

**UNIVERSITY OF GHANA**

**HYGIENE PRACTICES AMONG STREET FOOD VENDORS AND  
MICROBIAL CONTENT OF FOODS SOLD AT AYENSUANO  
DISTRICT**

**BY**

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**THIS THESIS IS SUBMITTED TO THE SCHOOL OF  
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PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE  
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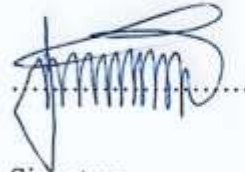
**DECEMBER, 2021**

### DECLARATION

I hereby declare that this project work is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

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INTEGRI PROCEDAMUS

## DEDICATION

This study is dedicated to my lovely wife Mrs. Juliana Aku Gbedze for providing me with the financial support and encouragement to complete the research. I wish to gratefully thank the Lord God for all his blessings, generosity and mercy upon me.

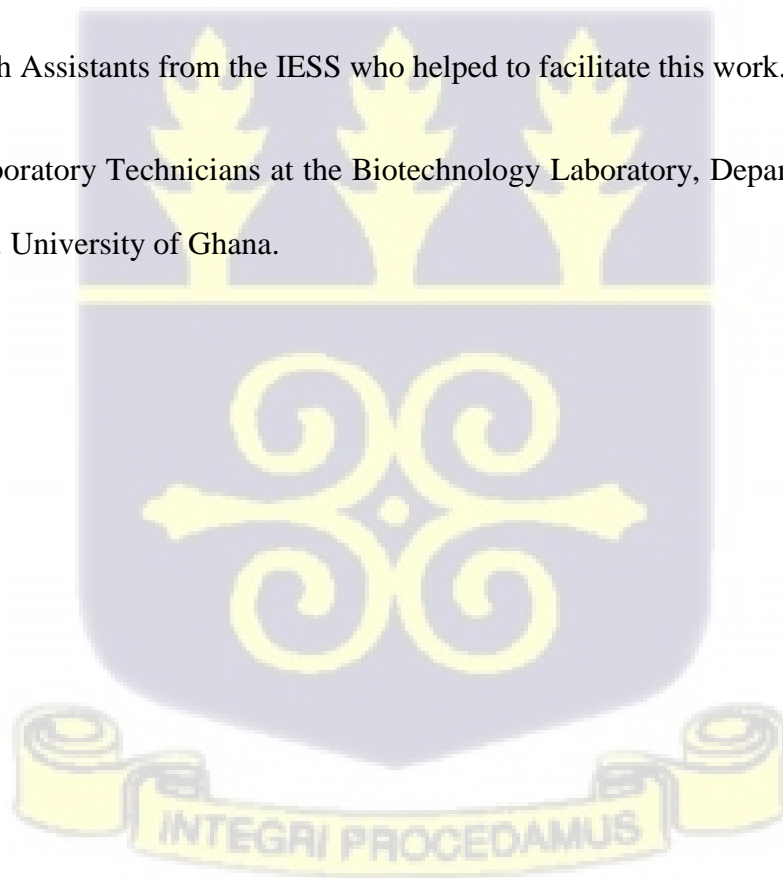


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- Environmental Health Officers of Ayensuano District Assembly.
- Research Assistants from the IESS who helped to facilitate this work.
- The Laboratory Technicians at the Biotechnology Laboratory, Department of Animal Science. University of Ghana.



## ABSTRACT

Globally, the estimated amount of food found to be contaminated from street vendors particularly in developing countries is on the ascendancy. The contribution vendors unhygienic practices make to food contamination. This study sought to investigate hygiene practices among street food vendors and microbial content of some selected food sold at Ayensuano District in the Eastern Region of Ghana. First, 76 food samples which includes “kenkey” with pepper, “waakye”, porridge and fried rice were analyzed using molecular techniques to determine the presence of microbial content of *Escherichia coli*, *Salmonella typhi*, *Staphylococcus aureus* and *Campylobacter jejuni* at the Biotechnology Laboratory, University of Ghana. The study was cross sectional and systematically recruited 304 food vendors using simple random sampling method. A structured questionnaire was administered to gather data on the knowledge level of food vendors on food-borne diseases, personal hygiene status and environmental cleanliness of vending premises. Data collected on 304 respondents were entered into an SPSS version 25. The descriptive tool categorized consumers’ knowledge and attitude in frequencies and percentages. Using inferential statistics, chi-square test was employed to determine the relationship between the dependent and independent variables. This study showed a statistically significant association ( $p < 0.05$ ) between the characteristics of selling sites, including selling foods by the open gutter, selling foods in the presence of refuse dumpsites, selling foods with flies hovering on the foods and clean environment. There was also a significant relationship ( $p < 0.05$ ) between marital status and personal hygiene practices. There was statistically significant ( $p < 0.05$ ) relation between educational qualification and personal hygiene practices. It was observed that 65% of the food vendors sell food in fly infested areas, 48.8% sell foods by the open gutter and 57.7% of the vendors do not have any idea in sterilization of tools used in the kitchen. The study revealed that of the 76 food samples

collected, *Escherichia coli*, *Salmonella typhi*, *Staphylococcus aureus* and *Campylobacter jejuni* were present/absent in the food samples especially kenkey with hot pepper and waakye.

The study confirmed that there was a problem with contamination of street foods within Ayensuano District and regular training and medical examination of street food vendors within the district should be done to ensure good food hygiene.



## TABLE OF CONTENTS

DECLARATION .....	ii
DEDICATION .....	iii
ACKNOWLEDGEMENT .....	iv
ABSTRACT.....	v
LIST OF FIGURES .....	xiii
LIST OF PLATES .....	xiv
LIST OF ABBREVIATIONS .....	xv
GLOSSARY .....	xvi
CHAPTER ONE.....	1
INTRODUCTION .....	1
1.1 Background .....	1
1.2 Statement of the Problem .....	3
1.3 Research Questions .....	5
1.4 Objectives.....	6
1.5 Justification of the Study.....	6
1.6 Conceptual Framework .....	7
1.7 Significance of the Study .....	8
CHAPTER TWO .....	9
LITERATURE REVIEW .....	9
2.1 Literature Review .....	9
2.2 Microbial Quality .....	9
2.2.1 The Potential of Food Handling Personnel to Transmit Diseases Via Food .....	13
2.2.2. Classification of Food Handling Personnel According to the Potential Risk.....	13
2.2.3 Excretion of Pathogens .....	15
2.2.4 Transmission of Pathogens - Environmental Hygiene .....	15
2.2.6 Food and Quality .....	17
2.2.7 Source of Food Contamination.....	20
2.3 Knowledge Levels of Food Vendors on Food Borne Diseases.....	25
2.4 Personal Hygiene of Food Vendors .....	35
2.5 Sanitary Conditions Food of Vending Premises .....	40
CHAPTER THREE .....	43

METHODOLOGY .....	43
3.1 Introduction .....	43
3.2 The Study Area.....	43
3.2.1 Population Size .....	43
3.2.2 Structure of the Local Economy .....	44
3.3 Methodology .....	44
3.3.1 Research Design .....	44
3.4 Data Collection Technique.....	44
3.5 Study Population, Sample Size and Sampling Technique .....	45
3.5.1 Sampling of Food Vendors.....	45
3.5.2 Food Sampling.....	47
3.6 Laboratory Analysis .....	47
3.6.1 Microbial Isolation .....	47
3.6.2 DNA Extraction.....	47
3.6.3 Amplification of the flic gene by Polymerase Chain Reaction (PCR) .....	48
3.6.4 Primers, Sequence and Organisms .....	49
3.7 Sample Chart.....	50
3.8 Quality Checks/Controls .....	54
3.9 Data Analysis .....	54
3.10 Ethical Consideration .....	56
3.11 Limitation of the Study .....	57
3.12 Justification and Description of Selected Foods .....	57
3.14 Assumptions.....	57
3.15 Operational Definitions .....	58
CHAPTER FOUR.....	60
RESULTS .....	60
4.1 Introduction .....	60
4.2 Response Rate and Demographic Characteristics .....	60
Figure 4.1: Response Rate .....	60
4.4 Attitude of Food Vendors Towards Food Contamination.....	63
4.4.1 Practice of Hand Hygiene towards Prevention of Food Contamination .....	63
Figure 4.2: Practice of Hand Hygiene .....	63
4.4.2 Food Storage Practices to Avoid Food Contamination .....	64

Figure 4.3: Food Storage Practices to Avoid Food Contamination.....	64
4.4.3 Ways of Storing “Left-Over” Food .....	64
Figure 4.4: Ways of Storing Left-Over Food .....	65
4.4.4 Sterilization of Cooking Equipment .....	65
Figure 4.5: Sterilization of Cooking Equipment .....	66
4.4.5 Sanitary Conditions of Street Food Vendors .....	66
Figure 4.6: Sanitary Environment of The Street Food Vendors.....	67
Figure 4.7: Selling of Food by Gutter (Location of food on Sale) .....	68
Figure 4.8: Flies Hovering on Food.....	69
4.4.6 Health Status of Street Food Vendors .....	69
Figure 4.9: Medical Screening of Street Food Vendors .....	70
Figure 4.10: Reporting of Illness to Medical Expert by Street Food Vendors .....	70
4.4.7 Hand Washing with Soap .....	71
Figure 4.11: Hand Washing With Soap Among the Street Food Vendors .....	71
4.5 Level of Street Food Vendors Knowledge on Food Borne Diseases.....	71
4.5.1 Knowledge of Street Vendors on Food Borne Diseases.....	71
4.5.2 Knowledge of Street Food Vendors on Microorganisms that Cause Food Contamination .....	72
4.5.3 How Cooked Food is Handled.....	73
4.5.4 Ways by which Food can be Prevented from Contamination .....	74
4.5.5 Temperature of Water Used for Sterilization .....	75
4.6 Socio-Demographic Characteristics and Personal Hygiene Practices .....	75
4.6.1 Relationship between Age and Personal Hygiene Practices .....	76
4.6.2 Relationship between Gender and Personal Hygiene Practices .....	76
4.6.3 Relationship between Marital Status and Personal Hygiene Practices.....	77
4.6.4 Relationship between Educational Qualification and Personal Hygiene Practices.....	77
4.7 Knowledge on Food Hygiene and Clean Environment.....	77
4.7.1 Relationship between Attending Food Hygiene Training and Clean Environment .....	78
4.7.2 Relationship between Use of Waste Bins and Clean Environment.....	78
4.7.3 Relationship between Choice of Selling Site and Clean Environment .....	79
CHAPTER FIVE .....	86
DISCUSSION OF FINDINGS .....	86
5.1 Demographic Characteristics of Respondent .....	86

5.2 Practice of Hand Hygiene Towards Prevention of Food Contamination.....	87
5.3 Cooked Food Storage Practices.....	88
5.3.1 Ways of Storing Left-Over Foods .....	88
5.4 Sterilization of Cooking Equipment.....	89
5.5 Sanitary Conditions of Street Vending Premises .....	90
5.5.1 Selling Food by the Gutter.....	90
5.5.2 Flies Hovering on Food .....	91
5.6 Health Status of Food Vendors .....	92
5.6.1 Medical Screening .....	92
5.6.2 Reporting illness to Medical Expert .....	93
5.7 Hand Washing with Soap.....	93
5.8 Level of Street Food Vendors Knowledge on Food Borne Disease .....	95
5.8.2 Knowledge of Street Food Vendors on Microorganisms .....	96
5.8.3 How Cooked Food is Handled.....	96
5.9 Ways by which Food can be Prevented from Contamination.....	97
5.10 Temperature of Water Used in Sterilization .....	97
5.11 Relationship between Age and Personal Hygiene Practices .....	98
5.12 Relationship between Sex and Personal Hygiene Practices.....	98
5.13 Relationship between Marital Status and Personal Hygiene Practices .....	99
5.14 Relationship between Educational Qualification and Personal Hygiene Practices.....	99
5.15 Relationship between Attaining Food Hygiene Training and Personal Hygiene Practices .....	100
5.16 Relationship between Use of Waste Bins and Clean Environment .....	100
5.17 Relationship between Choice of Selling Site and Clean Environment .....	101
5.18 Microbial Content of Some Selected Foods.....	102
5.18.1 Microbial Content found In Kenkey with Hot Pepper .....	104
5.18.2 Microbial Content found In “Waakye” .....	104
5.18.3 Microbial Content found In Porridge .....	105
5.18.4 Microbial Content found In Fried Rice .....	105
CHAPTER SIX.....	107
CONCLUSION AND RECOMMENDATIONS .....	107
6.1 Conclusion.....	107
6.1.1 Knowledge Level Among Street Food Vendors on Food Borne Diseases .....	107

6.1.2 Personal Hygiene Practices Among Street Food Vendors .....	107
6.1.3 Sanitary Conditions of Street Food Vendors Premises .....	107
6.1.4 Microbial Content Found in Food .....	108
6.2 Recommendations .....	108
REFERENCES .....	111
APPENDIX (1) ONE.....	120



## LIST OF TABLES

Figure 4.1: Response Rate .....	60
Figure 4.2: Practice of Hand Hygiene.....	63
Figure 4.3: Food Storage Practices to Avoid Food Contamination .....	64
Figure 4.4: Ways of Storing Left-Over Food.....	65
Figure 4.5: Sterilization of Cooking Equipment.....	66
Figure 4.6: Sanitary Environment of The Street Food Vendors .....	67
Figure 4.7: Selling of Food by Gutter (Location of food on Sale).....	68
Figure 4.8: Flies Hovering on Food .....	69
Figure 4.9: Medical Screening of Street Food Vendors.....	70
Figure 4.10: Reporting of Illness to Medical Expert by Street Food Vendors.....	70
Figure 4.11: Hand Washing With Soap Among the Street Food Vendors.....	71



## LIST OF FIGURES

Figure 4.1: Response Rate .....	60
Figure 4.2: Practice of Hand Hygiene.....	63
Figure 4.3: Food Storage Practices to Avoid Food Contamination .....	64
Figure 4.4: Ways of Storing Left-Over Food.....	65
Figure 4.5: Sterilization of Cooking Equipment .....	66
Figure 4.6: Sanitary Environment of The Street Food Vendors .....	67
Figure 4.7: Selling of Food by Gutter (Location of food on Sale).....	68
Figure 4.8: Flies Hovering on Food .....	69
Figure 4.9: Medical Screening of Street Food Vendors.....	70
Figure 4.10: Reporting of Illness to Medical Expert by Street Food Vendors.....	70
Figure 4.11: Hand Washing With Soap Among the Street Food Vendors.....	71



**LIST OF PLATES**

Plate 1: PCR amplification of *Escherichia coli* pathogen in prepared food samples collected from three Zonal Councils at Ayensuano District, E.R. Samples: (1-76), Nc: Negative control (Sterile- free water). Pc: Positive control M-DNA Ladder (1kb).....83

Plate 2: PCR amplification of *Salmonella typhi* pathogen in prepared food samples collected from three Zonal Councils at Ayensuano District, E.R. Samples: (1-76), Nc: Negative control (sterile-free water). Pc: Positive control M-DNA Ladder. ....84



### LIST OF ABBREVIATIONS

<b>AYDA</b>	Ayensuano District Assembly
<b>CDC</b>	Center for Disease Control
<b>EHP</b>	Environmental Health Practitioner
<b>EHSU</b>	Environmental Health & Sanitation Unit
<b>FAO</b>	Food and Agriculture Organization
<b>HACCP</b>	Hazard Analysis & Critical Control Point
<b>SFVs</b>	Street Food Vendors
<b>SPSS</b>	Statistical Package for Social Sciences



## GLOSSARY

### **Contaminated food**

Harmful microorganisms found in food which can lead to illness when consumed.

