

THE UNIVERSITY OF YAOUNDE I

FACULTY OF SCIENCES

CENTER FOR RESEARCH AND
TRAINING IN
GRADUATE STUDIES IN LIFE,
HEALTH AND ENVIRONMENTAL
SCIENCES



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FACULTE DES SCIENCES

CENTRE DE RECHERCHE ET DE
FORMATION DOCTORALE, EN
SCIENCE DE LA VIE, SANTE ET
ENVIRONNEMENT

DEPARTMENT OF BIOCHEMISTRY

DEPARTEMENT DE BIOCHIMIE

LABORATORY OF PHARMACOLOGY AND TOXICOLOGY

LABORATOIRE DE PHARMACOLOGIE ET TOXICOLOGIE

**KNOWLEDGE, ATTITUDE AND PRACTICES OF HYGIENE
AND SANITATION BY STREET FOOD VENDORS AND
IMPACTS ON CONSUMERS HEALTH IN THE BIYEMASSI AND
OBILI YAOUNDE CAMEROON**

*A dissertation submitted to the Faculty of Science, University of Yaounde I in partial
fulfillment of the requirements for the award of a Master's Degree in Biochemistry.*

Option: Public Health and Biotechnology

Candidate:

AKUMACHI GLORY ZEE

(BSc. Nursing; Matricule number: 21U2627)

Supervisor:

Wilfred Angie ABIA

Senior lecturer

University of Yaoundé



Academic Year: 2022- 2023

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CERTIFICATION

This is to certify that the research title “evaluating the knowledge, attitudes and practices of hygiene and sanitation by street food vendors and impacts on consumers health at the Biyemassi and obili communities in Yaounde, Cameroon” is the original work of AKUMACHI GLORY ZEE and had not been submitted anyway

Name: AKUMACHI GLORY ZEE

EXAMINER

Signature: _____

Date: _____

Supervisor: Dr Wilfred Angie Abia

PRESIDENT OF JURY

Signature: _____

Date: _____

DECLARATION

I, Akumachi Glory Zee, confirm that the work presented in this dissertation is my own. Where information has been derived from other sources, I confirm that this has been indicated in the dissertation.

DEDICATION

I dedicate this work to my father, Mr. AKUMA CHI RICHARD

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

CERTIFICATION.....	i
DECLARATION	ii
DEDICATION	iii
ACKNOWLEDGEMENTS	iv
LIST OF FIGURES.....	vii
LIST OF TABLES	viii
LIST OF ABBREVIATIONS AND ACRONYMS/GLOSSARY.....	ix
ABSTRACT	x
RESUME.....	xi
INTRODUCTION	1
1 Background	1
2 Problematic	2
3 Research questions.....	3
3.1 General Research Question	3
3.2 Specific Research Question.....	3
4 Objectives	3
4.1. Main Objective	3
4.1. Specific Objective	3
5 Hypothesis.....	4
1.6. Definition of key terms	4
CHAPTER ONE.....	5
LITERATURE REVIEW	5
1.1 Brief History	5
1.2 Situation in Africa.....	5
1.3 Situation in Cameroon	6
1.4 food safety knowledge and hygienic practices	7
1.5 Importance of food hygiene practices	8
1.6 Food safety and hygienic practices of street food vendors	8
1.7 How to practice food and personal hygiene.....	9
1.8 Epidemiology Situation	9
1.9 Risk factors of food borne diseases include;.....	10
1.10 Mood of transmission of food borne diseases include;.....	11
1.11 Consequences of poor food hygiene practices	12
1.12 The five keys to safer food.....	12
1.12.1 Keep clean	12
1.12.3 Cook thoroughly.....	14

1.13-Paradigms of street food vending in sustainable development.....	15
1.15- The Socioeconomic Factors of Street Food Vending in Developing Countries and Its Implications for Public Health	16
1.15.1- Consequences of the Non-Respect of Good Hygiene Practices on Health of Consumers.....	17
CHAPTER TWO	19
MATERIALS AND METHODS	19
2 Study design.....	19
2.1 Study site.....	19
2.2 Study population	20
2.3 Participants, data collection and analysis.....	20
2.3.1 Sample population and sample size	20
2.3.2 Data collection.....	21
2.4 Materials and procedures used.....	22
2.5 Variables and definitions	22
2.5.1 Dependent variable.....	22
2.5.2 Independent variable	22
2.6 Statistical analysis.....	22
CHAPTER THREE	23
RESULTS AND DATA INTERPRETATION	23
3.1 Demographic information.....	23
3.2 Information on business	24
3.3 Knowledge of hygiene and sanitation among food vendors in Biyemassi and obili communities.....	25
3.3 Practice of hygiene and sanitation among food vendors in Biyemassi and Obili communities.....	26
CHAPTER FOUR	34
DISCUSSION, CONCLUSION AND RECOMMENDATION.....	34
4.1 Discussion	34
4.2 Conclusion	36
4.3 Prospective of the studies.....	36
4.4 Recommendations.....	36
REFERENCES.....	37
APPENDICES.....	46

LIST OF FIGURES

Figure 1: Diagram representing different sources of food contamination	11
Figure 2 : Diagram representing the chain of infection.....	11
Figure 3: Field of exposed food on the streets of Cameroon	12
Figure 4 : Map localizing Yaounde in Cameroon and Cameroon in Africa	20
Figure 5: Knowledge of food hygiene and sanitation among vendors in both locations	25
Figure 6: Knowledge of foodborne diseases	25
Figure 7: Personal hygiene and sanitation practice by food vendors in both locations	26
Figure 8: Environmental hygiene and sanitation practices by vendors	27
Figure 9: Food hygiene practice by vendors of both locations	28
Figure 10: Different Health challenges faced by consumers in both communities.....	29

LIST OF TABLES

Table 1: Tabular presentation of socio- demographic data of vendors	23
Table 2: Tabular presentation of socio demographic data of consumers	24
Table 3: Tabular presentation of their business	24
Table 5: presentation of the practice of hygiene and sanitation among food vendors collected based on personal hygiene	26
Table 6: Data based on the environmental hygiene and sanitation practices of vendors of both locations	27
Table 7: Tabular presentation of food hygiene practices among vendors	28
Table 9: Assessment of the impact of consumption of street foods on consumers' health.	30
Table 10: Assessment of the impact of consumption of street foods on consumers' health...	31

LIST OF ABBREVIATIONS AND ACRONYMS/GLOSSARY

FAO	: Food and Agriculture Organization
FSD	: Food Safety Division.
GIT	: Gastro – Intestinal Tract
IAMAT	: International Association for Medical Assistance to Travelers
IDP	: Internally Displaced Persons
MOPH	: Ministry of Public Health
NOSO	: North West and South west
RSDV	: Road side drug vendors
SDGs	: Sustainable Development Goals
SFC	: Street Food Consumers
SFV	: Street Food Vendors
WHO	: World Health Organization

ABSTRACT

Food is anything solid or liquid which when swallowed, digested and assimilated in the body provides it with essential substances called nutrients. Street food vending are ready-to-eat food and beverages prepared and sold by vendors in different public places especially in the streets and crowded bus or train stations. WHO introduced five key features to safer food which are as follows; keep clean, separate raw and cooked materials, keep food at safe temperature and use safe water and raw materials? WHO estimates 600million foodborne diseases each year were related to poor food safety and hygienic practices with about 420000 deaths. As such, this study was conducted to investigate the practices of hygiene and sanitation by street food vendors and impacts on consumers health at the Biyemassi and obili communities in Yaounde, Cameroon. To evaluate the practices of hygiene and sanitation by street food vendors and impacts on consumers health at the Biyemassi and obili communities in Yaounde, Cameroon. A cross-sectional descriptive study was conducted using a qualitative and quantitative method to achieve the objectives of this work. Structured questionnaires were used to obtain information on KAPs on food hygiene and sanitation amongst SFV, consumers, Clinics, RSDV in the Biyemassi and obili neighborhoods. Responses between SFV, consumers, clinics, RSDV were correlated with the observed KAPs of street vendors to ascertain any specific linked. A total of 250 participants provided data for this studies (100 SFV, 50 consumers, 50 health persons from 50 clinics, 50 RSDV). Majority of participants were within 21-30 years, where 72% were females and 28% were males for vendors, 56% female and 44% male for consumers. Greater part of the part had secondary and/or university education, and 56% were single. Base on the nature of business 62% had informal were 48% are associated to the street. 78% of food vendors had knowledge on food hygiene and sanitation, 29% practice personal and environmental hygiene while 58% practice food hygiene.

This study also review the implication of street food on consumer's health were it is recorded that, a good number of participants 66% faced health challenges after consuming street food while a minority of 34% for both communities did not faced any health challenge after eating street food. Base on clinics; health issues related to Street food consumption are not the most frequent illnesses that causes people to visit the hospital, majority reported with illness such as malaria with 42% , typhoid with 34% in Biyemassi and obili communities. Also they had a minority registration of problems related to street food consumptions of 8% in biyam assi and obili communities. Whereas; RSDV revealed that, they sell more medications (42 %) with regards to effects of street food consumption in the Biyemassi and obili communities. This study finding shows that food vendors were knowledgeable but did not put in adequate practice measures hence affecting consumer's health. Researcher therefore suggests that continuous food education trainings and frequent checkups should be done for vendors. Also continuous sensitization of hygiene and sanitation to the general public.

KEY WORDS: Food, Hygiene, Sanitation, Knowledge, Practice, street food vendors, consumer's health.

RESUME

La nourriture englobe tout ce qui, une fois ingéré, fournit des nutriments essentiels au corps. La vente de nourriture de rue implique des aliments et boissons prêts à consommer, souvent préparés dans des lieux publics tels que les rues et les gares. L'Organisation mondiale de la santé (OMS) a identifié cinq principes clés pour garantir une alimentation sûre : maintenir la propreté, séparer les aliments crus des cuits, bien cuire, conserver les aliments à des températures sûres, et utiliser de l'eau et des matières premières sûres. Environ 600 millions de cas de maladies d'origine alimentaire sont liés à de mauvaises pratiques d'hygiène, entraînant environ 420 000 décès chaque année.

Cette étude visait à analyser les pratiques d'hygiène et d'assainissement des vendeurs de nourriture de rue et leur impact sur la santé des consommateurs dans les communautés de Biyemassi et Obili à Yaoundé, Cameroun. Une étude descriptive transversale, utilisant des méthodes qualitatives et quantitatives, a été réalisée. Des questionnaires structurés ont été distribués à 250 participants (100 vendeurs, 50 consommateurs, 50 professionnels de santé, 50 vendeurs au détail) pour évaluer leurs connaissances et pratiques en matière d'hygiène. La majorité des participants étaient jeunes, avec une proportion plus élevée de femmes. Les résultats montrent que 78 % des vendeurs connaissaient les principes d'hygiène, mais seulement 29 % adoptaient des pratiques d'hygiène personnelle et environnementale. Environ 66 % des consommateurs ont signalé des problèmes de santé après avoir consommé de la nourriture de rue, bien que les maladies d'origine alimentaire n'étaient pas les principales causes de visites aux cliniques. Les problèmes de santé les plus fréquents étaient le paludisme (42 %) et la typhoïde (34 %). Les conclusions de l'étude indiquent que, malgré une connaissance des pratiques d'hygiène, les vendeurs ne les appliquent pas suffisamment, ce qui impacte la santé des consommateurs. Les chercheurs recommandent des formations continues sur l'hygiène alimentaire et des contrôles réguliers pour les vendeurs, ainsi qu'une sensibilisation accrue à l'hygiène pour le grand public.

