the introduction to the study. It gives an overview and background to the study. This section also describes the problem statement, the purpose of the study, the significance of the study, the assumptions of the study, the limitations of the study, and the layout of the thesis.

CHAPTER 2 (LITERATURE REVIEW): Provides the literature review of an overview of existing literature on street food, factors affecting the consumption of street food, the socio-economic aspect of street food vendors, street food vendors in Nigeria and challenges, operational policies and regulations of street food vending in Nigeria, street food vending food safety concerns, and foodborne diseases associated with contaminated foods.

CHAPTER 3 (Research) Outlined the research area, data collection methods and research instruments.

CHAPTER 4 (GENERAL CONCLUSION AND RECOMMENDATIONS): Provides the conclusions of the research study findings and recommendations for improvements. The list of references and appendices then follows.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

The fast-growing population globally made it essential for people to consume street food. Street food is found in all countries of the world, but its roots trace back to ancient cultures such as Rome, Egypt, and China in the 12th century (Kelly, 2014; Sousa et al., 2022). In developing countries with low income, such as Nigeria, there is a notable increase in the fast-food industry because street foods have a different method of processing and selection of ingredients (Mohammed & Shehasen, 2020), and many urban dwellers who lack resources and time to prepare food at home depend on street food (Oloko & Ekpo, 2021). Street foods serve as snacks to tourists, and they vary in nature, aroma, and appearance (Fusté-Forné, 2022).

The street food is prepared daily to retain its freshness and taste by the street food vendors. It is supplied to consumers for immediate consumption with no additional preparation to meet their dietary needs (Rosales, Linnemann & Luning, 2023). In developing countries like Nigeria, the intake of street food is high because it is cheap, attractive, convenient and accessible, especially to individuals who spend long hours at work (Adeosun, Oosterveer & Greene, 2023; Leshi & Leshi, 2017). In Nigeria, it is found that preparing these meals at home is more expensive than buying them from street food vendors (Mazi et al., 2023).

2.2 FACTORS AFFECTING THE CONSUMPTION OF STREET FOOD

Almost 2.5 billion people globally consume street food as a common practice, mostly in places with low employment chances (Mohammed & Shehasen, 2020). However, the research studies conducted in China attributed the consumption of street foods to reasonable prices, portability, availability and ready-to-eat (Kowalczyk & Kubal-Czerwińska, 2020; Atinkut et al, 2018). Street foods are sold in busy open areas such as busy street corners, bus stations on a stand, railways, beaches and pavements where consumers can have access to the food (Rosales Chavez et al., 2021; Mjoka, Selepe & Preez, 2016).

Nevertheless, most consumers are not concerned about the safety, hygiene and quality of the food, but they are attracted by the appearance of the food (Imtiyaz, Soni, & Yukongdi, 2021; Young & Waddell, 2016). In contrast, consumers of street foods

are exposed to the consumption of unhygienic food because most street food vendors expose food to the consumer for visibility (Negassa et al., 2023; Mwove et al, 2020). Generally, street food vendors lack basic amenities that affect food safety at every critical stage, such as the purchase of raw food ingredients and food storage stages (Mazi et al., 2023; Huynh-Van et al., 2022). The foods are prepared at the vending site or homes and displayed at the roadside (Lah et al, 2022).

2.3 SOCIO-ECONOMIC ASPECT OF STREET FOOD VENDORS

Food safety is vital to human health because it contributes to the economic growth and social stability of the nation (Hendriks et al., 2023; Vågsholm, Arzoomand & Boqvist, 2020). Pilato, Séraphin and Yallop (2020) highlight the significance of street food vending in developing countries as it provides an opportunity to cultivate business skills with minimal financial investment. This food vending business made the street food vendors free from paying taxes without formal recognition (Abdullah, Carr & Lee, 2023). The demand for street food has increased in major cities because the majority of urban residents depend on street food as a significant portion of their diet (Adeosun, Greene & Oosterveer, 2022). Likewise, street food provides low-priced, nutritious meals for low-income dwellers in developing countries (Sgroi, Modica & Fusté-Forné, 2022; Nakpathom et al., 2021). The impact of street vending business in developing countries has increased the provision of employment, boosted entrepreneurial activity, improved food security and helped lessen poverty (Rajabu, 2022; Sarker et al., 2019).

2.4 STREET FOOD VENDORS IN NIGERIA AND CHALLENGES

African street food vendors are faced with several challenges, although larger people depend on their food as a leading source of nourishment (Adaku et al., 2024). In Nigeria, street food vendors are found in public places such as motor parks, markets and schools where they can find a high number of customers (Mazi et al., 2023). The consumption of street food is common among the working-class group in Nigeria because of accessibility, availability, and affordability (Beniwal & Mogra, 2023; Hayden, 2021). The high demand for street food has helped to promote the sale of agricultural products such as livestock products, vegetables, and grains (Resnick et al., 2022). Likewise, street food consumers are willing to consume street foods without considering the quality of the food (Khanna et al, 202).

Research studies in developing countries identified global concern about the safety of street food for consumers, which calls for improvements (Alimi, 2016; Alimi & Workneh, 2016; Onyeaka et al., 2021). In Nigeria, the street food vending business is ever-growing, increasing the employment rate and reducing the crime rate (Mazi et al., 2023). The environmental conditions in developing countries, including Nigeria, such as warm temperatures, offer encouraging conditions for microbial growth; hot weather, inadequate vending sites, and a dusty environment (Alimi, Lawal & Odetunde, 2022). In Nigeria, street food vendors lack access to basic hygienic amenities such as potable water, rubbish bins, and clean toilets (Odipe et al, 2019). Food prepared under these conditions is not far from the risk of contamination (Alimi, Lawal & Odetunde, 2022; Kamboj et al., 2020).

2.5 OPERATIONAL POLICIES AND REGULATIONS OF STREET FOOD VENDING IN NIGERIA

The Federal Government of Nigeria had food safety regulations for the food handlers to promote food safety, prevent the incidence of food contamination, maintain adequate sanitation, and promote public health and safety (Onyeaka et al., 2021). Street food vendors did not have a specific allocated place for operation, although the street food vendors were required to obtain a permit for operation from the Environmental Health Authority (Edeme & Nkalu, 2018). The regulations of street food vending business are usually done at the Local Government level in Nigeria by the Environmental Health Officers (Amfani-Joe, 2017). The food regulations in Nigeria are in place to regulate private and public sector relationships with the aim of maintaining adequate sanitation, promoting public health and safety. The Department of the Federal Ministry of Health, under the unit of the Environmental Health Authority, controls food safety regulations at the state and local government levels in Nigeria (Ezirigwe, 2018).

2.6 STREET FOOD VENDING FOOD SAFETY CONCERNS

The safety of street food cannot be ignored because it serves as a means of food contamination and foodborne disease. The primary purpose of a food vending business is to produce healthy food without any health hazards and to avert the consequences associated with a lack of safe food production, to avoid the costs associated with food contamination. Factors such as quality of raw materials, storage

practices and food preparation method may affect the quality of street foods (Rosales, Linnemann & Luning, 2023; Salamandane, Malfeito-Ferreira & Brito, 2023; Salamandane et al., 2021).

The use of dirty utensils, untreated water, poor hygiene and poor personal hygiene by the street food vendors serves as a transmission medium between the street food vendors and food (Ghosh, 2023; Nizame et al., 2019). The challenges of food safety vary globally; these challenges include inadequate access to basic infrastructures in the vending areas, poor working conditions, lack of food safety knowledge and inadequate monitoring of the authorities (Islam et al., 2024; Adaku et al., 2024; Barnabas et al., 2024; Desye et al., 2023).

Street food vending business is growing globally, leading to the production of safe food (Mazi et al., 2022). The production and selling of unhygienic foods to consumers is a great concern, which may result in the consumption of contaminated food that may cause foodborne diseases (Mwove et al, 2020; Mohammad et al., 2018). Diarrhoea, a foodborne disease, has resulted in deaths in many people, especially in developing countries, including Nigeria (Nordhagen, 2022; Ugboko et al., 2020; WHO, 2015). According to Irelosen, Paul and Noel (2022), “Amongst children below five years old, diarrhoea accounts for over 16% of deaths, estimated at 150,000 annually in West Africa”.

The food preparation method may influence food contamination during food preparation. Food handlers who have poor personal hygiene can be potential sources of food contamination during food preparation (Zenbaba et al, 2022). A review study in the United States on food poisoning outbreaks identified that 97% of reported food poisoning outbreaks were associated with improper food handling processes during food preparation by the food handlers (Akabanda, Hlortsi & Owusu-Kwarteng, 2017). Similarly, there was a gap between food handlers in Bole sub-city, Addis Ababa, Ethiopia, and food safety knowledge, resulting in poor hygienic conditions and poor food hygiene practices by the food handlers (Abdi et al., 2020). Food safety training programmes are recommended for food handlers regularly to improve their food safety knowledge (Teffo & Tabit, 2020).

2.7 FOODBORNE DISEASES ASSOCIATED WITH CONTAMINATED FOODS

Foodborne diseases are foodborne infections or food poisoning that are usually caused by consuming contaminated food or water (WHO, 2020; Bhalla et al, 2019). In developing countries, foodborne disease is caused through infected food handlers, the use of unsafe raw food materials, poor food handling and preparation, lack of potable water, inadequate storage facilities and lack of food safety knowledge (Yemane & Tamene, 2022; Ling, Hassan & Regina, 2021). The World Health Organisation estimated 33 million deaths globally from foodborne diseases annually due to the consumption of contaminated food (WHO, 2020). According to Abebe, Gugsu and Ahmed (2020), 'the main causes of foodborne illness are bacteria (66%), chemicals (26%), virus (4%) and parasites (4%).

The symptoms of foodborne diseases resulting from the consumption of contaminated foods include diarrhoea (which may be watery or bloody), vomiting, nausea, fever and abdominal pain, which usually occur hours to days after ingestion of the contaminated food (Bintsis, 2017; Elbehiry et al., 2023). In severe cases, foodborne disease symptoms may extend to headache, muscle aches, dehydration, fatigue, and, in vulnerable populations such as children, pregnant women, the elderly, and immunocompromised persons, complications such as kidney failure, septicaemia, neurological disorders, or miscarriage may occur (Switaj, Winter & Christensen, 2015; Gourama, 2020). The severity and period of foodborne disease symptoms mostly depend on the type of food contaminant, the infectious dose, and the individual's immune status (Odo, Uchechukwu & Ezemadu, 2021; Gazu et al., 2023).

Globally, over 600 million foodborne diseases were reported from 31 different foodborne diseases in 2010 namely: Norovirus, *Campylobacter* spp., Enteropathogenic *Escherichia coli*, Enterotoxigenic *E. coli*, Shigatoxin-producing *E. coli*, Non-typhoidal *Salmonella enterica*, *Shigella* spp., *Vibrio cholerae*, *Cryptosporidium* spp., *Entamoeba histolytica*, *Giardia* spp., Hepatitis A virus, *Brucella* spp., *Listeria monocytogenes*, *Mycobacterium bovis*, *Salmonella Paratyphi A*, *Salmonella Typhi*, *Toxoplasma gondii*, *Echinococcus granulosus*, *Echinococcus multilocularis*, *Taenia solium*, *Ascaris* spp., *Trichinella* spp., *Clonorchis sinensis*, *Fasciola* spp., Intestinal flukes, *Opisthorchis* spp., *Paragonimus* spp., Aflatoxin, Cassava cyanide and Dioxins (Havelaar et al., 2015; Hoffmann et al, 2017; Lee &

Yoon, 2021; Pires & Devleesschauwer, 2021). The death in developing countries caused by diarrheal diseases from the consumption of contaminated food is the second leading cause of death (Ugboko et al, 2020). In Nigeria, 90,000 foodborne disease cases occur annually through the consumption of contaminated food and water, although there is limited information on the foodborne disease (Christiana Cudjoe et al., 2022). Foodborne diseases may be mild, severe or deadly. The symptoms of foodborne diseases include vomiting, diarrhoea, abdominal pain, dry mouth, headaches, flu-like symptoms (backache, fever and chills), nausea and trouble in swallowing (Guptaa & Chaudharyb, 2022).

Globally, the majority of foodborne diseases are linked to the consumption of contaminated food through the consumption of street food because contaminated food spreads pathogenic microorganisms that cause diseases (Hamaideh et al., 2024). Likewise, the environment in which street food is prepared exposes it to heavy metals, dust, and chemical hazards such as pesticide residues, which contribute to foodborne diseases (Rakha et al., 2022; Ahmed et al., 2019). The health hazard and economic loss posed by the consumption of contaminated food are a global concern (Focker & van der Fels-Klerx, 2020; Rather et al., 2017). According to Chen et al (2024), several foodborne disease outbreaks have been reported to be associated with food handlers' poor personal hygiene of foodstuffs. The attitude of the street food vendors such as inadequate protection of street food from flies by the street food vendors, lack of hand washing facilities, unusual disinfection of vending facilities, lack of organised refuse disposal, and lack of adequate storage facilities can result into outbreaks of foodborne disease (Desye et al., 2023; Hassan& Fweja, 2020; Lamin-Boima, 2017).

Food safety hygiene practices such as food hygiene education, correct food preparation methods, handling and storage, if adequately carried out by the street food vendors, can prevent foodborne diseases (Islam et al., 2024; Negassa et al, 2023). According to de Andrade et al (2019), in many countries, the consumption of food prepared outside the home increases the exposure to the risk posed by poor hygiene in foodservice.

2.8 CONCEPTUAL FRAMEWORK

The food safety lies in the hands of two leading entities (authorities and SFVs) (Figure 2.1) who are supposed to influence the implementation of national food safety policies

and procedures (Onyeaka et al., 2021; Khairuzzaman, 2014). If the two entities fail in their responsibility, the risk of foodborne diseases is inevitable (Boatema et al., 2019). If they both play their roles in implementing the NFSPs, indeed, there would be a reduction in the risk/risk of foodborne diseases (Nkosi & Tabit, 2021; Imathiu, 2017). The first entity is the authorities, while the other entity is the SFVs. The primary responsibility of the authorities is to train and enforce the implementation of the NFSPs through thorough monitoring and supervision of the SFVs, and this will help to influence the SFVs to produce quality foods that provide beneficial nutrients for the consumers (Asiegbu, Lebelo & Tabit, 2020). Most SFVs lack adequate food safety knowledge, which affects their behaviours and attitudes during food handling and preparation, making it difficult to implement NFSPs (Kanaan et al., 2023; Putri & Susanna, 2021; Elobeid, Savvaidis & Ganji, 2019). The SFVs food safety behaviour and attitudes can be a critical point to monitor and control foodborne disease outbreaks because the quality and safety of food depend on the hygiene standard of the SFVs (Labović et al., 2023; Al Banna et al., 2022). Similarly, SFVs have the responsibility to implement NFSPs to prevent contamination during food preparation that may lead to the risk of foodborne diseases (Figure 2.1) (Nneoma, 2024). Contamination may occur through a lack of clean water supply at the vending premises, inadequate food storage facilities, unhygienic food personnel, unhygienic vending environment, lack of adequate hand-washing facilities, lack of rubbish bins and toilet facilities (Mwove et al., 2020). Following the policies and procedures will assure quality production of hygienic foods for the consumption of the consumers. All these are diagrammatically represented in the conceptual framework as follow:

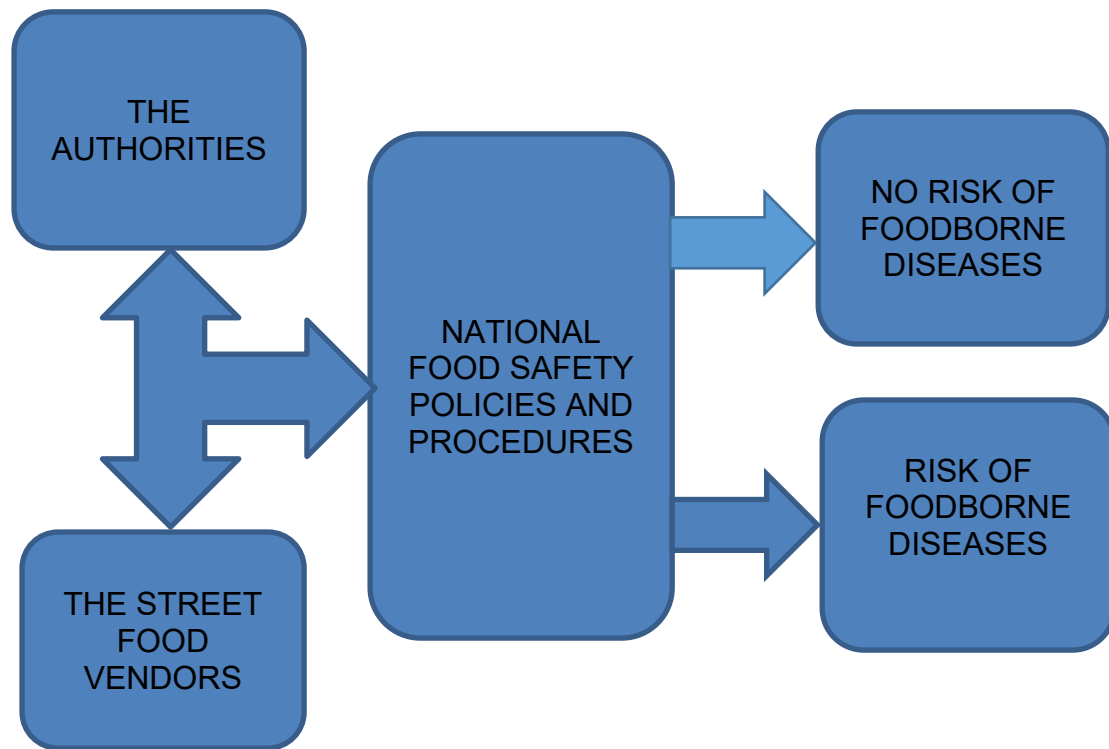


Figure 2.2: Conceptual framework for the study

CHAPTER 3: RESEARCH

3.1 AN INVESTIGATION INTO THE ENFORCEMENT AND COMPLIANCE WITH FOOD SAFETY REGULATIONS AT STREET FOOD VENDING SITES IN OYO STATE, NIGERIA

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3.1.1 Abstract

The inadequate enforcement and compliance with sanitary regulations and the lack of sanitary regulation resources at street food vending sites may result in the risk of food contamination and outbreaks of foodborne diseases. This study aimed to assess the enforcement and compliance with sanitary regulations at street food vending sites in Oyo State, Nigeria. A cross-sectional survey research design was used for this study, in which data was collected from 600 street food vending sites in various towns in different senatorial zones in Oyo State, Nigeria. Street food vendors who were available and willing to participate in the study were then sampled conveniently. A structured sanitary compliance checklist was used for data collection at street food vending sites from 2023 to 2024. Most street food vendors were female (89.7%) and above the age of 46. The vast majority of street food vending sites (75.7%) had low compliance with food safety regulations, 12.5% had moderate compliance, and 11.8% had high compliance. 85.7% of the street food vending sites had not been inspected by the authorities. Regarding enforcement of sanitary requirements by health inspectors, 85.7% of street vended facilities had not been inspected. The enforcement and compliance with sanitary requirements at street food vending sites were found to be low and therefore, the sanitary conditions and food safety practices at these sites cannot be guaranteed. A positive correlation exists between sanitary compliance and the enforcement of sanitary requirements at street food vending sites. It is recommended that municipal authorities register all the street food vending sites, to enable effective monitoring in ensuring that food safety regulations are implemented at street food vending sites.