### ***Campylobacter jejuni***

A spiral shaped bacterium that is a common cause of food poisoning in humans.

### **Cross-contamination**

Harmful bacteria or allergies which spread to food from other foods.

### **Disinfection**

Killing or removal of many but not all microorganisms

### ***Escherichia coli***

A bacterium found in the colon of human and animals and a serious contamination found in food and water.

### **Food Borne Diseases**

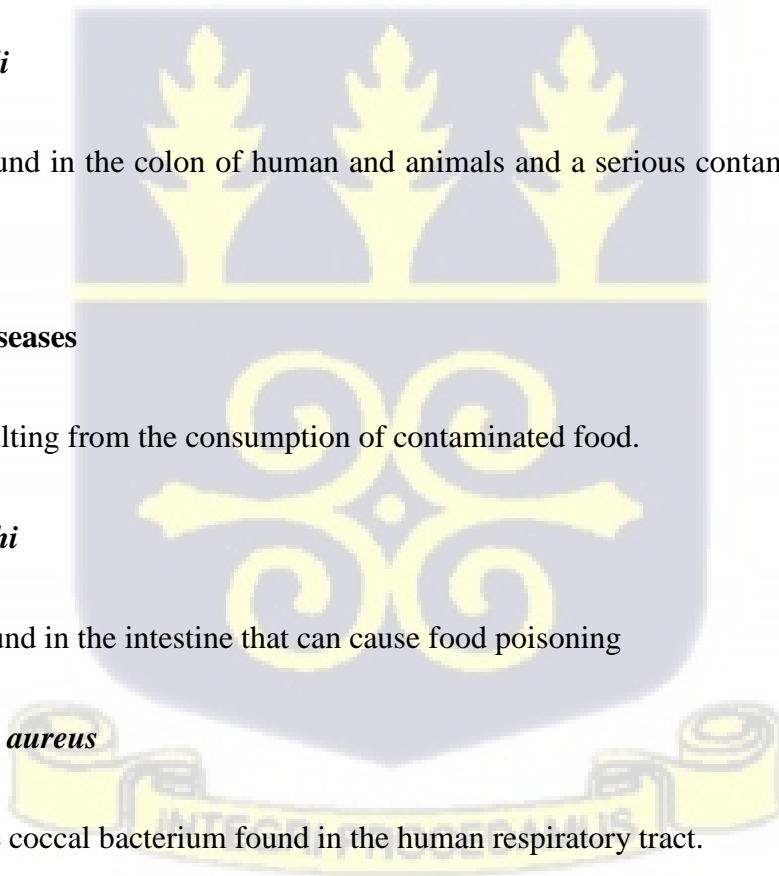
Any illness resulting from the consumption of contaminated food.

### ***Salmonella typhi***

A bacterium found in the intestine that can cause food poisoning

### ***Staphylococcus aureus***

A gram positive coccal bacterium found in the human respiratory tract.



## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background

In many developing countries including Ghana, street food vendors form an integral part of the food supply chain, particularly with increasing urbanization (Akintaro, 2012). The street food industry has contributed immensely to human and economic development as studies conducted in some of the African countries like Nigeria, Morocco, and Kenya have shown that major street food vendors usually earn above the countries' minimum wage (Omenu & Aderoju, 2008). The socioeconomic role of the street food sector in terms of its potential for employment creation, yielding income particularly for women, and provision of food at affordable cost to lower income groups in the cities has been documented (Tavonga, 2014).

The Street food sector in Ghana is confronted with challenges. There is inadequate supervision and proper monitoring by food safety officers and the enforcement of food hygiene regulation is weak (Oyeneho & Hedberg, 2013), lack of training in food safety and good hygiene practices is also rife among food handlers. Hence street foods are at risk of contamination at all stages of handling. Street foods are sometimes stored at improper temperatures and are sold from vending sites which include kiosks, push carts as well as other temporary structures. Street foods are prepared at unhygienic surroundings with waste water and garbage disposed nearby, providing nutrient and breeding ground for rodents and vermin (Barro, Bello, Salvadogo, Ouatarra, Iiboudu and Traore, 2006). In most cases running water is not available at vending sites, washing of hands and crockery are done in bowls or buckets and sometimes without soap (Abdalla, Suleiman, Alien and Bakheti, 2008). Furthermore, the conditions under which food is prepared and vended are worsened by weak implementation of relevant environmental and public health regulations. In Ghana the Public Health Act 851( 2012) Section 51, 52 and 53

stipulates the regulations of food vendors, but the implementation and the enforcement become difficult by the public health officers responsible.

Food is a basic necessity of life without which man cannot survive. The total life of an individual from development to productivity and whether a person become ill or healthy depend on what he/she eats. Dr. Edith Clarke of the Ghana Health Service (GHS) puts it that, the accessibility and availability of safe food is a basic human right.

Food leads to an improvement in the health of people, contributes to productivity and provides an effective basis for development and poverty alleviation (Clarke, 2005).

Industrialization, economic hardship and crave for money have resulted in people spending less time at home. This has led to many people eating mostly from street food vendors. Professor Patience Mensah, the Regional Advisor on Food Safety at the World Health Organization Regional office for Africa also shares this view when she said —there's a shift towards eating food prepared outside the home. Some people view this trend as a mark of affluence (WHO,2006). This has made the food vending industry increase tremendously in terms of numbers. Apart from meeting the food demand of people, the food vending industry also offer a significant amount of employment often to persons with little education and training (FAO, 2013). All kinds of food are sold by food vendors, presenting the options for variety and choice for customers. Food sold by these food vendors have significant nutritional implications, nutritionally balanced diets, sufficient in quantity and quality.

According to studies done in Africa (Uganda) on food vending, the tremendous unlimited and unregulated growth has placed a severe strain on city resources, such as water, sewage systems and interference with the city plans through congestion and littering that adversely affect daily life. Food safety is a matter of great public health concern worldwide and particularly crucial if the environment in which the food is handled is heavily contaminated. There is the potential

for serious food poisoning outbreak due to improper use of additives, the presence of adulterants and environmental contaminants, as well as, improper food handling practices among food vendors. Some food vendors are often untrained in food hygiene and sanitation and work under crude unsanitary conditions (FAO 2012). Adequate sanitary conditions, good maintenance and proper hygiene practices are steps that can be taken to control chances for food contamination (Desenclos et al., 1996).

The Food and Drugs Authority(FDA) and the Environmental & Sanitation Unit in the Eastern Region of Ghana have developed program's to improve the safety of the street-vended foods. For instance, every year food vendors undergo medical screening of health and upon that a health certificate is issued to the vendors. One of the requirements of food vendors laid down by the FDA is to obtain health permit before selling foods. Unfortunately, some of the street vendors ignored all these protocols.

Therefore, the present study seeks to investigate the hygiene practice among street food vendors and the microbial content of food sold to safeguard the local public health in the Ayensuano District.

### **1.2 Statement of the Problem**

The issue of food hygiene covers a broad area including the selection and handling of raw foodstuffs, personal hygiene of food vendors, sanitary conditions of place of cooking, waste management and treatment of leftovers as well as prevention of contamination. It is an undisputable fact that food can cause illness if it is contaminated with harmful microorganisms. It is a fact that harmful microorganisms are opportunistic ubiquitous in the environment in which food is been prepared. Food is likely to be contaminated at every stage of its preparation, storage and serving. This statement stands true considering the preparation of food for sale in open spaces.

According to records from the Environmental Health & Sanitation Unit of the Ayensuano District (EHSU, 2020), during their annual medical screening, about 45% out of the total food vendors screened were diagnosed for typhoid fever. A workshop organized by the Unit for the same food vendors reveals that about 80% of the vendors lack knowledge on issue of food borne diseases. A routine food premises inspection carried out by the researcher as part of the researcher's job description showed that about 70% of the food vending premises were not clean, with rubbish, infested with houseflies hovering on cooked foods, cobwebs hanging on walls and roof, and exposed food without covers.

Food safety has been declared a global concern and an increasing public health concern by international agencies such as the FAO (Food and Agriculture Organization) and the WHO (World Health Organization). However, the exact number of food poisoning and food borne diseases is not known since most incidences are not reported. It has been estimated that food and waterborne diarrheal diseases are leading causes of illness and death in less developed countries killing an approximately 1.8 million people annually (WHO, 2002). Thus, food-borne diseases have the potential of seriously damaging the health status of the population and simultaneously creating an enormous social burden on the communities and their health system. Most people go along way to protect themselves from food related threats at home. They practice proper refrigeration, wash fruits and vegetables among others. However, no matter the precaution put in place, food is prone to contamination at the vending premises. The more food is handled, the more the opportunity for contaminants to be introduced. As many people eat more and more food prepared and sold outside their homes, the higher their risk of exposure to micro-organisms. It has recently been discovered that the food vending industry has become a greater contributor to the illness problem (Magee, 2007). The morbidity trends from food-related illnesses in Ghana reveal that —two of the food related illnesses reporting to health facilities namely diarrheal among children and tuberculosis in

adults are among the five leading causes of death (Clarke, 2005). Any ignorance or carelessness on the part of the food handler would lead to the spread of infectious micro-organisms, such as *Escherichia coli*, *Salmonella typhi*, and *Vibrio cholerae*.

Poor food hygiene practices by food vendors can have a lot of effects on a substantial number of people who patronize their services. Talk of the spread of feco-oral diseases like typhoid fever, Cholera among others and the amount that the government and individuals spend on the treatment of these diseases. Food, not water, is the source of most causes of diseases in developing countries (WHO, 1996). Most illnesses are due to preventable errors in food selection. In 1996, the WHO recommended that member countries should ensure that street food vending is regulated with measures taken to ensure the education of street food vendors in hygienic food preparation principles (WHO, 1996).

The risks of illness may be reduced by taking measures to minimize contamination which may occur during preparation in the kitchen, transporting or during storage (FAO, 2004). Street foods are readily available, inexpensive, nutritionally-balanced and also provide a source of income for the food vendors (Dawson & Canet, 1991, Ekanem, 1998; Swanepoel et al., 1995).

Despite these benefits, concerns have been raised about their safety and quality because most of the vendors lack training in basic hygienic food practices concerning raw material acquisition, food preparation, storage, handling, and final delivery to the consumer (Moy et al., 1997 ; Bryan et al., 1988).

### **1.3 Research Questions**

This research sought to answer the following questions.

- i. What is the level of street food vendors knowledge on food borne diseases?
- ii. To what extent do street vendors practice personal hygiene in Ayensuano District?

- iii. Do the street food vendors sell their food within a clean environment?
- iv. Does the food sold by vendors in Ayensuano district contain disease causing microorganisms?

#### **1.4 Objectives**

The overall objective of the study is to assess the hygiene practices among street food vendors and determine the microbial content of foods sold at Ayensuano district.

Specifically, the study seeks to:

1. Establish the level of knowledge of food borne diseases among food vendors.
2. Determine the personal hygiene practices of the food vendors.
3. Determine the sanitary conditions of the vending premises both in the kitchen and selling premises.
4. To determine the microbial content of some selected foods sold by the street vendors.

#### **1.5 Justification of the Study**

With the increasing pace of globalization and tourism, the safety of street food has become one of the major concerns of public health, and a focus for government and scientists to raise public awareness. Street foods provide a source of affordable nutrients to the majority of the people especially the low-income group in the developing countries (Muzaffar, et al., 2009). Streetfood vendors in underdeveloped countries are generally unaware of food regulations and have no training in food related matters. They also lack supportive services such as water supply of adequate quality.

Most street vending occurs at places with poor sanitary conditions, lack adequate water, lack proper food storage equipment, lack adequate washing facilities and lack of proper toilet

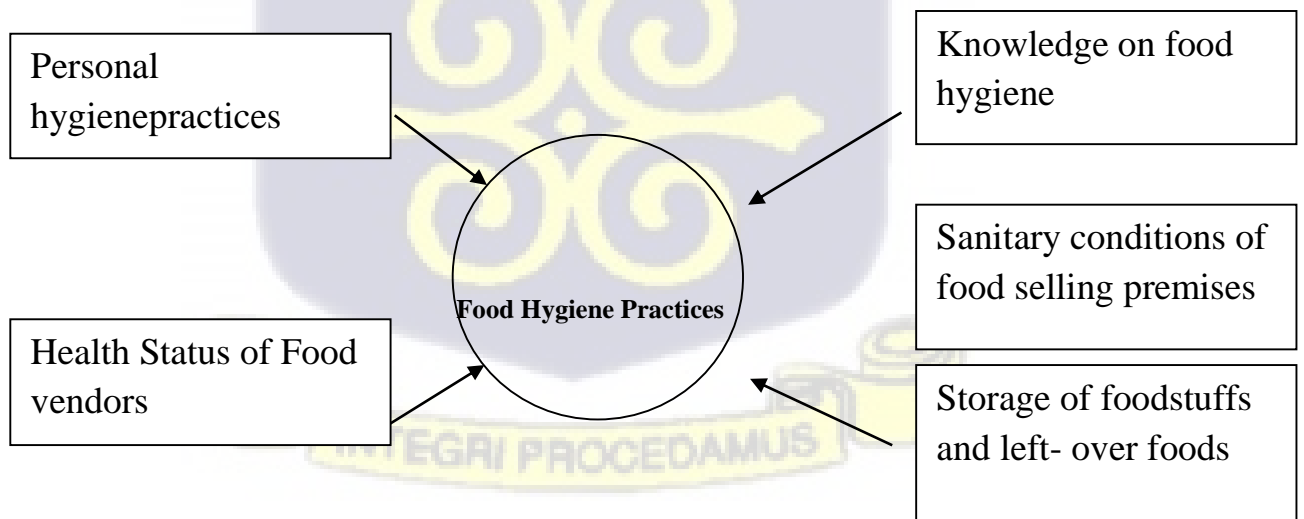
facilities. Some of the street vendors also have poor hygiene practice such as not washing their hands after visiting toilet, operating at few meters from the garbage dumps, long dirt fingernails, nose picking and sneezing while preparing and serving food.

Adherence to the safety and approved measures with regards to food hygiene practices is important to avoid the consumption of unwholesome and contaminated street foods by the thousands of Ghanaians who patronized them every day.

This study is planned to assess the level of knowledge by the street food vendors and the predisposing factors that lead to contamination..The personal hygiene practices of the vendors and the sanitary conditions of the food premises will be examined at Ayensuano District.

This study will help to determine the potential health hazards from consuming food from street vendors contaminated with harmful pathogens and to make recommendations for future implementation by the local authorities concerned.

### 1.6 Conceptual Framework



### 1.7 Significance of the Study

The study would:

- Contribute to knowledge especially in the food industry.
- Help improve upon the quality of food sold by street vendors in the Ayensuano District.
- Influence policy decision regarding the regulation of food hygiene in the Ayensuano District.
- It will be of immense benefits to Food and Drugs Authority(FDA) within the Eastern region as it will reveal lapses and associated with poor handling of food by street vendors
- Serves as a source of information for future researchers especially in the field of public health



## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Literature Review

This chapter deals with the literature review to the topic “ hygiene practices among street food vendors and the microbial content of some selected foods sold at Ayensuano District”.