MOTS CLÉS: Nourriture, Hygiène, Assainissement, Connaissances, Pratique, Vendeurs de nourriture de rue, Santé des consommateurs.

INTRODUCTION

INTRODUCTION

1 Background

Street foods are ready-to-eat foods and beverages prepared and sold by vendors in public places and on the streets (Sharma *et al.*, 2017). The global food demand has gradually been increasing, and is expected to rise by 35% due to increase in population size over the years (Bansal *et al.*, 2017). This results in the increase of street food vending. Street food selling is mostly of an informal nature and is often not regulated by any relevant authority (Lues *et al.*, 2006; Samapundo *et al.*, 2016). Millions of people daily feed on street foods, a wide variety of which are easily accessible and relatively cheap. (Bamuwanye *et al.*, 2015). Street food vending businesses contribute significantly in solving socio-demographic shortcomings through the provision of ready to eat meals at affordable prices as well as a means of providing employment. (Lakshan *et al.*, 2022).

Food safety is an umbrella term that encompasses many facets of handling, preparation and storage of foods in order to prevent illness and injury that may result from microbiological, chemical and microphysical contaminants. Microbiological contamination of food is closely linked to poor hygiene practices during the handling, preparation and storage of foods and its generally the cause of food borne diseases and food intoxications. Food hygiene is defined as the measures and conditions necessary to control hazards and to ensure fitness for human consumption of food (Heggum *et al.*, 2016).

Food hygiene is a concern in both developed and undeveloped countries. The World Health Organization (WHO) considers food hygiene as a public health priority with the most vulnerable population consisting of infants, young children, pregnant mothers, the elderly and people with underlying diseases. Nearly 45 percent of all people in Africa will face unclean sanitary conditions in their lives (Montgomery *et al.*, 2007). This includes poor sanitation during food preparation by food sellers. Most street food vendors possess low educational training and often lack adequate food safety knowledge and skills (Samapundo *et al.*, 2015). They are likely not to execute food hygiene and sanitation procedures during the handling and preparation of food (Noor *et al.*, 2016) and this could lead to the contamination of food. The occurrence of food contamination is intertwined with various factors, such as a lack of good hygiene, incorrect food temperatures and an inability to follow proper food preparation techniques (Monney *et al.*, 2013). Furthermore, most street food vendors have been found to possess inadequate equipment resources such as refrigerators, potable water and electricity supply (Farahat *et al.*, 2015). Inadequate resources - such as no electricity and contaminated

water - may hamper the implementation of food hygiene and sanitation practices; hence, exposing food to spoilage and contamination (Monney *et al.*, 2013). Food hygiene and sanitation is thus of utmost importance to global health. In South Africa, street-vended foods are often prepared and sold on busy street corners and at taxi ranks and railway stations. These sites are usually located outdoors or within makeshift shelters (Kubheka *et al.*, 2001). In Cameroon street food vending is one of the major activities in the large informal sector. The major street food consumption points are located around areas of high social activities such as public markets and road junctions. About 40 % of people who are into street food vending in Cameroon rely on the activity to generate incomes (Edima *et al.*, 2014). The general hygiene of the vendors is poor and is more often due to lack of running water at the vending sites, lack of proper toilets and the lack of demand quality in terms of hygiene by consumers. Even though it has been found that consumers lack confidence in the safety of these foods, their preference for these foods is often not hampered (Asiegbu *et al.*, 2016). Biyemassi and Obili are examples of the busiest quarters in Yaoundé Cameroon, notably due to the increase of street food vending. Currently, there is little research information regarding street food vendors in the Biyemassi and obili and their compliance to good hygiene practices.

2 Problematic

Food hygiene is a concern in both developing and underdeveloped countries. Food and Agricultural Organizations (FAO) defines food security as a situation that exist when all people at all times have physical, social and economic access to sufficient safe and nutritious food that meets their dietary need and food preference and active and healthy life. For this to be achieved there is need for sanitary measures to be taken on both the parts of the consumers and the sellers. Globally, 1 in 10 people fall ill from consuming contaminated food and 48 million people get sick from food borne diseases, 420,000 die every year resulting from foodborne diseases (WHO 2007). The consumption of street foods among young, black African males was found to be very common, due to its convenience, availability and affordability. Even though it has been found that consumers lack confidence in the safety of these foods, their preference for these foods is often not hampered (Asiegbu *et al.*, 2016). The Biyemassi and Obili is undergoing rapid population growth and food disease propagation due to enteric virus and bacteria is a concern. The population partly depends on street foods either as consumers or as vendors (NIV 2011). One may speculate that hygiene and sanitation practices around SFV may be jeopardized. Currently, there is little researched information

regarding street food vendors' knowledge, attitude and practice on hygiene and sanitation on street food vending sites.

3 Research questions

3.1 General Research Question

What is the knowledge, attitude and practices of hygiene and sanitation by street food vendors and impacts on consumers' health at the Biyemassi and obili communities in Yaounde, Cameroon?

3.2 Specific Research Question

1. What is the knowledge, attitude and practices of hygiene and sanitation by street food vendors at the Biyemassi and obili communities in Yaounde, Cameroon?
2. What impact does street food vending poses on consumers' health at the Biyemassi and obili communities in Yaounde, Cameroon?
3. What standard operating protocol (SOPs) can be developed for street food vending at the Biyemassi and obili communities in Yaounde, Cameroon?

4 Objectives

4.1. Main Objective

The main objective of this study was:

- To evaluate the knowledge, attitudes and practices of hygiene and sanitation by street food vendors and impacts on consumers health at the Biyemassi and obili communities in Yaounde, Cameroon.

4.2. Specific Objective

To accomplish the above general objective, specifically this study was intended:

1. To determine the knowledge, attitude and practices of hygiene and sanitation by street food vendors at the Biyemassi and obili communities in Yaounde, Cameroon
2. To examine the correlation between street consumption and consumers health outcome Biyemassi and obili communities in Yaounde, Cameroon
3. To propose educational interventions strategies (in the form of standard operating procedures, SOPs), aim at improving hygiene and sanitation practices amongst street food vendors in the Biyemassi and obili communities in Yaounde, Cameroon.

5 Hypothesis

A poor hygiene and sanitation practice by street food vendors poses a negative health outcome on consumers' health.

5.1. Definition of key terms

Hygiene: the conditions or practices conducive to maintaining health and preventing disease, especially through cleanliness.

Sanitation: having access to facilities for the safe disposal of human waste (feces and urine). As well as having ability to maintain hygienic conditions, through services such as garbage collection, industrial/hazardous waste management, and wastewater treatment and disposal.

Knowledge: Facts, information and skills acquired through experience or education; the theoretical or practical understanding of a subject.

Practice: Practice refers to the act of repeatedly performing an activity or skill in order to improve one's proficiency and expertise.

Attitude: Attitude is a psychological term that refers to an individual's overall disposition, feelings, or general mindset towards a particular object, person, situation, or idea. It is a mental state that can influence how a person perceives, thinks, and behaves.

Food: Any nutritious substance that people or animals eat or drink or that plants absorb in order to maintain life and growth.

Hygiene and sanitation: the facilities, behaviors, and services that prevent diseases caused by contact with human waste while hygiene refers to behaviors that can improve cleanliness and lead to good health.

Food safety: refers to the practices and procedures that ensure food is prepared, handled, and stored in ways that prevent foodborne illnesses and contamination. It involves a series of steps aimed at ensuring that food is safe for consumption from production to consumption.

Food security: the adequacy of the food supply in terms of individuals having access food to sufficient amounts of nutritious and safe food.

Foodborne disease: a disease caused by eating or drinking contaminated food. You can get foodborne illness by eating food contaminated by harmful organisms, such as bacteria, parasites, and viruses.

Vendor: An individual offering something for sale especially a trader in the street in order to make profit and another name is handlers.

CHAPTER ONE
LITERATURE REVIEW

CHAPTER ONE: LITERATURE REVIEW

1.1 Brief History

Food hygiene and sanitation are crucial factors in ensuring the safety and quality of food consumed by the public. Food vendors play a significant role in providing meals and snacks to a large number of people, making it essential for them to possess adequate knowledge and adhere to proper practices of food hygiene and sanitation. People sold ready to eat food since earlier civilizations, ancient Greeks had street vendors that sold fried fish, while ancient Romans depended on street food for nutrition because they often didn't have ovens in their homes to prepare food. In China, street food was intended for the poor but the wealthier classes will sometimes send their servants to buy street food for them. Food vending activities evolved in the 14th century in Egypt, then in North America, in the American Colonial periods similarly in Europe. Food like French fries came to existence from the 19th century where potatoes were cut in strips and fried. This proves that food vending has been a practice from time immemorial and it still remains a very common practice or occupation today (Dominique *et al.*, 2016).

In low- and middle-income countries, a large proportion of ready-to-eat foods are sold on the street without maintaining their hygienic conditions. Studies have shown that street food vendors are not familiar with the WHO's five keys to safer food for food handlers (Bakar K *et al.*, 2022), which include keeping clean, separating raw and cooked food, cooking thoroughly, keeping food at safe temperatures, and using safe water and raw materials. Food safety knowledge and practices is important because inadequate knowledge, negative attitudes, and poor sanitation practices by street food vendors can cause significant public health problems with food safety issues food control (2010). Therefore, the knowledge and practices of street food vendors on food safety contributes significantly to the occurrence of FBDs among consumers (Kim *et al.*, 2019).

1.2 Situation in Africa

Street foods are perceived to be a major public health risk due to lack of basic infrastructure and services, difficulty in controlling the large numbers of street food vending operations because of their diversity, mobility and temporary nature. Very little is known about street food consumption in many African countries even though the sectors play a large role in national economy in terms of employment and sales of food (Steyn *et al.*, 2011).