Keywords: Food safety; monitoring; compliance; street food; vending sites

3.1.2 Introduction

Street-vended foods are ready-to-eat foods prepared and sold in public places (Desye et al., 2023). Globally, street-vended foods may serve as a vital source of affordable nutrition for a significant portion of the population due to their proximity to residential and commercial areas (Imathlu, 2017; Salamandane Malfeito-Ferreira & Brito, 2023). Street foods remain an important meal option in most developing countries, including Nigeria, and have contributed to the daily nutrient intake of consumers (Steyn et al., 2014). The economic importance of street food vending activities cannot be underestimated as they provide self-employment opportunities to those who cannot gain employment in the formal sector (Mazi et al., 2023). The sale of street-vended foods constitutes a major source of income for self-employed individuals from low-income communities (Nkosi & Tabit, 2021). Street food vendors are mostly located in parks, bustling street corners, transportation hubs, public squares, marketplaces, commercial districts, and cultural and tourist attraction centres, where potential street food consumers can be found (Adeosun, Greene & Oosterveer 2022). These areas are hotspots for street-vended food activities due to the presence of offices and businesses, heavy pedestrian traffic and the influx of visitors from other areas (Adaku et al., 2024). This setting encourages street food vending activities due to the provision of quick, convenient foods with diverse tastes and preferences, making them ideal destinations for diverse culinary experiences (Nkosi & Tabit, 2021).

The rapid urbanization and population growth in some developing countries, such as Nigeria, have created a favourable environment for street food businesses (Ejaro & Abubakar, 2013). The rise in population translates to more individuals with disposable income seeking cheap and convenient alternative meals away from home (Imathlu, 2017; Khairuzzaman et al., 2014). Street foods play an important role in the everyday lives of Nigerians, offering different flavours, textures, and cultural experiences (Mazi et al., 2023; Sgroi, Modica & Fusté-Forné, 2022). Despite their accessibility and popularity, street-vended foods constitute an important public health issue due to a lack of adequate understanding of food safety procedures (Rane, 2011).

The enforcement of food safety regulations at street food vending sites is often inefficient due to the overwhelming non-compliance with food safety regulations by

street food vendors (Grangxabe et al., 2024). The vastness and the informal nature of street food vending activities can render monitoring and enforcement efforts by health inspectors ineffective due to the setting up of street food vending activities at non-designated areas (Nkosi & Tabit, 2021; Mwove et al., 2020). Most street food vending activities are not regulated and are often associated with poor sanitation and food safety practices, constituting a public health risk (Nkosi & Tabit, 2021). Most street food vendors have not undergone food safety training and are often not aware of existing food safety regulations and therefore do not comply with these regulations (Adeosun, Greene & Oosterveer 2022; Onyeaka et al., 2021). Furthermore, low levels of enforcement of sanitary regulations at street food vending sites mean street food vendors are unlikely to comply with sanitary regulations, hence the risk of food contamination at street food vending sites (Amaami, Dominic & Collins, 2017). The sale of contaminated street-vended food under these instances, will remain a potential health risk to consumers (Nkosi & Tabit, 2021; Khairuzzaman et al., 2014). Non-compliant street food vending sites often lack access to electricity, potable water, waste disposal systems and food preparation equipment, and these conditions can contribute to unhygienic practices at street food vending sites (Marutha & Chelule, 2020). The absence of potable water specifically can render washing of hands and cleaning of surfaces and utensils ineffective (Putri & Susanna, 2018). The consumption of contaminated street-vended food by consumers can lead to foodborne disease outbreaks, which in turn, will lead to hospitalization and cost productivity losses due to illness and even death, especially in people with weak immune systems (Gargiulo et al., 2022). Oyo State is among the many states in Nigeria with increasing urbanization, which is accompanied by expanding street food vending activities (Ejaro, & Abubakar, 2013). The findings from this study will provide detailed information on the extent of compliance and enforcement of food safety regulations, which will provide the basis for action by municipal authorities and other stakeholders to harmoniously balance the needs of vendors and consumers (Elshater & Abusaada, 2024). This study aimed to assess the enforcement and compliance of food safety regulations at street food vending sites in Oyo State, Nigeria.

3.1.3 Research Methodology

The study area

This study was conducted in the three senatorial zones (Oyo Central, Oyo North and Oyo South) of Oyo State. The headquarters of all the 33 local government areas (LGAs) within the senatorial zones were targeted. The Oyo State is in the southwest of Nigeria and has a population of around 7,976,100 inhabitants (Haastrup et al., 2020). Agriculture is the cornerstone of Oyo State's economy because of fertile land and a favourable climate. In addition, the investment in Agriculture by the Government has led to higher wages and income generation in the state (Edafe et al., 2023). These activities have prompted rural-to-urban migration to vibrant commercial centres and dynamic trade sectors for regional economic opportunities (OYSIBS, 2023). Oyo State is home to many educational institutions, including universities, colleges, and secondary schools, and it has an influx of students who contribute to the human capital of Oyo State (Ezegwu & Okoye, 2024). Street food vending has benefited the human capital with disposable income in Oyo State (Verma et al., 2023).

Research design and sampling

A cross-sectional survey research design was used to collect data from many different street food vendors at a single point in time (Addo-Tham et al., 2020). A random draw was used to select five Local Government Areas from the list of each of the three senatorial zones in Oyo State (NPCN, 2021). Street food vendors were purposefully sampled in the headquarters of the 15 selected Local Government Areas. Forty street food vendors, individuals who sell food or drinks in public spaces, such as streets, sidewalks, or other outdoor areas, irrespective of their structures and who were available and willing to participate in the study, were then sampled conveniently per Local Government Area. A total of 600 street food vendors and their vending sites were used for the study. The study sample size (n) was estimated using Cochran's formula for a large population.

Data collection

The data collection instrument consisted of a structured sanitary compliance checklist designed purposefully for this study. The checklist had three sections: socio-demographics, characteristics of street food vending facilities, and sanitary

requirements checklist. A pilot study was conducted using 30 street food vendors, and the information was used to ascertain the validity and reliability of the instrument. The instrument's reliability was assured by administering the same questionnaire to the pilot group respondents at two different points in time, and a Cronbach's Alpha value of 0.7 and above was used to establish the internal consistency of the constructs. Furthermore, review feedback from 2 experienced researchers in food safety to ensure content validity. The sampled street food vendors were approached individually, and those interested in participating in the study were asked to sign the consent form before the data collection session. They were informed of the right to withdraw from the study anytime they wished. Data collection was done through face-to-face interviews with each respondent in a session that lasted twenty-five minutes in 2022. The questions were read to the respondents, and the researcher noted the responses anonymously. Ethics clearance with the reference 2021/CAES_HREC/037 was obtained from the UNISA-CAES Health Research Ethics Committee.

Statistical analysis

Data were analysed using the Statistical Package for Social Sciences (SPSS), IBM version 23. Descriptive statistics were used to observe the mean and frequency of variables. To calculate the sanitary compliance score, 1 point was assigned for each observed compliance requirement and 0 for non-compliance to a maximum total point of 33 (thirty-three), representing 33 sanitary requirements. To calculate the enforcement effectiveness score, 1 point was assigned for each inspection activity in the past year and otherwise a 0 for no observation activity, to a maximum of 2 enforcement points per street food vending site. The sanitary compliance and enforcement scores were assessed as follows: Low compliance (0–49%), moderate compliance (50–74%), and high compliance (75–100%). The nonparametric analysis of variance (ANOVA) was used to determine the difference in the compliance score between the factors of the independent variable and the relationship between the sanitary compliance score and the enforcement score. The Spearman rho correlation analysis was used to determine the correlations between sanitary compliance and enforcement of sanitary requirements at street food vending sites. Statistical significance was considered at $p \leq 0.05$.

3.1.4 Results and Discussions

Socio-demographic details of respondents

The socio-demographic result data of street food vendors involved in this study are presented in Table 3.1. Most street food vendors in the study were female (89.7%). A similar finding of 90.2% was reported by Mahopo et al. (2022) in a study conducted in the Vhembe district, South Africa, where female street food vendors were more than their male counterparts (Mahopo et al., 2022). The reason was that the street food vending business focused on meal preparation and serving, which usually involved women. In most African countries, women are often entrusted with the task of preparing and serving food, hence learning cooking skills from a young age. It is, therefore, not surprising that most street food vendors in this study were women (Letuka Nkhebenyane & Thekisoet al., 2021). In Nigeria, some women often engage in street food vending, which is a form of self-employment that generates income to support their families (Okojie & Isah, 2014). The results reveal that street food vending is a source of employment for some women, enabling them to contribute to the local economy (Sousa et al., 2021; Roy et al., 2023).

The majority of street food vendors had primary school (54%) as their highest education, while 26.8% had no formal education, and only a few had attained secondary (16.3%) or tertiary education (2.8%). This result is similar to those in a study conducted in Ghana in 2022 (Nortey et al., 2024) and in Ethiopia between December 2013 and June 2014 (Adane et al., 2018), where the primary school was the highest level of education for most street food vendors. This is because some cultural groups in these countries predominantly prefer boys to attend primary school, at the expense of girls (Monterrosa et al., 2020). In this study area, the lower level of education may be due to certain African cultures, where girls are typically limited to receiving only primary education, whereas boys are prioritised for further education (Salamandane, Malfeito-Ferreira & Brito, 2023). Girls are confined to domestic duties, giving rise to unequal educational and training opportunities when compared to male children (Monterrosa et al., 2020). Furthermore, street food vendors often hail from lower-income families and hence may not have enough financial means to afford secondary and higher education for their children (Salamandane Malfeito-Ferreira & Brito, 2023; Verma et al., 2023). Even though a higher level of education for a food handler does not always translate to high food safety knowledge and awareness, food handlers with

higher levels of education can easily grasp food safety concepts when exposed to educational materials (Wen et al., 2023). The governments of Nigeria should provide free post-primary education to low-income populations to enable them to acquire sufficient academic aptitude that can enhance the assimilation of content during food safety, hence likely to comply with sanitary regulations (Lian, Pei & Li, 2024).

Up to 60.5% of the street food vendors have been involved in street food vending for more than 11 years, among which 27.3% have done so for more than 15 years. A study conducted in Ghana in 2014 found that 80% of the street food vendors have been engaged in the street food vending business for the past decade, and the reason provided was the increasing interest in street food vending businesses (Monney et al., 2014). Mahopo et al. (2022), in a study conducted in the Vhembe district in 2019, found that most street food vendors in rural South Africa have been operating for the last ten years, since it is their primary source of income (Mahopo et al., 2022). Street food vendors who have worked for many years must have accumulated street food vending experience and generate vital income from it (Pick, Ross & Dada, 2002). These street food vending sites are strategically placed in areas with high human traffic, such as city centres, open-air markets, motor parks, and or event sites to ensure high sales volumes (Nkosi & Tabit, 2021; Marutha & Chelule, 2020). A stable street food vending business will contribute to the sustenance of the livelihood of street food vendors on a long-term basis in an environment where formal employment opportunities are limited (Salamandane, Malfeito-Ferreira & Brito, 2023). An association has been established between work experience and food safety practices of food handlers (Islam et al., 2024). Longer duration of work experience among street food vendors has been associated with better food safety and hygiene practices due to learning acquired on the job over time (Bantie et al., 2023).

Results on the characteristics of the street food vending sites of street food vendors are presented in Table 3.1. Most (55.6%) street food vendors had no street food vending facilities or were operating in makeshift street food vending facilities; only 44.4% had a permanent street food vending structure, and none had a mobile food unit. Similar results were reported in a study conducted in the Zululand District and Marabastad open market (Nkosi & Tabit, 2021) in South Africa, in which the majority of the street food vendors lack permanent food vending facilities. The lack of finance to construct proper food vending facilities is a significant challenge facing street food

vendors (Alimi, 2016; Ndaba & Reddy, 2024). The lack of proper food preparation facilities, essential sanitary resources, and food preparation equipment hampers good hygiene (Mazi et al., 2023). Poor sanitation and inadequate food preparation facilities can lead to food contamination and non-compliance with food safety standards (Nkosi & Tabit, 2021; Insfran-Rivarola et al., 2020).

The vast majority (95%) of street food vendors did not possess a valid permit or license to operate as street food vendors. Similarly, Hill et al. (2019) report that most street food vendors in Central Cape Town, South Africa, were unlicensed due to the lack of awareness of the administrative processes to get one (Hill et al., 2019). Due to low enforcement and monitoring of food safety regulations, many street food vendors may not be aware of licensing procedures (Nkosi & Tabit, 2021). Furthermore, street food vendors have been found to lack the finances to afford proper facilities and licensing fees (Moges, Rodland & Argaw, 2024; Azanaw et al., 2021), which results in only a few street food vendors having operating licenses. The high number of street food vendors operating without a permit means that the monitoring and enforcement of street food vending cannot be effective (Rosales, Linnemann & Luning, 2023). The lack of monitoring can lead to the perpetuation of unhygienic practices at street food vending sites and the potential to expose consumers to food safety risks (Olajubutu, Ologundudu & Adegbite, 2021; Mjoka & Selepe, 2017).

Table 3.1: Characteristics of street food vending sites (n = 600)

Variables		Frequency (%)
A1: Gender	Male	62(10.3)
	Female	538(89.7)
A2: Level of education	No formal education	161(26.8)
	Primary school	324(54.0)
	Secondary school	98(16.3)
	Tertiary education	17(2.8)
A3: Period of selling food (years)	Less than 5 years	99(16.5)
	5–10 years	138(23.0)
	11–15 years	199(33.2)
	More than 15 years	164(27.3)
A4: Foodservice/ hospitality diploma/degree obtained?	Yes	45(7.5)
	No	555(92.5)
A5: Food safety training attended	Yes	116(19.3)
	No	484(80.7)
	Yes	409(68.2)

A6: First place to work as a street food vendor	No	191(31.8)
A7: Average monthly income	Less than #30,000	177(29.5)
	#30,001 - #40,0000	185(30.8)
	#40,0001 - #50,000	177(29.5)
	Above #50,000	61(10.2)
A6: Street food as primary source of income	Yes	525(87.5)
	No	75(12.5)
B1: Senatorial sector	1 Oyo Central	200(33.3)
	2 Oyo North	200(33.3)
	3 Oyo South	200(33.3)
B3: Premise characteristics	1 Roadside with no shelter/facility/premise	113(18.8)
	2 Roadside with makeshift shelter	221(36.8)
	3 In a permanent facility/permanent building	266(44.4)
	4 Mobile food unit	0(0.0)
B4: Possession of a valid license/permit	1 Yes	30(5.0)
	2 No	570(95.0)

Compliance of street food vendors with sanitary regulations

Results on the compliance of street food vending sites with the food sanitation regulations of Nigeria are presented in Table 3.2. Sanitary requirements with more than 80% compliance were observed for clauses relating to non-exposure of cooked and uncooked food items (80.5%), availability of enough potable water at the vending premises (83%), presence of detergents for cleaning (83.7%), and no wounds or the exposure of wounds (93%). A similar result was reported by Olajubutu et al. (2021) in which most street food vendors in Afijio Local Government Area, Nigeria, have adequate potable water at the food vending site (Olajubutu, Ologundudu & Adegbite, 2021). The presence of potable water, cleaning detergents, and the absence of wounds or exposure thereof are the minimum requirements for basic hygiene practices that consumers can accept (Okojie & Isah, 2014). Compliance with basic hygiene requirements suggests a conscientious effort by street food vendors to mitigate food safety risks by implementing basic food hygiene practices (Monney et al., 2014; Alimi, 2016).

The sanitary requirements with less than 5% compliance include painting of premises with white non-washable paint (0%), renewal of medical certificates every six months

(0%), cooked and uncooked items being sold in approved vending areas (3.5%), adequate toilet facilities (3.5%), and cleaning of utensil with hot water (4.2%). This result also corresponds with findings from research conducted in Marabastad open market, South Africa, where the street food vending facilities had low compliance, considering that food items were being sold in street food vending sites without toilet facilities and hot water supply (Nortey et al., 2024). The non-compliance with these requirements can be attributed to financial constraints in acquiring adequate infrastructure equipped with resources and food preparation equipment (Amaami, Dominic & Collins, 2017). Additionally, most street food vendors were unaware of the food safety regulations due to inadequate communication and outreach from local health authorities. Non-compliance with the aforementioned food safety regulations can lead to food contamination and the spread of foodborne diseases (Mwove et al., 2020).

Table 3.2: Compliance of Street Food Vending Sites with the Food Sanitation Regulations of Nigeria (n=600)

	Sanitation Requirements	Compliance score (%)
C1	FOOD SANITATION	
C1.1	Are the food items in a state that maintains its wholesomeness? (clause number 41)	327 (54,5)
C1.2	Am I storing the food items in a state that adheres to the highest hygiene standards? (clause number 41)	374 (62,3)
C2	FOOD PREMISES TO BE APPROVED	
C2.1	Has the food items, both cooked and uncooked exposed before being sold to the public? (clause number 42)	483 (80,5)
C2.2	Are the food items properly packaged or covered when it is being served to the public? (clause number 42)	138 (23,0)
C2.3	Are the food items both cooked and uncooked being sold in a vending area approved by the Environmental Health Authority? (clause number 42)	21 (3,5)
C3	PERMIT TO OPERATE FOOD VENDING BUSINESS	
C3.1	Is the street food vendor in possession of a valid permit from the Environmental Health Authority to sell foodstuff in this vending site? (clause number 43)	138 (23,0)
C3.2	If yes, do I renew my permit annually? (clause number 41)	86 (14,3)
C4	FOOD PREMISES SANITATION	
C4.1	Is the street food vending premises kept clean always? (clause number 44)	322 (53,7)
C4.2	Are the wastes generated from the street food vending premises properly disposed of in a rubbish bin? (clause number 44)	432 (72,0)

C4.3	Are food waste removed from all food preparation areas regularly? (clause number 44)	322 (53,7)
C5	PAINTING OF THE FOOD PREMISES	
C5.1	Is the food vending premises painted white with non-washable paint? (clause number 45)	0 (0,0)
C6	FOOD PREMISES VENTILATION	
C6.1	Is the food vending premises adequately ventilated? (clause number 46)	179 (29,8)
C6.2	Are all the openings screened to ward off the flies and other vermin? (clause number 46)	135 (22,5)
C6.3	Are the external doors made to be self-closing? (clause number 46)	71 (11,8)
C7	TOILET FACILITIES IN THE FOOD VENDING PREMISES	
C7.1	Are there adequate toilet facilities in the street food vending site? (clause number 47)	21 (3,5)
C8	BASINS FOR HAND-WASH	
C8.1	Are there basins for handwashing in the street food vending premises? (clause number 48)	161 (26,8)
C9.1	Are there clean clothes/hand towels for an individual vendor(s) in the street food vending premises? (clause 49)	79 (13,2)
C9	PROVISION FOR HAND TOWEL	
C9.2	Are there clean clothes/hand towels for individual customers in food vending premises? (clause number 49)	90 (15,0)
C10	WATER SUPPLY TO THE FOOD PREMISES	
C10.1	Is there adequate tap water for food vending activities in the food vending premises? (clause number 50)	36 (6,0)
C10.2	Is there enough water for washing of plates and washing of hand before and after eating? (clause number 1c)	498 (83,0)
C10.3	Are detergents used to clean surfaces, equipment, floors and walls in the street food vending facility? (clause number 1f)	502 (83,7)
C10.4	Is hot water used for cleaning dishes, pots and cutlery in the food vending facility? (clause number 1f)	25 (4,2)
C11	PERSONAL HYGIENE AND HEALTH OF FOOD HANDLERS (Clause 51)	
C11.1	The hair of the street food vendor(s) is properly covered and neatly kept? (clause number 2c)	348 (58,0)
C11.2	The cloths and apron of street food vendor(s) are clean and not soiled? (clause number 2d)	222 (37,0)
C11.3	Street food vendor(s) is not wearing jewels such as rings, bangles while handling food (clause number 2e)	182 (30,3)
C11.4	The fingernails of street food vendor(s) are short, clean, and unpolished? (clause number 2f)	323 (53,8)
C12	MEDICAL CERTIFICATE OF FITNESS	

C12.1	Street food vendor(s) has been examined by a qualified medical practitioner and is in possession of a valid certificate of fitness to sell food? (clause number 52)	90 (15,0)
C12.2	The medical certificate of street food vendors is being renewed every six months (clause number 52)	0 (0,0)
C13	FOOD HANDLER SUFFERING FROM INFECTIOUS DISEASE (Clause 53)	
C13.1	Street food vendor(s) is not having or have been diagnosed with an infectious disease such as diarrhoea, eye discharge or flu or related ailments? (clause number 53)	190 (31,7)
C13.2	Street food vendor(s) is not having open cuts, wounds, sores and abrasions that are not covered with waterproof dressing while handling food? (clause number 53)	558 (93,0)
C14	FOOD HANDLERS TRAINING	
C14.1	Street food vendor(s) have been attending safe food handling training approved by the Environmental Health Authority in my area on a regular basis? (clause number 54)	161 (26,8)
C15	IDEAL TEMPERATURE OF COOKED FOOD	
C15.1	Are cooked foods served hot to customers at a temperature not lower than 60°C? (clause number 55)	32 (5,3)
C15.2	Cooked food is stored hot at a temperature not lower than 60°C (clause number 55)	138 (23,0)

NB Total number of possible correct responses = 33, representing 33 sanitary requirement criteria

Regarding the overall assessment of the compliance of street food vending sites to sanitary regulations (Figure 3.1), 75.7% had low compliance, 12.5% had moderate compliance, and 11.8% had high compliance. The results from research conducted in the Marabastad open market, South Africa (Nkosi & Tabit, 2021) show a similar trend with the street food vending sites having low compliance (less than 50%) for food safety and sanitary requirements scores. The reason was that the street food vendors lacked access to infrastructure with adequate sanitary requirements such as potable water, handwashing facilities, waste disposal systems and even an electricity supply (Berihun et al., 2022). The lack of proper street food vending facilities may be because street food vendors do not have the financial resources to invest in adequate infrastructure, which could enhance their operations (Khairuzzaman et al., 2014). The informal nature of the street food vending business makes it difficult to access financial services or government assistance (Salamandane, Malfeito-Ferreira & Brito, 2023). Similarly, the lack of government support for street food vendors aggravates non-compliance with sanitary requirements (Mazi et al., 2023). The consequences of low

compliance with sanitary requirements at street food vending sites increase the likelihood of unhygienic practices and food contamination, which pose a public health risk to consumers (Odeyemi, 2016).