In order to make the study easier, some references were made to relevant documents from different sources such as journals and textbooks.

#### 2.2 Microbial Quality

For decades and through evolution man has always made efforts to avoid diseases and find ways to cure existing ones in order to improve and prolong life. Diseases especially those caused by our daily intakes and activities, such as food and hygiene, continue to be a threat to human health and life. It is obvious and globally acclaimed that unhygienic food and other forms of contamination of our daily food and water have led to the death of millions of people throughout the world, especially in Africa where low level of education, poverty, poor public health policies, inadequate health personnel, poor financing health system among other reasons have left Africa and for that matter Ghana at the mercy of every outbreak from unhygienic food (Dun-Dery, 2012). There should therefore be a paradigm shift from looking for food diseases to cure, to what the diseases are and how they are caused. Globally, it is accepted that contaminated food and water causes serious health hazards to human and even animal life. Cholera, diarrheal, typhoid and hepatitis exist and are of great concern to public health professionals especially in West Africa where access to quality education on hygiene is merely a dream, especially for food vendors. Unclean, insufficiently or inadequately cleaned cooking equipment have been identified as a source of bacterial contamination in processed food. Containers, pumps or tanks used for holding or transporting

unprocessed raw materials, have occasionally been used for processed products without any cleaning and disinfection. It is therefore necessary that equipment in the processing establishment, coming in contact with food, be constructed in such a way as to ensure adequate cleaning, disinfection and proper maintenance to avoid the contamination.

Transfer of microorganisms from person to person particularly from hands, is of vital importance. During handling and preparation of food, bacteria are transferred from contaminated hands to food and subsequently to other surface (Samakupa, 2003). Low infectious doses of organisms such as *Shigella* and pathogenic *Escherichia coli* have been linked to hands as a source of contamination (Snyder, 1998).

Poor hygiene practices like deficient or absence of hand washing has been identified as the mode of transmission. Way side canteens and other food vendors undoubtedly are one of, if not the main source of contaminated food.

In Ghana it is not uncommon to notice that most health centers are filled with patients of various ages suffering from different food related diseases. Contaminated or unhygienic food can lead to various complications and diseases. From the food vendors' perspective, the variety, quality, preparation of foods and services are meant to just satisfy the needs of the consumer and not to waste resources and run at a loss.

Street food vendors are known to contribute a significant amount of money to the economy. Dr. Paa-Nii Johnson (2005) Head of Processing and Engineering Unit of the Food Research Institute, reported in Ghana News Agency that the socio- economic survey of 334 vendors and a mini census indicated that street-vended foods made an important contribution to the economy of Accra. The street foods sector employs more than 60,000 people with an estimated annual turnover of about 100 million dollars and a profit of 24 million dollars (Agyei-Takyi, 2012).

A study conducted by Rheinlander (2012) found that although vendors and consumers demonstrated basic knowledge of food safety, the study did not emphasize on basic hygiene practices such as hand washing, cleaning of utensils, washing of raw vegetables, and quality of ingredients. Instead, four main food selection criteria could be identified and were related to (1) aesthetic appearance of food and food stand, (2) appearance of the food vendor, (3) interpersonal trust in the vendor, and (4) consumers often chose to prioritize price and accessibility of food not putting much stress on food hygiene. Hence, consumers relied on risk avoidance strategies by assessing neatness, appearance, and trustworthiness of food vendor. (Rheinländer, 2012).

The study by Rheinländer, (2012) did not consider factors such as hand washing, washing of raw material and cleaning of utensils. This gap in their study is been taken care of as hygiene practices such as food vendors hand washing, and cleaning of utensils behaviors are considered in this study at Ayensuano district. In 1984, a joint FAO/WHO Expert Committee on Food Safety, in its report on the role of food safety in health and development, noted that: "it is not easy to maintain control over food handlers. There is often a rapid turnover and it may be difficult to keep track of them. Medical examinations are costly and do not guarantee the detection of more than a small proportion of carriers of pathogenic organisms. Also, infections may occur after the examinations. Screening for pathogens in stool specimens from foodhandlers is not costbeneficial and is not recommended, and the identification of a carrier is not likely to make a significant contribution to the control of food borne diseases. A much more effective preventive measure, the education of foodhandlers in hygienic practices, is most often neglected." These views were reinforced in 1987 by the second meeting of the WHO Regional Working Group on Food Safety, held in Kuala Lumpur, Malaysia, which questioned the relevance of the routine medical examination of such personnel.

Despite the conclusions of these meetings, the debate has continued among health professionals and public health authorities on the relative merits, costs and benefits of the health surveillance of food handling personnel, and there is no uniformity in the procedures adopted by countries in undertaking such surveillance. It is still uncertain as to whether, and under what circumstances, routine medical examinations are cost effective in preventing or at least minimizing food contamination. This study looked at the various medical examinations that forms the basis for accepting applicants into the food vending industry, the number of times of each food vender would have to go through in a year and underscore the importance of going through medical examination.

New food borne pathogens (such as *Campylobacter spp*, *Vibrio cholera non-O 1*, *Vibrio vulnificus*, *Escherichia coli* 0157:H7 and *Listeria monocytogenes*) have emerged in recent years and their significance needs to be examined in relation to their possible implications for the health surveillance of food handlers. The task of the consultation by FAO and WHO was therefore to review systematically those food borne diseases that may be transmitted by food handling personnel via food to the consumer, and to determine the kinds of food contamination that can be prevented and the kind of health surveillance of such personnel necessary for the purpose. In view of the great importance of the education of food-handling personnel in preventing contamination of food, the consultation was also requested to consider ways and means of achieving this.

This study tried isolating *E. coli* and *Salmonella* Species of the new food borne pathogens in selected foods such as “kenkey” and pepper, “waakye,” fried rice and “porridge” sold at Ayensuano District.

### **2.2.1 The Potential of Food Handling Personnel to Transmit Diseases Via Food**

The ability of food handling personnel to transmit disease is related to the degree of contact that they are likely to have with particular sorts of food. The risks they pose clearly vary widely, which raises the question whether all such personnel should be treated in the same way.

Investigations of outbreaks of food borne disease throughout the world show that, in nearly all instances, they are caused by failure to observe satisfactory standards in the preparation, processing, cooking, storing or retailing of food (Nigussé & Kumie, 2012). Organisms may be introduced into the food chain from a variety of sources, and at different stages. Gastrointestinal pathogens may be derived from animal sources, the environment or occasionally, from humans (WHO, 1989).

Many raw foods, particularly of animal origin, are heavily contaminated with organisms of various kinds and attempts to reduce microbial loads at various stages of production have generally been unsuccessful (WHO, 1989). The elimination of pathogenic organisms therefore depends largely on the correct application of processing technologies, such as pasteurization, irradiation, cooking, freezing and pickling at the industrial, retail and domestic levels. Thus, the prevention of outbreaks of food borne disease depends on the correct application of these technologies, especially in terms of time and temperature control, and on proper storage and the prevention of cross-contamination (WHO, 1989).

### **2.2.2. Classification of Food Handling Personnel According to the Potential Risk**

The term food handling personnel, in its broadest sense, include all those who may come into contact with part or all of an edible end-product at any stage from its source, e.g. the farm, to the consumer. This concept is embodied in the definition contained in the report on the WHO Working Group on Health Examinations of Food Handling Personnel: " a

person in the food trade or someone professionally associated with it such as an inspector who, in his routine work, comes into direct contact with the food itself in the course of its production, processing, packaging or distribution, including producers of raw milk for direct consumption." This definition recognizes that responsibility for the application and control of food-handling techniques extends from management to the consumer. Not all, however, actually come into contact with food; equally, those who do have such contact are not necessarily in a position to transfer pathogenic organisms from themselves to food in such a way that illness might result.

A distinction between those whose work could allow such transfer to occur and those for whom such a risk does not exist is in order. Those who present a risk of transmitting pathogenic organisms in this way can be defined as persons whose work involves touching unwrapped foods to be consumed raw or without further cooking or other forms of treatment. This category will include people involved in such activities as the preparation of salads, sandwiches, and cooked foods to be served cold, and the handling of cooked meats and meat products and of certain dairy products, including fresh cream and egg-based foods. In the wider context, workers in water treatment plants should also be included. Street vendors, common in both developing and industrialized countries, also fall into this group, and may present special problems related to their way of life and difficulties in determining whether they have complied with control measures.

The nature of the work that they are to carry out must be taken into account in the assessment of the training provided to food handlers. The food that is contaminated is not treated in such a way as to destroy the organisms before they reach the consumer. Either the number of organisms on the food constitutes an infective dose or the nature of the food or its conditions of storage are such as to allow the organisms to multiply and produce an infective dose or to produce toxins in quantities sufficient to cause illness (WHO, 1989).

### **2.2.3 Excretion of Pathogens**

Gastrointestinal pathogens are excreted, often in very large numbers, in the acute phase of disease and in decreasing numbers and for variable periods of time during and after convalescence. In some cases excretion starts in the incubation period, as with viral hepatitis A, and may cease when the major clinical manifestations become apparent. Certain infections, such as typhoid fever, may not manifest themselves clinically at any stage but the organism concerned may be excreted for varying periods of time (WHO, 1989).

There is, therefore, a significant difference between those who are acutely ill from a gastrointestinal infection and continue to excrete the organism after the clinical illness is over. In the former case, the stools are characteristically loose and frequent, the concentration of organisms may be very high, and the organisms are likely to be easily and widely disseminated. Carriers, on the other hand, have recovered clinically, have normally formed stools and excrete diminishing numbers of organisms as time passes. The potential risk of spreading organisms widely is clearly very much greater for those who are clinically ill than for carriers. It is therefore imperative for all food vendors to be screened to be able to eliminate the risk of spreading diseases through the food they sell to their patrons. This study sought to find out how comprehensive the medical examination is for food vendors within the Ayensuano district and also assess avenues through which transmission of these microbes are made possible.

### **2.2.4 Transmission of Pathogens - Environmental Hygiene**

Primary food production should not be carried out in areas where the presence of potentially harmful substances would lead to an unacceptable level of such substances in food. Potential sources of contamination from the environment should also be considered by food vendors to safe food production. Dangerous microorganisms are widely found in soil, water, animal and people and these microorganisms are carried on hands, wiping cloths and

utensils, cutting boards and the slightest contact of these microorganisms to food can cause food borne diseases (WHO, 2012).

These following points are means of ensuring hygienic environment according to

WHO (2010) and FAO (1999);

1. Protection of food and food ingredients from contamination by pests or by chemical, physical or microbiological contaminants or other objectionable substances during handling, storage and transport.
2. Waste of not be allowed to accumulate in food handling, food storage and other working areas and the adjoining environment. Waste stored must be kept appropriately clean.
3. Adequate drainage and waste disposal system and facilities should be provided. They should be designed and constructed so that the risk for contaminating food or the portable water supply is avoided.(FAO, Corporate Document Repository,1999)
4. Water use for cleaning should be from a safe source or made safe.
5. Wash and sanitize all surfaces and equipment used for food preparation (WHO, 2010). The hands are the most important vehicle for transfer of organisms from feces, nose, skin or other sites to food. Epidemiological studies of *Salmonella typhi*, non-typhi salmonellae, *Campylobacter* and *Escherichia coli* have demonstrated that these organisms can survive on fingertips and other surfaces for varying periods of time, and in some cases after hand-washing (WHO, 1989). *Staphylococci* may well not be removed from the hands by washing when they form part of the resident flora (WHO, 2002).

The cooked food serving utensils used at the vending site are often contaminated with *Micrococcus spp.* and *Staphylococcus aureus spp.* (Sharmila, 2015) They may have

originated from the vendors hands when they touched the food preparation areas, dish cloths, or the water during dish washing or hand washing which indicates cross contamination between dishwater, food preparation surfaces, and the food itself. It is reported that bacteria from dirty dish washing water and other sources adhere to the utensil surface and can constitute a risk during the food vending process (Rane, 2011).

### **2.2.6 Food and Quality**

It is important to take caution when selecting raw materials for food preparation. These raw materials, including water and ice may be contaminated with dangerous microorganisms and chemicals. (Katarzyna. 2015) Toxic chemicals may be formed in damaged and mould foods.

Important hygienic aspects related to Food and Quality include:

1. Food vendors should select fresh and wholesome foods to prepare food for sale.
2. Food vendors must choose food processed to reduce the risk associated with cooking raw foods for foods.
3. Food vendors should make ice from safe water (FAO Corporate Document Repository, 1999).
4. Food vendors should use safe water or treat it to make it safe

(WHO, 2010) Microbiological analysis of utensils surface and knives have the presence of *Salmonella* and *Shigella* ( Rane, 2011). It is also reported that during the preparation of food, the raw material is cut and chopped using the same knife which may not be cleaned and are often invaded by flies ( Rane, 2011).

A study conducted by Annan-Prah et al (2011) on street foods in Cape Coast, Ghana confirms the statement made above. Handling, vending and hygienic quality of street foods available to local residents, internal and foreign tourists to Cape Coast, the most important tourism hub in Ghana, were investigated. Questionnaires assessed stakeholder commitment to and expectations of food hygiene. Laboratory analysis evaluated microbial contamination levels of the street foods. The study showed that both local residents and foreign tourists put the hygienic safety as the principal criterion over curiosity and price to patronize street foods. Although licenses had been given to 27 (54%) of the investigated food vendors, only 15 (55.5%) of the licensed vendors had had medical examination (8 only once and 7 annually).

Food vending premises visibly needed improvement in sanitation. The foods had the following bacterial contamination levels in colony forming units per gram (cfu/g): meat pie ( $1.3 \times 10^5$ ), “khebab” ( $5 \times 10^4$ ), rice with stew ( $4.1 \times 10^5$ ), fried fish ( $8 \times 10^4$ ), pepper sauce ( $1.4 \times 10^5$ ), stew or “banku” ( $3 \times 10^5$ ), beans with gari ( $2 \times 10^4$ ), “fufu” ( $1.6 \times 10^5$ ) “waakye” ( $6.6 \times 10^5$ ) and dakua ( $2.3 \times 10^5$ ). The presence of *Escherichia coli* was detected in all investigated food samples. “Khebab”, fried fish and beans with gari had acceptable bacterial contamination levels of  $<5 \log_{10}$  cfu/g. The following major fungi were identified in the street foods: *Aspergillus flavus*, *Aspergillus niger*, *Aspergillus candidus*, *Cladosporium herbarum*, *Necrosporacrassa*, *Penicillium citrinum*, *Fusarium*, *Mucor* and yeast species. Yeasts were found in all investigated food items. The street foods were, therefore, found to have threatening unacceptable microbial contamination levels.

Street vended foods are not only appreciated for their unique flavors, convenience and the role which they play in the cultural and social heritage of societies, they have also become important and essential for maintaining the nutritional status of the populations.