Ready to eat food are pre-cooked, pre-cleaned, and mostly packaged foods that are ready for consumption without prior preparation or cooking. Ready to eat food includes salads, cooked meat, smoked fish desserts, sandwiches, cheese and food cooked in advance to serve cold, being an increasing commodity in the industrialized world (Camellini *et al.*, 2021). However, another aspect of these foods is present in developing countries, where ready to eat street foods are sold by vendors and hawkers in public places for immediate or later consumption without further processing or preparation (Cardoso *et al.*, 2017). Street food is an important source of ready to eat food in these countries and provides significant contribution to the economy by providing employment, household income, and affordable food while also being appreciated for its convenience and typical flavors (Sousa *et al.*, 2021; Habib, 2016). It is estimated that approximately 2.5 billion people consume street food daily (Samapundo *et al.*, 2016). This type of consumption supports the livelihoods of millions of low-income people and contributes significantly to the economy. (MA *et al.*, 2019). In developing countries mainly in Africa, street food vendors are usually associated with small family businesses whose food preparation locations are the vendor's own homes, sidewalks, or any other informal places (Cardoso *et al.*, 2017).

In Africa, the contribution of street food vending is largely neglected despite its major contribution to the socio-economic stability of many low-income urban communities (Mahopo *et al.*, 2022; Kiran *et al.*, 2019). It is estimated that in South Africa, in 2022, this informal sector of employment, representing about 18% of citizens working in the street vending sector, where more than 70% of street vendors sold ready to eat street food.

1.3 Situation in Cameroon

Cameroon just like most countries of the developing world faces several challenges with regards to adequate hygiene, accessibility to water, proper food hygiene and resolving health issues especially those which are food borne. Women and children are the main actors in the street food sector (Salamandane *et al.*, 2021; Mahopo *et al.*, 2022). In most cases, the female entrepreneurs are single mothers or widows working in this sector to support the family economy throughout their working lives due to the lack of opportunities in the formal sectors (Nyoni *et al.*, 2019; Chauke *et al.*, 2017). As they are informal sellers, these entrepreneurs have difficulties accessing financing through credit institutions (PK *et al.*, 2017). Nor do they count on the support of government entities in their training in good manufacturing practices and/ or business management (Salamander *et al.*, 2021). With the outbreak of the COVID-19, hand washing practices became very prominent and widely accepted preventive measure by

the population of Cameroon, and this had a great influence in reducing the spread of microbes and also reducing infections related to food contaminations. The implementation of this sanitary measures was however short lived as majority of the population reverted to poor hand hygiene practices. food consume by Cameroonians are often termed traditional as they consume the food with their bare hands which also calls for concern as to how well hands are washed to prevent infections. Thus, these two communities have intense human activities going on, the presence of infrastructures such as; schools, shops, financial institutes, markets, construction sites etc. in which has a large population size. Examples of some vended foods are; rice, beans, fries, spaghetti, tomato sauce, fried chicken, water-fufu and eru, pap, fufu corn and vegetables, fried pork and many others. Therefore, the need for food vendors to adhere to high standards of hygiene and maintain clean vending environments cannot be overemphasized. This has prompted considerable research to assess hygiene and food handling practices among food vendors across the globe in order to contribute to efforts aimed at improving food handling practices.

1.4 food safety knowledge and hygienic practices

It has been argued that sufficient knowledge of food hygiene would result in proper handling of food and good preparation practices of food vendors. On the other hand, insufficiency of the knowledge of food hygiene would lead to poor handling of raw materials for food. During food preparation, food handlers have direct contact with food and some of these food handlers out on some jewelry which lead to contamination of food. It is therefore very important to equip food handlers with knowledge on good hygiene practices and the need to tidy the environment to avoid contamination from the environment (Kibret *et al.*, 2012).

Food borne diseases exist because there is contaminated foods that are being consumed. It is overviewed that the situation of food borne diseases is a major public health with significant influence on economic loss. Millions of people fall ill each year and hundreds of thousands of them die after consuming contaminated food due to poor food handling and safety practices by food vendors. Food poisoning and food related diseases caused by intestinal parasite and pathogenic bacteria can occur as a result of improper handling of food and food products. Food contamination can occur through food preparation and storage. Involving infected individuals in food preparation will lead to increased chance of contamination of food through fingers which serves as reservoir to most microorganisms. Consumption of contaminated food is a major reason for more than half of diarrhea diseases in most communities in developing countries As a result, knowledge, attitude and food hygienic

practices are crucial to good safety and hygiene at food establishments or joints (Galgamuwa *et al.*, 2016).

1.5 Importance of food hygiene practices (Bas *et al.*, 2006, Beumer *et al.*, 2003)

1. Food hygiene and safety prevent germs from multiplying thereby reducing the risk of food contamination.
2. Keeping one healthy and preventing the additional cost of buying medication and medical check-up.
3. Hand washing accounts for 33% of all related food poisoning cases. It is therefore important to maintain good personal hygiene practice. This is something we were taught early in our childhood.
4. It protects consumers by ensuring that the food produced and sold is safe to consume.
5. Food hygienic practices is important as it helps businesses build a positive reputation, avoid financial losses due to legal fees or compensation claims, and protect their financial interests.
6. The risk is significantly for those with weak immunities like HIV or cancer or rare pregnant women, children and elderly.
7. To prevent serious complications such as gastroenteritis and dehydration or even more serious health issues such as kidney failure.

1.6 Food safety and hygienic practices of street food vendors

People irrespective of age have actually lost their lives as a result of diseases especially those diseases that are caused by either our food consumption or our daily activities. Food hygiene and safety remain a threat to public health over the globe. It is obvious and worldwide accepted that unhygienic food including contamination of what we take in daily has claimed the lives of millions of the world's populations most especially in Africa where there is poor or low level of education, poverty, lack of street enforcement and adherent to public health policies, inadequate qualified personnel's, poor financing healthcare systems making Africa (Dun-Dery 2012).

In spite of the low level of food hygiene observed, improvement in the practice of food hygiene such as wearing of aprons and covering of hair can be realized with increase in knowledge of food vendors (Iwu *et al.*, 2017). According to WHO 2019, hazardous substances such as chemical, physical as well as radioactive and microbial agents in food are one of the main causes of food borne diseases. This hazard may as part of other things

comprise of viruses, bacteria and parasites. The nature of these diseases could range from acute to chronic diseases. The best way of reducing the amount of microorganisms in order to make food wholesome is by proper cooking of food to recommended temperature levels. While cooking can reduce microorganisms, it will not destroy the toxins they must have produced. For this reason, it is critical to handle food safely before it is cooked. Lack of proper personal hygiene including the washing of hands has been recognized to be one of the main sources of food born epidemic around the globe which is attributed to low level of knowledge by some food vendors. Proper hand washing with soap can remove bacteria from the hands and prevent gastro intestinal infection. In this study, it was found out that majority of respondents had no practices of washing hands with soap and water during food handling process (Galgmwa *et al.*, 2016).

1.7 How to practice food and personal hygiene (-CDC, August 2023, U.S FDA, 2023)

- Practice good personal hygiene
- Clean utensils and cooking equipment's before and after use
- Keep food that need to be kept cold in the fridge
- Wash fruits and vegetables before use
- Use appropriate kitchen tools for food preparations
- Keep dry foodstuffs separate from liquids
- Cook food in appropriate temperature
- Keep insects and pest away from food areas
- Always use clean water to prepare food
- Clean the kitchen and mop the floor after each food preparations
- Keep kitchen towels, sponges and cleaning cloths clean

1.8 Epidemiology Situation

In Cameroon like in most countries in Africa, diarrhea diseases are one of the major causes of death especially in children. It is ranked as the 5th death causing epidemic in Cameroon (WHO 201), gastrointestinal diseases or infections such as Dysentery, Cholera, Typhoid, diarrhea etc. are very common forms of infections rampant in Cameroon including the center region. Below are some of these GIT diseases and their causative agents.

- Bacillary dysentery (shigellosis) caused by *Shigella* is a bacterial infection and is severe diarrhea containing blood or mucus.

- Amoebic dysentery caused by *Entamoeba histolytica* is an infection caused by a parasite that is found in food and water contaminated by stool.
- Cholera caused by *Vibrio cholera* is a bacterial infection that causes severe diarrhea and dehydration, usually in water.
- Taeniasis caused by worm infections like *Taenia solium*, *Taenia saginata* is a tapeworm infection caused by eating undercooked beef or pork that contains tapeworm eggs.
- Typhoid fever caused by *Salmonella typhi* is a bacterial infection spread through contaminated food, water or close contact.
- Diarrheal diseases caused by *Staphylococcus aureus*.

1.9 Risk factors of food borne diseases include; (WHO, 2023)

- Poor personal hygiene
- Poor environmental hygiene
- Close contact with an infected person or animal crowded homes (dysentery, typhoid)
- Lack of education on food poisoning
- Unavailability of toilets
- Consumption of contaminated food or water (dysentery)
- Poor hand washing techniques
- Living in endemic areas
- Reduced or nonexistent stomach acid (taeniasis)
- Type O blood (taeniasis)
- Exposure to live stock (taeniasis)
- Proximity to flying insects feeding on faces (typhoid)
- Eating poorly cooked or raw meat (taeniasis, cholera)
- When you don't take prophylactic treatment against worms (taeniasis)
- Immune suppressed illnesses such as AIDS or prolonged illness

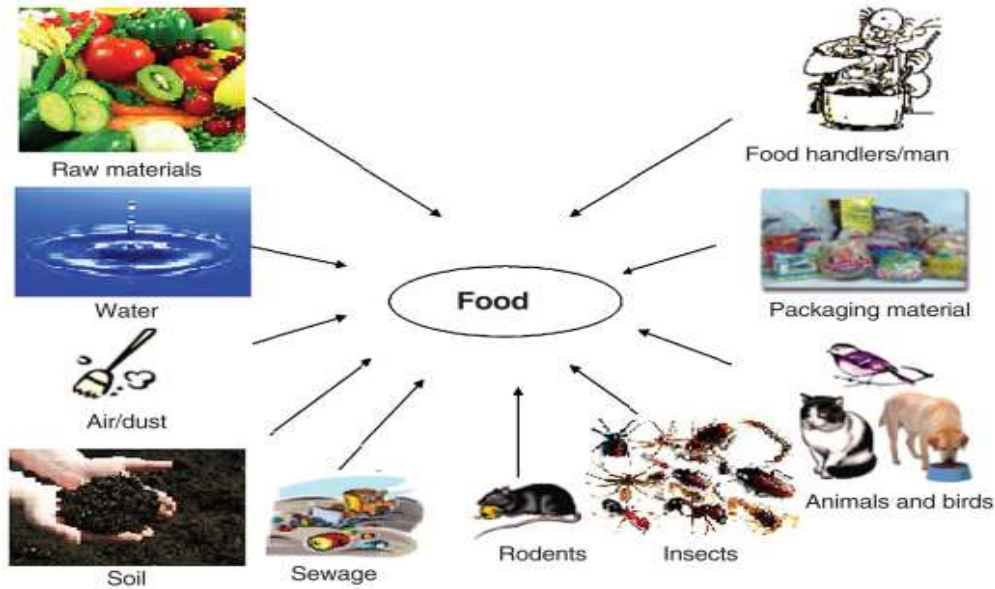


Figure 1: Diagram representing different sources of food contamination (FAO 2019)

1.10 Mood of transmission of food borne diseases include;

- Fecal oral routes (cholera, dysentery, typhoid fever) such as; eating contaminated food or water or contaminated hands.
- Person to person (cholera dysentery typhoid).
- By vectors carrying the germs on their bodies.
- Ingestion of poorly prepared meat



Figure 2 : Diagram representing the chain of infection (Ottawa public health 2020)

1.11 Consequences of poor food hygiene practices (Brent et al., 2023)

1. Food poisoning; poor food hygiene practices will lead to those consuming the food to become severely ill. Some food poisoning can be treated at home while others require serious medical attention.
2. Reputational damage; practicing poor food hygiene can lead to damage of reputation as people will criticize the food and stories will go round resulting in loss of respect for food business
3. Reduced staff morale; some people working for a food business which is unclean and practicing unhygienic practices will begin to look for elsewhere to go work which is responsible and isn't going to cause customer's harm.
4. Reduced income; due to the practice of poor food hygiene, some food vendors will loss many customers who will not want to eat poorly prepared food or contaminated food.