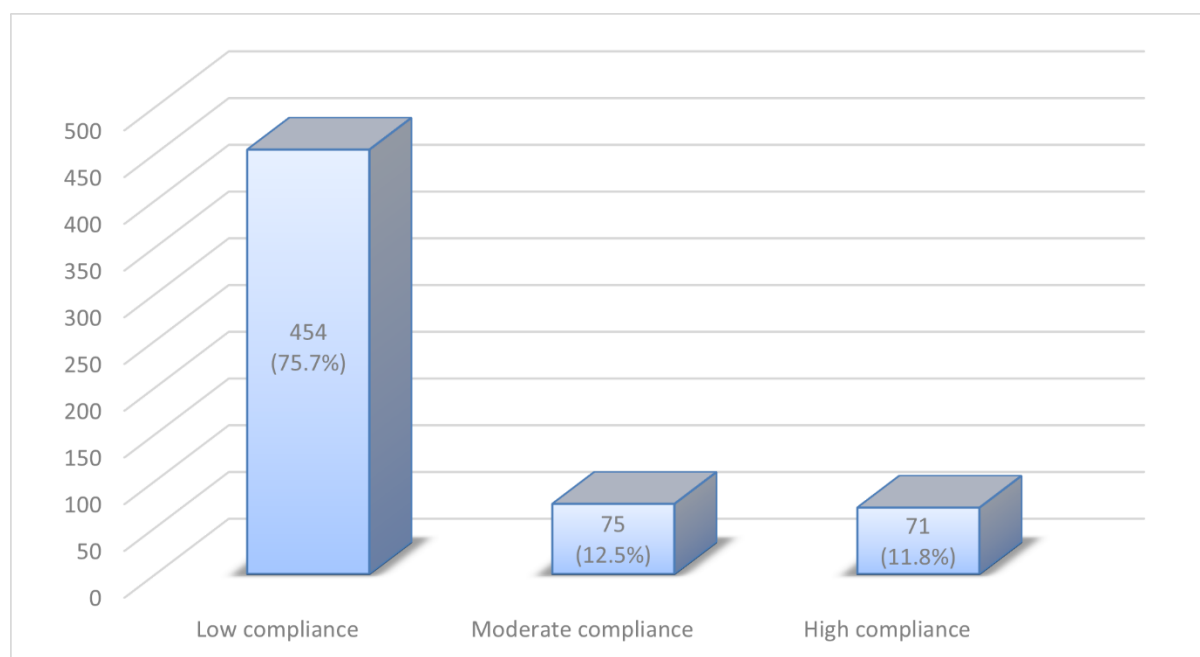


Figure 3.1: An overall assessment of the compliance of Street Food Vending Sites with the Food Sanitation Regulations of Nigeria (n=600).

NB: Low compliance (score 0-49%), Moderate compliance (score 50-74%) and High compliance (score 75-100%)

The Kruskal-Wallis test indicated that there was no significant difference in compliance with sanitary requirements among the different types of street food vending sites ($p=0.99$) and street food vending sites within different senatorial sectors ($p=0.233$) (Table 3.3). The reason there were no significant differences in compliance with sanitary regulations between street food vending sites within the different senatorial sectors and between different types of vending premises, can be attributed to the overwhelming non-compliance and lack of enforcement of sanitary regulations by authorities (Nkosi & Tabit, 2021; Enunwaonye & Olugbade, 2020). The low adherence to food sanitary regulations can lead to the risk of food contamination, increasing the risk of foodborne diseases, which can endanger the consumers' health (Tappes et al., 2019).

There was a significant difference in sanitary compliance between street food vending premises in which the owner possessed a valid license/permit and those in which the

owner did not possess a valid license/permit ($p = 0.033$) (Table 3.3). The reason is that street food vendors who possess a licence are likely to comply before the permit is issued (Koch, 2015). The street food vendors with permits are likely operating in compliance with sanitary requirements and municipal bylaws, showcasing a commitment to food safety standards to uphold the terms of their permits to ensure that their permits will be renewed (Boonjubun, 2022). The importance of having a permit implies that street food vendors will be committed to upholding sanitary standards to ensure the retention of their permits (Armas et al., 2024).

Regarding the enforcement of sanitary requirements, there was a significant ($p=0.016$) difference in the enforcement score among the senatorial sectors, with Oyo State having a relatively higher level of enforcement (Table 3.3). Lack of food safety compliance can be attributed to barriers such as the lack of trust in food safety legislation and enforcement officers, a lack of motivation in dealing with food safety legislation, and a lack of knowledge and understanding (Yapp & Fairman, 2006). The higher level of enforcement in Oyo State could be attributed to higher levels of compliance by street food vendors with food safety regulations (Huynh-Van et al., 2022). This shows that food safety regulations enforcement can be possible when municipal authorities plan and commit relevant resources to uphold bylaws (Oladipo-Adekeye & Tabit, 2021).

Similarly, there was no significant difference in enforcement among the different types of street food vending sites ($p= 0.919$) and among street food vending premises in which the owner possessed or did not possess a valid license/permit ($p= 0.216$) (Table 3.3). Nkosi & Tabit (2021) report that food vending facilities in Zululand District, South Africa, have inadequate monitoring of food safety regulations enforcement in food vending facilities (Nkosi & Tabit, 2021). The trend also corresponds with findings from research conducted in Kiambu County, Kenya (Mwove et al., 2020), where street food vending facilities lack the enforcement of authorities on appropriate food safety and hygiene practices. The informal nature of the vast street food vending activities prevents effective monitoring and enforcement of food safety regulations (Salamandane, Malfeito-Ferreira & Brito, 2023; Oladipo-Adekeye & Tabit, 2021). In many regions, limited financial resources contribute to municipal authorities' lack of consistent monitoring of street food vending sites (Amaami Dominic & Collins, 2017; Monney et al., 2014). Zones with intense informal street food vending activities can

lead to resource constraints, which hinder effective monitoring and enforcement of food safety regulations (Mazi et al., 2023).

Table 3.3: Analysis of variance of the sanitary compliance Score within location and characteristics of street food vending sites (n = 600)

Location and service types Variables		Sanitary Compliance Score		Enforcement	
		Media n	Kruska I Wallis Test	Media n rank	Kruska I Wallis Test
B1; Senatorial sector	1 Oyo Central (n=200)	294.30	0,99	294.72	0.016
	2 Oyo North (n=200)	300.12		291.43	
	3 Oyo South (n=200)	307.08		315.35	
B2: Premise characteristic	Roadside with no shelter/facility/premise(n=113)	297.20	0.233	302.25	0.919
	Roadside with makeshift shelter(n=221)	298.83		301.62	
	In a permanent facility/permanent building(n=266)	303.28		298.83	
B3: Possession of valid license/permit	Yes (n=30)	344.67	0.033	320.33	0.216
	No (n=570)	300.28		299.46	

Overall Assessment of the enforcement of sanitary requirements

Up to 85.7% of the street food vending sites had not been inspected by the authorities and only 10% were inspected, with 4.3% receiving fines for violations (Figure 3.2). A similar result was reported by Nkosi & Tabit (2021) in which 64.7% of street food vending sites in the Zululand District, South Africa were found not to have been inspected by municipal authorities (Nkosi & Tabit 2021). The reasons for the low inspection and monitoring by municipal authorities can be attributed to a lack of adequate financial, material and human resources, which include limited health inspectors, and the logistical hurdles posed by the multitude of street food vending sites located at non-demarcated areas (Amaami, Dominic & Collins, 2017). The informal nature of street food vending means that new sites are often established spontaneously in non-demarcated areas, making monitoring challenging (Nkosi &

Tabit 2021). The low rates of inspections and penalties for violations identify systemic challenges in ensuring compliance with food safety standards (Barnes et al., 2022).

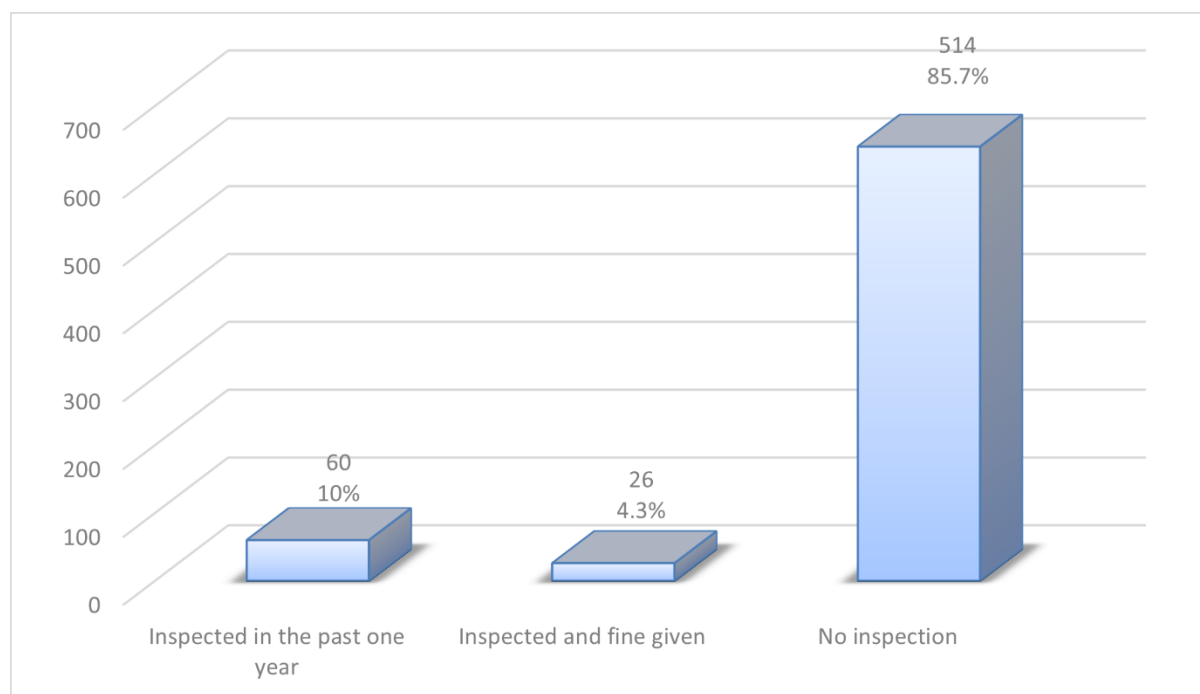


Figure 3.2: Enforcement of the food sanitary requirements by health inspectors in the past year as reported by street food vendors (n=600)

Regarding the overall assessment of the enforcement of sanitary requirements by health inspectors, 90% had low enforcement, 5.7% had moderate enforcement, and 4.3% had high enforcement (Figure 3.3). Research studies in Marabastad, Pretoria, Ejisu-Juaben Municipality, Ghana and Techiman Municipality, Ghana (Amaami, Dominic & Collins, 2017; Addo-Tham et al., 2020) show a similar trend of results, indicating that street food vending sites had low compliance (less than 50%) with food sanitary requirements. The lack of enforcement of sanitary requirements at street food vending sites is due to the vastness and informal nature of the street food vending sites, which can pose logistical challenges to municipal health inspectors due to limited resources and manpower (Nortey et al., 2024). Municipal health authorities often prioritise larger formal food businesses over street food vending sites (Salamandane, Malfeito-Ferreira & Brito, 2023). The significance of low enforcement of food safety is the increased risk of foodborne diseases, leading to potential outbreaks that can harm public health (Aluko et al., 2014).

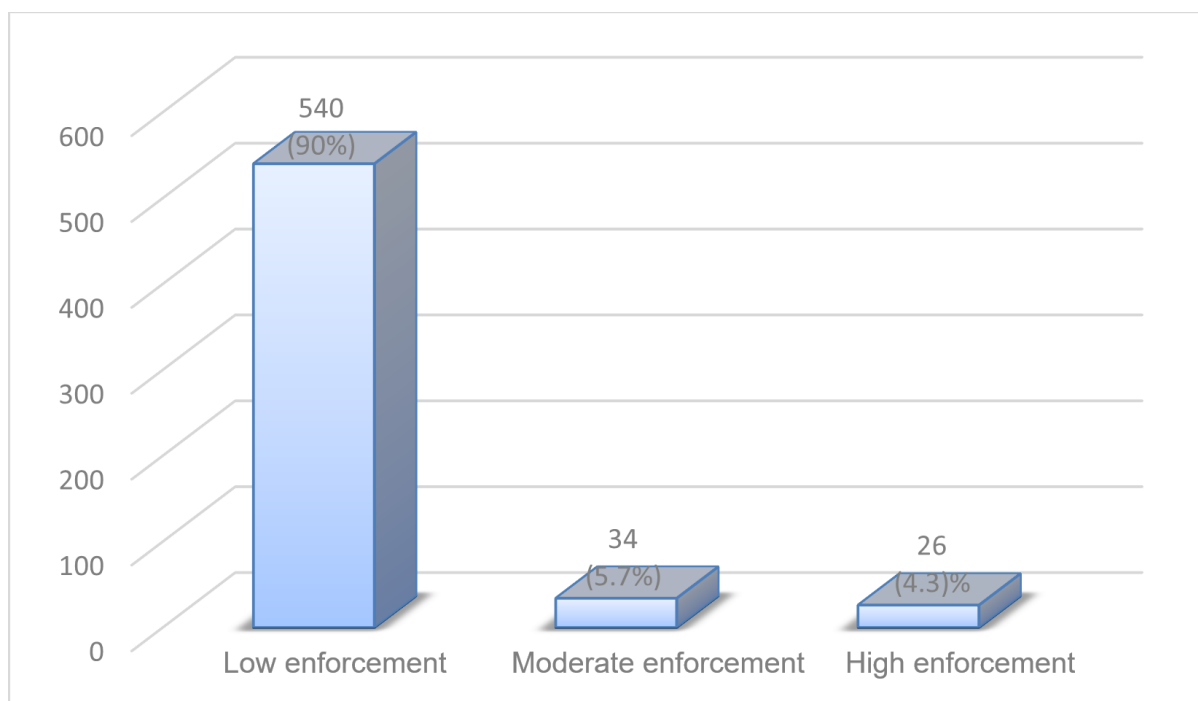


Figure 3.3: An overall assessment of the enforcement of the food sanitary requirements by health inspectors as reported by street food vendors (n=600)

NB: Low enforcement (score 0-49%), Moderate enforcement (score 50-74%) and High enforcement (score 75-100%)

There was a significant moderate positive correlation ($r=5.131$, $p=0.026$) between sanitary compliance and the enforcement of sanitary requirements at street food vending sites (Table 3.4). A similar result was reported by Mwove et al. (2020) in Kiambu County, Kenya, in which some (50%) street food vending sites that were monitored by authorities were found to have improved the implementation of food safety regulations (Mwove et al., 2020). The result suggests that as the enforcement of sanitary regulations increases, so does the level of sanitary compliance among street food vendors (Huynh-Van et al., 2022; Sarfo et al., 2025). This is because enforcement improves the street food vendors' knowledge about food safety, and as a result, their sites are improved. The result indicates that when authorities actively monitor and enforce compliance with food safety regulations, street food vendors are more likely to adhere to sanitary guidelines, which decreases the exposure of consumers to food safety risks (Insfran-Rivarola et al., 2020). Besides the lack of enforcement, other barriers to compliance with food safety regulations by street food vendors include lack of business registration and issuance of permits, limited

Resources, lack of awareness, the vast informal nature of street food vending, lack of zoning and the provision of food stalls by authorities (Sarfo et al., 2025).

Table 3.4: Spearman's correlation between sanitary compliance and the enforcement of sanitary requirements at street food vending sites (n = 600)

		Enforcement
Sanitary compliance and enforcement	Correlation Coefficient	5.131*
	Sig. (2-tailed)	0.026

NB: *Correlation is significant at the 0.05 level (2-tailed)

3.1.5 Conclusion and Recommendation

This research investigated the enforcement of sanitary regulations by authorities and the compliance of these regulations at street food vending sites in Oyo State, Nigeria. The majority of street food vendors did not have a permanent street food vending structure, nor a valid permit or license to operate as street food vendors. The majority of street food vending sites had low compliance with food safety regulations. There was no significant difference in enforcement between street food vending premises in which the owner possessed a valid license/permit and those in which the owner did not possess a valid license/permit. Most of the street food vending sites had not been inspected by the authorities, hence, enforcement was very low. A positive correlation was established between sanitary compliance and the enforcement of sanitary requirements at street food vending sites. This study is the first to study both the sanitary requirements of street food vending sites and the enforcement of sanitary requirements. It is recommended that municipal authorities register all the street food vending sites to enable effective monitoring in ensuring that food safety regulations are implemented at the street food vending sites. Furthermore, the government should facilitate and subsidise the acquisition of street food vending facilities and suitable catering equipment to enable food handlers to comply with sanitary requirements. More research should be done to determine the food safety knowledge of street food vendors and establish factors that limit compliance with food safety regulations.

3.2 AN INVESTIGATION OF THE FOOD SAFETY KNOWLEDGE OF THE STREET-FOOD VENDORS IN OYO STATE, NIGERIA

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3.2.1 Abstract

Street food vendors operating in Oyo State may not have adequate food safety knowledge, which is essential for hygiene practices at street food vending sites. Street food vendors must understand the principles of food hygiene to prevent food contamination during food preparation and service. Hence, this study aimed to investigate the food safety of street food vendors in Oyo State, Nigeria. A cross-sectional survey research design was conducted to collect data from 600 street-food vendors conveniently sampled from 15 randomly selected Local Government Areas (LGAs) from the three senatorial zones in Oyo state. Face-to-face interviews were conducted with street food vendors using a structured questionnaire. Most street food vendors were female (89.7%), and most (80.7%) of them had never been trained on food safety measures. Most (96.5%) street-food vendors did not have sufficient food safety knowledge, while 2.7% had moderate food safety knowledge, and only 0.8% had high food safety knowledge. There was a significant positive correlation [$r(598) = 0.72$; $p = 0.01$] between the overall food safety knowledge and the food safety awareness. Over 75% of street food vendors in Oyo State possess low food safety knowledge. This inadequate knowledge can constitute a health risk among street food consumers. This suggests an urgent need for training programs for street food vendors in the immediate and the future. It is recommended that authorities organize a continuous food safety training programme to ensure the implementation of food hygiene practices and compliance with food safety regulations at street food vending sites.