Besides offering business opportunities for developing entrepreneurs, the sale of street foods can make a sizeable contribution to the economies of developing countries. In India, the National Policy for Urban Street Vendors/Hawkers stated that street vendors constitute approximately 2% of the population of a metropolis (Indian Street Food Policy, 2004). Street foods are perceived to be a major public health risk due to lack of basic infrastructure and services, and difficulty in controlling the large numbers of street food vending operations because of their diversity, mobility and temporary nature (Rane, 2011).

A general lack of knowledge about the epidemiological significance of many street vended foods, poor knowledge of street vendors in basic food safety measures and inadequate public awareness of hazards posed by certain foods has severely hampered the deployment of a precise scientific approach to this very serious issue of public health and safety (Rane, 2011).

The epidemiological studies such as the one by Mensah et al., (2002) suggests that street foods contribute to a significant number of food poisonings are inadequate, due to paucity of data deficiencies in knowledge about important parameters in the food chain and host pathogen interactions. However, there have been several documented cases of food poisoning outbreaks due to street foods. Street foods were responsible for 691 food poisoning outbreaks and 49 deaths from 1983 to 1992 in Shangdong Province (China). FAO has implemented and supported several projects which aimed at improving various aspects of the street food sector in countries like Bolivia, Colombia, Ecuador, India, Zaire, etc. Malaysia, Philippines and India are the three countries which have regulations for protecting street vendor. Malaysia is the only country where licensed street vendors are provided facilities for conducting their trade. An initiative has been taken in Durban, Africa, where a coalition between local and national authorities, explored the food laws associated with

street vending and developed strategies that could be used to control identified food hazards (Sharmila, 2015).

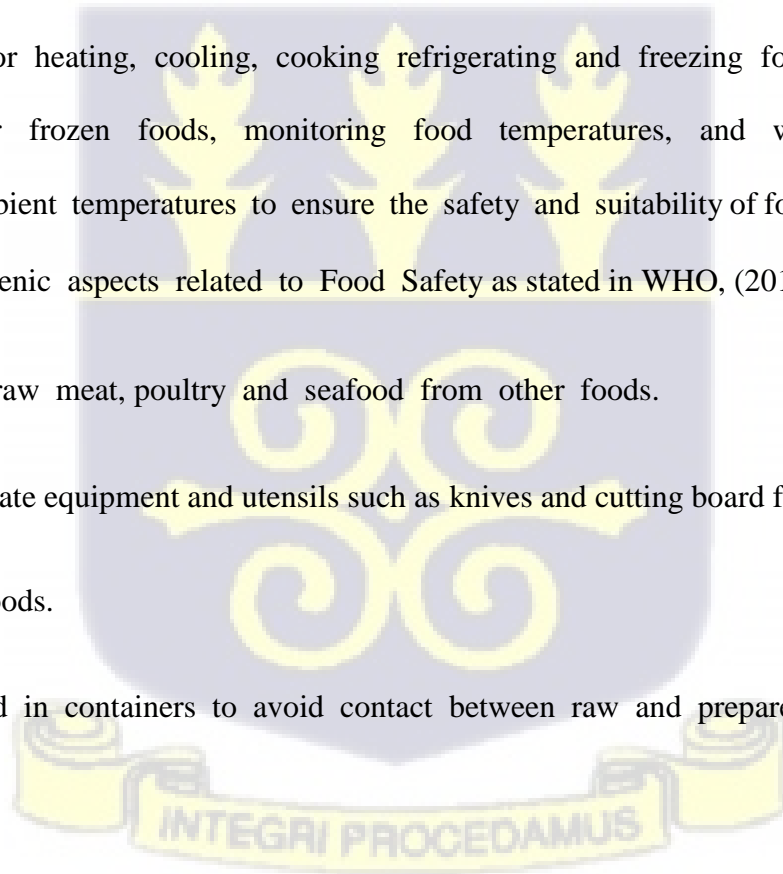
### **2.2.7 Source of Food Contamination**

Simple measures such as washing and peeling food material may reduce the risk of contamination with microorganisms from raw food. Also, proper cooking kills almost all dangerous microorganism, thus, studies have shown that cooking food to a temperature of 70C can help ensure it is safe for consumption (WHO, 2006).

Microorganisms can multiply very quickly if food is stored at room temperature. By holding at temperature below 50C or above 60C, the growth of microorganisms is slowed down or stopped but some dangerous microorganism will still grow below 50C (WHO, 2010). Depending on the nature of the food operations undertaken, adequate facilities should be available for heating, cooling, cooking refrigerating and freezing foods, for storing refrigerated or frozen foods, monitoring food temperatures, and when necessary, controlling ambient temperatures to ensure the safety and suitability of food (FAO, 1999).

Important hygienic aspects related to Food Safety as stated in WHO, (2010):

1. Separating raw meat, poultry and seafood from other foods.
2. Using separate equipment and utensils such as knives and cutting board for handling raw foods.
3. Storing food in containers to avoid contact between raw and prepared foods.
4. Washing fruits and vegetables, especially if eaten raw.



5. Removing outer leaves of leafy vegetables.

6. Cooking food thoroughly; make sure that the temperature has reached 70°C

7. Reheating cooked food thoroughly.

8. Avoid leaving cooked food at room temperatures for more than 2 hours.

9. Refrigerating promptly all cooked and perishable food (preferably below 5°C) According to WHO (2017) food handling personnel play an important role in ensuring food safety throughout the chain of food production, processing, storage and preparation. Mishandling and disregard of hygienic measures on the part of the food vendors may enable pathogens to come into contact with food and in some cases to survive and multiply in sufficient numbers to cause illness in the consumer. Some food handlers may introduce biological hazards by cross contamination after handling raw materials when they suffer from specific diseases and physical hazards by careless food handling practices (Rane, 2011).

Most of the vendors pack the food in polythene bags for their customers. When packing these foods, they blow air into the polythene bags to open them, in this process a number of pathogens can be passed on to the consumer, WHO (1989). Health surveillance and management procedures for food handling personnel (WHO technical report series, 785. WHO, Geneva, 52 pp).

A study in Santa Fe de Bogota, Colombia showed that over 30% of a group of food handlers examined were carriers of pathogenic microorganism including *Salmonella typhi*, *Staphylococcus aureus*, *Salmonella enteritidis*, and *Shigella* (Buchanan and Whiting, 1998). An important issue influencing food contamination and contributing to further increase in contamination is food storage temperature. The preparation of food long before its consumption, storage at ambient temperature, inadequate cooling and reheating,

contaminated processed food, and undercooking are identified as the key factors that contribute to food poisoning outbreaks. Holding foods at high ambient temperatures for long periods of time have been reported to be a major contributor to the occurrence of food poisoning outbreaks (Rane, 2011). Foods are often held for several hours after cooking and this includes overnight holding at ambient temperatures, until sold, and thus can harbor high microbial populations. Besides, some of the foods are held in the pans in which they are cooked, until sold or reheated, which results in longer holding time, hence creating favorable conditions for the growth of food borne pathogens.

In foods which are held under high ambient temperature, the counts of *Escherichia coli*, *Staphylococcus aureus*, *Bacillus cereus* and *Clostridium perfringens* are reported to be high (Rane, 2011). *B. cereus* was isolated from 42 (26.3%) samples of fried fish, tuwo, soup, boiled rice and moimoin suggesting that their spores survived the cooking process. The presence of this bacterium coupled with the storage of these foods at ambient temperatures (room temperature) for several hours under high temperature and high relative humidity showed that the product could be hazardous (Rane, 2011). *B. cereus* has been responsible for outbreaks of foodborne illness because it produces heat stable (emetic) and heat sensitive (diarrheal) toxins when foods are held under conducive conditions for several hours (Rane, 2011). Kaul & Agarwal (1988), reported high microbial count in fruit chat sold by a street vendor in Chandigarh, India where the counts ranged between  $10^6$  and  $10^8$  cfu/g, and a further increase in count by 1–3 log cycles was observed after 16 and 24 hours of storage at room temperature. A number of pathogens, such as *Escherichia coli*, *Salmonella typhimurium*, *Salmonella gallinarum*, *Shigella dysentery*, *Pseudomonas fluorescens* and *Klebsiella pneumoniae* were also found to be present in these samples.

Mensah et al., (2002) conducted a study on the safety of street foods in Accra to purposely investigate the microbial quality of foods sold on streets of Accra and factors predisposing to

their contamination. Structured questionnaires were used to collect data from 117 street vendors on their vital statistics, personal hygiene, food hygiene and knowledge of foodborne illness. Findings from the study indicate that most vendors were educated and exhibited good hygiene behavior.

Diarrheal was defined as the passage of 53 stools per day) by 110 vendors (94.0%), but none associated diarrheal with bloody stools; only 21 (17.9%) associated diarrheal with germs. The surroundings of the vending sites were clean, but four sites (3.4%) were classified as very dirty. The cooking of food well in advance of consumption, exposure of food to flies, and working with food at ground level and by hand were likely risk factors for contamination. This study by Mensah et al.,(2002) is similar to this study since the same parameters will be assessed to find out the similarities and differences in factors that affect microbial quality of street foods. In the same study, examinations were made of 511 menu items, classified as breakfast/snack foods, main dishes, soups and sauces, and cold dishes. Mesophilic bacteria were detected in 356 foods (69.7) 28 contained *Bacillus cereus* (5.5%), 163 contained *Staphylococcus aureus* (31.9%) and 172 contained *Enterobacteriaceae* (33.7%). The microbial quality of most of the foods was within the acceptable limits but samples of salads, macaroni, fufu, rice balls and red pepper had unacceptable levels of contamination. *Shigella sonnei* and entero aggregative *Escherichia coli* were isolated from macaroni, rice, and tomato stew, and *Salmonella arizonae* from light soup. In conclusion street foods can be sources of enteropathogens and vendors should therefore receive education in food hygiene. Special attention should be given to the causes of diarrheal, the transmission of diarrheal pathogens, the handling of equipment and cooked food, hand-washing practices and environmental hygiene. The microbiological quality of macaroni and vegetable salads served with waakye, was investigated. Aerobic mesophiles counts (AMC), coliforms counts (CC) and moulds and yeasts counts (MYC) were estimated,

and the coliform profiles for different samples of macaroni (raw, local/ imported, laboratory-cooked) served with waakye, and vegetable salads served with waakye were determined. Raw macaroni (local and imported) had AMC of 3.6 and 3.0 log<sub>10</sub> CFU/g, MYC of 1.9 and 1.0 log<sub>10</sub> CFU/g and no CC, respectively. Laboratory cooked local samples had AMC of 2.4 log<sub>10</sub> CFU/g and 3.3 log<sub>10</sub> CFU/g (after 4 h storage) and no MYC. Macaroni obtained from vendors had AMC mean of 3.1-8.4, CC mean of 2.5-7.3 and MYC mean of 0- 4.1 log<sub>10</sub> CFU/g depending on time of sampling. Vegetable salads sampled at early and late morning had AMC of 6.9 and 7.6, CC of 5.7 and 6.4, MYC of 4.9 and 5.4 log<sub>10</sub> CFU/g, respectively. Six coliform organisms were detected on macaroni and three were detected in addition to *Salmonella* spp. on vegetable salads. No significant difference was recorded in the microbial load of raw local and imported macaroni. Cooking improved the microbial quality of raw macaroni (AMC of 2.4 log<sub>10</sub> CFU/g).

Generally, there were increases of 3-5 log cycles in the AMC, CC and MYC in macaroni sampled from waakye vendors in the morning (early and late) compared to those at dawn. Although, the nature of raw macaroni and its cooking are adequate, cross-contamination from vegetable salads during the holding and bulk display periods cause deterioration in microbial quality of macaroni in waakye. A study conducted by Feglo, P. and Sakyi, K. (2008) in Kumasi, Ghana suggest that street vending foods are readily available sources of meals for many people but the biological safety of such food is always in doubt. The aim of this study was to ascertain bacterial isolate and determine total counts of bacterial species responsible for the contamination of the street vending food in Kumasi so as to determine the microbiological safety of such a food. This particular study was conducted among street vending food at four bus terminals in Kumasi. From November, 2008 to February, 2009, 60 food samples comprising “ice-kenkey” (15), cocoa drink (15), fufu (5), ready-to-eat red pepper (normally eaten with kenkey) (5), salad (10) and

macaroni (10) were purchased and analyzed. The food samples were purchased and transported to the laboratory in sterile plastic bags and analyzed for bacterial contamination. The mean bacterial counts in these foods expressed to log<sub>10</sub> CFU/ml were: fufu 6.36± 0.47, cocoa drink 6.16±0.5, red pepper 5.92± 0.64, ice-kenkey 5.58 ± 0.52, macaroni 5.58± 0.97 and salad 5.13± 0.77. Most of these foods contained higher than acceptable contamination level of <5.0 log<sub>10</sub> CFU/ml. The isolates obtained were Coagulate negative staphylococci (23.7%), *Bacillus* spp (21.5%), *Klebsiella pneumoniae* (18%), *Aeromonas pneumophila* (17.7%), *Enterobacter cloacae* (6.7%), *Staphylococcus aureus* (3.7%), *Escherichia coli* (2.2%) and *Pseudomonas aeruginosa* (2.2%).

The conclusion from this was that most ready to eat foods selected from Kumasi bus terminals were contaminated with enteric bacteria and other potential food poisoning organisms with bacterial counts higher than the acceptable levels. Food vendors therefore need education on food hygiene. Street foods are readily available, inexpensive and nutritionally balanced and also provide a source of income for the vendors (Dawson and Canet, 1991, Ekanem, 1998, Swanepoel et al., 1995). Despite these benefits, concerns have been raised about their safety and quality because most of the vendors lack training in basic food hygiene practices concerning raw material acquisition, food preparation, storage, handling, and final delivery to the consumer..

This study would want to find out whether street food in Ayensuano District also contaminated by these microorganisms since there is similar prevailing characteristics at bus terminal in Kumasi and Ayensuano.

### **2.3 Knowledge Levels of Food Vendors on Food Borne Diseases**

Knowledge of the consequences of unsafe food hygiene practice can enhance adherence to food safety guidelines. Studies on food hygiene have been done across the globe. In

Philippines, a survey on food safety knowledge and practice of street food vendors in a university campus in Quezon City was carried out by Azanza, Gatchalian, and Ortega (2000). Topics such as health and personal hygiene of vendors, food manufacturing procedures, food contamination and waste management as well as food legislations were assessed. The study found that among the 54 street food vendors surveyed, knowledge on food safety concepts was established particularly on topics that dealt with health and personal hygiene, food contamination and good manufacturing procedures; however, vendors were shown not to be knowledgeable in food legislation and waste management. A significant gap existed between knowledge and practice on these topics and this primarily attributed to the tendencies of street food vendors to compromise food safety for financial issue. The provision of continuous food hygiene education, some financial assistance through social service affiliation and basic water out waste management utilities were recommended to reduce the gap between knowledge and practices of safe vending on school campuses.

Burt, Volel and Finkel (2003), conducted a study to assess the food handling practice of 10 processing mobile food vendors operating in Manhattan, New York City and found out that over half of all vendors (67%) contacted served food with bare hands. Also some vendors were observed vending with visibly dirty hands or gloves and no vendors once washed his or her hands or changed gloves in the 20 minutes observation period, more so, four (4) vendors were observed to contaminate served food with uncooked meat and poultry.