Figure 3: Field of exposed food on the streets of Cameroon (MEDWIN 2022)

1.12 The five keys to safer food(WHO 2022, CDC 2021, FAO 2020)

1.12.1 Keep clean

While most microorganisms do not cause diseases, dangerous microorganisms are found in soil, water, animals, and people. These microorganisms are carried on hands, wiping cloths

and utensils, especially cutting boards, and the slightest contact can transfer them to food and cause food borne diseases.

Personal hands hygiene

Hands should be properly washed;

- Before handling food and often during food preparation
- Before and after eating
- After going to the toilet
- After touching animals
- After handling rubbish

Steps to proper hand washing

- Wet hands under running water
- Rub hands together for at least 20 minutes with soap
- Rinse hands under running water
- Dry hands thoroughly with a clean towel

How to clean plates and utensils (WHO 2022, CDC 2021, FAO 2020)

- Clean while preparing food so microorganisms do not get the chance to grow.
- Pay special attention to eating, drinking and cooking utensils that touch raw food or the mouth.
- Sanitize cutting boards and utensils after they have been in contact with sea foods.
- Don't forget to clean and dry the cleaning equipment's, as microorganisms grow fast on damp places.
- After cooking, scrape burnt food into the rubbish bin and wash pot
- Wash utensils with clean water.
- Leave dishes and cooking utensils to air-dry, or wipe with a clean dry cloth.

How to protect food preparation areas from pests

- Keep food covered or in closed containers
- Keep rubbish bins covered and remove the rubbish regularly
- Keep food preparation areas in good condition
- Use baits or insecticides to kill pests (taking care not to contaminate food)
- Keep domestic animals away from food preparation areas

2.12.2 Separate raw and cooked. (WHO 2022, CDC 2021, FAO 2020)

Raw food, especially meat, poultry and seafood and their juices, can contain dangerous microorganisms which may be transferred onto other foods during food preparation and storage.

How to keep raw and prepared food separate

- While shopping, keep raw meat, poultry and seafood separate from other foods.
- In the refrigerator, store raw meat, seafood and poultry below cooked or ready to eat foods to avoid cross contamination
- Store food in containers with lids to avoid contact between raw and prepared foods.
- Wash plates used food raw food. Use a clean plate for cooked foods.

1.12.3 Cook thoroughly

Proper cooking can kill all dangerous microorganisms. Studies have shown that cooking food to a temperature of 70c can help ensure it is safe for consumption. Foods that require special attention include minced meats, rolled roasts, large joints of meat whole poultry.

How to cook thoroughly

- Cook poultry until the juice are clear and the inside is no longer pink
- Cook eggs and seafood until piping hot throughout
- Bring liquid-based foods such as soups and stews to a boil and continue to boil for at least 1 minute
- If you have a thermometer, place it in the center of the thickest part of the meat
- Make sure the thermometer is not touching a bone or the side of the container
- Make sure the thermometer is clean and sanitized between each use to avoid cross contamination between raw and cooked food

1.12.4 Keep food at safe temperatures (WHO 2022, CDC 2021, FAO 2020)

Microorganisms can multiply very quickly if food is stored at room temperature. By holding at temperatures below 5c or above 60c, the growth of microorganisms is slowed down or stopped some dangerous microorganisms still grow below 5c.

How to keep food at safe temperatures

- Promptly cool and store leftovers
- Prepare food in small amounts to reduce the amount of leftovers

- Leftover food should not be stored in the refrigerator for longer than 3 days and should not be reheated more than once

Use safe water and raw materials. **(WHO 2022, CDC 2021, FAO 2020)**

Raw materials including water and ice may be contaminated with dangerous microorganisms and chemicals. Toxic chemicals may be formed in damaged and moldy foods. Care in selection of raw materials and simple measures such as washing and peeling may reduce risk.

What is safe water?

Untreated water from rivers and canals contains parasites and pathogens which can cause diarrhea, typhoid, or dysentery. Untreated water from rivers and canals are not safe!

Rainwater collected in clean tanks is safe as long as the tanks are protected from contamination from birds or other animals. Safe water is needed to; wash fruits and vegetables, add to food, make up drinks, make ice, clean cooking and eating utensils and wash hands.

How to select safe raw materials

- Select fresh and wholesome food
- Avoid food that is damaged or rotting
- Choose foods processed for safety such as pasteurized milk or irradiated meat
- Wash fruits and vegetables with safe water, especially if eaten raw
- Do not use food after its expiry date
- Throw away smashed, swollen or oxidized cans
- Choose ready to eat, cooked or perishable foods that are stored correctly

1.13-Paradigms of street food vending in sustainable development

The activity of street food vending started since earliest civilizations. Ancient Greeks had street vendors that sold small fries' fish, while Ancient Romans depended on street food for nutrition because they often didn't have ovens in their homes to prepare food. In China, street food was intended for the poor but the wealthier classes will sometimes send their servants to buy street food for them. Food vending activities evolved in the 14th century in Egypt then in North America, in the American Colonial periods similarly in Europe. This proves that food vending has been a practice from time immemorial and it still, remains a very common practice or occupation today (Dominique *et al.*, 2016). The world population has been increasing gradually and this growth has had an impact on food security of many countries,

especially underdeveloped countries. Street food vending continues to expand as a source of affordable food and beneficial economic activity in developing countries (Zawide *et al.* firdu, 2009.).

The significance of the street food industry has often been ignored because it is considered part of the informal sector. The term "informal sector" has been widely applied to describe loosely organized and often non-enumerated economic activities in the rapidly growing cities of the developing world. Actually, the division between the informal and formal sectors is not always obvious. Suppliers and consumers may "cross sectors" to exchange goods and individuals may be active in both formal and informal economic endeavors. Previously, the informal sector was thought to symbolize a lack of economic development that would and should disappear with modernization. Until more permanent jobs could be provided by the modern sector, the former was expected to absorb unskilled workers who migrated to the city from rural areas (Todaro *et al.*, 1969).

However, this phenomenon has lasted longer and may be less transitional in nature than previously anticipated. The informal sector appears to be growing more rapidly than the formal sector in the urban areas of many countries (Farbman *et al.*, 1980). Because of the rapid rise in urban populations and increasing awareness of the limited employment generated by large-scale industries, planners are beginning to acknowledge the importance of the informal sector.

1.15- The Socioeconomic Factors of Street Food Vending in Developing Countries and Its Implications for Public Health

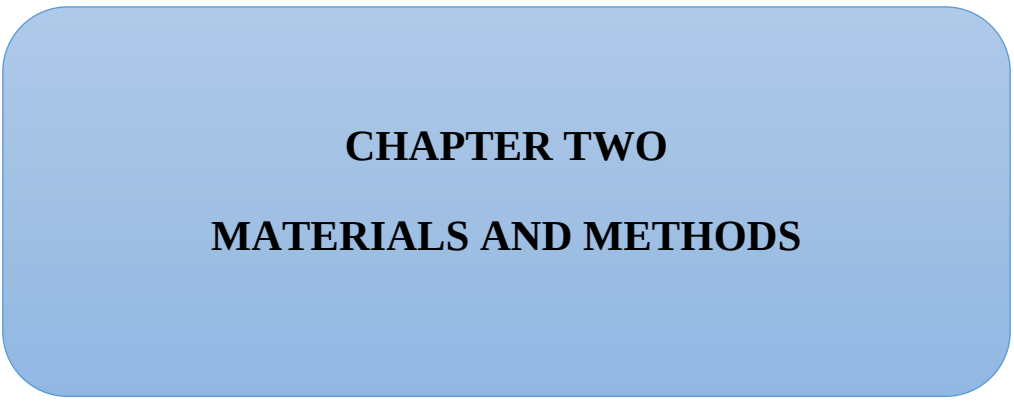
The sale of ready-to-eat (RTE) street food represents an important source of income in many developing countries. However, these foods are frequently implicated in outbreaks of gastrointestinal diseases (Andrade *et al.*, 2023). The European Food Safety Authority reported that in the year 2010 about 48.7% of foodborne diseases were associated with catering establishments (EFSA, 2010). Up to 70% of foodborne outbreaks in the UK were related to the food service sector (Jackson *et al.*, 2011). According to the World Health Organization (WHO), approximately 600 million cases of foodborne illness and 420,000 deaths occur each year, with 125,000 deaths among children under five years old, due to unsafe food consumption (Andrade *et al.*, 2023).

A review in 2007 stated that inappropriate food handling might have been involved in 97% of all foodborne illnesses associated with the food service sector (Egan *et al.*, 2007). One of the main contributors to foodborne outbreaks in the food service sector was found to be food

handlers (Jackson *et al.*, 2011, Jahan *et al.*, 2012). According to the WHO, worldwide epidemiological studies show that, in the majority of cases, outbreaks of foodborne diseases are due to the incorrect handling of food-by-food handlers (WHO, 2008). According to a report by Chang and Chen in 2003, bacterial pathogens were the cause of the majority (62.4%) of foodborne illnesses in central Taiwan, with food mishandling being the major contributor (Jahan *et al.*, 2012).

1.15.1- Consequences of the Non-Respect of Good Hygiene Practices on Health of Consumers

In Belgium, a review for outbreak by foodborne norovirus (NoV) revealed that from the year 2000-2007, 42.5% of outbreak cases were caused by food mishandling by workers (Baert *et al.*, 2009). In Malaysia, 50% of foodborne outbreaks were caused by food handlers, according to a 2007 report by the Ministry of Health (Abdul-Mutalib, Syafinaz, Sakai, & Sharai, 2015). Food handlers are defined by Al Suwaidi, Hussein, Al Faisal, El Sawaf, & Wasfy, 2015, as "employees who are employed directly in the production and preparation of foodstuffs. Those include employees in the manufacturing, catering and retail industries as well as those who are undertaking maintenance or repair of 10 equipment in food handling areas, whether permanent staff, workers on contract or visitors to food handling areas (Al Suwaidi *et al.*, 2015)", Food handling comprises all stages of food treatment and storage, from the reception of raw items to the end products and their distribution, i.e., from farm to fork (FAO and PAHO, 2017).