Keywords: Food safety training, food safety regulations, street food, food hygiene practices

3.2.2 Introduction

Street food vending plays a vital role in meeting the dietary needs of urban and suburban populations because it is affordable, accessible and convenient, particularly for low-income earners (Haleegoah et al., 2020). Street food vending provides valuable opportunities for self-employment and income generation for individuals with limited access to formal job markets

due to limited education and skills (Igudia, 2020). Many street-food vendors operate small-scale businesses which require minimal start-up capital to generate income and reduce unemployment (Tuffour et al., 2022). Having adequate food safety knowledge by street-food vendors is essential for mitigating the food safety risks associated with street food vending (Werkneh et al., 2023). Street-food vendors often lack the resources and infrastructure to ensure proper sanitation at street-food vending sites (Nkosi & Tabit, 2021; Mazi et al., 2023). A study conducted in Ibadan, Oyo state, found that the majority (81.7%) of food vendors had some basic knowledge of food hygiene preparation, but some (44.2%) were also found to lack enough food hygiene information (Arimi & Adebayo, 2024). A review of studies on the food safety perspective in Nigeria found a general lack of adequate sanitary resources, such as access to running water, soap, and sanitation facilities around street food vending environments (Nordhagen, 2022). Street-vended food sold in Nigeria may include, among others, grilled meat pieces, fried yeast dough products, fried bean cakes, meat or fish broth and stews, and fruit juice and other beverages (Odo et al., 2021).

Street food vendors often operate in public spaces with limited access to fit-for-purpose food preparation facilities and sanitary resources such as access to potable water, electricity and a sound garbage disposal system (Nkosi & Tabit, 2021; Moges, Rodland & Argaw, 2024). These limitations can lead to the preparation and sale of food under poor hygienic conditions (Akabanda, Hlortsi & Owusu-Kwarteng, 2017; Putri & Susanna, 2021). In many urban areas, the regulatory framework for street food vending is either non-existent or poorly enforced in specific zones within a municipality, allowing for non-compliance with hygiene regulations (Amaami, Dominic & Collins, 2017; Nkosi & Tabit, 2021). The absence of regular inspections and penalties for violations creates an environment where street-food vendors may prioritize profit over food safety (Mazi et al., 2023).

Training street food vendors on food hygiene practices is essential for developing knowledge, skills and attitudes toward food hygiene practices (Sudhagar & Rajendran, 2017). Poor hygiene practices at street food vending sites can lead to food contamination by spoilage and pathogenic microorganisms, which can cause foodborne illness outbreaks, thereby increasing the hospitalizations and medical costs of consumers (Dun-Dery & Addo, 2016). Providing food safety training to street-food vendors will improve food hygiene practices at street food vending sites and protect public health (Barnabas et al., 2024). Furthermore, implementing food hygiene practices at street food vending sites can enhance the reputation

of street food vendors, thereby instilling consumer confidence and encouraging business growth (Yakubu et al., 2023).

Urbanization and population growth have prompted the expansion of street food vending activities in Oyo State and Nigeria (Ejaro and Abubakar, 2013). These street food vendors are found in locations such as open markets, motor parks, schools and busy streets that municipal authorities have not demarcated for street food vending (Ibrahim et al., 2023; Mazi et al., 2023). Many street-food vendors operating in Oyo State may not have attended a food safety training course and are likely to have inadequate food safety knowledge, essential for good hygiene practices at these street food vending sites (Werkneh et al., 2023). The food handling by street food vendors with inadequate food safety knowledge constitutes a food safety risk for street food consumers in Oyo State (Nkosi & Tabit, 2021). This research sought to investigate the current situation regarding the food safety knowledge of street-food vendors, considering no previous studies on this have been conducted in Oyo State, Nigeria. Hence, this research aimed to investigate the knowledge of food safety of street food vendors in Oyo State, Nigeria. Furthermore, to establish if there is an association between food safety training attendance and food safety knowledge of street-food vendors.

3.2.3 Materials and methods

Study area and research population

This research was conducted in the different Local Government Areas in Oyo State, southwest Nigeria. The state has a population of about 7,840,900 persons with three (3) senatorial zones: Oyo Central, Oyo North, and Oyo South. Oyo Central has 11 LGAs, Oyo North has 13 LGAs, and Oyo South has 9 LGAs (NPCN, 2016). In 2022, the Nigeria multidimensional poverty profile reported that Oyo State has a poverty rate of 48% within the poverty index criterion (NMPI, 2022). Farming is a significant economic activity of the Oyo State, with few agro-food industries, including poultry farming, cultivation of cash crops, crop farming, and food processing (GI, Eo & Bo, 2015; Daramola et al., 2019). Oyo State is experiencing rapid urbanization, attracting self-employed entrepreneurs such as street-food vendors. Street food vendors have been found to earn income similar to the minimum wage of Nigeria (Adedayo et al., 2022). The study population includes street-food vendors who operate along the roadside and other street corners, making them accessible to consumers (Asiegbu et al., 2016; Oladipo-Adekeye & Tabit, 2021).

Research Design and Sampling

A cross-sectional survey design was employed, and quantitative data were collected using a questionnaire instrument. Six hundred street-food vendors were sampled based on their availability to partake in the study from 15 LGAs. The 15 LGAs (5 LGAs per senatorial zone) were selected randomly from a list of LGAs of each of the three senatorial zones in Oyo State (NPCN, 2016). Within each LGA, street-food vendors operating within street-food vending sites clustered in popular street places and willing to participate in the research were sampled using the convenient sampling technique. The sampled street food vendors were briefed on the purpose of the research and their right to withdraw if they desired to do so. They were also required to sign a consent form. Forty (40) street-food vendors were sampled within each of the 15 LGAs to a total of 600 street-food vendors for the study. The minimum sample size for the study was determined using Cochran's formula $n = (Z)^2 p(1-p)/d^2$, where the assumed fraction of the population with required food safety knowledge (p) of 0.5, z -value (z) of 1.96 and margin of error (d) of 5%, were used to arrive at a sample size of 383 later enlarged to 600 to ensure data saturation and minimized biased (Ahmed, 2024). The permission to conduct the study in the research area was obtained from the Oyo State Ministry of Health, and ethics clearance (ref: 2021/CAES_HREC/037) for the study was obtained from the College of Agriculture and Environmental Sciences (CAES) Health Research Ethics Committee of the University of South Africa.

Data collection

The data collection instrument was a structured questionnaire designed for this study using information from the Food Sanitation Charter of the National Environmental Health Practices Regulation 2016 of Oyo State, Nigeria and the Guidelines for Food Handlers Regulation 7 of the Federal Republic of Nigeria (FRNOG, 2016). The questionnaire instrument had three sections. The first section was on sociodemographic characteristics, the second was the location of street food vending facilities and service types rendered, and the third was food safety knowledge. Data was collected through face-to-face interviews in 2022, each lasting twenty-five minutes. A pilot study was conducted with 30 street-food vendors, and the feedback was used to ensure clarity, ambiguity and comprehensiveness of questions to ascertain the reliability and validity of the data collection instrument. Three researchers with expertise in food safety assessed the survey feedback to ascertain the instrument's validity. The internal consistency of the instruments was assessed, and Cronbach's α values ranged from 0.729 to 0.831.

Statistical analysis

Data was captured and analyzed using the Statistical Package for Social Sciences (SPSS) IBM version 23 (2021). Descriptive statistics such as frequency, percentages, and bar charts were used to show the distribution of the socio-demographics of respondents, the location and service type of street food vending sites, and the safety knowledge of street food vendors. To determine the food safety knowledge (FSK) score, 1 point was assigned for each correct response to food safety knowledge questions; otherwise, zero was assigned for an incorrect response. The food safety knowledge scores were assessed as follows: 0-49% as low FSK, considering the expected ideal goal of 100%, 50-74% as moderate FSK and 75-100% as high FSK. The Spearman rho correlation analysis was used to determine the correlations between food safety training attendance and food safety knowledge of street food vendors. Statistical significance was identified at a 95% confidence level ($p\text{-value} \leq 0.05$).

3.2.4 Results and Discussions

Socio-demographics

Results on the sociodemographic characteristics of street-food vendors are presented in Table 3.5. Most street food vendors were female (89.7%). Similarly, Mahopo et al. (2022) found 90.8% female dominance in street food vending in a study conducted in South Africa. In some African cultures, girls are primarily involved in preparing and serving meals, thereby acquiring culinary expertise from a tender age, hence the female dominance (Letuka, Nkhebenyane & Thekiso, 2021). Women often partake in street food vending as a means of income generation amidst job scarcity and economic hardships (Okojie & Isah, 2014). Most street food vendors were above 46 years of age (59.7%). Studies conducted in Jigjiga City, Eastern Ethiopia (Bereda et al., 2016), and China (Ma et al., 2019) reveal that more than fifty per cent of street food vendors tend to be over 46 years old. Street food vending appeals to adults as a means to earn a livelihood due to the low start-up capital requirements and the fact that no formal education qualification is required to be active and involved in street food vending (Singh, 2020). Up to 45.5% of street food vendors were unmarried or separated from their partners, 21.2% were married, and the rest were widowed (16%) or divorced (16%). The low marital outcome could stem from Nigeria's decreasing marriage rates, which are influenced by unemployment, poverty, and the high cost of living (Akerle et al., 2012). Up to 26.8% of street-food vendors had no formal education, while 54% had attained primary school, and only 16.3% and only 2.8% had attained secondary education and tertiary education, respectively. The results trend mirrors research outcomes from diverse locales,

such as the Metropolitan District in Ghana, reporting 61.6% (Nortey et al., 2024), and Dessie Town in Ethiopia, reporting 49.2% (Adane et al., 2018), indicating the prevalence of street-food vendors with primary schooling or no formal education. These findings could partly be attributed to poverty and street food vendors' limited access to higher education due to financial constraints (Otoo et al., 2012).

Street food vendors often possess limited educational qualifications because they come from low-income households, which may lack the financial resources to facilitate higher education (Verma et al., 2023; Salamandane, Malfeito-Ferreira & Brito, 2023). The majority of street-food vendors (60.5%) had been involved in street-food vending for over 11 years, among which 27.3% have been involved for more than 15 years. Research conducted in Ghana found that 80% of food vendors have been active in the street food sector for the past decade (Monney et al., 2014). Street food vendors depend on street food vending for income generation to sustain their livelihoods (Adhikari, 2018). These vendors strategically position their stalls in high-traffic areas, such as busy city streets, open-air markets, parks, and events, to ensure higher sales volumes and income generation (Kariuki, Waithera Ng'ang'a & Wanzala, 2017; Nkosi & Tabit, 2021). Their flexible schedules allow greater work-life balance control (Tuffour et al., 2022). Street food vending businesses typically require low financial inputs and overhead costs, ensuring long-term involvement (Mwove et al., 2020). Street food vending, therefore, provides employment opportunities for many people with no or limited formal qualifications and work experience who cannot access mainstream employment on a long-term basis (Salamandane, Malfeito-Ferreira & Brito, 2023).

The majority of street-food vendors (92.5%) had not obtained a food service/hospitality qualification, and up to 80.7% had not attended any food safety training. The results trend aligns with findings from research conducted in some countries, including the Zululand District in South Africa (Nkosi and Tabit, 2021) and the Central Region of Ghana (Odonkor & Odonkor, 2020), where the majority, 77% and 63.1% respectively of street-food vendors did not obtain a food service/hospitality qualification and did not attend any food safety training. Food safety training courses suitable for street food vendors are not available, and commercial food safety training courses are costly (Madaki & Bavorova, 2019). The lack of food safety training courses means limited food safety awareness and hygiene practices at street food vending sites (Putri & Susanna, 2021; Desye et al., 2023). Most street food vendors (68.2%) indicated their current vending site as their first street food vending site. This

finding suggests that the street food vendors have settled and have established a customer base at their current sites and may not see the need to relocate to other areas (Mazi et al., 2023). Up to 70.5% of the street-food vendors indicated they earned above ₦30,000 (1 US Dollar = 1,502 Naira as of 02 March 2025) from their street food vending activities as their average monthly income, among which 10.2% earned above ₦50,000. The result shows that street food vending is a significant source of income for many street food vendors, exceeding the ₦30,000 minimum wage in Nigeria per month (Anetor, 2015). The result reveals that the street food vending industry can employ many individuals who earn an income comparable to Nigeria's minimum wage benchmark (Mazi et al., 2023). The majority (87.5%) of the street-food vendors identified street food as their primary source of income. This is because street-food vendors lack formal education and skills to access the formal job market and hence depend on street food vending as their sole source of income (Adeosun, Oosterveer & Greene, 2023). The result shows that street food vending plays a critical role in the livelihood of street food vendors (Rakha et al., 2022).

Table 3.5: Socio-Demographics of the respondents (n = 600)

Sociodemographic Variables		Frequency (%)
Gender	Male	62(10.3)
	Female	538(89.7)
Age (years)	18-25	15(2.5)
	26-35	118(19.7)
	36-45	109(18.2)
	46-55	244(40.7)
	56-65	114(19.0)
Marital status	Married	127(21.2)
	Not married	55(9.2)
	Separated	218(36.3)
	Divorced	100(16.7)
	Widowed	100(16.7)
Level of education	Absence of formal schooling	161(26.8)
	Primary school	324(54.0)
	Secondary school	98(16.3)
	Tertiary school	17(2.8)
Period of selling food (years)	<5 years	99(16.5)
	Between 5 and 10 years	138(23.0)
	Between 11 and 15 years	199(33.2)
	> 15 years	164(27.3)
Foodservice/ hospitality diploma/degree obtained?	Yes	45(7.5)
	No	555(92.5)
Food safety-training attended	Yes	116(19.3)
	No	484(80.7)
First place to work as a street food vendor	Yes	409(68.2)
	No	191(31.8)
Average monthly income	Less than ₦30,000	177(29.5)
	₦30,001 - ₦40,000	185(30.8)
	₦40,001 - ₦50,000	177(29.5)
	Above ₦50,000	61(10.2)
Street food as a primary source of income	Yes	525(87.5)
	No	75(12.5)

NB: 1 US Dollar = ₦1,502 (Naira) as of 02 March 2025

Location of street food vending facilities and service types rendered

Results on the location of street food vending facilities and service types rendered were presented in Table 3.6. The majority of street-food vendors (55.6%) operated at the roadside with no shelter/facility/premise or in makeshift shelters (temporary structures). The result is similar to the findings of research conducted in Kenya (Mwove et al., 2020) and Lebanon (Loukieh et al., 2018), where most street-food vendors ($\geq 50\%$) operated in temporarily

constructed stalls on the roadsides. Most street-food vendors operate where there is no shelter/facility/premise due to the high cost of renting or acquiring formal premises, due to limited funds (Oladipo-Adekeye & Tabit, 2021). The operation of street food vending in temporary facilities brings up food safety challenges, such as the lack of potable water, electricity, a garbage disposal system and inadequate hygiene practices at these sites (Kariuki et al., 2017; Khuluse & Deen, 2020; Adaku et al., 2024). Street food vending sites with limited sanitation and unhygienic practices can contaminate food (Mkangara, 2023).

Most (95%) street food vendors did not have a valid license/permit to operate street food vending activities in their current locations. This study result was higher than the Zululand district South Africa study, where only a few (26.8 %) street food vending sites were not licensed with the Companies and Intellectual Property Commission (CIPC) due to the inadequate organization of street food vending sites in the Zululand district (Nkosi & Tabit, 2021). One possible reason for the lack of valid licenses/permits can be attributed to the cost of obtaining one (Kiambi et al., 2020). Another reason may relate to the informal nature of the business and widespread non-compliance with regulations among street-food vendors (Mwove et al., 2020). The high rate of unlicensed street food vendors raises serious concerns about regulating street vending activities to ensure the safety of street food consumers (Nkosi & Tabit, 2021). The majority of the street-food vendors (97.3%) operate eating on-site services. Most street food vending sites in African countries are rooted in the communal dining spirit of many communities, where people eat and have conversations in a jovial manner with people they may not know (Bouafou, Beugré & Amani, 2021). Eating on-site fosters a communal atmosphere, encourages social interaction, and contributes to the vibrant street life in many cities (Marovelli, 2019).

Table 3.6: Location and service type of street food vending sites (n = 600)

Location of street food vending sites		Frequency (%)
Senatorial sector	Oyo Central	200(33.3)
	Oyo North	200(33.3)
	Oyo South	200(33.3)
Premise characteristics	Roadside with no shelter / facility / premise	113(18.8)
	Roadside with temporal (makeshift) shelter	221(36.8)
	In a permanent facility	266(44.3)
	Mobile food unit	0(0.0)
Possession of a valid license/permit	Yes	30(5.0)
	No	570(95.0)
The place where food is prepared	Prepare them at home	30(5.0)
	Prepare them on the vending facility	570(95.0)
The food services provided	Takeaway services	16(2.7)
	Eating on-site services	584(97.3)

Food safety knowledge of street food vendors

None of the food safety knowledge questions on personal hygiene (Table 3.7), food hygiene knowledge (Table 3.8), cooking and storage temperature (Table 3.9), or microbial hazards (Table 3.10) were answered by more than 50% of the street-food vendors. These findings can be attributed to the possession of limited food safety knowledge among street-food vendors due to the absence of some form of food safety training on various aspects such as temperature control for safety, prevention of cross-contamination, and food storage conditions (Okojie & Isah, 2019; Desye et al., 2023; Nortey et al., 2024). This result indicates a significant gap in the food safety awareness of street-food vendors (Kanaan MHG et al., 2023), which poses a food safety risk to street-vended foods to consumers (Lamin-Boima, 2017; Mwove et al., 2020). The low knowledge of cooking and food holding temperatures can be attributed to the lack of food safety training (Rifat et al., 2022). The lack of knowledge on cooking and storage temperatures among street-food vendors can lead to food handling in unsafe temperature zones between 8 and 63 °C, where bacteria can flourish (Tuglo et al., 2021). The lack of knowledge about the correct cooking and holding temperatures for different food types can increase the likelihood of undercooking with the risk of microbial growth (Ricci et al., 2020). Using the correct cooking and storage temperatures is fundamental to preventing the growth and propagation of bacteria in food (Samapundo et al., 2016; Gautam & Curtis, 2021). The result is similar to the findings of research conducted in

Kenyatta University's Environs, Kenya (Were, Were & Aduol, 2020) and Zululand District, South Africa (Nkosi & Tabit, 2021), where more than two-thirds ($\geq 75\%$) of street-food vendors were unaware of food microorganism due to the lack of formal training on microbial hazards and their associated diseases. This low knowledge on microbial hazards can be due to a lack of food safety training programs to address this aspect of food safety (Mwove et al., 2020; Nkosi & Tabit, 2021). Street-food vendors with low microbial knowledge can lack awareness and rigour to prevent food contamination with these pathogens (Bintsis, 2017; Elbehiry et al., 2023).

Up to 59.3% of the street food vendors correctly identified that some foodborne bacteria could cause diseases that might lead to death. Studies conducted in Ghana (Madilo et al., 2023) and Zululand District, South Africa (Nkosi & Tabit, 2021) report a similar trend where more than fifty per cent of street-food vendors were aware that foodborne bacteria could cause diseases that might lead to death and the reason put forward were inadequate knowledge on foodborne diseases microorganisms. The reason for correctly identifying that some foodborne bacteria could cause diseases that might lead to death may be due to the lifelong learning of the devastating foodborne disease outbreaks due to foodborne pathogens such as Salmonella and E. coli (Moreb et al., 2017). The result is encouraging because the risk of contracting foodborne diseases from contaminated street food remains a significant concern for consumers of street-vended food (Asiegbu et al., 2016). Staphylococcus, Clostridium, and Escherichia coli were identified the least by street food vendors as foodborne pathogens, while Salmonella was identified the most as foodborne. A study in the Bori metropolis, River State, Nigeria, identified Staphylococcus aureus as an ordinary and well-known foodborne pathogen associated with street foods made of meat (Amadi et al., 2016). The possible reason for the low identification of some bacteria as foodborne pathogens by street-food vendors can be attributed to unfamiliarity with the scientific names of these foodborne pathogens due to the lack of food safety training on microbial hazards and associated foodborne illnesses (Al-Kandari et al., 2019; Woh et al., 2016). The findings show that street-food vendors' inadequate awareness of common foodborne pathogens can worsen their understanding of their risks (Madilo et al., 2023). The microbial hazard knowledge of street-food vendors was very low, followed by the understanding of cooking and storage temperatures. A similar result was reported with street-food vendors in Kiambu County, Kenya, where 96.8 % of them touched food with bare hands and 86.1 % handled money while serving food without washing their hands due to the poor microbial hazard knowledge,

contributing to unhygienic behaviour (Mwove et al., 2020). The knowledge and awareness of microbial hazards during cooking, storage, and serving food are essential in preventing food contamination from foodborne pathogens (Bintsis, 2017).