Chukuezi (2010) conducted a study on food safety and hygienic practices at street food vendors in Owerri, Nigeria. Data collection was done with help of structured interviews, semi structured questionnaires as well as through observations. A descriptive survey design was used. Results shows that 23.81% of the vendors prepared food in on hygienic conditions, 42.86% did not use aprons, 47.62% handled food with bare hands and 52.38% wore no hair coverings while 61-90% handled money while serving food. In all, 19.05% wore jewelry while

selling foods and 28.57% blew air into polythene bag before use. Some (9.52%) of the vendors, stored food for serving openly in the stalls while 23.81% stored then in the wheel barrows. A good number (42.86%) of food vendors had left over's for serving the next day with poor storage facilities. In all, 47.62% of the vendors washed their utensils with dirty water which is recycled and used severally in 28.57% despite the fact that only 9.52% of them complained of water shortages. The researcher recommends that there is need for health education of those vendors in order to ensure food safety for the consumers.

Muinde (2005) had a study on hygiene and sanitary practices of vendors of street foods in Nairobi, Kenya. The accessible population was all street food vendors from Dandora and Kayole estates. Data collection was done by using in depth interview schedule and observational checklist. Data was analyzed using both descriptive and inferential statistics. Results show that 35% of vendors belong to 20-25 years, 60% were males while 40% were females. Slightly over half of vendors (57.5%) were married.

In all, 62% of vendors had primary education and below, 36.3% had secondary education while only 1.3% had college education. Most vendors 61% vendors acquired cooking principles by observation, 33.3% were taught by parents while 6.3% gained by trial and error. Based on observation about 85% of vendors prepared their foods in unhygienic conditions given that garbage and dirty waste were consciously close to the stalls, about 92.5% did not have garbage receptacles, hence they dispose their waste just near the stalls. In all, 92% of vendors threw waste water just beside the stalls making the environment surrounding the eaters quite filthy. Hence there is a significant P value  $> 0.5$  indicating that there was no relation between education and state of environment.

Benny –Oliviera (2007) conducted a study on Hygienic practices by vendors of the street food double and public perception of vending practices in Trinidad. A structured

questionnaire was administered to 120 street vendors and 115 public members in Trinidad, West Indies. Most vendors are male (61.7%), had been vending for 5 years (81.7%) and received primary level of education (72.5%). Preparation of doubles was mainly by family (84.2%) in the morning of vending (81.7%).

Vendors were appropriately dressed (99.2%), used forks/spoons (100%) and tongs (81.7%) for serving. At vending sites, containers with faucets supplied water (85.7%) and toilets were not close (97.5%). Most respondents (86.1%) consumed doubles. Some (30.6%) felt ill from eating doubles, but only 2.7% reported to a medical doctor/health authority. Significant associations were found for vending practices and sanitation of vending environment.

Furthermore, a study conducted in Latin America by Arambulo, Almeida, Gueller and Belotto (1994) on street food vending showed that there was a rapid rise of food vending. It was also found out that the generally unregulated and quasi - clandestine street food industry tended to observe poor hygiene practices which pose significant public health problems. Latin America rice cholera epidemics in this context have drawn increasing attention to street food potential for disease transmission and have created growing support for attempts to resolve these problems. To them this could be achieved through legal re-organization directed at structurally developing the street for food vending and permitting application of measures especially provision and use of safe food.

Programs that would provide appropriate training for inspectors as well as health education for both vendors and consumers of street food, the promotion and adaptation of improved methods for preparing and selling such food were advocated for. This they said may not provide immediate panacea for the street food vending problem in Latin America but can immensely improve the situation that existed at the time. Some studies have been done

globally on contamination of street food, to assess microbiological contamination of street food.

Begue, Gonzales, Correa-Gracian and Tang (1997) studied the dietary risk factors, associated with the transmission of *Helicobacter pylori* in Lima, Peru, in trying to establish the facts influencing the risk of acquisition of *Helicobacter pylori* infection. They sampled one hundred and four children within the age range of 0-17 years requiring an endoscopy for the evaluation of gastrointestinal systems. These children had their demographic and dietary data collected and biopsy specimens of the gastric antrum stained for the identification of *Helicobacter pylori*. They discovered that 52 representing 50% infected subjects were significantly older than the uninfected ones with no difference in gender, crowding, source of drinking water, or exposure to 30 domestic animals, increased consumption of fish, chicken, beef, beans, vegetables, rice cheese, milk and un-boiled water. They concluded that their findings supported the role of food prepared under unhygienic conditions as a probable mechanism of transmission of *Helicobacter pylori* in developing countries.

Also a study carried out by Volland, Ali, Van Asten, Ismid, Widjaja, Visser et al., (2004) to assess the risk factors for transmission of food borne illness in restaurants and street vendors in Jakarta, Indonesia sought to explain a previous study in Jakarta which showed that eating from restaurant was not associated with disease. To explain this 128 street food vendors with the food handlers from restaurant were engaged in a cross sectional study. Poor hand washing hygiene and direct hand contact with food, male sex and educational level were independent characteristics of street vendors in logistic regression analysis.

Fecal contamination of drinking water in 65% of samples, dish water in 91% and ice cubes in (100%) was frequent. Transmittable pathogens including *S. typhi* and nontyphoid

salmonella were isolated in fecal sample in 13 (7%) vendors. It was established that there is poor food hygiene among food vendors as compared to restaurant vendors. The study recommended that, health intervention to reduce the transmission of food borne illness should include hand washing with soap, adequate food hygiene and frequent and renewal of dish water in street food truck.

Musa & Akande (2003) carried out a research on food hygiene practices of food vendors in Ilorin Secondary School in Nigeria. The study reveals that among 185 respondents, premedical practice was high 141 (76%) but periodic medical examination was low 30 (16%). More than 61 (33%) and 72 (39%) respondents prepared food in advance and reheated food before sale respectively. The major unhygienic practices 31 observed among the food vendors were poor care of utensils, 100 (57%) use of previously used water for washing and cleaning, lack of covering apron among food vendors 128 (69%) and lack of hand washing basin for immediate cleaning, lack of soap and water to clean their utensils, while the rest 100 (57%) used unhygienic methods to clean their utensils. Some of the food contaminating risk factors including unclean finger nails, skin lesions and poor protection from flies. According to the study, the need exist for food vendors and other handlers to be trained in basic principle of safe food handling.

In Kenya, Muinde & Kuria (2005) conducted a study to determine the hygienic and sanitary practices of vendors in Nairobi using a descriptive survey design. A sample size of 80 street food vendors selling commonly consumed food was selected. Most of the food vendors neither underwent any form of formal training in food preparation nor did they attempt to seek it. Moreover, water for washing utensils and hygiene was compromised.

Also, stalls were poorly constructed. They would not give proper protection of the street food from the dust and smoke from vehicles. Furthermore, vendors observed minimal

personal hygiene. It was found out that 81.3% of the vendors did not use apron, 60% handled food with their hair uncovered. All the vendors handled money while serving food and only 10% of them wore jewelry of their hand. Also, utensils were washed using water in buckets which were rinsed only once and the water used repeatedly before it was replaced. The water for washing and rinsing the utensils was observed to be dirty. More so, proper methods of storing leftover food were not used, hence this could have promoted the sale of stale food. Out of the food vendors interviewed, 32.1% reported consuming them and rest saved for the following day's sale. Vendors stored leftover food in open places (21%) refrigerator (21%) and plastic containers (21%) while 16% kept them either in polythene bags or in cupboards for sale the next day. Findings also showed that vendors prepared the food either at home or at the stalls, which were located by the road side. These places were highly unhygienic as food vendors deposited their food and waste water beside stalls which rendered the environment dirty and attracted houseflies. Their presence compromised sanitation.

Similarly, Okojie, Wagbatsoma and Ighoroge (2005), also carried out a study to assess the knowledge and practice of food hygiene by food handlers in a Nigerian University. A descriptive, cross sectional study was carried out on randomly selected for handlers operating on the campus. A total of 102 respondents were interviewed and inspected using a structured questionnaire administered by researchers. The study showed that 90 (88.21%) of the respondents were females and these had a predominantly poor level of food hygiene knowledge. The practice of steering and reheating left over was a very low and was practiced by 15 (30.41%) of the respondents, which was a very low frequency of hand washing. Inspection of food handlers showed a low level of personal hygiene. Only 31 (30.41%) had pre-employment medical examination and 49 (48%) had received any form of health education.

Moreover, Barro, Ouattara, Nikiema, and Traore (2002), conducted a study on microbial quality assessment of some street food widely consumed in Ouagadougou, Burkina Faso. The first part of their research showed that 75% of food vendors were women. The vendors sat close to water drainage system and solid waste. Sometimes food was not as in areas infested by flies and other insect it was also found that water used to wash food materials was of poor quality. The second part of the study showed some foods which were not preheated such as milk product; fruit juice vegetable and fruit failed the microbial quality assessment.#

In Ghana, Mensah, Yeboah- Manu, Owusu-Darko and Ablordey (2002), carried out a study entitled, Street food in Accra, Ghana how safe are they? The study investigated the microbial quality of food sold on street of Accra and factors predisposing food to contamination.

They found out that 177 street vendors 79 (66.7%) were educated and these vendors exhibited good hygiene behavior. The surroundings of the vending sites were clean but some sites (3.4%) were classified as very dirty. The cooking of food well in advance of consumption, exposure of food to flies and preparing food on the ground were likely risk factors for contamination. Examinations made from 511 menu items classified as breakfast/snack food, main dishes, soups and cold dishes showed the presence of Mesophilic bacteria in 356 foods (69.7%), 28 contained *Enterobacteriaceae* (33.7%).

The microbial quality of most of the food was within the acceptable limits but samples of salads, macaroni, fufu, rice balls and red pepper had unacceptable level of contaminating. To them, street foods can be a source of pathogens. Tjoa et al., (1997) were quoted to have confirmed the role played by unwholesome meat in the causation of disease. They recommended that food vendors should receive education on food hygiene and moreover special attention be given to the causes of diarrhea, transmission of diarrhea pathogens, the handling equipment's and cooked food, hand washing practices and environmental

hygiene. Similarly, this study also assesses the presence of micro organisms that can cause diarrhea in the selected food sample at Ayensuano district. Environmental and personal hygiene, handling of equipment which has been identified by Tjoa to contaminate meat will also be assessed to find out similarities and difference between these two settings. Also, PaaNii (2005), in collaboration with some institutions in Ghana had the concerns that livelihood of vendors and health of consumers may be at risk if concerns over food safety are not addressed. A survey of 180 vendors in five different markets in Accra was conducted and the result showed that most vendors worked under poor sanitary conditions. (George, 2010) They also found out from a micro biological survey (45 samples) that some streets foods were intrinsically safer than others. It was found out that kenkey and waakye were safe products while fufu was contaminated. The study also showed that most food vendors (197) sampled had no concern regarding heavy metal (lead metal).

Finally, in a study by Okai & Dordi (2002), a non-experimental design was used to determine the knowledge, attitude and practices on food hygiene by food vendors of University of Ghana campus. The study highlighted on two types of vendors. Those who brought already prepared food from home and those who cooked on site. It was showed that, food vendors' educational background and the relation of the selling had further established that the food vendors had high knowledge with regard to purchasing, transporting, storing, preparing and handling food as well as personal cleanliness. The study also showed that food vendors practiced poor food hygiene as evidenced by the poor state of cooking and selling environment as well as improper handling and washing of drinking cups, napkins and lack of proper water storage facilities.

Food safety experts have identified the most common food handling mistakes made by consumers as well as food vendors. The mistakes include serving contaminated raw food, cooking or heating food inadequately, obtaining food from unsafe sources and

cooling food inadequately. Consumers need to appreciate the seriousness of food borne-disease. They must learn to recognize unsafe food handling practices, the latency period for some microbes and the symptoms of foodborne diseases. They also need to understand how to protect themselves through kitchen and personal hygiene, including frequency of hand washing, temperature control and safe food choices.

Besides water, other raw materials are also important to the safety of the street vended foods because of the biological, chemical and physical hazards that they might introduce. In order to keep prices down, some vendors purchase cheap or adulterated ingredients containing unpermitted chemical additives from unauthorized suppliers which may further increase the risks associated with the food so prepared. Raw meat, poultry and vegetables are commonly contaminated with large numbers of bacteria, including potential foodborne pathogens such as *B. cereus*, *C. perfringens*, *C. jejuni*, *E. coli*, *L. monocytogenes*, *Salmonella* and *S. aureus*. Spices are known to harbor a large number of microorganisms which include members of the genus *Bacillus*, anaerobic spore formers, *enterococci*, members of *Enterobacteriaceae*, a variety of yeast and moulds and pathogens like coagulase positive *Staphylococci* (International Commission on Microbiological Specifications for Foods (ICMSF, 1996). Contamination of foods by spices which act as spore carriers has been reported to lead to food spoilage and can even lead to food poisoning. Spore formers in spices may lead to food spoilage, when they survive the cooking process and multiply under favorable conditions. (Powers, Latt and Brown, 1976).

A study done in Calcutta, samples that were suspected of adulteration were analysed and 30 out of the 50 samples, unauthorized food additives were detected. Similarly, pathogens like *B. cereus*, *Saureus*, *C. perfringens*, and *E. coli* were reported in raw chicken, salad and gravy raw materials (Mosupye & Von Holy 1999). These organisms were probably present in these foods either prior to purchase by vendors or may have been introduced by

cross contamination during food handling or during preparation. The above literature reviewed internationally and locally shows the peril a person's health is exposed to through the consumption of unhygienic street foods. It indicates that poor personal and environmental hygiene, lack of food hygiene knowledge on the part of food vendors can go a long way to affect the health of the patrons of street foods. Reasons for contamination could be the location of the stall (surroundings), poor personal hygiene, and poor food hygiene practices during cooking, storing and serving, poor source of drinking water, poor storage system, uncovered food container, improper practices of taking out water from the pitcher, long hours of storage of food among others.

#### **2.4 Personal Hygiene of Food Vendors**

Poor personal hygiene frequently contributes to foodborne illness which indicates that food handlers' knowledge and handling practices needs to be improved. Studies on the conditions of food and drink establishment have been scarily in Ethiopia. (Zeru & Kumie, 2004).

A study conducted by Abera et al., (2010) at Bahir Dar town among food handlers indicated that most of them were infected with enteric bacteria and parasites. Good personal hygiene and food handling practices are the basis for preventing the transmission of pathogens from food handlers to the consumers. A USA based study suggested that improper food handling practices contributes to about 99% of food borne illness in food services establishment and home. Howes M, McEwen S, Griffiths M, Harris L. (1996). Therefore, to reduce foodborne illness, it is crucial to practice good personal hygiene.

It is important to take caution when selecting raw materials for food preparation. These raw materials, including water and ice may be contaminated with dangerous microorganisms and chemicals. Toxic chemicals may be formed in damaged and mouldy foods.

Important hygienic aspects related to Food and Quality includes:

1. Food vendors should select fresh and wholesome foods to prepare food for sale.
2. Food vendors must choose food processed to reduce the risk associated with cooking raw foods for foods.
3. Food vendors should make ice from safe water (FAO Corporate Document Repository, 1999).
4. Food vendors should use safe water or treat it to make it safe (WHO, 2010).