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CHAPTER TWO

MATERIALS AND METHODS

CHAPTER TWO: MATERIAL AND METHODS

2 Study design

A descriptive cross-sectional study was used to carry out this research, which involved the assessment of street food vendors' knowledge, practice on the importance of sanitation and hygiene during food preparation and food vending. Also, street food consumers, roadside drug vendors and clinics were investigated on the health impacts, through administration of a structured questionnaire. Also, their attitude and practice of personal and environmental hygiene and sanitation were observed by the means of surveillance (using surveys like observational survey, environmental survey, customers' satisfaction survey, vendors self-assessment survey etc.), after which a standard of protocol (SOP) for street food vending was proposed. This design allowed for one time data collection on the knowledge, practices of food hygiene and sanitation on street food vendors and consumer's health in the Biyemassi and Obili communities. Questionnaires were shared and responses were given to these questionnaires by filling and also verbally by food vendors and consumers. These questionnaires contain demographic data, knowledge and practices on food hygiene and sanitation on their environment and also the implication of poor hygiene on consumer's health.

2.1 Study site

This study was conducted in two urban settings, Biyemassi and Obili, in Yaoundé VI, Mfoundi division, Center region Cameroon. These areas are occupied by people from diversified villages in Cameroon with different cultural values and assumable varied in food ways. Additionally, many have assumable crowded households, especially those from the crisis areas, that is the North West and South west (NOSO), a scenario which influence stress food vending and street food consumption. This study sites were considered suitable for this study because they have recently known an increase of population due to the crisis in the Norwest and south west regions of the Country. Many of internally displaced persons (IDPs) depend on food vending as a source of income. Also, these areas are well known for a high density of food vendors and cuts across all the representative groups involving the indigenous population, students, workers, public transporters, farmers, the rich and poor.

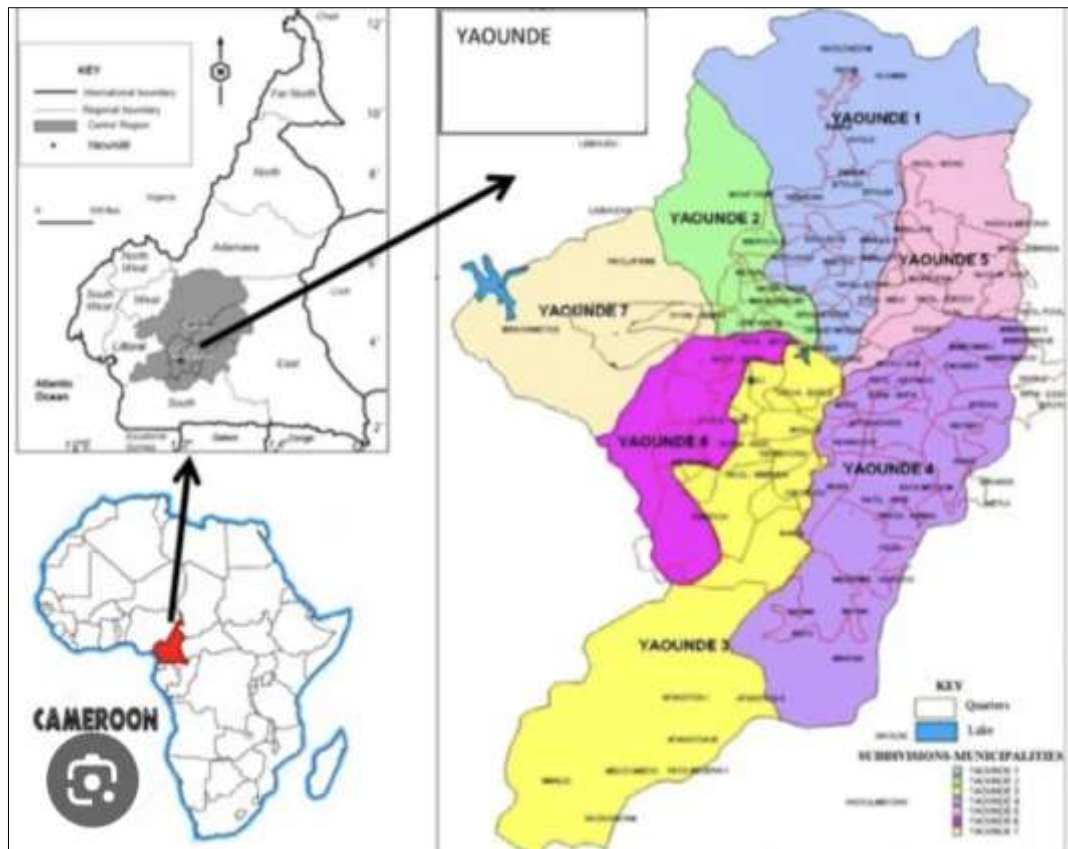


Figure 4 : Map localizing Yaounde in Cameroon and Cameroon in Africa (**kamda A. et al., 2021**)

2.2 Study population

The study population was made up of street food vendors, street drugs vendors and nurses in the clinics at the Biyemassi and Obili communities.

2.3 Participants, data collection and analysis

2.3.1 Sample population and sample size

Participants consisted of all street food vendors, consumers, roadside drug vendors, nurses in the clinic, be it male or female, literate or illiterate living in the Biyemassi and Obili areas. Participants were recruited using a simple random sampling technique. The sample size ($n=250$) was estimated using the Yamne simple size formula. These was made up of 100 food vendors, 50 consumers, 50 clinics, 50 road side drug in the Biyam –ass, and Obili communities evenly. The questionnaires were pre-tested on 10 SFV, 5 consumers, 3 clinics, 3 road site vendors and corrections necessary were made. The questionnaires were administered at the respondents' vending sites were the opportunity was used to start

discussion with vendors, in some cases food purchase was made as an opportunity for interaction with SFV.

Yamane formula for determining sample size $n = N / (1 + Ne^2)$, where n =collected sample size, N =population size and e = margin of error (MoE), $e=0.05$ based on this research condition (Yamane, 1967).

$$n = \frac{N}{1 + Ne^2}$$

Where:

n = minimum sample size

N = Population size

e = margin of error (0.05)

The sample size $= 500 / (1 + 500(0.0025 * 2))$

$$= 500 / (1 + 500(0.0005))$$

$$= 500 / (2)$$

$$500 / 2$$

$n=250$ sample size

2.3.1a Inclusive criteria

Street food vendors, consumers, road side drug vendors, nurses in the clinics who gave their consent and were present at the time of the study.

2.3.1b Exclusive criteria

Street food vendors, consumers, road side drug vendors, nurses in the clinics who did not give their consent and were absent at the time of the study.

2.3.2 Data collection

Data for this research study was collected using questionnaires which were filled by respondents who gave their consent. 300 respondents were given questionnaires which comprised of 4 sections. Section one comprised of socio-demographic data, section two comprised of knowledge on food hygiene and sanitation of food vendors, section three comprised of practices of food hygiene and sanitation of food vendors and section four comprised of implication of street food on consumers health. The researcher recruited siblings and friends who helped in the distribution and collection of questionnaires to and from the various communities. Participation for this study was voluntary

2.4 Materials and procedures used

- Questionnaires
- Pen and paper
- Laptop
- Data
- Telephone
- Test book
- Internet

2.5 Variables and definitions

2.5.1 Dependent variable

- consumers health is the dependent variable in this study

2.5.2 Independent variable

- Knowledge and Practice are the independent variable in this study

2.6 Statistical analysis

Data was then analyzed using Microsoft Excel 2013 and SPSS (Statistical package for social sciences) version 26. Results were presented in frequency distribution tables. An ANOVA test was done and used to assess the significance difference between the means of knowledge and practice score. Results were then presented using tables, bar charts, pie charts.

CHAPTER THREE
RESULTS AND DATA INTERPRETATION

CHAPTER THREE : RESULTS

3.1 Demographic information

Table 1: Tabular presentation of socio- demographic data of vendors

	FREQUENCY	BIYEM-ASSI	OBILI	PERCENTAGE (%)
GENDER	Male	17	11	28%
	Female	33	39	72%
TOTAL		50	50	100%
AGE	10-20 years	5	9	14%
	21-25years	16	12	28%
	26-30years	13	10	23%
	31-35years	7	5	12%
	36-40years	6	7	13%
	41years and above	3	7	10%
TOTAL		50	50	100%
LEVEL OF EDUCATION	Primary	6	5	11%
	Secondary	23	25	48%
	University	19	20	39%
	None	2	0	2%
TOTAL		50	50	100%
MARITAL STATUS	Single	26	30	56%
	Married	22	16	38%
	Widow/widower	2	4	6%
TOTAL		50	50	100%

The results from table one above showed that the minority was 28% male and the majority 72% females. 14% of them were aged 10-20years, 28% were 21-25years, 23% were 26-30years, 12% were 31-35years, 13% were 36-40years, 10% were 41 years and above. Concerning the level of education, 11% ended at primary level, 48% at secondary level, 39% at university level and 2% for none while 56% of them were single, 38% were married and 6% of them were widows/widowers.

Table 2: Tabular presentation of socio demographic data of consumers

	FREQUENCY	BIYEM-ASSI	OBILI	PERCENTAGE (%)
GENDER	Male	15	13	56%
	Female	10	12	44%
TOTAL		25	25	100%
AGE	10-20 years	9	7	32%
	21-25years	5	4	18%
	26-30years	4	5	18%
	31-35years	3	3	12%
	36-40years	2	3	10%
	41years and above	2	3	10%
TOTAL		25	25	100%
LEVEL OF EDUCATION	Primary	5	6	22%
	Secondary	9	12	42%
	University	11	7	36%
	None	0	0	2%
TOTAL		25	25	100%
MARITAL STATUS	Single	15	13	56%
	Married	8	11	36%
	Widow/widower	2	1	6%
TOTAL		25	25	100%

3.2 Information on business

Table 3: Tabular presentation of their business

	Frequency	BIYEMASSI	OBILI	Percentage (%)
What do you sell	Heavy meals	22	26	48%
	Fast foods	12	16	28%
	Fruits	16	8	24%
Total		50	50	100%
Nature of business	Formal	20	18	38%
	Informal	30	32	62%
Total		50	50	100%
Ownership	private	12	8	20%
	rented	15	17	32%
	Mobile food vendors	23	25	48%
Total		50	50	100%

The table above shows that the majority of the vendors in both communities sold heavy meals 48% (Biyemassi 22 while Obili 26), an average of 28% sold fast foods while the minority

was fruits with 24%. 38% of the respondents had a formal business while 62% had an informal business were 48% were associated to the street.