Table 3.7: The personal hygiene knowledge of street-food vendors (n = 600)

Variables	Frequency (%)
1) The correct approach to washing your hands during the preparation and serving of foods	1. Wash hands with soap and warm running water 126(21.0) 2. Wash hands with soap and cold running water 228(38.0) 3. Wash hands using cold and running water potable water 234(39.0) 4. Wash hands using soap, warm running water, and wipe using a clean cloth 12(2.0)
2) As a food vendor, which of the following makes you wash your hands when you are involved in the preparation and serving of food	1. After using the toilet only 223(37.2) 2. After picking your nose, eye, mouth, ear or hair, using the toilet and smoking 355(59.2) 3. All of the above 22(3.7)
3) As a food vendor, you are allowed to prepare and sell food, even if you may be ill.	1. Yes 530(88.3) 2. No 70(11.7)
4) As a food vendor, are you allowed to handle food when you have boil, running nose and eye discharge?	1. Yes 574(95.7) 2. No 26(4.3)
5) As a food vendor, you are not allowed to handle food when you have diarrhoea, even if you wash your hands regularly	1. Yes 584(97.3) 2. No 16(2.8)
6) Which of the following is the right way to dry your hands after you have washed them well?	1. Wipe using a clean and dry serviette or paper towel 28(4.7) 2. Use an apron to wipe and dry hands 379(63.2) 3. Wipe with a dry and clean dishcloth 176(29.3) 4. 1 and 3 are correct 17(2.8)
7) As a food vendor, which of the following is the right thing(s) to do if you have a wound in your hands during food preparation?	1. Dress the wound with waterproof dressings 188(31.3) 2. Use a bandage to cover the wound 353(58.8)

	3. Wear gloves to cover the wound	58(9.7)
	4. All of the above	1(0.2)
8) You can wear small jewellery during food preparation and serving	1. True 2. False	447(74.5) 153(25.5)
9) No need to wash your finger after tasting hot food during preparation	1. True 2. False 3. No idea	476(79.0) 123(20.5) 1(0.2)
10) You can be chewing gum while preparing food and serving food?	1. True 2. False 3. No idea	336(56.0) 206(34.3) 58(9.7)
11) You can keep long fingernails with polish during food preparation and serving.	1. True 2. False 3. No idea	423(70.5) 161(26.3) 16(2.7)
12) You can keep your hair uncovered during food preparation and serving?	1. True 2. False 3. No idea	302(50.3) 257(42.8) 41(6.8)

NB: Correct responses in bold

Table 3.8: The food hygiene knowledge of street-food vendors (n = 600)

Variables		Frequency (%)
1) Eating and drinking during the preparation and serving of food should be avoided to avoid contamination of the food you sell.	1. True	213(35.5)
	2. False	373(62.2)
	3. No idea	14(2.3)
2) Food can be stored at room temperature, provided you will heat it before serving it to customers.	1. True	526(87.7)
	2. False	74(12.3)
3) Flies cannot contaminate your food if there are no toilets or rubbish bins around.	1. True	395(65.8)
	2. False	142(23.7)
	3. No idea	63(10.5)
4) Keeping cooked in the fridge can help kill some germs in food and prevent people from getting sick.	1. True	409(68.2)
	2. False	92(15.3)
	3. No idea	99(16.5)
5) Food is spoiled only when there are changes in colour, odour or taste.	1. True	476(79.3)
	2. False	84(14.0)
	3. No idea	40(6.7)
6) You can use one cutting/chopping board for food preparation in your kitchen so long as you wash it well with soap.	1. True	543(90.5)
	2. False	57(9.5)
7) No need to keep milk, meat and fish in the refrigerator so long as you will use them to prepare food before the end of the day	1. True	494(82.3)
	2. False	106(17.7)
8) Assuming there is an electricity failure in your kitchen and the soup in your fridge went to room temperature. The safest thing to do to prevent foodborne disease is to throw out all the soup.	1. True	11(1.8)
	2. False	589(98.2)

NB: Correct responses in bold

Table 3.9: Knowledge on cooking and storage temperature (n = 600)

Variables		Frequency (%)
1) Indicate the appropriate minimum internal cooking temperature for roasted chicken?	1. 90 ⁰ C	60(10.0)
	2. 65 ⁰ C	22(3.7)
	3. 100 ⁰ C	234(39.0)
	4. 78⁰C	45(7.5)
	5. No idea	239(39.8)
2) Indicate the appropriate minimum internal cooking temperature for a vegetable dish?	1. 87 ⁰ C	263(43.8)
	2. 77 ⁰ C	1(0.2)
	3. 67 ⁰ C	24(4.0)
	4. 57⁰C	24(4.0)
	5. No idea	288(48.0)
3) Indicate the correct temperature guideline for cold storage of ready-to-eat protein-rich foods such as beef, chicken and fish stews?	1. Approximately 25 ⁰ C	38(6.3)
	2. Approximately 10 ⁰ C	45(7.5)
	3. Approximately 5⁰C	118(19.7)
	4. No idea	399(66.5)
4) Indicate the appropriate temperature for the hot holding of protein-rich foods during serving?	1. Approximately 100 ⁰ C	163(27.2)
	2. Approximately 63⁰C	51(8.5)
	3. Approximately 25 ⁰ C	104(17.3)
	4. No idea	282(47.0)

NB: Correct responses in bold

Table 3.10: The microbial hazards knowledge (n = 600)

Variables		Frequency (%)
1) Only food with bad odour or change in colour and consistency has bacteria	1. Yes	399(66.5)
	2. No	163(27.2)
	3. No idea	38(6.3)
2) Some foodborne bacteria can cause diseases that might lead to death.	1. Yes	356(59.3)
	2. No	194(32.3)
	3. No idea	50(8.3)
3) Is <i>Salmonella</i> a foodborne bacteria?	1. Yes	130(21.7)
	2. No	134(22.3)
	3. No idea	336(56.0)
4) Is Coronavirus a foodborne bacteria?	1. Yes	186(31.0)
	2. No	191(31.8)
	3. No idea	223(37.2)
5) Is <i>Escherichia coli</i> foodborne bacteria?	1. Yes	106(17.7)
	2. No	444(74.0)
	3. No idea	50(8.3)
6) Is <i>Listeria</i> a foodborne bacteria?	1. Yes	150(25.0)
	2. No	409(68.2)
	3. No idea	41(6.8)
7) Is <i>Campylobacter</i> a foodborne bacteria?	1. Yes	111(18.5)
	2. No	163(27.2)
	3. No idea	326(54.3)
8) Is <i>Staphylococcus</i> a foodborne bacteria?	1. Yes	80(13.4)
	2. No	437(72.8)
	3. No idea	83(13.8)
9) Is <i>Clostridium</i> is a foodborne bacteria?	1. Yes	97(16.2)
	2. No	262(43.8)
	3. No idea	241(40.2)

NB: Correct responses in bold

The vast majority (96,5%) of street-food vendors had low food safety knowledge (Figure 3.4). The result is similar to findings in other countries where street-food vendors were found to possess low food safety knowledge: 93% in Kenya (Mwove et al., 2020), 85% in Bangladesh (Islam et al., 2024), and 76% in Pretoria (Ndhlovu & Tabit, 2024), due to the lack of food safety training. The low food safety knowledge among street-food vendors can be due to the cost and time required for proper food safety training, language barriers, low education levels, and lack of awareness about the significance of food safety knowledge (Desye et al., 2023). The prevalence of low food safety knowledge among street food vendors suggests that consumers of street-vended food may be exposed to food safety hazards. This scenario may

lead to serious health consequences ranging from severe illness and even death, especially in individuals with weak immune systems, such as people with HIV/AIDS and cancer, young children, the elderly and even pregnant women (Rosales, Linnemann & Luning, 2023). The prevalence of street-food vendors with low food safety knowledge indicates that many may be unaware of hygiene practices to prevent the spread of food safety hazards (Addo-Tham et al., 2020; Barnabas et al., 2024). This unawareness can lead to food contamination and outbreaks of foodborne illnesses due to poor sanitation (Mwove et al., 2020).

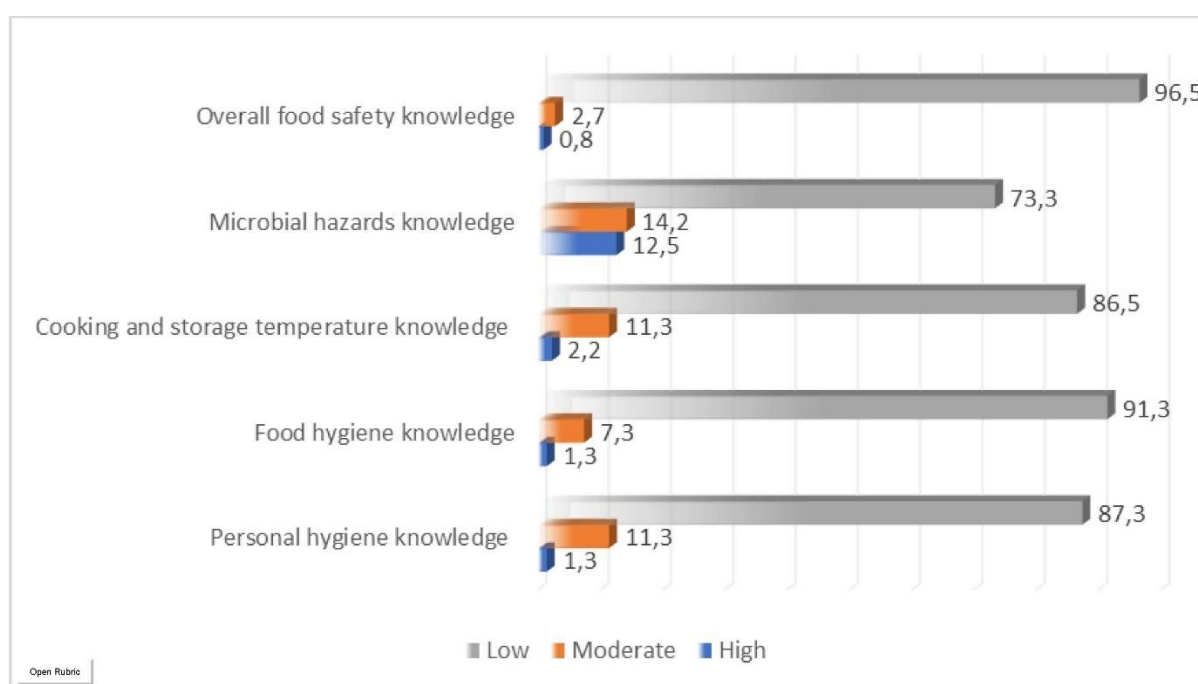


Figure 3.4: Assessment level of Food Safety Knowledge of street food vendors (N = 600)

NB: Low FSK (0-49); Moderate FSK (50-74); High FSK (75-100)

The association between food safety training attendance and food safety knowledge

There was a significant positive correlation between food safety training and overall food safety knowledge [$r(598) = 0.60$; $p = 0.01$] and food safety awareness [$r(598) = 0.65$; $p = 0.01$] (Table 3.11). A similar study reports a significant correlation ($p < 0.002$) between the level of food safety knowledge and food safety training among food handlers in North Jakarta, Indonesia (Putri & Susanna, 2021). This indicates that food safety training is essential in improving the knowledge and skills of food hygiene procedures during food preparation,

storage and serving to avoid contamination (Wan Nawawi et al., 2022). This result emphasizes the effectiveness of food safety training courses in enhancing street-food vendors' comprehension and implementation of essential safety measures (Berglund, Simsek & Feng, 2024). Improved knowledge in these areas can lead to better food-handling practices and reduce the incidence of foodborne illness outbreaks (Ehuwa, Jaiswal & Jaiswal, 2021).

Similarly, there was a significant positive correlation between the overall food safety knowledge and the food safety awareness [$r(598) = 0.72$; $p = 0.01$] of street-food vendors (Table 3.11). Jianu and Goleț (2014) report a significant correlation between food safety knowledge and food safety awareness among food handlers in western Romania. The result indicates that the training of street-food vendors can effectively improve their food safety knowledge and awareness, which are crucial in implementing food hygiene practices and preventing food contamination at street food vending sites (Al-Akash et al., 2022). Street-food vendors with adequate food safety knowledge will implement cross-contamination measures better than those with low food safety knowledge (Adil, 2023). The result suggests that street-food vendors should be trained regularly in temperature control for safety, prevention of cross-contamination, food storage conditions, food safety hazards and foodborne disease outbreaks to boost their food safety knowledge and awareness, which in turn will ensure the safety of street-vended foods sold to consumers (Madaki & Bavorova, 2019).

Table 3.11: Spearman's correlation (rho) between food safety training attendance and food Safety Knowledge of street-food vendors (n = 600)

	Attendance of food safety training	Overall Food safety knowledge	Food safety awareness
Attendance of food safety training	1	0.60**	0.65**
Overall Food safety knowledge	0.60**	1	0.72**
Food safety awareness	0.65**	0.72**	1

**Correlation is significant at the 0.01 level (2-tailed),
 *Correlation is significant at the 0.05 level (2-tailed)

3.2.5 Conclusions

Most street food vendors were female and were above 46 years. Most street-food vendors had been involved in street-food vending for over 11 years and had not attended any food safety training course. Most street food vendors identified street food as their primary source of income. Most street-food vendors operated at the roadside with no shelter/facility/premise, or in makeshift shelters (temporary structures). None of the food safety knowledge questions on personal hygiene, food hygiene knowledge, cooking and storage temperature, or microbial hazards were answered by more than 50% of the street-food vendors. Over 75% of street food vendors in Oyo State possess low food safety knowledge. This inadequate knowledge can constitute a health risk among street food consumers. This suggests an urgent need for training programs for street food vendors in the immediate and the future. There was a significant positive correlation between food safety training and overall food safety knowledge and food safety awareness.

3.2.6 Recommendations

It is recommended that the health and safety authorities in Oyo State provide demarcated areas with stalls adapted for street food vending in the local context, provide sanitary resources, issue licences and monitor and enforce food safety regulations. Furthermore, food safety training programs, which are adapted to the local context, should be conceptualized and provided by authorities, in which vendors will be trained on aspects such as food preparation techniques, food hygiene practices, food safety hazards, foodborne pathogens, cleaning and sanitization and food safety regulations.

3.3 THE CONCEPTUALISATION AND EVALUATION OF A FOOD SAFETY TRAINING PROGRAMME FOR STREET FOOD VENDORS

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3.3.1 Abstract

The purpose of this research was to design and evaluate a tailored food safety training programme for street food vendors in Ibadan, Oyo State, Nigeria. A one-group pre-/post-test quasi-experimental design was used. Forty-two vendors with at least five years' experience and no prior formal food safety training completed a three-day face-to-face programme (5–7 December 2022). The curriculum, guided by the Health Belief Model and the WHO Five Keys to Safer Food, covered personal hygiene, food hygiene, cross-contamination, temperature control, microbial hazards, foodborne diseases, and facility sanitation. Knowledge was assessed using a validated questionnaire. Pre- and post-training scores were compared using paired statistical tests based on diagnostic checks (paired t-test or Wilcoxon signed-rank test). Significance was set at $p \leq 0.05$. Internal consistency was assessed using Cronbach's alpha. Most street food vendors were female (90.5%), over 35 years old (90.5%), predominantly unmarried (71.4%), and mainly had primary education (71.4%), with none having prior food safety training or formal qualifications. The majority (76.2%) had more than 11 years of vending experience. Post-training results showed statistically significant improvements across all knowledge domains: personal hygiene, food hygiene, temperature control, and foodborne disease awareness ($p < 0.001$). Both parametric and non-parametric analyses confirmed large effect sizes, indicating substantial learning gains. Pre-training scores were clustered at low levels, whereas post-training scores were higher and more widely distributed. All participants demonstrated improved competency, confirming the strong positive impact of the training intervention. This study confirms that street food vendors lacked formal food safety training and demonstrated low baseline knowledge, particularly in critical areas such as temperature control, posing notable public health risks. The interactive, context-specific training programme significantly improved knowledge across all domains, with median scores increasing markedly from 1.0 to 10.0. Despite variations in individual gains influenced by socio-

demographic factors, overall food safety competency improved substantially. Scaling up the programme and integrating it into licensing requirements, using literacy-sensitive and tiered approaches, would enhance sustainability and inclusivity. Provision of essential infrastructure and ongoing monitoring, refresher training, and multi-stakeholder collaboration are crucial to sustain behavioural change and ensure long-term public health impact.

Keywords: Health Belief Model, street food vendors, food safety training

3.3.2 Introduction

Street food vending constitutes an essential sector of urban food systems in several developing countries, providing affordable meals and employment opportunities to socioeconomically disadvantaged residents (Rakha et al., 2022). The sector sustains the livelihoods of vendors and their households (Abdullah et al., 2023). In Nigeria, various low-cost foods are widely available through street vendors in major urban centres (Adeosun, Oosterveer & Greene, 2023). Despite its socioeconomic importance, the unregulated and informal nature of street food vending renders it vulnerable to food safety risks (Nkosi & Tabit, 2021). Inadequate access to affordable, context-appropriate food safety training remains a persistent challenge (Okojie & Isah, 2019). For example, in the Zululand District of South Africa, 77% of vendors had not received any formal food safety training, primarily due to limited availability and high costs of industry-based courses (Nkosi & Tabit, 2021). Low risk perception among vendors and weak regulatory monitoring further constrain training uptake (Wallace et al., 2014; Negassa et al., 2023).

Insufficient training is strongly associated with poor hygiene practices, including inadequate personal hygiene, improper temperature control, cross-contamination, and deficient environmental sanitation (Ay M and M Doğan, 2025). These gaps increase the likelihood of food contamination and foodborne disease outbreaks (Teffo & Tabit, 2020), which impose significant public health and economic burdens through healthcare costs, productivity losses, and, in severe cases, mortality (Wong et al., 2026). Food safety incidents may also expose vendors to regulatory sanctions and legal liability (Zanetta et al., 2022). Consequently, policy frameworks increasingly advocate mandatory food safety training as a prerequisite for licensing and operation

(Sarfo et al., 2025). Evidence demonstrates that structured training programmes improve vendors' knowledge, attitudes, and compliance with hygiene standards (Malavi, Abong & Muzhingi, 2021), while consistent inspection and clear guidelines further strengthen risk mitigation (Chelule & Ranwedzi, 2022).

Comprehensive food safety training should address personal and food hygiene, cross-contamination prevention, cleaning and sanitation, temperature control, microbial hazards, allergens, and relevant food safety regulations (Adil, 2023; da Silva Cota, et al., 2023; Radu et al., 2023). Equipping vendors with this knowledge enhances their capacity to prevent foodborne hazards and protect consumer health (Putri & Susanna, 2021). In informal settings, tailored and context-specific interventions are particularly critical (Sheehama & Singh, 2025). Accordingly, this study aimed to design and evaluate a contextually adapted food safety training programme for street food vendors in Oyo State, Nigeria, to strengthen hygiene practices and reduce food safety risks within this population (Moges et al., 2024).

3.3.3 Research methodology

Research design and sampling

A mixed-methods, design-based research approach was used to conceptualise and evaluate a tailored food safety training programme for street food vendors in Ibadan, Oyo State, Nigeria. The study employed a one-group pre-test/post-test quasi-experimental design to assess changes in food safety knowledge following the intervention, a design suitable for real-world informal settings where randomisation is impractical. Ibadan, a major urban centre with extensive informal food vending activities, provided the study context. Street food vendors were recruited through local vendor networks and community engagement. Inclusion criteria were ≥ 5 years of vending experience, active vending within selected areas of Ibadan, and no prior formal food safety training. Vendors unable to attend the full training or unwilling to provide consent were excluded. A total of 42 eligible vendors voluntarily participated.