Microbiological analysis of utensils surface and knives have the presence of Salmonella and Shigella (Rane, 2011). It is also reported that during the preparation of food, the raw material is cut and chopped using the same knife without in between cleaning and such knives are often invaded by flies (Rane, 2011).

Handling, vending and hygienic quality of street foods available to local residents, internal and foreign tourists to Cape Coast, the most important tourism hub in Ghana, were investigated. Questionnaires assessed stakeholder commitment to and expectations of food hygiene. Laboratory analysis evaluated microbial contamination levels of the street foods. The study showed that both local residents and tourists, foreign tourists put the hygienic safety as the principal criterion over curiosity and price to patronize street foods. Although licenses had been given to 27 (54%) of the 50 investigated food vendors, only 15 (55.5%) of the licensed vendors had had medical examination (8 only once and 7 annually). Food vending premises visibly needed improvement in sanitation. The foods had the following bacterial contamination levels in colony forming units per gram (cfu/g): meat pie ( $1.3 \times 10^5$ ), khebab ( $5 \times 10^4$ ), rice with stew ( $4.1 \times 10^5$ ), fried fish ( $8 \times 10^4$ ), pepper sauce ( $1.4 \times 10^5$ ), stew or “banku” ( $3 \times 10^5$ ), beans with gari ( $2 \times 10^4$ ), “fufu” ( $1.6 \times 10^5$ ) “waaky”e ( $6.6 \times 10^5$ ) and dakua ( $2.3 \times 10^5$ ). The presence of *Escherichia coli* of fecal origin

was detected in all investigated food samples. “Khebab”, fried fish and beans with gari had acceptable bacterial contamination levels of  $<5 \log_{10}$  cfu/g. The following major fungi were identified in the street foods: *Aspergillus flavus*, *Aspergillus niger*, *Aspergillus candidus*, *Cladosporium herbarum*, *Necrosporacrassa*, *Penicillium citrinum*, *Fusarium*, *Mucor* and yeast species. Yeasts were found in all investigated food items. The street foods were, therefore, found to have threatening unacceptable microbial contamination levels. Street vended foods are not only appreciated for their unique flavors, convenience and the role which they play in the cultural and social heritage of societies, they have also become important and essential for maintaining the nutritional status of the populations. Besides offering business opportunities for developing entrepreneurs, the sale of 19 street foods can make a sizeable contribution to the economies of developing countries. In India, the National Policy for Urban Street Vendors/Hawkers stated that street vendors constitute approximately 2% of the population of a metropolis (Indian Street Food Policy, 2004).

Street foods are perceived to be a major public health risk due to lack of basic infrastructure and services, and difficulty in controlling the large numbers of street food vending operations because of their diversity, mobility and temporary nature (Rane, 2011). A general lack of factual knowledge about the epidemiological significance of many street vended foods, poor knowledge of street vendors in basic food safety measures and inadequate public awareness of hazards posed by certain foods has severely hampered the deployment of a precise scientific approach to this very serious issue of public health and safety (Rane, 2011).

The epidemiological studies such as Mensah et al (2002) which suggests that street foods contribute to a significant number of food poisonings are inadequate, due to paucity of data deficiencies in knowledge about important parameters in the food chain and host pathogen interactions; however, there have been several documented cases of food poisoning outbreaks

due to street foods. Street foods were responsible for 691 food poisoning outbreaks and 49 deaths from 1983 to 1992 in Shangdong Province (China). FAO has implemented and supported several projects which aimed at improving various aspects of the street food sector in countries like Bolivia, Colombia, Ecuador, India, Zaire, etc. Malaysia, Philippines and India are the three countries which have regulations for protecting street vendors (Sharmila, 2015). Malaysia is the only country where licensed street vendors are provided facilities for conducting their trade. An initiative has been taken in Durban, Africa, where a coalition between local and national authorities, explored the food laws associated with street vending and developed strategies that could be used to control identified food hazards. As a consequence of humans also containing microorganisms naturally or from the surrounding environment it is important to maintain an appropriate personal hygiene.

Important hygienic aspects related to Personal Hygiene includes:

1. Food vendors practicing hand washing before handling food and often during food preparation.
2. Food vendors washing hands after going to the toilet (WHO, 2010).
3. Food vendors drying hands after hand washing procedure.
4. Food vendors wearing clean protective clothing.
5. Food vendors wearing head covering.
6. Food vendors ensuring that cuts and wounds are covered by suitable Waterproof dressings.
7. Food vendors avoiding personal behavior such as smoking, spitting, chewing or eating, sneezing or coughing over unprotected food.

Code of hygiene practice for food service establishment in the hospitality industry by FDA/FSMD /CP-2013/03 stipulates that,

1. All employees who come into contact with the food in the course of their work shall be medically certified to handle food prior to employment and shall undergo the food handler test at least every six (6) months.
2. Food service employees shall keep their hands and exposed portions of their arms clean by thoroughly washing their hands and the exposed portions of their arms (or surrogate prosthetic devices for hands or arms) with soap and warm water, including lathering bands for at least 20 seconds. This includes immediately,
  - before putting gloves on
  - after using tobacco products
  - before or after eating
  - before starting work
  - upon reentering the kitchen and
  - after using the washroom or being potentially contaminated by other means, shall not clean their hands in a sink used for food preparation, ware washing or in a service or a curbed cleaning facility used for the disposal water and similar liquid waste.
3. Employees shall keep their fingernails clean and trimmed to no longer than the tips of the fingernail and shall not wear polish or artificial fingernails when working with exposed food.

4. Approved hand sanitizer and chemical hand sanitizer solutions used as a hand dip shall be used only after the thorough washing of hands.
5. Adequate measures shall be taken to prevent perspiration from contaminating foods, food contact surfaces, equipment and utensils.
6. The clothing of all employees shall be clean.
7. Employees who prepares food shall limit jewelry won on their hands and arms to one plain ring and watch.
8. Employees shall not use tobacco in any form while engaged in food preparation or service in areas used for equipment or utensils washing, food preparation or food storage.

### **2.5 Sanitary Conditions Food of Vending Premises**

Sanitation may be defined as the process involved in ensuring good health by means of preventing human contact with the hazards of wastes. Such hazards may be physical, microbiological, biological, or chemical agents of disease (Hui et al., 2003). The major goal of food processing industries is to provide safe, wholesome and acceptable food to the consumer and control of microorganisms is essential. In line with this food premises should be designed to ensure cleanliness at all stages of food processing. Separation of raw and cooked food must be maintained at the vending premises.

Studies by FAO (2018) recorded poor knowledge, practices in food handling in the assessment of microbial contamination of food sold by vendors. Lack of basic infrastructure, lack of knowledge of hygiene, absence of proper storage facility and unsuitable environment for food operations such as proximity to sewers and In addition, poor sanitary practices in food storage, handling and preparation can create an environment in which bacteria and other infectious agents are more easily transmitted ( Fielding et al.,2001).

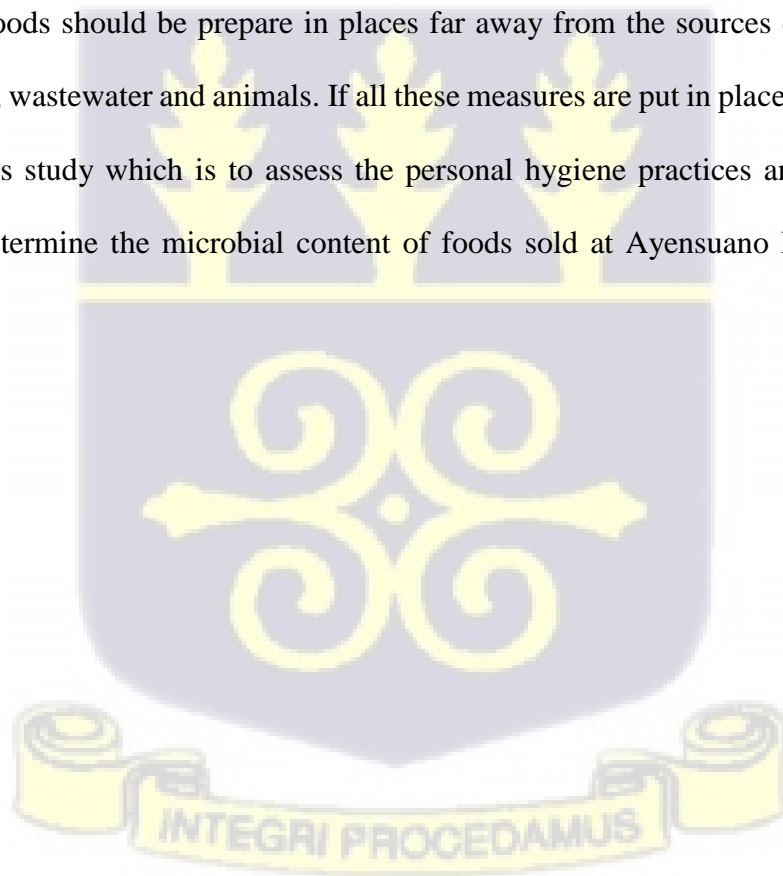
FDA/FSMD/CP-FSE/2013/03 regulations regarding sanitary keeping of vending premises includes,

1. Receptacles and waste handling units for refuse recyclables, and returnable shall be kept covered.
2. A storage area and enclosure for refuse, recyclable, or returnable shall be maintained clean and free of items unnecessary to the operation or maintenance of the establishment.
3. Receptacles and waste handling units for refuse, recyclable, and returnable used with materials containing food residue and used outside the food establishment shall be designed and constructed to have tight-lids, doors and covers.
4. The presence of insects, rodents and other pests shall be controlled to minimize their presence on the premises by
  - ❖ Routinely inspecting incoming food and supplies
  - ❖ Routinely inspecting the premises of evidence of pests
  - ❖ Eliminating harborage conditions

This study focus on the following parameters as compared to the previous study done by Okoji (2014), (1) Hair covered (2) wearing of aprons (3) presence of hand washing basin (4) presence of flies (5) talking while selling (6) nature of fingernails (7) putting on of artificial nails (8) presence of nearby refuse dumpsite (9) wounds on hands by vendors and (10) number of selling plates.

Food premises have been implicated in a significant proportion of foodborne disease outbreaks and sporadic gastrointestinal infections (Kassa et al., 2001, Angulo et al., 2006, Insulander et al., 2008, U.S. CDC, 2017). Studies shows that food premises were estimated to account for one-third of all gastrointestinal illness cases in Ontario, Canada (Vrbova et al., 2012). It is for this reason that local public authorities in Ontario, that is, health units, addresses these risks primarily through health professionals and provision of food handler training certification to operators of food premises (Campbell et al., 1998, Thompson et al.,2005, MOHLTC, 2018).

Ready to eat foods sold in unsanitary locations are susceptible to contamination by flies and domestic animals and diarrheal diseases has been reported by FAO (1986) in their study where dogs and cats are known to carry pathogens such as *E. coli* and *Salmonella*. A study by FAO (1995) shows that liquid and solid waste were disposed at food establishment. They were of the view that foods should be prepare in places far away from the sources of contamination such as rubbish, wastewater and animals. If all these measures are put in place, then the general objective of this study which is to assess the personal hygiene practices among street food vendors and determine the microbial content of foods sold at Ayensuano District could be achieved.



## CHAPTER THREE

### METHODOLOGY

#### 3.1 Introduction

This chapter describes the study area, the population, the sample and sampling technique used in the study. The methodology also focuses on the instrument that was used for data collection, pre-testing of the instrument, the validity and reliability of the instrument and the procedure for data collection. In other words, this chapter highlights what was done in the research, how it was done in order to avoid biases and the population for the study.

#### 3.2 The Study Area

The Ayensuano District is one of the thirty-three districts in Eastern Region of Ghana. Originally it was part of the Suhum-Kraboia-Coaltar District till 1988, when it was split off with Coaltar as its capital. The District lies within latitudes 5° 45'N and 6° 51' N and longitudes 0° 15'W and 0° 45' W. It is located in the Southern part of the Eastern Region and shares boundaries with Suhum Municipality to the North; the Nsawam Adoagyiri Municipality to the South; Akwapem South District to the East and Upper West Akim District and West Akim Municipality to the West.

The area has few highlands with the Atiwa range which stands at about 610 m above sea level, been the highest elevation in the district. This range is the catchment area of the major rivers and streams in the district, namely Ayensuano Kua.

##### 3.2.1 Population Size

The total population for the district is 94,594 which is made up of 47,108 (49.8%) males and 47,486 (50.2%) females. (Statistical Department, 2021). Majority of the district population live in the rural area (93%) with (7%) in the urban areas. 99:2 and higher for the age group 0-19 years. (2010 population and Housing Census, Ghana Statistical service).

### **3.2.2 Structure of the Local Economy**

The district has an agrarian economy because as about 64% of its labour force in the agricultural sector, followed by commerce which employs about 12% of the population in the food industry.

## **3.3 Methodology**

### **3.3.1 Research Design**

A descriptive cross-sectional study was used to assess the level of knowledge of food vendors on food borne disease at Ayensuano District. The study involved determine the personal hygiene practice of street food vendors, so a census was conducted to obtain the list of food vending establishment in Ayensuano District. The district was divided into three (3) zonal council namely Coaltar, Abesua and Anum Apapam. A proportional sample size was collected for each zonal councils of food service establishment. The food vendors were randomly selected from the three zonal councils. Three hundred and four (304) food handlers working in chop bars, food joints, restaurants, day and nights markets were randomly selected for the study.

### **3.4 Data Collection Technique**

A structured questionnaire as well as an observation checklist was used to collect data from 304 food vendors. Data collectors were oriented about the purpose of the study. The components of the questionnaire were pre-tested before administering the reviewed questionnaire. The questionnaire was prepared in the English language but was translated in Twi for easy understanding of the interviewees. The researcher also made use of primary and secondary data from the environmental and sanitation unit of the Ayensuano District Assembly.

### 3.5 Study Population, Sample Size and Sampling Technique

The study had as its population the total number of street food vendors in Ayensuano District.

This includes vendors selling food by the road side, “bush canteen” and other public places.

#### 3.5.1 Sampling of Food Vendors

Structured questionnaires as well as observational checklist were used to collect data from 304 street vendors on their demographic, knowledge on food borne disease, personal hygiene.