3.3 Knowledge of hygiene and sanitation among food vendors in Biyemassi and obili communities

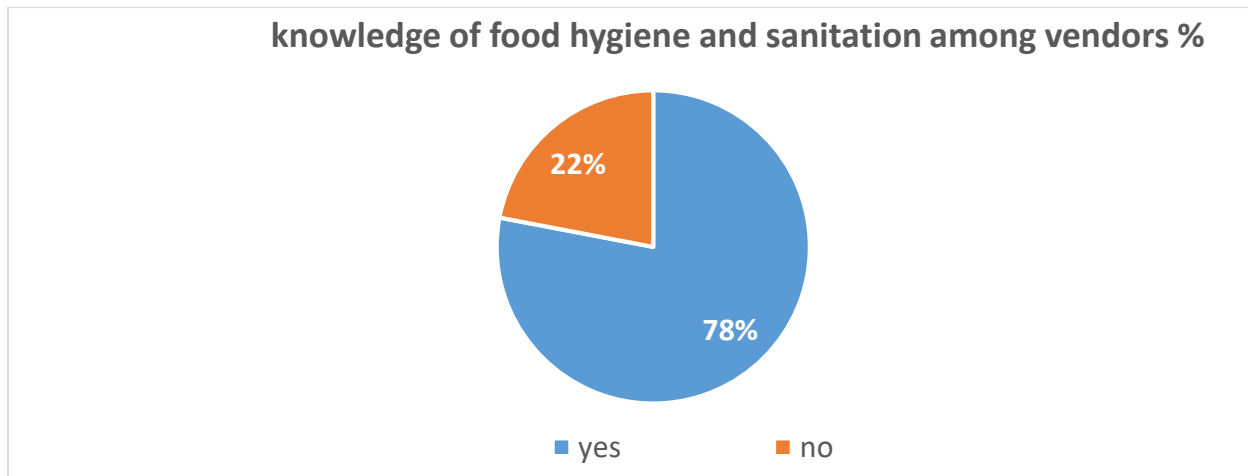


Figure 5: Knowledge of food hygiene and sanitation among vendors in both locations

According to figure 1 above, majority of the vendors (78%) had good knowledge of food hygiene and sanitation while a minority (22%) had no knowledge.

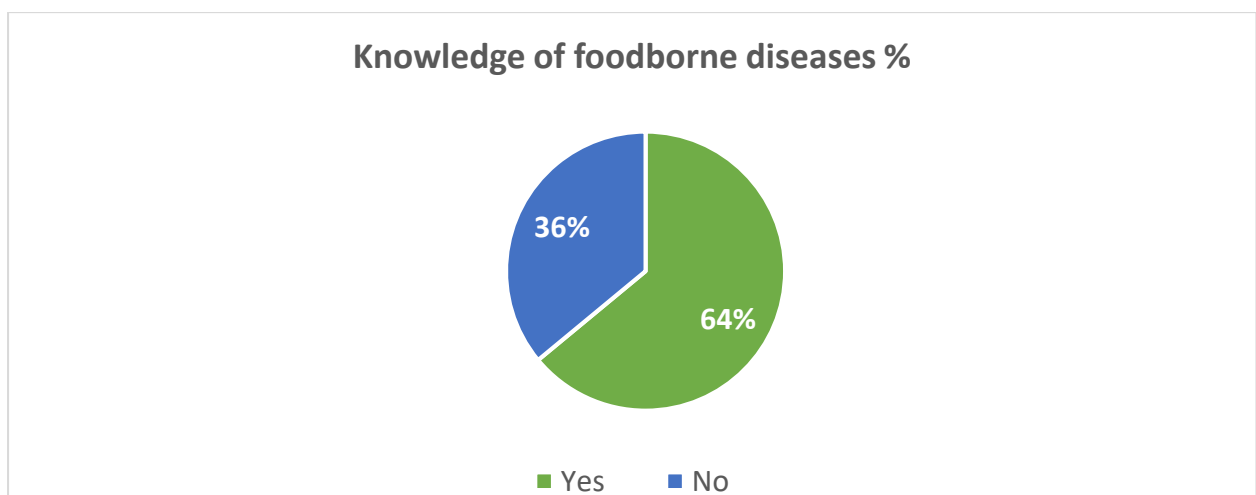


Figure 6: Knowledge of foodborne diseases

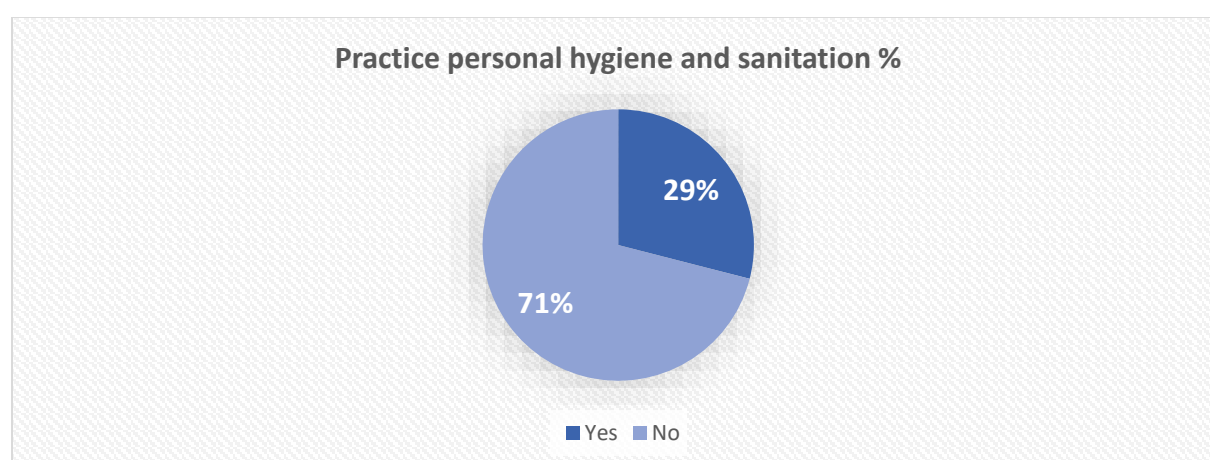
According to figure 2 above, a good number of the vendors (64%) from both communities had moderate knowledge on FBD as they could identify some FBDs while 36% had no knowledge.

3.3 Practice of hygiene and sanitation among food vendors in Biyemassi and Obili communities

Table 4: presentation of the practice of hygiene and sanitation among food vendors collected based on personal hygiene

	Personal hygienic practices	Respond	Biyem-assi	Obili	Percentages (%)
1	wash hands before and after handling food	Yes	23(46%)	25(50%)	48%
		No	27(54%)	25(50%)	52%
2	Do you stay home when you have common cold	Yes	16(32%)	10(20%)	26%
		No	34(68%)	40(80%)	84%
3	Do you trimmed finger nails frequently	Yes	17(34%)	12(24%)	29%
		No	33(66%)	38(76%)	71%
4	have a hand washing stand	Yes	10(20%)	8(16%)	18%
		No	40(80%)	42(84%)	82%

Based on table 4 above, 46% of the respondents in the Biyemassi and 50% of the respondents in Obili washed their hands before handling food. 26% of respondents in both communities took their baths before entering the kitchen or serving food while 74% don't. 85% of vendors in both location still did food vending even while having a cold. Also, concerning trim finger nails frequently 29% of both community do whereas 71% doesn't and short nails while. Most respondents in both location (80% Biyemassi and 84% Obili) didn't provide a hand washing stand and when asked why, the complained of inadequate supply of water and that it was strenuous carrying water from their homes or from far distance places. They also claimed that most clients eat with cutleries as such water was giving to them only when they requested for it.



In figure 3 above, 29% of participants practiced personal hygiene while 71% had a poor personal hygiene practice.

Figure 7: Personal hygiene and sanitation practice by food vendors in both locations

Table 5: Data based on the environmental hygiene and sanitation practices of vendors of both locations

	Environmental hygiene	Responds	BIYEM-ASSI	OBILI	Percentages %
1	clean your environment daily before and after cooking or serving	Yes	22(44%)	16(32%)	38%
		No	28(56%)	34(68%)	62%
2	Is vending stall protected from dust and sun?	Yes	14(28%)	11(22%)	25%
		No	36(52%)	39(78%)	75%
3	adequate waste disposal facilities in your area of vending	Yes	13 (26%)	11(22%)	24%
		No	37(74%)	39(78%)	76%
4	Presence of pet animals in your area of vending site	Yes	22(44%)	16(32%)	38%
		No	27(54%)	34(68%)	62%
5	adequate supply of water	Yes	7(14%)	11(22%)	18%
		No	43(86%)	39(78%)	82%

44% of vendors in Biyemassi and 32% of vendors in Obili communities practiced environmental hygiene and sanitation. A greater proportion (76%) of vendors in both communities lacks adequate waste disposal facilities in their vending side, also 75% vend food without protection from the dust (52%Biyemassi and 78% Obili). 38% had the presence of pet animal in their vending site while 62% didn't for both communities. Concerning adequate water supply, the majority in Biyemassi (86%) and Obili (78%) respondents lacked adequate water supply while 14% Biyemassi and 22% Obili respondents had adequate supply which was mainly forage.

General percentage on environmental hygiene and sanitation practice

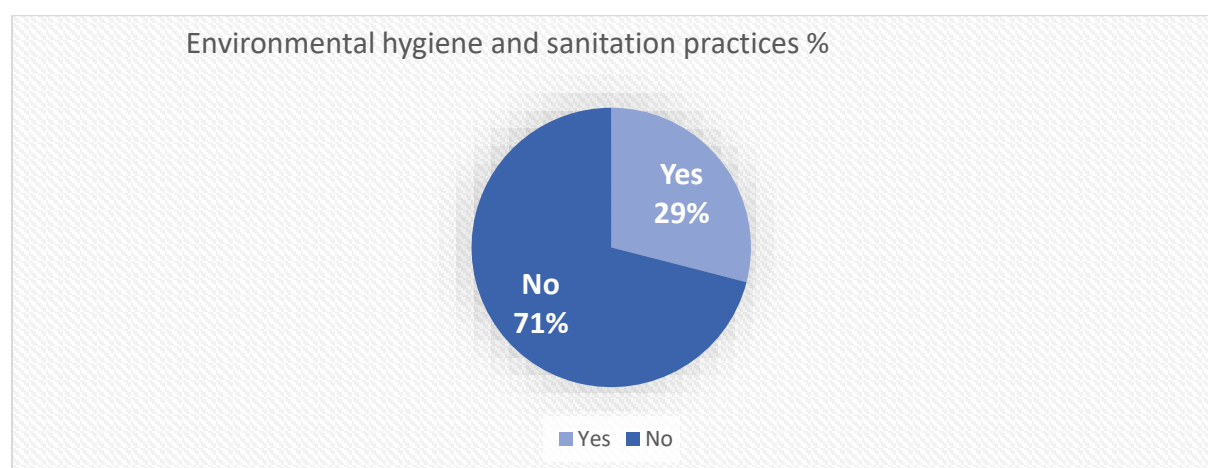


Figure 8: Environmental hygiene and sanitation practices by vendors

The figure above shows that majority (71%) of vendors had poor environmental hygiene and sanitation practiced while a minority 29% had good environmental hygiene practice in both communities.