The training curriculum was guided by the Health Belief Model (Rosenstock, Strecher & Becker, 1988) and aligned with the World Health Organisation Five Keys to Safer Food framework to ensure comprehensive coverage of essential food safety principles (Figure 3.5) (WHO, 2006; Shuvo et al., 2025). Modules addressed personal hygiene, food hygiene, cross-contamination prevention, safe cooking and storage

temperatures, microbial hazards and foodborne diseases, and cleaning and sanitation practices (Appendix B). Materials were adapted to the informal vending context using simplified language, visual aids, demonstrations, and participatory discussions to accommodate varying literacy levels. The intervention consisted of a three-day, face-to-face training programme conducted from 5–7 December 2022, incorporating lectures, practical demonstrations, scenario-based discussions, and interactive sessions, delivered by researchers with expertise in food safety and public health. Attendance was monitored to ensure full participation.

Data collection and analysis

Food safety knowledge was assessed using a structured, validated questionnaire by three food safety research experts, covering personal hygiene, food hygiene, temperature control, foodborne diseases, and environmental sanitation (Appendix A). Responses were scored dichotomously (1 = correct; 0 = incorrect) and administered immediately before (pre-test) and after (post-test) the training. Internal consistency reliability was assessed using Cronbach's alpha for all knowledge scales before and after training. Pre-training alpha values ranged from 0.68 to 0.73, indicating acceptable internal consistency overall, although the Cooking & Storage Temperature scale showed borderline reliability ($\alpha = 0.68$). Post-training, reliability improved across all scales, with values ranging from 0.75 to 0.81. Personal Hygiene Knowledge ($\alpha = 0.81$) and Microbial Hazard Knowledge ($\alpha = 0.80$) demonstrated good internal consistency, while Food Hygiene Knowledge ($\alpha = 0.78$) and Cooking & Storage Temperature ($\alpha = 0.75$) showed acceptable reliability. Overall, all scales met acceptable reliability thresholds, with improvement observed following the training intervention. Data were analysed using R (version 4.5.2; R Core Team). Descriptive statistics summarised participant characteristics and knowledge scores. For pre-/post-training comparisons, assumptions for paired t-tests were assessed using the Shapiro–Wilk normality test and the 1.5×IQR rule for extreme outliers. Where assumptions were met, paired t-tests with Cohen's d_z were applied; otherwise, Wilcoxon signed-rank tests with rank-based effect size r were used. Statistical significance was set at two-sided $\alpha = 0.05$. Ethical approval was obtained from the University of South Africa CAES Health Research Ethics Committee (Ref: 2021/CAES_HREC/037) and permission from the Oyo State Ministry of Health. Participation was voluntary, with written informed consent obtained, and confidentiality maintained throughout.

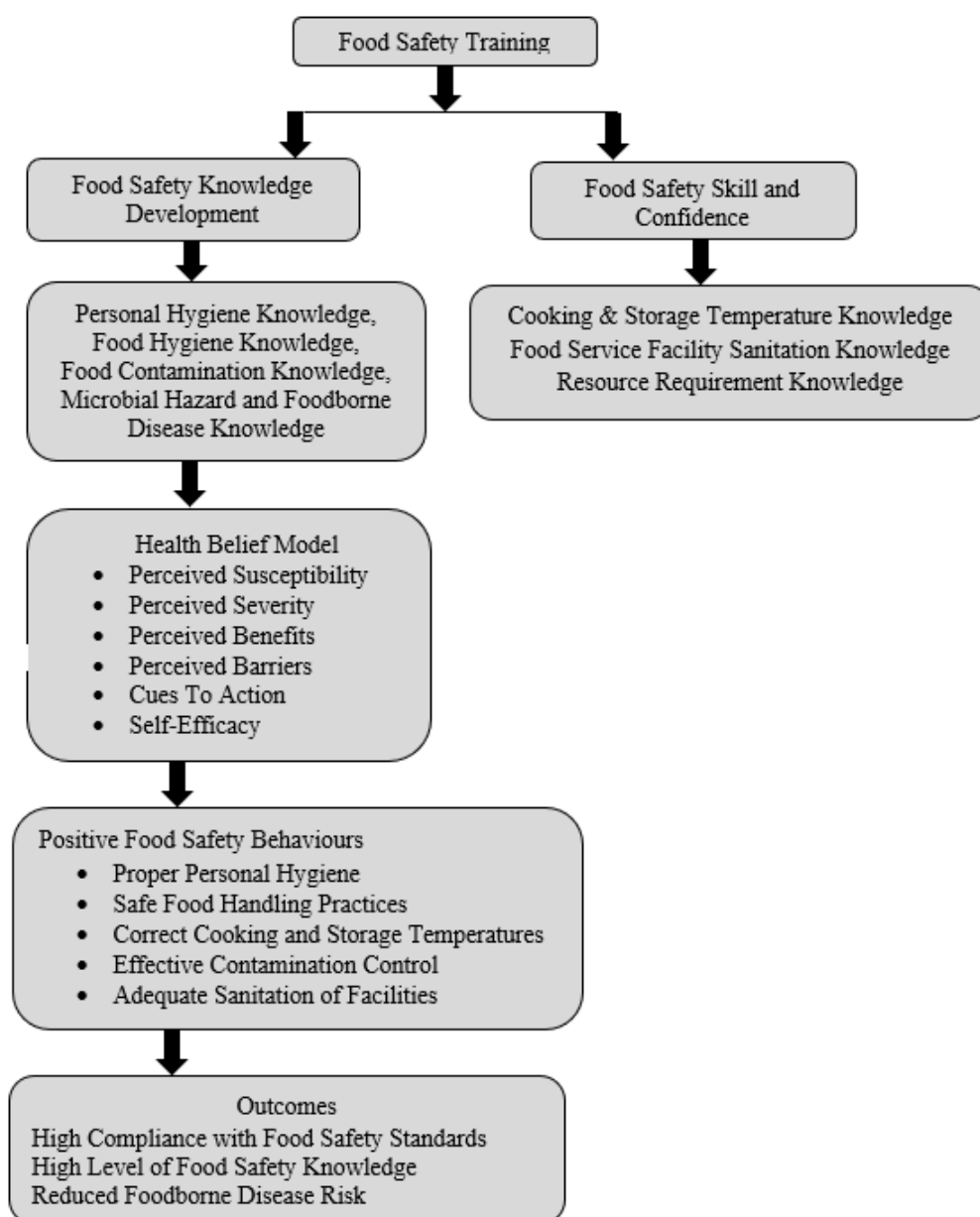


Figure 3.5: The Health Belief Model (HBM) (Rosenstock, Strecher & Becker) [1988]

3.3.4 Results and Discussion

Socio-demographic characteristics of street food vendors

The socio-demographic profile of the participating street food vendors is summarised in Table 3.12. The sample was overwhelmingly female (90.5%), with men accounting for only 9.5% of respondents. The predominance of women in this sector aligns with social and cultural expectations in many African communities, where food preparation responsibilities are typically assigned to girls and women from early childhood

(Mahopo et al., 2022). This trend is consistent with observations from other African contexts—for example, female representation in street food vending has been reported at 59.6% in South Africa and 90.2% in Nigeria (Marutha & Chelule, 2020). The age distribution further indicates that a large proportion of participants were 35 years or older (90.5%). This suggests that street food vending frequently serves as a long-term livelihood strategy for adults with limited access to formal employment opportunities or advanced educational qualifications (Meher et al., 2022). Similar age patterns have been noted in South Africa's Zululand District, where more than half of the vendors surveyed were over the age of 35 (Nkosi & Tabit, 2021). A majority of the respondents were unmarried (71.4%), a trend often associated with economic hardship and unstable employment conditions that can hinder long-term financial planning (Ndhlovu & Tabit, 2024).

Educational attainment among the vendors was generally low. Most had completed only primary school (71.4%), with smaller proportions reporting no formal education (23.8%) or secondary schooling (4.8%). Such limited educational backgrounds are frequently linked to financial barriers and systemic socioeconomic challenges (Ma et al., 2019). Consequently, individuals with restricted schooling often turn to informal sector activities such as food vending, which provide accessible income-earning opportunities with few entry requirements (Werkneh et al., 2023). Despite the low formal education levels, most vendors had substantial experience in the trade. Approximately 76.2% had worked in the street food sector for more than 11 years, demonstrating the stability and sustainability of vending as a long-term economic activity. The relatively low start-up costs, flexible work hours, and absence of formal employment prerequisites make street vending an attractive option for many (Soon, 2019). Importantly, none of the vendors reported having any formal qualifications in food service, hospitality, or food safety, nor had they attended food safety training prior to the study. This reflects a broader trend across informal food markets in low- and middle-income regions, where training opportunities are limited and often inaccessible (Nurudeen, Lawal & Ajayi, 2014). Comparable findings have been documented in Kenya's Kiambu County, where 93% of surveyed vendors had never received formal food hygiene instruction (Mwove et al., 2020).

Table 3.12: Socio-demographic of respondents (n=42)

Demographic Characteristics		N (%)
1 Gender	Male	4 (9.5)
	Female	38 (90.5)
2 Age:	18-35	4 (9.5)
	36-55	28 (66.7)
	56-65	10 (23.8)
3 Marital Status	Married	10 (23.8)
	Not married	30 (71.4)
	Separated	0 (0.0)
	Divorced	2 (4.8)
	Widowed	0 (0.0)
4 Level of education	No formal education	10 (23.8)
	Primary school (grades 1-7)	30 (71.4)
	High school (grade 8-12)	2 (4.8)
	Tertiary education	0 (0.0)
5 Period of selling food (years)	Less than 5 years	0 (0.0)
	5–10 years	10 (23.8)
	11–15 years	20 (47.6)
	More than 15 years	12 (28.6)
6 Foodservice/ hospitality diploma/degree	Yes	0 (0.0)
	No	42 (100.0)
7 Food safety-training attended	Yes	0 (0.0)
	No	42 (100.0)

Impact of food safety training

Post-training analyses demonstrated statistically significant improvements across all four evaluated domains—personal hygiene, food hygiene, cooking and storage

temperature, and microbial hazard/foodborne disease awareness. In the area of personal hygiene, the data satisfied parametric assumptions, and a paired t-test revealed a substantial improvement ($t(41) = 11.47$, $p < 0.001$, Cohen's $d_z = 1.77$). This pronounced gain is consistent with earlier research suggesting that personal hygiene behaviours are generally easier to teach and reinforce in low-resource settings, given their visibility and immediate relevance to daily routines (Sheehama & Singh, 2025; Rakha et al., 2022). For food hygiene, the distribution of paired differences was non-normal due to an extreme outlier; accordingly, a Wilcoxon signed-rank test confirmed a significant improvement ($V = 0$, $p = 4.21 \times 10^{-8}$, $r = 0.88$). This elevated performance suggests that practical demonstrations, participation, group interaction, and simplified instruction were effective in helping vendors adopt safer food-handling practices (Nkosi & Tabit, 2021; Gungor, 2024).

Similarly, cooking and storage temperature knowledge exhibited non-normality with notable outliers, necessitating the use of a Wilcoxon test, which confirmed significant improvement ($V = 33$, $p = 2.45 \times 10^{-6}$, $r = 0.80$). Despite the clear post-training gains, temperature control remains a challenging domain for many street vendors, largely due to inconsistent electricity, the need for thermometers, and cold-chain maintenance—resources that are often limited or unreliable in informal environments (da Silva Cota et al., 2023). For microbial hazard and foodborne disease awareness, although normality criteria were largely met, the presence of an extreme outlier justified a Wilcoxon test, which again showed a significant improvement ($V = 14.5$, $p = 9.39 \times 10^{-8}$, $r = 0.84$). The high effect size indicates that the use of relatable examples and culturally attuned explanations likely enhanced retention of pathogen-related concepts, World Health Organisation Five Keys to Safer Food framework (Shuvo et al., 2025). Collectively, these findings confirm that the training intervention meaningfully improved food safety knowledge across all domains, using the Health Belief Model (HBM) as a framework (Figure 3.6).

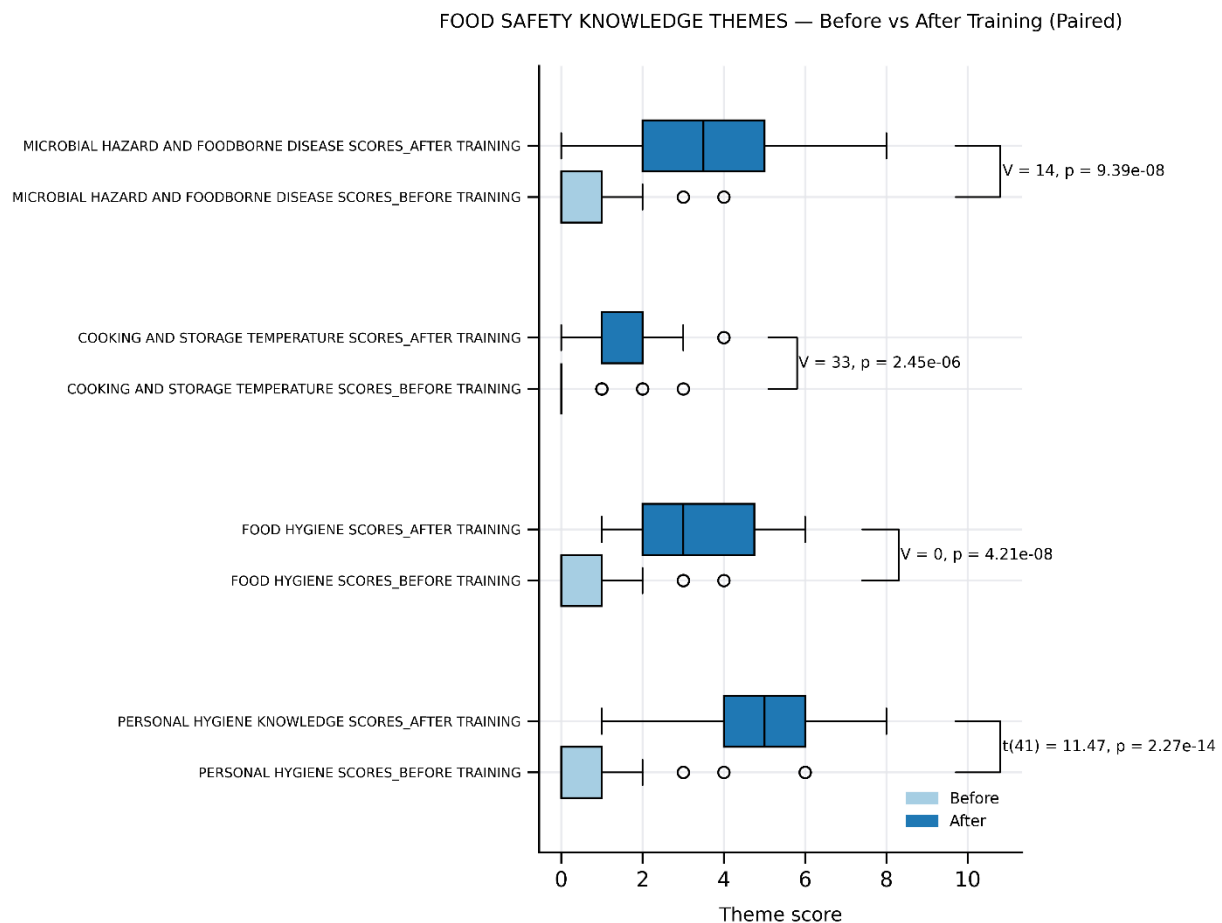


Figure 3.6: Effect of food safety training on knowledge scores of street food vendors across personal hygiene, food hygiene, temperature control, and foodborne disease awareness, analysed using paired t-tests and Wilcoxon signed-rank tests (N=42)

The distribution of knowledge scores before and after training also changed markedly. Pre-training scores clustered tightly between 0 and 5, revealing a uniformly low baseline knowledge, likely influenced by participants' similar socio-demographic backgrounds and limited exposure to formal food safety instruction (Gungor, 2024). This narrow distribution highlights a clear need for dedicated training interventions to address the risks associated with foodborne illnesses and to strengthen professional competence within the street food sector (Nkosi & Tabit, 2021). After the training, scores were more widely dispersed, ranging from approximately 7 to 15, indicating that although all participants benefited, the extent of learning varied among individuals (Figure 3.7). Such variation is commonly linked to differences in education level, literacy, and prior experience in food vending (Werkneh et al., 2023).

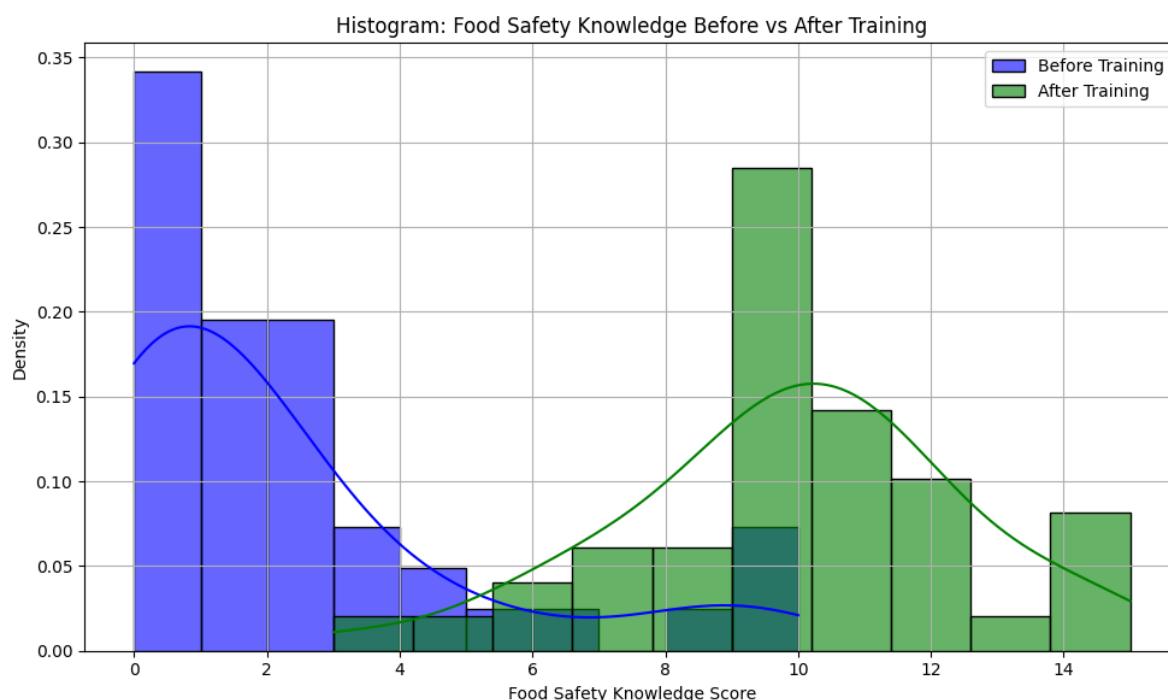


Figure 3.7: Histogram of Pre- and Post-Training Food Safety Competency Scores of street food vendors(N=42)

Participant-level score trajectories show consistent improvements across individuals, with most pre-training scores between 0 and 4 and post-training scores ranging from about 7 to 15 (Figure 3.8). This confirms that the training effectively enhanced food safety competency across the entire cohort. Paired comparisons further revealed that post-training scores were consistently higher than pre-training scores for every vendor. A Wilcoxon signed-rank test confirmed that this shift was statistically significant ($V = 0$, $p < 0.001$), demonstrating a pronounced improvement in overall knowledge following the intervention (Figure 3.9). The median score rose sharply from 1.0 to 10.0, with a maximum of 10.0, eliminating the near-zero baseline and reflecting the benefits of interactive, culturally tailored training approaches that combine demonstrations with guided practice (Shuvo et al., 2025; Alkhaldi et al., 2025).