The sample size for the study was determined by using the Daniel formula (1999).

$$n^2 = \frac{Nz^2p(1-p)}{d^2(n-1) + z^2p(1-p)}$$

$n^1$ =sample size

N= population size=1450

Z = statistics for a level 4 confidence

P= expected proportion 50% =0.5

d=precision 5%=0.05

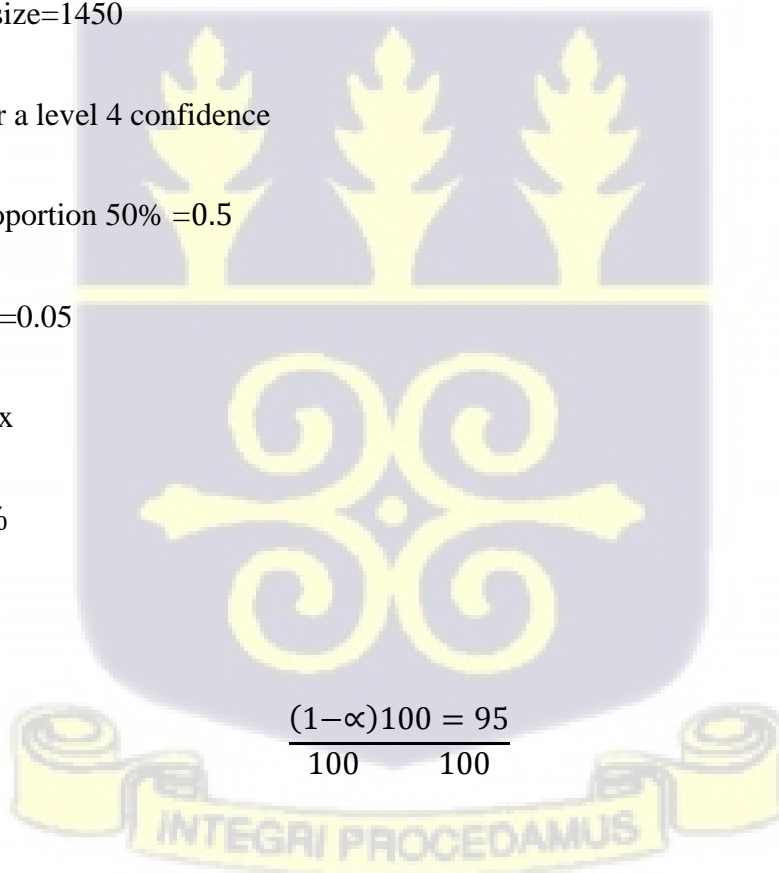
Calculation for x

$(1-\alpha)100 = c\%$

$$\frac{(1-\alpha)100}{100} = \frac{95}{100}$$

1.  $\alpha = 0.95$

$\alpha = 0.05$



$$\alpha = 0.05$$

$$Z_{1-\frac{\alpha}{2}}$$

$$Z_{1-\frac{0.005}{2}}$$

$$Z_{0.05}$$

$$= Z_{0.975}$$

= 1.96 (on the standard normal curve)

$$\frac{nz^2 p(1-p)}{d^2 (N-1) + z^2 p(1-p)}$$

$$= \frac{(1450)(1.96)^2(0.5)(0.5)}{(0.05)^2(1200-1) + (1.96)^2(0.5)(0.5)}$$

$$= \frac{(1450)(3.8416)(0.5)(0.5)}{(0.0025)(1449) + (3.8416)(0.5)(0.5)}$$

$$= \frac{1392.58}{4.58}$$

= 304 sample size

The sample size for the study was 304. The sample size was used to generalize the entire population of the food vendors.

A proportional sample was obtained from each of the three zonal councils. The respondents were selected using a simple random sampling method based on the population density and the type of food sold by the food vendors. The records from the district environmental health office (2020) indicate that 1450 food vendors have registered to operate within the district and are screened medically in which health certificates were issued to them.

### 3.5.2 Food Sampling

A stratified random sampling method was used to collect 76 food samples after categorizing the vending sites into three (3) zones for the study. Food samples which include “kenkey” and hot pepper, “waakye”, porridge and fried rice were collected within a period of one (1) month (1st March to 31st March, 2021) from the three(3) selected zonal areas, well packaged in zip-lock bags, labeled and transported on ice to the Biotechnology Centre of the University of Ghana, Legon for microbial isolation and molecular studies.

### 3.6 Laboratory Analysis

Food-borne pathogens such as *Escherichia coli*, *Salmonella typhi*, *Staphylococcus aureus* and *Campylobacter jejuni* were isolated from the collected food samples and identified using molecular approach as detailed below.

#### 3.6.1 Microbial Isolation

10g of each food sample was weighed and macerated into fine paste in approximately 90ml of Luria Bertani broth (LB broth) (Zigma Aldrich). The mixture was then incubated at 37°C for 48 hours and further sub-cultured (100µl) into 900µl of LB broth, incubated at 37°C for 24 hours and stored at 4°C for further analysis.

#### 3.6.2 DNA Extraction

Bacterial DNA was prepared as described by Soumetet al.(1994) with modifications. 100µl of the bacterial isolates were inoculated in 900µl of LB broth and incubated at 37°C for 24 hours in a shaking incubator at 100 revolutions per minute [rpm]. 1 ml of each culture was then centrifuged for 3minutes at 13000xg and the resulting pellets were washed twice in 500µl 1x TAE buffer(Tris, Acetic Acid and EDTA, pH 8.0) and centrifuged at 13000 xg for 3 minutes(4°C). The pellets were re-suspended in 200µl of 0.1MTris EDTA(TE) buffer, boiled for 8minutes and stored at -20°Cfor further analysis.

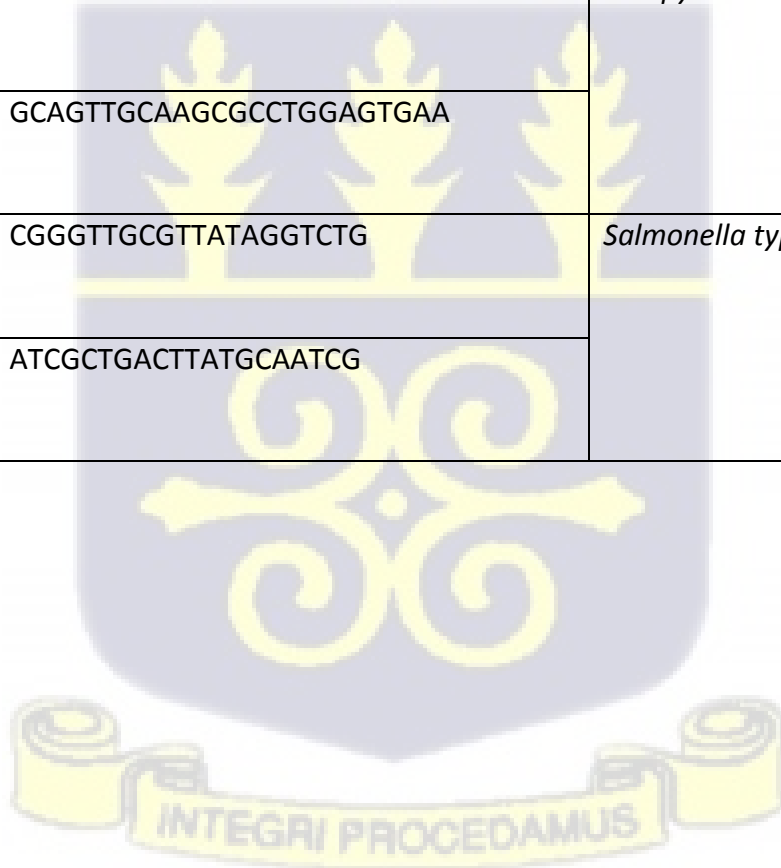
### 3.6.3 Amplification of the flic gene by Polymerase Chain Reaction (PCR)

Polymerase Chain Reaction (PCR) reaction mixtures containing 7.5 $\mu$ l nuclease-free water (Zymo Research Inc.), 12.5 $\mu$ l of Quick-load 2x master mix with standard buffer (Zymo Research Inc.) 0.5 $\mu$ l of each primer and 4.0 $\mu$ l of DNA template were prepared. The thermocycler was programmed with 1 cycle of 94°C for 5minutes, 35 three-step cycles (denaturation at 94 °C for 45 seconds, annealing at 5 °C for 1 minute, extension at 72 °C for 2 minutes), and final cycle at 72°C for 7minutes. The PCR products (amplicons) were analyzed on 1.5% agarose gel stained with Ethidium bromide and ran at 80 volts for 1hour. Products sizes were then compared to a 100 bp ladder (New England Biolabs) and presence (+) or absence (–) data collected for further analysis.



### 3.6.4 Primers, Sequence and Organisms

PRIMER NAME	SEQUENCE (5' – 3')	ORGANISM	BAND SIZE
EC1	GCGCTGTCGAGTTCTATCGAGC	<i>E. coli</i>	600 bp
EC2	CAACGGCGACTTTATCGCCATTCC		
SA1	CGATCCATATTTACCATATCA	<i>Staphylococcus aureus</i>	630 bp
SA2	ATCACGCTCTTCGTCTAGTT		
CJ1	CAAAGTCTAACACAGCTACT	<i>Campylobacter jejuni</i>	250 bp
CJ2	GCAGTTGCAAGCGCCTGGAGTGAA		
ST1	CGGGTTGCGTTATAGGTCTG	<i>Salmonella typhi</i>	600 bp
ST2	ATCGCTGACTTATGCAATCG		



3.7 Sample Chart

SAMPLE CODE	ZONALCOUNCIL/COMMUNITY	FOOD TYPE
1.	ABESUA (NEW TOWN)	"KENKEY" WITH PEPPER
2.	ANUM APAPAM	PORRIDGE
3.	ANUM APAPAM (ASODJA)	"KENKEY" WITH PEPPER
4.	ANUM APAPAM	"WAAKYE"
5.	ANUM APAPAM	PORRIDGE
6.	ANUM APAPAM (MARFO-KROM)	"WAAKYE"
7.	ANUM APAPAM (KUANO)	FRIED RICE
8.	ANUM APAPAM (KUANO)	"WAAKYE"
9.	ANUM APAPAM (KUANO)	PORRIDGE
10.	ANUM APAPAM	"WAAKYE"
11.	ANUM APAPAM	"KENKEY" WITH PEPPER
12.	ANUM APAPAM	"KENKEY" WITH PEPPER
13.	ANUM APAPAM (KUANO)	"WAAKYE"
14.	ANUM APAPAM (SOWATEYO)	"WAAKYE"
15.	ANUM APAPAM	"WAAKYE"
16.	ABESUA (NEW TOWN)	"WAAKYE"

17.	ANUM APAPAM (KUANO)	"KENKEY" WITH PEPPER
18.	ABESUA (NEW TOWN)	"KENKEY" WITH PEPPER
19.	ABESUA (NEW TOWN)	"WAAKYE"
20.	ANUM APAPAM	PORRIDGE
21.	ANUM APAPAM	"KENKEY" WITH PEPPER
22.	ANUM APAPAM (ASODJA)	PORRIDGE
23.	ANUM APAPAM (SOWATEY)	PORRIDGE
24.	ANUM APAPAM (ASODJA)	"WAAKYE"
25.	ANUM APAPAM (SOWATEY)	"KENKEY" WITH PEPPER
26.	ANUM APAPAM (KUANO)	"WAAKYE"
27.	ABESUA (NEW TOWN)	"KENKEY" WITH PEPPER
28.	ABESUA (T. MANTE)	"WAAKYE"
29.	ABESUA (NEW TOWN)	"WAAKYE"
30.	ABESUA (NEW TOWN)	"WAAKYE"
31.	ABESUA (MANKRON)	"WAAKYE"
32.	ABESUA (MANKRON)	"WAAKYE"
33.	ABESUA (KYEKEYEWERE)	"KENKEY" WITH PEPPER

34.	ABESUA (MANKRON)	<b>“KENKEY” WITH PEPPER</b>
35.	ABESUA (KYEKEYEWERE)	<b>“KENKEY” WITH PEPPER</b>
36.	ABESUA (KYEKEYEWERE)	<b>“WAAKYE”</b>
37.	ABESUA (T. MANTE)	<b>PORRIDGE</b>
38.	ABESUA (T. MANT)	<b>PORRIDGE</b>
39.	ABESUA (T. MANTE)	<b>“WAAKYE”</b>
40.	ABESUA (T. MANTE)	<b>“WAAKYE”</b>
41.	ABESUA (AMANASE)	<b>“WAAKYE”</b>
42.	ABESUA (AMANASE)	<b>PORRIDGE</b>
43.	ABESUA (AMANASE)	<b>“KENKEY” WITH PEPPER</b>
44.	ABESUA (ASUBOI)	<b>PORRIDGE</b>
45.	ABESUA (ASUBOI)	<b>“WAAKYE”</b>
46.	ABESUA (AUBOI)	<b>“KENKEY” WITH PEPPER</b>
47.	ABESUA (ASUBOI)	<b>“WAAKYE”</b>
48.	ABESUA (AMANASE)	<b>FRIED RICE</b>
49.	ABESUA (T. MANTE)	<b>“KENKEY” WITH PEPPER</b>

50.	ABESUA (T.MANTE)	FRIED RICEE
51.	ABESUA (T. MANTE)	"KENKEY" WITH PEPPER
52.	ABESUA (T.MANTE)	FRIED RICE
53.	COALTAR (OTOASE)	FRIED RICE
54.	COALTAR (OTOASE)	PORRIDGE
55.	COALTAR (OTOASE)	"KENKEY" WITH PEPPER
56.	COALTAR (KRABO-KESE)	PORRIDGE
57.	COALTAR (DISTRICIT CAPITAL)	"WAAKY"E
58.	COALTAR (KRABO-KESE)	PORRIDGE
59.	COALTAR (KRABO)	"WAAKYE"
60.	COALTAR (AFRO-ADJEI)	"KENKEY" WITH PEPPER
61.	COALTAR (KRABO)	"WAAKYE"
62.	COALTAR (ANFASO)	"KENKEY" WITH PEPPER
63.	COALTAR (KRABO-KESE)	PORRIDGE
64.	COALTAR (MARFO-KROM)	"WAAKYE"
65.	COALTAR (KRABO-KESE)	PORRIDGE
66.	COALTAR (OTOASE)	"WAAKYE"

67.	COALTAR (MARFO-KROM)	“WAAKYE”
68.	COALTAR (KRABO-KESE))	“KENKEY” WITH PEPPER
69.	COALTAR (ANFASO)	PORRIDGE
70.	COALTAR (ANFASO)	“WAAKYE”
71.	COALTAR (KRABO-KESE))	“KENKEY” WITH PEPPER
72.	COALTAR (AFRO-ADJEI))	“WAAKYE”
73.	COALTAR (DISTRICT CAPITAL)	“WAAKYE”
74.	COALTAR (AFRO-ADJEI)	“KENKEY” WITH PEPPER
75.	COALTAR (KRABO))	“KENKEY” WITH PEPPER
76.	COALTAR (OTOASE)	“WAAKYE”

### 3.8 Quality Checks/Controls

Quality control measures were put in place to ensure quality laboratory results included making sure food samples were placed into zip-locked polythene bags with ice immediately it was purchased. Media and plates which were sterilized and doing inoculation in an air condition room.

### 3.9 Data Analysis

Data collected from the questionnaire administration were entered, cleaned, and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. The coding of the

questionnaire facilitated and eased the data coding process using the SPSS. The data was further generated into frequency tables and charts, which aided in the analysis. The study employed both descriptive and inferential statistical tools in the software (SPSS). The descriptive tool categorized consumers' knowledge and attitude in frequencies and percentages. Using inferential statistics, chi-square test was employed to determine the relationship between the dependent and independent variables. Table 3.1 presents a summary of the objectives of the study and how they were measured and the tools employed in the analysis.