Table 6: Tabular presentation of food hygiene practices among vendors

	Food hygiene	Responds	Biyemassi	Obili	Percentage %
1	wash all stuffs before cooking	Yes	30(60%)	33(66%)	63%
		No	20(40%)	17(34%)	37%
2	wash your utensils with clean water	Yes	23(46%)	29(58%)	52%
		No	27(54%)	21(8%)	48%
3	separate raw food from cooked food to prevent cross contamination	Yes	32(64%)	27(54%)	59%
		No	18(36%)	23(46%)	31%
4	protect food from flies	Yes	21(42%)	17(34%)	38%
		No	29(58%)	33(66%)	62%
5	Your source of water is safe for consumption	Yes	26(52%)	28(56%)	54%
		No	24(48%)	22(44%)	46%
6	Is the Food handler also the cashier?	Yes	40(80%)	42(84%)	82%
		No	10(20%)	8(16%)	18%

In table 6 above, 96% of the Biyemassi and 100% Obili respondents wash their food stuffs before preparing. Majority of the participants in both communities washed their utensils with clean water (96% Biyemassi and 92% Obili). Most vendors in both locations didn't serve food with water because according to 48% of respondents in Biyemassi and 44% of respondents in Obili, their water source wasn't safe for consumption as such customers bought their own water to drink. 84% of both communities protected food from flies and 92% of both communities separated raw food from cooked food to prevent cross-contamination.

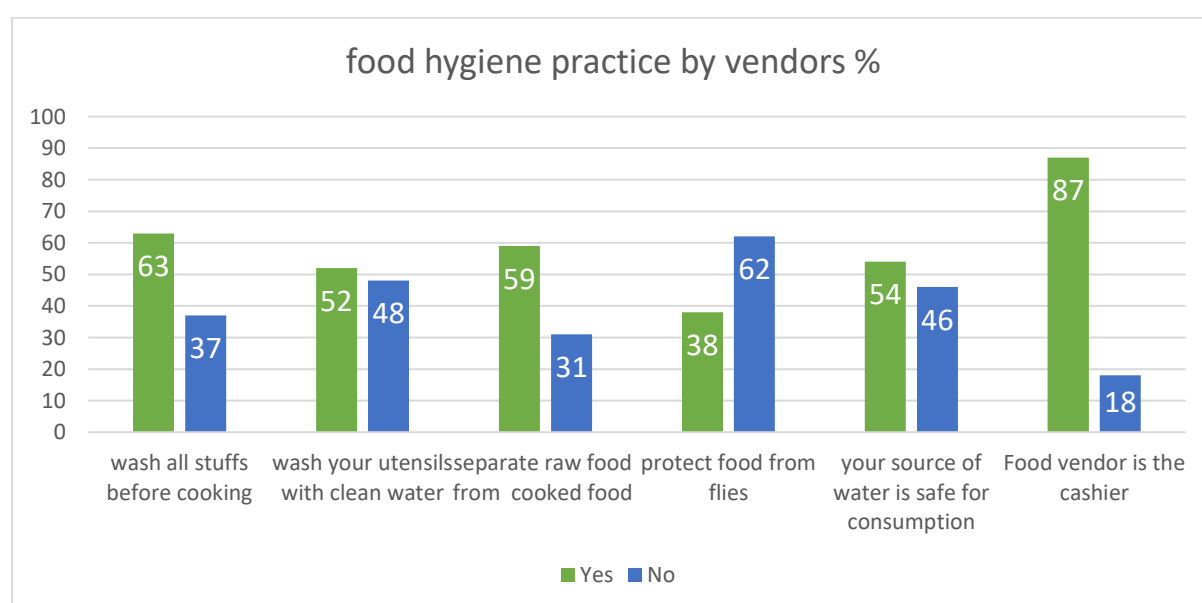


Figure 9: Food hygiene practice by vendors of both locations

Almost half (42%) of the vendors in both communities didn't practice food hygiene while 58% practice food hygiene

Percentage of consumers that Face health challenge

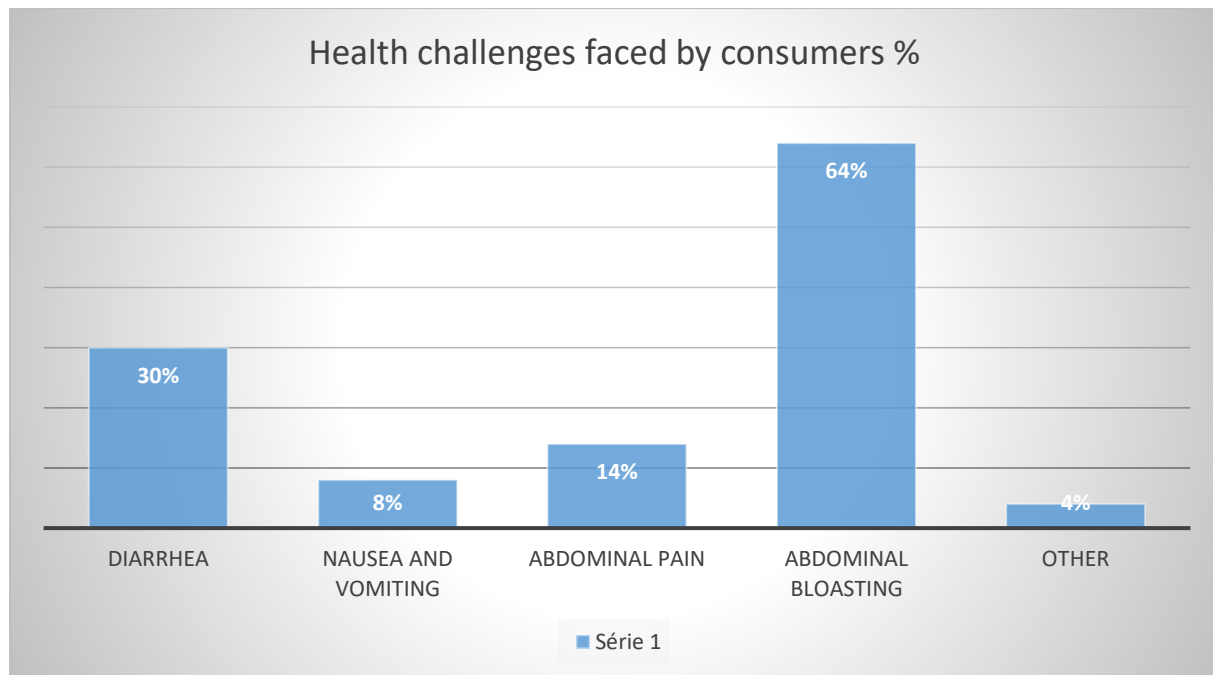


Figure 10: Different Health challenges faced by consumers in both communities

Majority (64% and 30%) of the consumer's suffer from abdominal bloating and diarrhea respectively while minority (4%) from other health conditions.

Table 7: Assessment of the impact of consumption of street foods on consumers' health.

(Questions to clinic workers)

Questions	Option	Biyam assi	Obili	Percentage
How many patients do you have at the hospital per week?	A) 1 – 10	8(32%)	9(36%)	34%
	B) 20 – 30	15(60%)	13(52%)	56%
	C) 30 and above	2(8%)	3(12%)	10%
Do you suffered from food borne diseases?	YES	4(16%)	4(16%)	16%
	NO	5(20%)	6(24%)	22%
	Sometimes	7(28%)	5(20%)	24%
	Rarely	9(36%)	10(40%)	38%
What are the disease conditions that frequent your register?	A) Malaria	10(40%)	11(44%)	42%
	B) typhoid	8(32%)	9(36%)	34%
	C) food borne diseases	02(8%)	02(8%)	8%
	D) Urinary tract infection	5(20%)	3(12%)	16%
When is the highest time you have patient's food with borne diseases or food poisoning?	A) During the festival period	12(48%)	10(40%)	44%
	B) During the dry season	05(20%)	04(16%)	18%
	C) During the raining season	03(12%)	04(16%)	14%
	D) During holidays	05(20%)	07(28%)	24%
	E) All the time	00	00	%
What are some of the signs and symptoms of food borne diseases?	A) Diarrhea	08(32%)	10(40%)	36%
	B) Constipation	02(8%)	03(12%)	10%
	C) Vomiting	05(20%)	04(16%)	18%
	D) I don't know	00	00	%
	E) Stomach discomfort	10(40%)	8(32%)	36%

Table 8 above shows that majority of the disease that frequents clinics is malaria with 40% in Biyemassi and 44% in obili. Also, the mostly receives cases relate to food effects is during festival periods with the population of 48% Biyemassi and 40% .

Table 8: Assessment of the impact of consumption of street foods on consumers' health.
(Questions to road side drug vendors)

Questions	Option	Biyam – assi	Obili	Percentage
Which medication do you sell the most?	A) Metronidazole	10(40%)	12(48%)	44%
	B) Albendazole	03(12%)	02(4%)	8%
	C) Paracetamol	05(20%)	05(20%)	20%
	D) Ciprofloxacin	03(12%)	02(8%)	10%
	E) Artemether	04(16%)	05(20%)	18%
What does the medication treat)?	A) Stomach discomfort and diarrhea	11(44%)	10(40%)	42%
	B) Worm infection	02(8%)	03(12%)	10%
	C) Pain relief	5(20%)	5(20%)	20%
	D) Salmonella infection	03(12%)	02(8%)	10%
	E) malaria	04(16%)	05(20%)	18%
How many clients can you have a week?	A) 1 – 10	4(16%)	03(12%)	14%
	B) 20 – 30	10(40%)	10(40%)	40%
	C) 30 and above	11(44%)	12(48%)	46%
Do you frequently have people who complain of food borne diseases or food disturbance?	A) Yes	10(40%)	11(44%)	42%
	B) No	00	00	0%
	C) Sometimes	8(32%)	5(20%)	26%
	D) A little	02(8%)	03(12%)	10%
	E) A lot	05(20%)	06(24%)	22%
What are their sources of food?	A) street vended food	12(48%)	16(64%)	56%
	B) homemade meals	05(20%)	4(16%)	18%
	C) I don't know	8(32%)	5(20%)	26%

Table 9 above shows, road side drug vendors have many customers within the week with a majority of participant 44% in Biyemassi and 48% in obili.