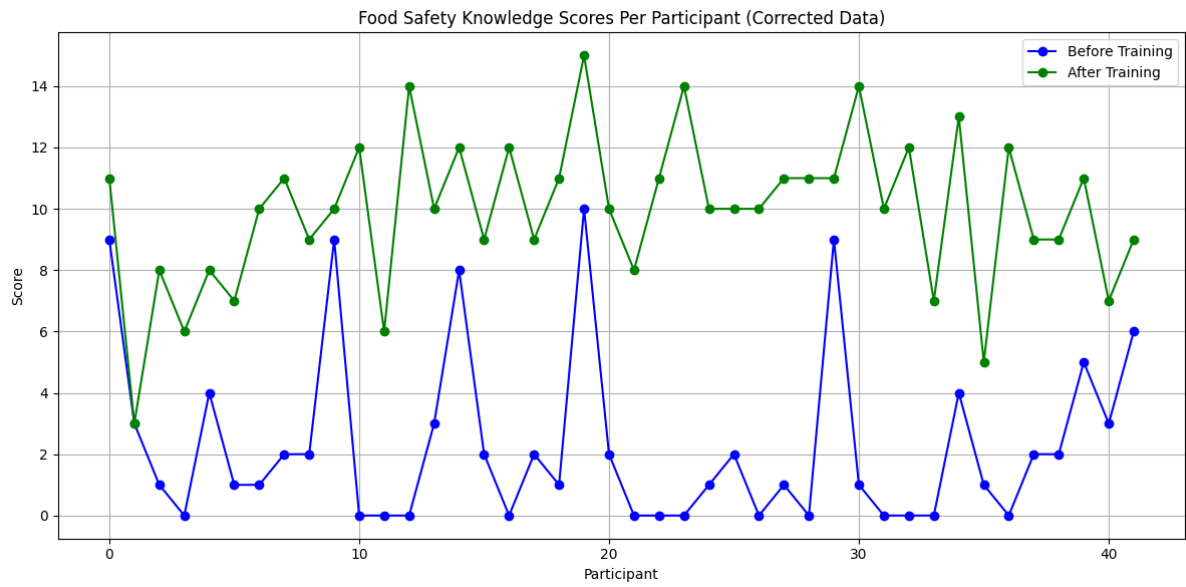


Figure 3.8: Food Safety Knowledge Scores Per Participant Before and After Training (N=42)

Pre- vs Post-Training Knowledge Scores (Paired)

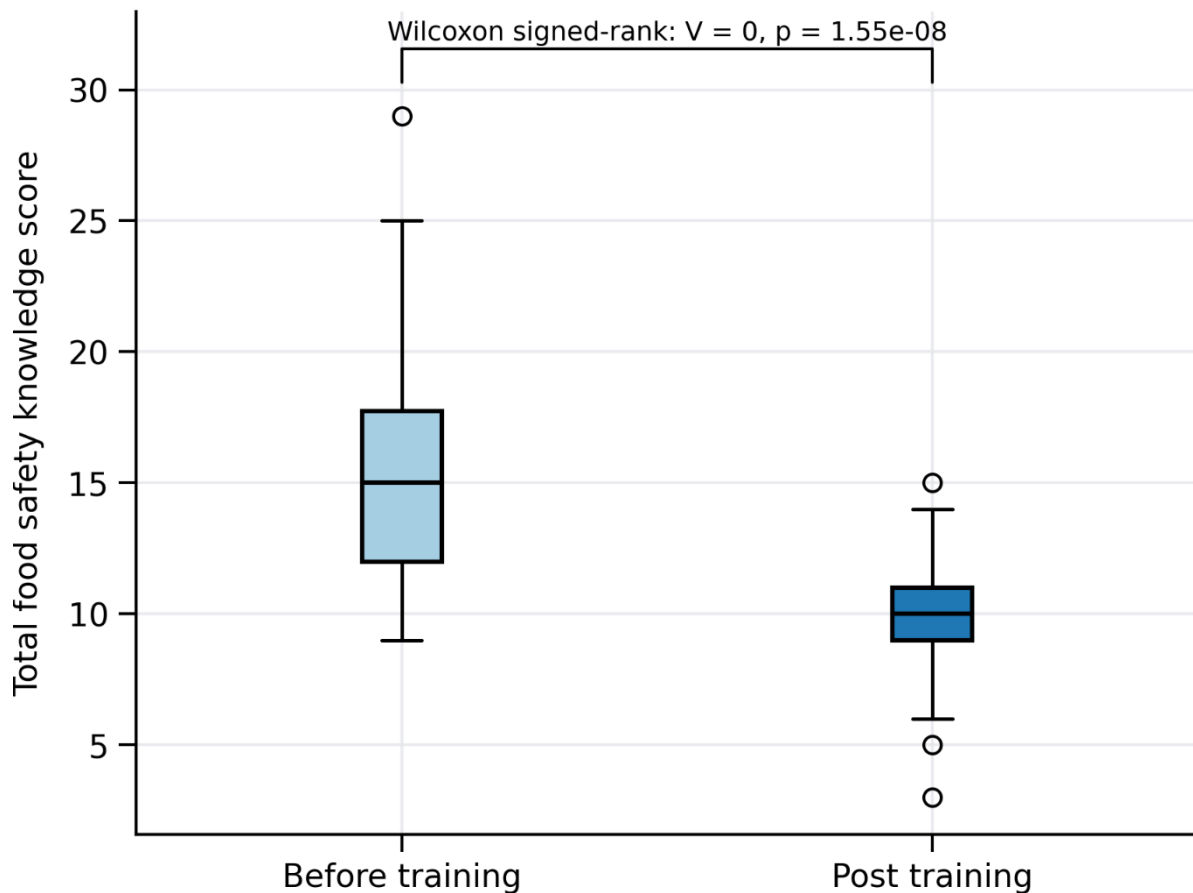


Figure 3.9: Boxplot of pre- and post-training food safety knowledge scores (N = 42). The Wilcoxon signed-rank test indicated a significant change ($V = 0$, $p < 0.001$). Values are paired per participant.

Despite the general improvement, some variability persisted. Higher pre-training scores (approximately 8–10) suggest that a few participants may have had prior informal exposure to food safety concepts. Conversely, one post-training low outlier (approximately 3) indicates potential barriers such as functional illiteracy, learning difficulties, or a disconnect between instructional methods and participant needs (Fanta et al., 2023). These patterns highlight the limitations of standardised instruction and suggest the need for multi-tiered, literacy-independent training strategies supported by ongoing reinforcement (Begum et al., 2025; Salamandane, Malfeito-Ferreira & Brito, 2023).

The study clearly demonstrates that structured, targeted food safety training can significantly improve the knowledge and practices of street food vendors, thereby contributing to better public health outcomes (Ituma, Akpa & Iyare, 2017; Young et al., 2019). However, persistent gaps—particularly in temperature control and storage—underscore the importance of complementing educational efforts with infrastructural support, regulatory oversight, and continuous community engagement. Addressing these barriers may require a combination of practical, low-cost tools, periodic refresher sessions, and stronger integration of training programmes into local food safety governance frameworks (Rakha et al., 2022; Rosales, Linnemann & Luning, 2023). By tackling both knowledge limitations and structural constraints, future interventions will be better positioned to promote sustainable, long-term improvements in food safety within the informal street food environment.

3.3.5 Conclusion

This study demonstrates that street food vendors in the study population largely lack formal training in food service or food safety, with most having only primary education and no prior exposure to food safety instruction. However, these results only measure vendors' short-term retention, and a small sample size was used to confirm the effectiveness of the food safety training programme. Baseline assessments revealed consistently low knowledge, particularly in cooking and storage temperature control, posing significant public health risks. The conceptualised, interactive, and context-specific food safety training programme significantly improved participants' knowledge across all domains, with the median score rising from 1.0 to 10.0. Although individual improvements varied due to socio-demographic factors, the programme effectively elevated overall food safety competency. To sustain and expand these gains, the training should be scaled up and integrated into licensing requirements, using literacy-independent, tiered instruction to accommodate diverse educational backgrounds. Complementary infrastructure support, including access to thermometers, refrigeration, potable water, and sanitation facilities, is essential to enable practical implementation. Regular monitoring, refresher courses, and collaboration between regulatory authorities, health departments, and vendor associations are recommended to reinforce learning, promote peer support, and establish a culture of food safety. Continuous evaluation of knowledge and practices will ensure the programme's relevance, effectiveness, and long-term impact on public health.

CHAPTER 4: GENERAL CONCLUSION AND RECOMMENDATIONS

4.1 CONCLUSION

The major outcomes of the study

- 4.1.1 The study found that the street food vending business was largely unorganised, operated by older, low-educated female vendors, with inadequate infrastructure, poor regulatory oversight, and limited food safety knowledge, all of which contributed to low compliance with food safety standards.
- 4.1.2 The study found that despite long-term involvement in street food vending, most street food vendors possessed low levels of food safety knowledge, particularly in key areas such as food hygiene, temperature control, and microbial hazards. This knowledge gap highlights a weak linkage between street food vendors and health authorities and the urgent need for continuous food safety training programmes to reduce the risk of foodborne disease outbreaks among consumers.
- 4.1.3 The study demonstrated that a properly designed food safety training programme significantly improved street food vendors' food safety knowledge, indicating that targeted training is an effective tool for enhancing safe food preparation practices and reducing the risk of foodborne diseases.

4.2 RECOMMENDATIONS

The major recommendations of the study

- 4.2.1 It is recommended that regulatory authorities strengthen the street food vending sector through formal registration, improved infrastructural support, and targeted food safety education to enhance compliance with established food safety standards.
- 4.2.2 Based on the results obtained, it is recommended that the health authorities establish structured and continuous food safety training programmes targeting the street food vendors, emphasising food hygiene practices, temperature control, and microbial hazard prevention, which can reduce the risk of foodborne disease outbreaks among consumers.

4.2.3 Additionally, it is recommended that authorities and relevant stakeholders conduct regular, well-structured food safety training programmes for street food vendors, targeting interventions training should focus on key areas of food hygiene, safe handling, storage, and preparation practices to promote compliance with food safety standards and reduce the risk of foodborne disease outbreaks among consumers.

4.3 FUTURE RESEARCH CONSIDERATION

Based on the limitations of this study, some areas of future research have been identified. There is a need to investigate food safety compliance and knowledge level of street food vendors in other states outside Oyo State to provide more reliable data for training street food vendors in food safety regulations. It is equally important to analyse how food cultures, beliefs, and attitudes determine street food vendors' compliance with food safety requirements.

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APPENDIX A: QUESTIONNAIRE INSTRUMENT

SECTION A: SOCIO-DEMOGRAPHICS OF RESPONDENTS

Please, mark the appropriate box with X

A1 Gender

1. Male	2. Female
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A2 Age (Years)

1. 18-25	2. 26-35	3. 36-45	4. 46-55	5. 56-65	6. 66-75
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A3 Marital status

1. Married	2. Not married	3. Separated	4. Divorced	5. Widowed
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A4 Which of the following best describes your education level?

1. No formal education	2. Primary school	3. Secondary school	4. Tertiary education
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A5 How long have you been selling food in this place (years)?

1. Less than 5 years	2. 5–10 years	3. 11–15 years	4. More than 15 years
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A6 Have you obtained any food service/ hospitality diploma/degree?

1. Yes	2. No
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A7 Have you ever attended any food safety-training course?

3. Yes	4. No
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NB: If your answer is yes to question A7, proceed to question A8 & A9. Otherwise, proceed to question A10.

A8 If your answer was yes to question 7, when last did you attend the food safety training?

1. Less than 6 months ago	2. Between 7 months and 1 year	3. > 1 year ago	4. Not applicable
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A9 If your answer was yes to 7, have you ever received food safety training while selling food at this street food vending site?

1. Yes	2. No	3. Not applicable
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A10 Is this the first place you have worked as a street food vendor?

1. Yes	2. No
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A11 Which of the following represent your average monthly income generated from street food vending?

1. Less than #30,000	2. #30,001 - #40,0000	3. #40,0001 - #50,000	4. Above #50,000
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A12 Is the selling of street food your primary source of income?

1. Yes	2. No
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SECTION B: LOCATION AND SERVICE TYPE OF STREET FOOD VENDING SITES

B1: In which of the following senatorial sector is your food vending facility located?

1. Oyo Central	2. Oyo North	3. Oyo South
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B2: In which of the following local government sector is your food vending facility located?

Oyo Central

1. Afijo	2. Atiba	3. Ogo Oluwa	4. Oyo East	5. Oyo West
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Oyo North

6. Ogbomoso North	7. Ogbomoso South	8. Iwajowa	9. Iseyin	10. Itesiwaju
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Oyo South

11. Ibadan North	12. Ibadan North East	13. Ibadan North West	14. Ibarapa East	15. Ibarapa Central
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B3: Which of the following best define your street food-vending facility?

1. Roadside with no shelter/facility/premise	2. Roadside with makeshift shelter	3. In a permanent facility/permanent building	4. Mobile food unit
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B4: Do you have a valid license/permit issued by Environmental Health Authorities for your street food-vending business?

1. Yes	2. No
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B5: Where are the foods you sell at this vending facility being prepared?

1. Prepare them at home	2. Buy and sell pre-cooked foods	3. Prepare them on this vending facility	4. Other
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B6: Which of the following types of foodservice do you provide at this street food-vending facility?

1. Takeaway	2. Eating on sites	3. Takeaway & eating on-site combined
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SECTION C

Objective C: To investigate the implementation of the Food sanitation charter of the National Environmental Health Practices Regulation 2007 of the Federal Republic of Nigeria in Oyo State, Nigeria.

Answer to the following questions by placing a cross (X) in the box.

FOOD SANITATION CHECKLIST

C1	FOOD SANITATION	Yes	No
I	Are the food items in a state that maintains its wholesomeness? (clause number 41)		
ii	Am I storing the food items in a state that adheres to the highest hygiene standard? (clause number 41)		
C2	FOOD PREMISES TO BE APPROVED		
I	Has the food items, both cooked and uncooked exposed before being sold to the public? (clause number 42)		
ii	Are the food items properly packaged or covered when it is being served to the public? (clause number 42)		
iii	Are the food items both cooked and uncooked being sold in a vending area approved by the Environmental Health Authority? (clause number 42)		
C3	PERMIT TO OPERATE FOOD VENDING BUSINESS		
I	Is the street food vendor in possession of a valid permit from the Environmental Health Authority to sell foodstuff in this vending site? (clause number 43)		
ii	If yes, do I renew my permit annually? (clause number 41)		
C4	FOOD PREMISES SANITATION		
I	Is the street food vending premises kept clean always? (clause number 44)		
ii	Are the wastes generated from the street food vending premises properly disposed of in a rubbish bin? (clause number 44)		
iii	Are food waste removed from all food preparation areas regularly? (clause number 44)		
C5	PAINTING OF THE FOOD PREMISES		
i	Is the food vending premises painted white with non-washable paint? (clause number 45)		
C6	FOOD PREMISES VENTILATION		
I	Is the food vending premises adequately ventilated? (clause number 46)		
ii	Are all the openings screened to ward off the flies and other vermin? (clause number 46)		
iii	Are the external doors made to be self-closing? (clause number 46)		
C7	TOILET FACILITIES IN THE FOOD VENDING PREMISES		
I	Are there adequate toilet facilities in the street food vending site? (clause number 47)		
C8	BASINS FOR HAND-WASH		
i	Are there basins for handwashing in the street food vending premises? (clause number 48)		
C9	PROVISION FOR HAND TOWEL		

I	Are there clean clothes/hand towels for an individual vendor(s) in the street food vending premises? (clause 49)		
li	Are there clean clothes/hand towels for individual customers in food vending premises? (clause number 49)		
C10	WATER SUPPLY TO THE FOOD PREMISES		
I	Is there adequate tap water for food vending activities in the food vending premises? (clause number 50)		
ii	Is there enough water for washing of plates and washing of hand before and after eating? (clause number 1c)		
lii	Are detergents used to clean surfaces, equipment, floors and walls in the street food vending facility? (clause number 1f)		
iv	Is hot water uses for cleaning dishes, pots and cutlery in the food vending facility? (clause number 1f)		
C11	PERSONAL HYGIENE AND HEALTH OF FOOD HANDLERS (Clause 51)		
I	The hair of the street food vendor(s) is properly covered and neatly kept? (clause number 2c)		
li	The cloths and apron of street food vendor(s) are clean and not soiled? (clause number 2d)		
lii	Street food vendor(s) is not wearing jewels such as rings, bangles while handling food (clause number 2e)		
iv	The fingernails of street food vendor(s) are short, clean, and unpolished? (clause number 2f)		
C12	MEDICAL CERTIFICATE OF FITNESS		
I	Street food vendor(s) has been examined by a qualified medical practitioner and is in possession of a valid certificate of fitness to sell food? (clause number 52)		
li	The medical certificate of street food vendors is being renewed every six months (clause number 52)		
C13	FOOD HANDLER SUFFERING FROM INFECTIOUS DISEASE (Clause 53)		
I	Street food vendor(s) is not having or have been diagnosed with an infectious disease such as diarrhoea, eye discharge or flu or related ailments? (clause number 53)		
li	Street food vendor(s) is not having open cuts, wounds, sores and abrasions that are not covered with waterproof dressing while handling food? (clause number 53)		
C14	FOOD HANDLERS TRAINING		
I	Street food vendor(s) have been attending safe food handling training approved by the Environmental Health Authority in my area on a regular basis? (clause number 54)		
C15	IDEAL TEMPERATURE OF COOKED FOOD		
I	Are cooked foods served hot to customers at a temperature not lower than 60°C? (clause number 55)		
li	Cooked food is stored hot at a temperature not lower than 60°C (clause number 55)		

SECTION D

FOOD SAFETY KNOWLEDGE OF STREET FOOD VENDORS

Objective D1: To assess the food safety knowledge of street food vendors in terms of the Guidelines for Food Handlers Regulation 7 (2) of the Environmental (Sanitation and Wastes Control) Regulations 2013.

Part 1: Personal hygiene

D1. Which of the following is the correct approach to wash your hands during the preparation and serving of foods? (Clause 1c)

1. Wash hands with soap and warm running water and wipe dry with clean cloth	(1)	
2. Wash hands with soap and cold running water and then wipe dry with a clean cloth	(2)	
3. Wash hands with cold running water and wipe dry with a clean cloth	(3)	
4. Wash hands with soap and warm running water and then wipe dry with a clean cloth	(4)	
5. No idea	(5)	

D2. As a food vendor, which of the following makes you wash hands when you are involved in the preparation and serving of food? (Clause 2h)

1. After picking your nose, eye, mouth, ear or hair	(1)	
2. After using the toilet only	(2)	
3. After smoking	(3)	
4. None of the above (1,2,3)	(4)	
5. All of the above (1,2,3)	(5)	
6. No idea	(6)	

D3. Respond to the following statement (Clause 2a)

		Yes	No	No idea
D3.1	As a food vendor, you are allowed to prepare and sell food, even if you may be ill?			
D3.2	As a food vendor, you are allowed to handle food when you have boils, running nose and eye discharge?			
D3.3	As a food vendor, you are not allowed to handle food when you have diarrhoea, even if you wash your hands regularly			

D4 As a food vendor, which of the following is the right way to dry your hands after you have washed them well? (Clause 2d)

1. Wipe using a clean and dry serviette or paper towel	(1)	
2. Wipe using an apron	(2)	
3. Wipe using a clean and dry dishcloth	(3)	
4. 1 and 3 are correct	(4)	
5. All of the above	(5)	
6. No idea	(6)	

D5 As a food vendor, which of the following is the right thing(s) to do if you have a wound in your hands during food preparation? (Clause 2b)

1. Dress the wound with waterproof dressings	(1)	
2. Cover the wound with a bandage	(2)	
3. Wear gloves to cover the wound	(3)	
4. All of the above	(4)	
5. None of the above	(5)	

6. No idea	(6)	
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D6 As a food vendor, which of the following is correct during food preparation? (Clause 2b)

	True	False	No idea
1. You can wear small jewellery during food preparation and serving			
2. No need to wash your finger after tasting hot food during preparation?			
3. You can be chewing gum while preparing food and serving food?			
4. You can keep long fingernails with polish during food preparation and serving?			
5. You can keep your hair uncovered during food preparation and serving?			