CHAPTER FOUR
DISCUSSION, CONCLUSION AND
RECOMMENDATION

CHAPTER FOUR : DISCUSSION, RECOMMENDATION, AND CONCLUSION

4.1 Discussion

In investigating the practices of hygiene and sanitation in street food vending and impacts on consumer's health at the Biyemassi and Obili communities in Yaounde, Cameroon. It was revealed that there is a significant association between good hygiene and sanitation practices and a positive consumers' health outcome and vice versa,

From our table 4.1, the respondents were mainly within the ages of 21-30 years old in both communities with the majority being females (33 in Biyemassi and 39 in Obili community). This is similar with a previous study conducted by Tuglo *et al.*, 2021 whereby majority of respondents were aged 26-35 years, they were married and the majority were females. This could be due to the fact that, most women try as much as possible to contribute in their family but don't have jobs as such goes into vending. On the other hand majority (56%) of the consumer were single male with the ages of 21 to 30 year in both communities. This could be due to the fact street food is readily available at all-time at affordable prices for young hustlers. 39% consumers and 36% consumer's attained university level and when asked why they got into vending, they reported that it was due to unemployment and lack of finances. 38% of the vendors sold under a formal nature of their business while 62% sold under an informal nature of business in both communities.

With the harsh economic situation in developing countries especially Cameroon, food vending is rapidly expanding even in urban areas and serving as accessible, affordable, complementing source of family income and employment most especially for women. This could probably be due to, the need for employment or other entrepreneurial pursuits, cultural believes, high rates of immigration of internally displaced persons (IDPs) who relocated in Yaoundé due to the crisis in the NOSO. Most of them went through formal education and were working in their respective towns but due to the crisis, they had to abandon their jobs and after relocating in Yaoundé, they turned to street food vending as a means of survival

This study reviewed that seventy eight percent (78%) of the participants are knowledgeable about food hygiene and sanitation as well as FBDs, 64% could identify at least two FBDs. This is similar to study done in Douala by H.C Edema *et al.*, in 2022 which shows that the overall good knowledge of the participants was 89% this could be as a result of the educational level of the participants as majority were between high school and university.

This study also shows very poor hygiene and sanitation practice of street food vendors, 70.6% for personal hygiene practice, 71% environmental hygiene, and 58% food hygiene practices.

This is in contrast with a research work carried out in Nigeria by M. Johnson et al in 2020 which shows that 27% of Benin street food vendors didn't practice food hygiene where 73% did. This alarming poor practices could be traceable to; inadequate water supply in the two communities, limited adequate waste disposal facility, high cost of rental stores for vending, ineffective official regulatory authorities etc.

This study also review the implication of street food on consumer's health were it recorded a good number (34%) for both community who did not faced any health challenge after eating street food whereas (66%) had challenges. 44% abdominal bloating 30% diarrhea, 14% abdominal pain 8% nausea and vomiting, 4% others. majority (44% Biyemassi and 48% Obili) of participant consume heavy meal, where 62% wash their hands while 38% do not or they use cutlery. This health challenges faced after eating might be as a result of inadequate practice of food hygiene and sanitation. Personal hygiene of the consumers and overall health condition of the consumers.

From our table on clinics, It Shows that, food borne diseases are not the frequent illnesses that cause people to visit the hospital, the majority illness being malaria with 48% in Biyemassi and 44% in obili. This justify by the fact that malaria is an endemic in Cameroon and we have tropical climate that is very conducive for malaria. And an average registration of typhoid with 32% in Biyemassi and 36% in obili communities. This is due to the fact that, poor hygiene and lack of access to clean water can lead to contaminated of water sources used for drinking, cooking and bathing. And also, typhoid is primarily transmitted through the ingestion of food or water contaminated with salmonella typhi bacterium. Also, a minority registration of problems related to street food consumption of 8% in Biyemassi and 8% in obili. This could be due to the fact that most people turn to roadside drugs when symptoms of food borne diseases appear rather than visiting the hospital.

From our table on RSDV, it Shows roadside drug vendors have more clients a week with 44% Biyemassi 48% in obili compare to clinics with 8% and 12% in Biyemassi and obili. And sell more medications with regards to minor ailments such as allergies, food poisoning, food borne diseases etc. with 44% in Biyemassi and 42% in obili. This could be due to the fact that many people are ignorance of the fact that SFV is a major public health concern and have the negative mentality of "black man nodi die derty"

4.2 Conclusion

Based on our research findings on the knowledge and practice of food hygiene and sanitation among food vendors in Biyemassi and Obili communities, the researcher found out that the level of knowledge was high among vendors while that of practice was mild. As such there is the need for increased vigilance and control of food vendors practice through the enforcement of rules and regulations and food safety controls. The percentages of females who participated in the study were higher than that of males. Those with primary education had little or no knowledge regarding food hygienic practices. This implies that demographic factors such as sex and educational level greatly influenced the knowledge and practices of food hygiene and sanitation among food vendors in Biyemassi and Obili communities. Also, most of the people who suffer from SFC do not go to the hospital for consultation but rather turn to roadside drug vendors for purchase of un-prescribe medications.

4.3 Prospective of the studies

A similar study should be conducted involving regulatory authorizes for SFVs as participants to evaluate how they do inspections and sanctions on SFVs.

Also, a similar study should be conducted in other regions of Cameroon.

4.4 Recommendations

It is public health interest that, food vendors both mobile and stationary get actively involved in the development of coordinated, effective, integrated and preventive strategies which promote food hygiene and reduces risks factors of FBDs.

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APPENDIX 1: INFORMED CONSENT

Dear Respondents,

I am Akumachi Glory Zee, a student in the University of Yaoundé 1, faculty of sciences, offering Masters in Public Health Biotechnology, carrying out a Research on the topic: Knowledge, attitude and practice of hygiene amongst street food vendors and the impacts on consumer's health at the Biyemassi and Obili. You have been chosen as the target population of this study. Please kindly respond to the following questions to enable me obtain information on the above subject. The results of this research will help the researchers suggest an SOP for street food vending and quality for SFC health. Every information provided is 100% confidential. Please express your honest response. Please tick or fill the most appropriate answer where necessary.

If you accept to participate in the study, please sign the consent form below.

Thank you.

Participants' signature.....

APPENDIX 2 : QUESTIONNAIRES

SECTION 1: Demographic information

1. Gender : a) Female ☐ b) male ☐
2. Age: a) 10 - 20 ☐ b) 21 – 25 ☐ c) 26 – 30 ☐ d) 31 - 35 ☐ e) 36 – 40 ☐
f) 41 and above ☐
3. Marital status: a) married ☐ b) single ☐ c) widow (widower) ☐
4. Location: a) Biyemassi ☐ b) Obili ☐
5. Level of education: a) Primary ☐ b) Secondary ☐ c) University ☐ d) Non ☐
6. What is the nature of your business? a) formal ☐ b) informal ☐
7. What do you sell? a) Heavy meals ☐ b) fast foods ☐ c) fruits ☐

SECTION 2: Knowledge of food hygiene and sanitation

8. Have you heard of food hygiene and sanitation? a) Yes ☐ b) No ☐
9. If yes, how did you hear about it? a) in school ☐ b) through the radio ☐ c) through the television ☐ d) others ☐
10. Do you know some food borne diseases? a) Yes ☐ b) No ☐

If yes, mention some of them: _____

11. Do you know the effects of food borne diseases on the community? a) Yes ☐ b) No ☐
12. Do you know some symptoms of foodborne diseases? a) Yes ☐ b) No ☐

If yes, mention some of them _____

SECTION 3: Practices of food hygiene and sanitation practices

Personal hygienic practices

13. Do you wash your hands before and after handling food? a) Yes ☐ b) No ☐
14. Do you have a hand washing stand? a) Yes ☐ b) No ☐
15. Are your finger nails well kept, that is short and clean? a) Yes ☐ b) No ☐
16. Do you sell even when you are sick? a) Yes ☐ b) No ☐

Environmental hygiene

☐

17. Do you clean your environment daily before and after cooking and serving? a) Yes ☐ b) No ☐

18. Do you have adequate waste disposal facilities in your area of vending?

If yes, what do you use; _____

If no, why; _____

19. Do you have pet animals in your cooking or vending site? a) Yes ☐ b) No ☐

20. Do you have adequate supply of water a) Yes ☐ b) No ☐

Food hygiene

21. Do you wash all food stuffs before cooking? a) Yes ☐ b) No ☐

22. Do you wash your utensils with clean water? a) Yes ☐ b) No ☐

23. Do you separate raw food from cooked food to prevent cross-contamination a) Yes ☐ b) No ☐

24. Do you protect food from flies? a) Yes ☐ b) No ☐

25. Do you know if the water quality of your source is safe for consumption? a) Yes ☐ b) No ☐

If yes, what is your water source: _____

Section 4.1: Identifying the impact of street food on consumers' health from consumers

27. What do you think about street food? Good source of nutrition ☐ bad source of nutrition ☐

28. Do you face any health challenge after eating street food? Yes ☐ no ☐

29. If yes above what health challenge? Diarrhea ☐ nausea and vomiting ☐
abdominal pain ☐ bloating ☐ others ☐

30. What are/is your most consume street food? Fast food ☐ heavy meals ☐ fruits or fruit juice ☐

31. Do you always wash our hand before eating? Yes ☐ no ☐

Section 4.2. Identifying the impact of street food on consumers' health from CLINICS

32. How many patients do you have at the hospital per week?

A) 1 – 10 ☐ B) 20 – 30 ☐ C) 30 and above ☐

33. Do you people who suffered from food borne diseases?

YES ☐ NO ☐ sometimes ☐ rarely ☐

34. What are the disease conditions that frequent your register?

A) Malaria ☐ B) typhoid ☐ C) food borne diseases ☐ D) Urinary tract infection ☐

35. When is the highest time you have patient's food borne diseases or food poisoning

A) During the festival period ☐ B) During the dry season ☐ C) During the raining season ☐ D) During holidays ☐ E) All the time ☐ F) Never ☐

36. What are some of the signs and symptoms of food borne diseases?

A) Diarrhea ☐ B) Constipation ☐ C) Vomiting ☐ D) I don't know ☐ E) Stomach discomfort ☐ F) others ☐

Section 4.3 Identifying the impact of street food on consumers' health

Questions to Road side vendors

37. Which medication do you sell the most?

A) Metronidazole ☐ B) Albendazole ☐ C) Paracetamol ☐ D) Ciprofloxacin ☐
E) Artemether ☐ F) others ☐

38. What does the medication treat?

A) Stomach discomfort and diarrhea ☐ B) Worm infection ☐ C) Pain relief ☐ D) Salmonella infection ☐ E) malaria ☐ F) others ☐

39. How many clients can you have a week?

A) 1 – 10 ☐ B) 20 – 30 ☐ C) 30 and above ☐

40. Do you frequently have people who complain of food borne diseases or food disturbance?

A) Yes ☐ B) No ☐ C) Sometimes ☐ D) A little ☐ E) A lot ☐

41. What are their sources of food?

A) street vended food ☐ B) homemade meals ☐ C) I don't know ☐