Part 2: Food Hygiene Knowledge

Respond to the following statement (Clause 2b)

Indicate true or false in the following statement with regard to food services

	True	False	No idea
2.1 Eating and drinking during the preparation and serving of food should be avoided to avoid contamination the food you sell?			
2.2 Food can be stored at room temperature provided you will heat them before selling to customers?			
2.3 Flies cannot contaminate your food if there is no toilet or rubbish bins around?			
2.4 Keeping cooked in the fridge can help kill some germs in food and prevent people from getting sick?			
2.5 Food is spoiled only when there are changes in the colour, odour or taste?			
2.6 You can use one cutting/chopping board for food preparation in your kitchen so long as you wash it well with soap?			
2.7 No need to keep milk, meat and fish in the refrigerator so long as you will use them to prepare food before the end of the day			
2.8 Assuming there is electricity failure in your kitchen and the soup in your fridge went to room temperature. The safest thing to do to prevent foodborne disease, is to throw all the soup? (clause 1a)			

Part 3: Knowledge on Cooking and Storage temperature (Clause 2o)

Tick the correct answer with regard to food services	Answer options	
3.1 Which of the following is the correct minimum internal cooking temperature for roasted chicken?	90°C	
	65°C	
	100°C	
	78°C	
	No idea	
3.2 Which of the following is the correct minimum internal cooking temperature for a vegetable dish?	87°C	
	77°C	
	67°C	
	57°C	
	No idea	
	At about 25°C	
	At about 10°C	

3.3 Which of the following is the correct temperature guideline for cold storage of ready-to-eat protein-rich foods such as beef, chicken and fish stews?	At about 5°C	
	No idea	
3.4 Which of the following is the correct temperature for the hot holding of ready-to-eat protein-rich foods such as beef, chicken and fish stews during serving?	At about 100°C	
	At about 63°C	
	At about 25°C	
	No idea	

Part 4: Microbial Hazard knowledge and Foodborne disease knowledge (clause 1g)

Tick the correct answer

Variables	Yes	No	No idea
1. Only food with bad odour or change in colour and consistency has bacteria?			
2. Some foodborne bacteria can cause disease that might lead to death?			
3. Is Salmonella a foodborne bacteria?			
4. Is Corona a foodborne bacteria?			
5. Is Escherichia coli foodborne bacteria?			
6. Is Listeria a foodborne bacteria?			
7. Is Campylobacter a foodborne bacteria?			
8. Is Staphylococcus a foodborne bacteria?			
9. Is Clostridium is a foodborne bacteria?			

Part 5: Knowledge of Food Service facility sanitation and resource requirement (Clause 44)

Tick the correct answer

Variables	Yes	No	No idea
1. Is the environment around your food vending site clean?			
2. Is your food vending facility has access to tap water at the site or close to the site?			
3. Is your food vending facility has adequate handwashing facilities available?			
4. Is your food vending facility has adequate food disposal or wastewater facilities available?			
5. Is your food vending facility far from the rubbish bin?			
6. Is your food vending facility far from wastewater?			
7. Is your food vending facility far from toilet facilities and open drains?			
8. Is your food vending facility far from animals?			
9. Is your food vending facility free from flies?			
10. Is your food vending facility free from rats or cockroaches?			

FOOD SAFETY ATTITUDE OF STREET FOOD VENDORS

Objective D2: To assess the food safety attitude of street food vendors on the implementation of Guidelines for Food Handlers Regulation 7 (2) of the Environmental (Sanitation and Wastes Control) Regulations 2013.

Part 1: Personal hygiene attitudes

	1 Strongly disagree	2 Disagree	3 Not sure	4 Agree	5 Strongly agree
1. Food vendor should always wash hands after picking nose, touching the eye, touching the mouth, touching ear or hair, smoking and using the toilet (Clause 2h)					
2. Food vendors should be allowed to prepare and sell food even if they are ill? (Clause 2a)					
3. Food vendors should handle and sell food even when they have running nose and eye discharge so long as they have a clean serviette? (Clause 2a)					
4. Food vendors should handle and sell food even when they have diarrhoea if they wash their hands regularly? (Clause 2a)					
5. Food vendor should dress their wound with a piece of cloth if there is no waterproof dressing? (Clause 2b)					
6. Food vendors may wear a small piece of jewellery during food preparation and serving? (Clause 2b)					
7. Food vendors may eat during food preparation and selling if they are hungry? (Clause 2b)					

Part 2: Food hygiene knowledge attitude

	1 Strongly disagree	2 Disagree	3 Not sure	4 Agree	5 Strongly agree
1. Food vendor can keep cooked food at room temperature before selling to customers if they do have a refrigerator or cooler box? (Clause 2b)					
2. Food vendors should not worry about flies coming to the food they sell if there is no toilet or rubbish bins around? (Clause 2b)					
3. Food vendors are allowed to use one cutting/chopping board for food preparation even if they wash it with soap (Clause 2b)					

4. Food vendors should always throw away soup and stew that has stayed at room temperature for long? (Clause 2b)					
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Part 3: Microbial hazard attitude and foodborne disease attitude (Clause 1g)

	1 Strongly disagree	2 Disagree	3 Not sure	4 Agree	5 Strongly agree
1. Food vendor can heat cooked foods that are a bit sour to make them safe for consumption?					
2. Diseases caused by bacteria in contaminated food may lead to death?					
3. The presence of Salmonella in food can cause disease that can lead to death?					
4. Food vendors should not worry because only younger children can die of foodborne disease?					
5. Foodborne bacteria are present only in leftover food that has been in room temperature overnight?					
6. Bacteria in food can be killed in the stomach of an adult during digestion?					
7. Foodborne bacteria cannot be in food that has been cooked before selling?					

Part 4: Awareness on the purpose of the existing regulation and enforcing authorities (Clause 43)

	Yes	No	No idea
As food vendors;			
1. Do you know that you need a permit approved by the Environmental Health Authority before you can sell food?			
2. Do you know that the Environmental Health Authority should inspect your food vending facility?			
3. Do you know that you can receive penalty/warning for non-compliance from Environmental Health Authority?			

SECTION E Objective 3: To assess the effectiveness of the enforcement of national food safety

Answer to the following questions by placing a cross (X) in the box.

E.1 The Effectiveness of Enforcement Food safety regulations by Environmental Health Authorities

	Questions	Yes	No
1	Has your food vending facility been permitted and authorised to sell food? (Clause 42)	Yes	No
2	Has your food vending business been registered with the Environmental Health Authority? (Clause 42, 43 (1))	Yes	No
3	If you have been issued with a permit for your food vending facility, do you renew your permit annually? (Clause 43 (2))	Yes	No

.4	Has street food vending site been inspected before by Environmental and Health authorities in the past one year? (Clause 45)	Yes	
		No	
5	If yes, how often is your facility being inspected? (Clause 45)	Monthly	
		After 4 months	
		After 6 months	
		After a year	
		More than a year	
6	If your facility has been inspected before, have you ever received a penalty/warning or seizure of goods for non-compliance?	Yes	
		No	
7	Do you have a medical certificate of fitness from the medical practitioner before selling food? (Clause 1a, 52)	Yes	
		No	
8	Do you renew your medical certificate every six months? (Clause 52)	Yes	
		No	
9	Do you attend the food handler's training approved by the Environmental Health Authority in your area? (Clause 54)	Yes	
		No	

THANK YOU FOR YOUR PARTICIPATION!

Kind regards

Oluwatoyin Wumi Alawode

Doctoral candidate, UNISA



APPENDIX B: FOOD SAFETY TRAINING CURRICULUM

FOOD SAFETY TRAINING CURRICULUM

FOOD SAFETY TRAINING SYLLABUS FOR THE STREET FOOD VENDORS IN OYO STATE, NIGERIA

by
ALAWODE Oluwatoyin Wumi (PhD candidate in Consumer Science)

INTRODUCTION

Overview of the food safety training programme

The syllabus entails understanding food safety measures during food preparation and serving.

Learning Outcomes

This training expects to boost the street food vendors' appropriate knowledge on personal hygiene, food hygiene, cooking and storage temperature, food contaminations, microbial hazard and foodborne diseases and food service facility sanitation and resource requirement.

Training Structure

The food safety training programme is divided into six (6) modules: personal hygiene knowledge, food hygiene knowledge, cooking and storage temperature knowledge, food contamination knowledge, microbial hazard and foodborne disease knowledge, and food service facility sanitation and resource requirement knowledge.

S/N	TOPIC	DOMAIN	HOURS
Module 1	Personal hygiene knowledge	Learning Outcomes: We expect the street food vendors (SFVs) to know the following: Importance of the correct approach to hand washing during the preparation and serving of foods. Reasons for hand washing during the preparation and serving of foods Reasons for not allowing them to prepare and serve food when ill. Reasons for not allowing to prepare and serve when they have boiled, running nose and eye discharge Reasons for not allowing them to prepare and serve foods when they	2 Hours

		have diarrhoea, even when they wash regularly. Importance of the right way to dry hands after washing them well. Importance of knowing the suitable materials to cover hand wounds during food preparation and serving. Importance of not wearing jewellery during food preparation and serving. Reasons for the need to wash fingers after tasting hot food during preparation. Reasons for not chewing gum while preparing and serving food. Importance of not covering hair during food preparation and serving. Questions As street food vendors: What is your understanding of hand washing during the preparation and serving of food? What did you do with food preparation and serving when you have boils, wounds, chewing gum and during illness? Do you think you have to decorate your body during food preparation and serving?	
Module 2	Food Hygiene Knowledge	Learning Outcomes: We expect the street food vendors (SFVs) to know the following: Reasons why they must not eat and drink while preparing and serving food. Reasons why food cannot be stored at room temperature even if it will be heated before selling to customers.	2 Hours

		Reasons why flies can contaminate food if there is no toilet or rubbish bins around Reasons why keeping cooked food in the fridge cannot help to kill some germs and prevent people from getting sick Reasons why only changes in colour, odour or taste cannot determine if food is spoiled Reasons why one cutting/chopping board cannot be used in food preparation in the kitchen even if it is washed with soap Reasons why milk, meat and fish need to be stored in the refrigerator even if they will be used the same day Reasons why it is essential to prevent electricity failure in the kitchen Questions As street food vendors: Did you prepare and serve food when you were eating and drinking? Can flies and using one cutting/chopping board contaminate food during preparation and serving? Can food be stored at room temperature, and changes in its colour, odour, or taste lead to spoilage? Is electricity essential in the kitchen to preserve milk, meat and fish?	
Module 3	Knowledge on Cooking and Storage temperature	Learning Outcomes: We expect the street food vendors (SFVs) to know the following: Importance of correct minimum internal cooking temperature for roasted chicken	2 Hours

		Importance of correct minimum internal cooking temperature for a vegetable dish Importance of correct temperature guidelines for cold storage of ready-to-eat protein-rich foods such as beef, chicken and fish stews Importance of correct temperature guidelines for hot storage of ready-to-eat protein-rich foods such as beef, chicken and fish stews Questions As street food vendors: Is it important to know the correct internal cooking temperature for roasted chicken and vegetable dishes? Is it important to know the correct temperature guideline for cold and hot storage of ready-to-eat protein-rich food?	
Module 4	Food Contamination Knowledge	Learning Outcomes: We expect the street food vendors (SFVs) to know the following: That food contaminants are harmful to human health. The sources of food contamination such as food containers, dirty equipments and pollution. Types of food contaminations such as chemical, physical and biological. The symptoms of consumption of contaminated foods such as fever, nausea, diarrhoea, chronic illness and even death. Questions Are the food contaminated foods harmful if consumed? What are the sources and types of food contamination?	

		What are the symptoms of food contamination?	
Module 4	Microbial Hazard knowledge and Foodborne disease knowledge	Learning Outcomes: We expect the street food vendors (SFVs) to know following: The importance of the main foodborne pathogenic bacteria features in contaminated food. The types of foodborne diseases pathogens which includes viruses, bacteria, fungi, protozoa, and worms. That some foodborne diseases microorganisms are mesophilic with optimal growth temperature range from 20 °C to 45 °C, examples are <i>Listeria monocytogenes</i>, <i>Staphylococcus aureus</i>, and <i>Escherichia coli</i>. That some foodborne diseases microorganisms are capable of growth under refrigerated conditions or temperatures less than 10 °C such as <i>Listeria monocytogenes</i>, and <i>Yersinia enterocolitica</i> That foodborne diseases microorganism can multiply and double its number within 20 minutes. That flies pests and rodents can transmit foodborne diseases into food. Questions What are the features of bacteria-contaminated food? Are <i>Salmonella</i>, <i>Escherichia coli</i>, <i>Listeria</i>, <i>Campylobacter</i>, <i>Staphylococcus</i> and <i>Clostridium</i> foodborne bacteria? Is Corona a foodborne bacteria?	2 Hours
Module 5	Knowledge of Food Service facility sanitation and resource requirement	Learning Outcomes: We expect the street food vendors (SFVs) to know the importance of the following:	2 Hours

		Keeping the food vending site clean Food vending facilities having access to tap water on the site or close to the site Food vending facility has adequate hand-washing facilities on the site. Food vending facility having adequate food disposal or wastewater facilities on the site. Food vending facility far from the rubbish bin Food vending facility far from the wastewater Food vending facilities far from toilet facilities and open drains Food vending facilities far from the animals Food vending facility far from flies Food vending facility far from rats or cockroaches Questions Is the food vending facility clean, far from the rubbish bins, wastewater, toilet facilities, open drains and animals? Does your food vending facility have access to adequate tap water, hand-washing facilities and food disposal or wastewater facilities? Is the food vending facility free from flies, rats and cockroaches?	
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APPENDIX C: CONSENT FORM



7-10-2020

PARTICIPANT INFORMATION SHEET

Title: The food safety knowledge of street food vendors and the implementation of food safety policies and procedures in Oyo State, Nigeria.

Dear Prospective Participant,

My name is ALAWODE OLUWATOYIN WUMI; I am doing my PhD research in the Department of Life and Consumer Sciences, University of South Africa. The title of my research project is "The food safety knowledge of street food vendors and the implementation of food safety policies and procedures in Oyo State, Nigeria". My project supervisor is Prof Frederick Tabit.

WHAT IS THE PURPOSE OF THE STUDY?

This study aims to investigate the food safety knowledge of street food vendors and the implementation of food safety policies and procedures in Oyo State Nigeria.

WHY AM I BEING INVITED TO PARTICIPATE?

You are invited to take part in this research because relevant information concerning your food safety knowledge and details of your street food vending facility will be gathered. Your information and other participants will be analysed to produce scientific data that will assist the Ministry of Health (both local and state) on future intervention in implementing national food safety policies and procedures that may benefit the street food vending business.

WHAT IS THE NATURE OF MY PARTICIPATION IN THIS STUDY?

You will provide answers to questions on your socio-demographics, vending site, type of services provided and food safety knowledge. Information on the sanitary condition of street food vending facility will be collected. You will be spending nearly 25 minutes in answering the questions.

CAN I WITHDRAW FROM THIS STUDY EVEN AFTER HAVING AGREED TO PARTICIPATE?

You may withdraw from this study at any time because your participation is voluntary.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

The outcome of this research will be made available to relevant government authorities which may assist them in making decisions that can improve the safety of street vended foods and which may, in turn, boost consumers' confidence in purchasing street vended foods.

ARE THERE ANY NEGATIVE CONSEQUENCES FOR ME IF I PARTICIPATE IN THE RESEARCH PROJECT?

No harmful consequences will result from your participation in this project.

WILL THE INFORMATION THAT I CONVEY TO THE RESEARCHER AND MY IDENTITY BE KEPT CONFIDENTIAL?

Your response to questions and your opinions will be viewed as strictly confidential, and only members of the research team will have access to such information. No data published in dissertations and journals will contain any information by means of which you may be identified; hence, your anonymity is therefore ensured.

HOW WILL THE RESEARCHER(S) PROTECT THE SECURITY OF DATA?

The researcher will store hard copies of your answers for a period of five years at the Department of Life and Consumer Science at UNISA for future research or academic purposes. Electronic information will be stored on a password-protected computer.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICIPATING IN THIS STUDY?

No incentive will be given for your participation.

HAS THE STUDY RECEIVED ETHICS APPROVAL

This study will receive written approval from the Research Ethics Review Committee of Unisa. A copy of the approval letter can be obtained from the researcher if you so wish.

HOW WILL I BE INFORMED OF THE FINDINGS/RESULTS OF THE RESEARCH?

If you are interested in the final findings of this study, you may contact Mrs OW Alawode, +2348161173368, 49371347@mylife.unisa.ac.za, or Prof FT Tabit, +27114712080, Tabitft@unisa.ac.za

Thank you for taking the time to read this information sheet and for participating in this study.

CONSENT TO PARTICIPATE IN THIS STUDY

I, _____, confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable).

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I have received a signed copy of the informed consent agreement.

Participant Name & Surname.....
(Please print)

Participant Signature.....Date.....

Researcher's Name & Surname: **OLUWATOYIN WUMI ALAWODE**

Researcher's signature.....Date.....

APPENDIX D: PERMISSION LETTER

TELEGRAMS.....

TELEPHONE.....



MINISTRY OF HEALTH
DEPARTMENT OF PLANNING, RESEARCH & STATISTICS DIVISION
PRIVATE MAIL BAG NO. 5027, OYO STATE OF NIGERIA

Your Ref. No.
All communications should be addressed to
the Honorable Commissioner quoting *A*
Our Ref. No. AD 13/479/ *4050*

th
26 February, 2021

The Principal Investigator,
Department of Life and Consumer Sciences,
University of South Africa,

Attention: Alawode Oluwatovin

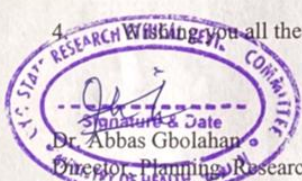
ETHICS APPROVAL FOR THE IMPLEMENTATION
OF YOUR RESEARCH PROPOSAL IN OYO STATE

This is to acknowledge that your Research Proposal titled: "The Food Safety Knowledge of Street Food Venders and the Implementation of Food Safety Policies and Procedures in Oyo State Nigeria." has been reviewed by the Oyo State Ethics Review Committee.

2. The committee has noted your compliance. In the light of this, I am pleased to convey to you the full approval by the committee for the implementation of the Research Proposal in Oyo State, Nigeria.

3. Please note that the National Code for Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations, in line with this, the Committee will monitor closely and follow up the implementation of the research study. However, the Ministry of Health would like to have a copy of the results and conclusions of findings as this will help in policy making in the health sector.

4. *Wishing you all the best.*



Signature & Date
Dr. Abbas Gbolahan
Director, Planning, Research & Statistics
Secretary, Oyo State, Research Ethics Review Committee

APPENDIX F: ETHICS APPROVAL LETTER



UNISA-CAES HEALTH RESEARCH ETHICS COMMITTEE

Date: 16/11/2023

Dear Ms Alawode

NHREC Registration # : REC-170616-051
REC Reference # : 2021/CAES_HREC/037
Name : Ms OW Alawode
Student # : 49371347

**Decision: Ethics Approval
Confirmation after First Review
from 04/03/2021 to 28/02/2026**

Researcher(s): Ms OW Alawode
49371347@mylife.unisa.ac.za

Supervisor (s): Prof FT Tabit
tabitft@unisa.ac.za; 011-471-2080

Working title of research:

The food safety knowledge of street food vendors and the Implementation of food safety policies and procedures in Oyo State, Nigeria

Qualification: PhD Consumer Science

Thank you for the submission of your yearly progress report to the Unisa-CAES Health Research Ethics Committee for the above mentioned research. Ethics approval is confirmed to continue for the originally approved period, subject to submission of yearly progress reports. **Failure to submit the progress report will lead to withdrawal of the ethics clearance until the report has been submitted.**

Due date for next progress report: 31 October 2024

The progress report form can be downloaded from the college ethics webpage:

<https://www.unisa.ac.za/sites/corporate/default/Colleges/Agriculture-&-Environmental-Sciences/Research/Research-Ethics>

The medium risk application was originally reviewed by the UNISA-CAES Health Research Ethics Committee on 04 March 2021 in compliance with the Unisa Policy on



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www.unisa.ac.za

Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
7. No field work activities may continue after the expiry date. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

*The reference number **2021/CAES_HREC/037** should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Yours sincerely,





Prof MA Antwi

Chair of UNISA-CAES Health REC

E-mail: antwima@unisa.ac.za

Tel: (011) 670-9391

Prof M Ntwasa

Acting Executive Dean: CAES

E-mail: ntwasmm@unisa.ac.za

Tel: (011) 717-6351