**Table 3. 1Analytical Tools**

Objectives	Dependent Variable	Independent Variable	Scale of Measurement	Analytical Tools
To assess street vendors knowledge on food borne disease?	Food Borne Diseases	<ul style="list-style-type: none"> <li>• Knowledge of Street Vendors</li> <li>• Microorganisms that cause food contamination</li> </ul>	Nominal	Frequencies and Percentages
Extent of street vendors practice personal hygiene at Ayensuano District?	Personal Hygiene Practices	Socio-Demographic Characteristics	Nominal	Chi-Square Test
Do the street food vendors sell their food within a clean environment?	Clean Environment	<ul style="list-style-type: none"> <li>• Attending Food Hygiene Training</li> <li>• Use of Waste Bins</li> <li>• Choice of Selling Site</li> </ul>		Chi-Square Test
Microbial content of food samples	Microorganism	Eating contaminated food	Ordinal	Laboratory result

**3.10 Ethical Consideration**

Ethical clearance was sought from the ethics committee of the College of Basic and Applied Sciences (CBAS) of the University of Ghana. Clearance was also sought from Ayensuano District Assembly. Questionnaires and observational guide had no space for names of

respondents, chop bars, restaurant or markets. Also, informed verbal consent was obtained from the food vendors before the interview. Above all, participation in this study was voluntary.

### **3.11 Limitation of the Study**

Translation of research questions on the questionnaire into the language that the research participants understand could change the actual meaning of the question. There is a possibility that what the research team may have observed and the meanings they had given to it using observational guide may be different from the meaning food vendors may give to the observed situation. That notwithstanding, data collectors made sure that questionnaires have been duly explained repeatedly to the food vendors before options were ticked or answers supplied appropriately.

Transporting food samples over two hours may affect the microbial load of food samples since temperature variations can cause a difference in microbial load though the researcher ensured that ice packs were put on the samples collected, well packaged to avoid heat exposure.

### **3.12 Justification and Description of Selected Foods**

The street foods in the study were selected on the basis of prior medical screening conducted by the Ayensuano District Environmental Health & Sanitation Unit (2020) on food vendors shows a considerable number of typhoid cases recorded. “Waakye”, “kenkey” with hot pepper, fried rice and porridge were selected for the study because they are the major food that are most common in the district. Also, these foods are mostly patronized by many Ghanaians.

### **3.14 Assumptions**

It was assumed that the respondents provided accurate and concise information when answering the questionnaire and observations were made without predetermined ideas. It was

assumed that the district authorities (political, traditional and health) considered the research findings and accepted the recommendations that were made.

### 3.15 Operational Definitions

**Acceptable.** Test results indicating good microbiological quality

**Certified.** Informal traders who are regulated to comply with Food Safety Regulations relating to food premises and have been issued a Certificate of operation.

**Environmental Health Officers (EHOs).** Trained professionals, competent to enforce laws amongst others, Food Safety Legislation in Ghana. For law enforcement, they are authorized to do so.

**Food Hygiene.** All practices conducive to maintaining food is in healthy conditions, safe for consumption/ all conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain.

**Food Safety.** The assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use.

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

**Formal food vendor.** Person involved in food preparation or selling thereof in the mainstream sector for examples, restaurant, hospitals, catering establishment, food factories etc.

**HACCP approach.** Food Safety Management plan that utilizes an assessment of Hazard, analysis thereof and identification and implementation of Critical Control Points.

**Knowledge.** General awareness, ideas and facts about food preparation, handling and serving by cooked food sellers.

**Microbial quality.** The terms used to express the microbiological quality of the ready to eat food are.

**Portable water.** Water that is considered suitable for human consumption (drinkable) as per the WHO Drinking water Guidelines, 2006.

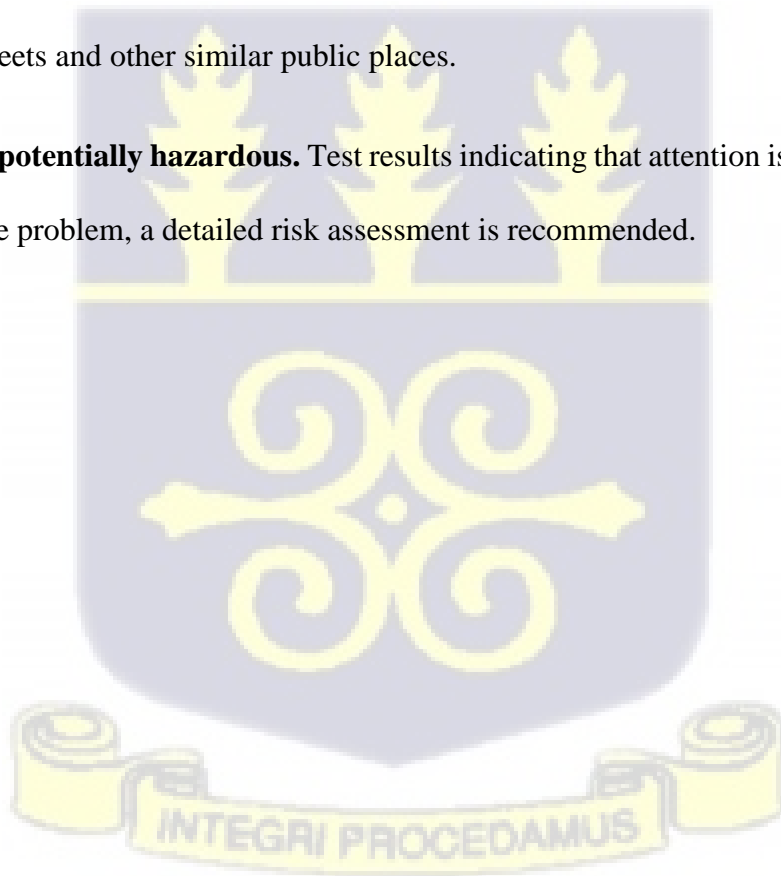
**Practices.** The accustomed ways and habits employed by food vendors during cooking handling and serving.

**Registered.** Informal traders who are legally operating by complying to business/ trade regulation.

**Street food vendors.** Entrepreneurs selling ready to eat foods and beverages.

**Street foods.** Ready -to-eat foods and beverages prepared and/or sold by vendors and hawkers especially in streets and other similar public places.

**Unacceptable /potentially hazardous.** Test results indicating that attention is needed to locate the source of the problem, a detailed risk assessment is recommended.



## CHAPTER FOUR

### RESULTS

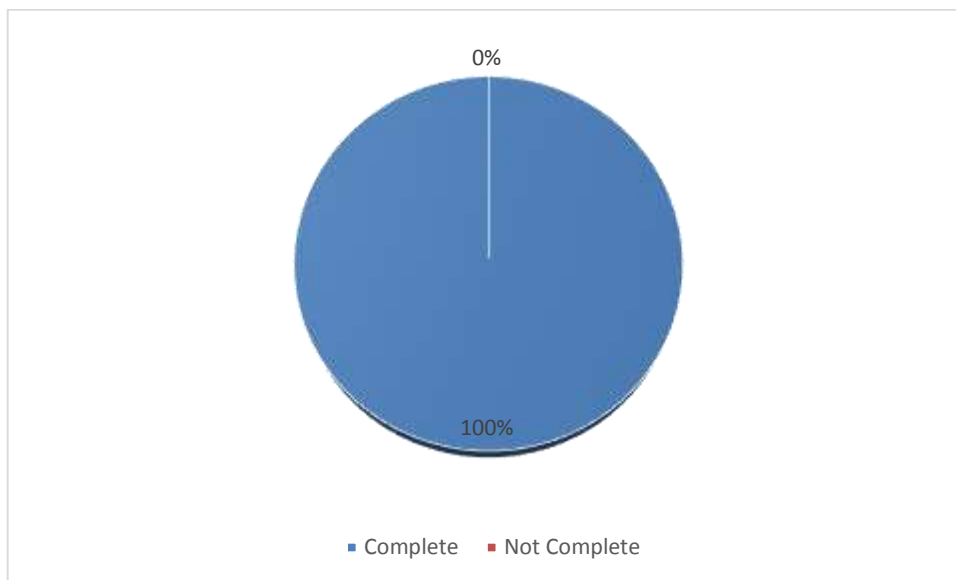
#### 4.1 Introduction

This chapter presents the findings from the data analysis generated from the study.

#### 4.2 Response Rate and Demographic Characteristics

Figure 4.1 indicate the distribution of research participants response rate for the study. The response rate for this study was 100%.

**Figure 4.1: Response Rate**



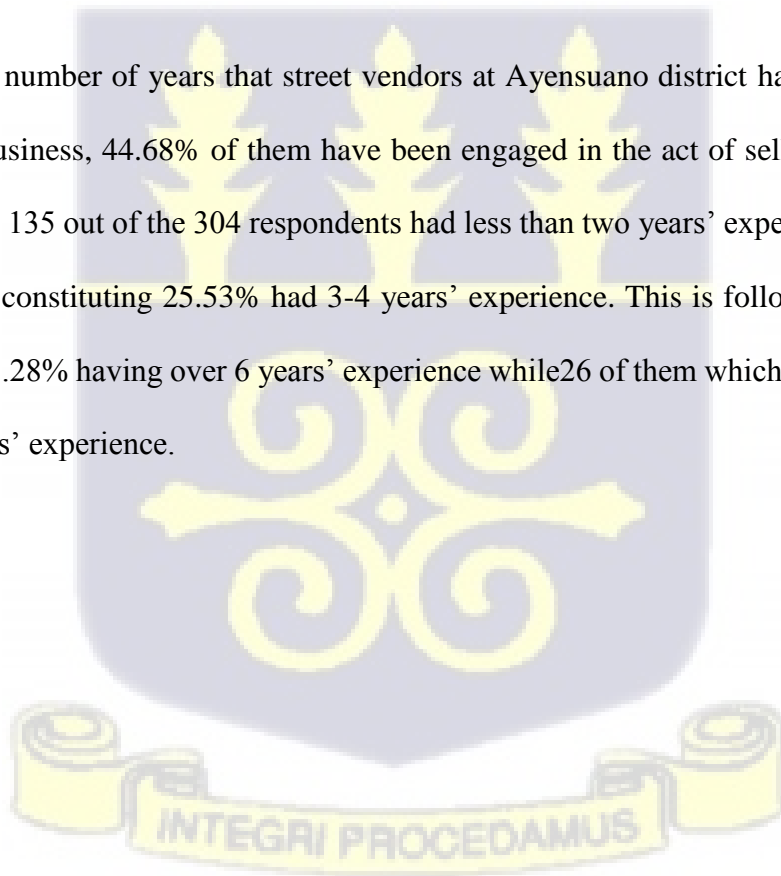
The study received 304 responses hence a response rate of 100%. Five demographic parameters were analyzed which were age, gender, marital status, education level, and years selling. First, regarding gender, out of the 304 responses, there were 30 men in the sample, accounting for 10%, and 274 women, constituting 90%. From Table 4.1, participants within 26-33 years were the highest number of all the age groups with a percentage of 31.40%. Thus, most street vendors at Ayensuanodistrict fall within the age bracket 26-33. This was followed by the age bracket of

18-25 and 34- 41 with 28.37%. This age category is the second highest in the distribution. The age group that was least representation was 42 years and above with 11.28% representation.

Majority of the street vendors at Ayensuano district were married (60.52%). Also, the participants in this study who were single, divorced/separated, and widowed formed 31.40%, 3.92% and 4 %, respectively.

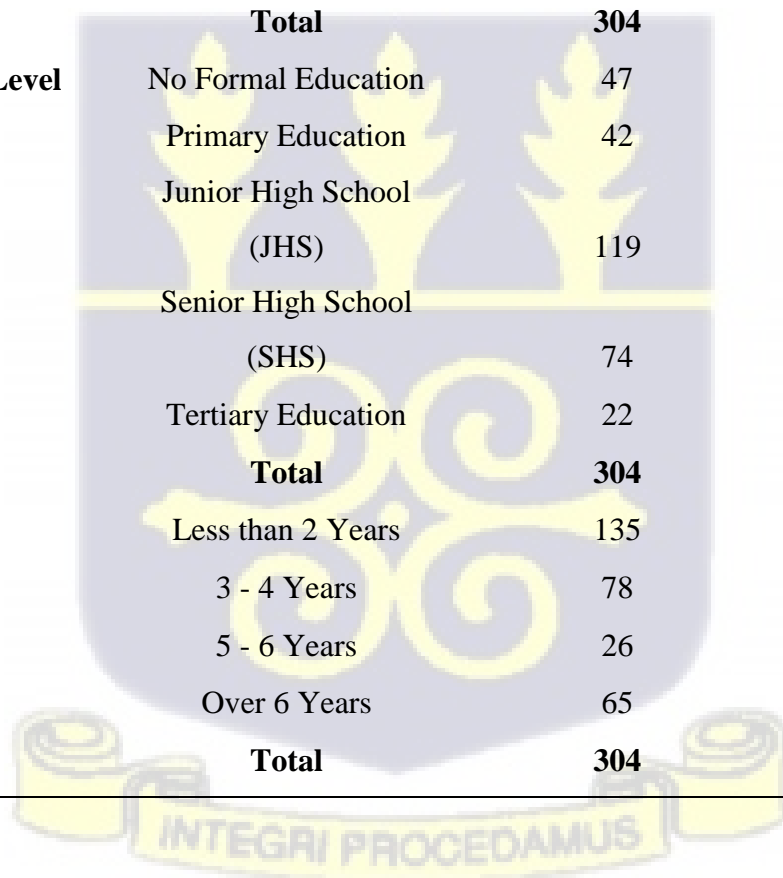
Furthermore, the respondent's degree of education was the next demographic factor to consider. Findings reveal that 47 of the 304 respondents had no formal education. Thus, their level of education, accounted for 15.6%. Additionally, the participant with primary level of education were 42, representing 13.7%. Furthermore, 39% of the respondents had Junior High School level of education. Respondent with Senior High School (SHS) and tertiary level of education formed 24.4% and 7.3%, respectively.

Concerning the number of years that street vendors at Ayensuano district had been engaging in the selling business, 44.68% of them have been engaged in the act of selling for less than two years. Thus 135 out of the 304 respondents had less than two years' experience. A total of 78 respondents constituting 25.53% had 3-4 years' experience. This is followed by 65 street vendors with 21.28% having over 6 years' experience while 26 of them which forms 8.51% are having 5-6 years' experience.



**Table 4. 1Demographic and Socioeconomic Characteristics of Food Vendors**

<b>Variable</b>	<b>Category</b>	<b>Frequency (n)</b>	<b>Percentage</b>
<b>Age</b>	18 – 25	87	28.37%
	26 – 33	95	31.40%
	34 – 41	86	28.37%
	42 and above	36	11.82%
	<b>Total</b>	<b>304</b>	<b>100%</b>
<b>Sex</b>	Male	30	10%
	Female	274	90%
	<b>Total</b>	<b>304</b>	<b>100%</b>
<b>Marital Status</b>	Single	96	31.40%
	Married	184	60.52%
	Divorced/Separated	12	3.92%
	Widowed	12	4%
	<b>Total</b>	<b>304</b>	<b>100%</b>
<b>Educational Level</b>	No Formal Education	47	15.60%
	Primary Education	42	13.70%
	Junior High School (JHS)	119	39%
	Senior High School (SHS)	74	24.40%
	Tertiary Education	22	7.30%
	<b>Total</b>	<b>304</b>	<b>100</b>
<b>Years Selling</b>	Less than 2 Years	135	44.68%
	3 - 4 Years	78	25.53%
	5 - 6 Years	26	8.51%
	Over 6 Years	65	21.28%
	<b>Total</b>	<b>304</b>	<b>100</b>



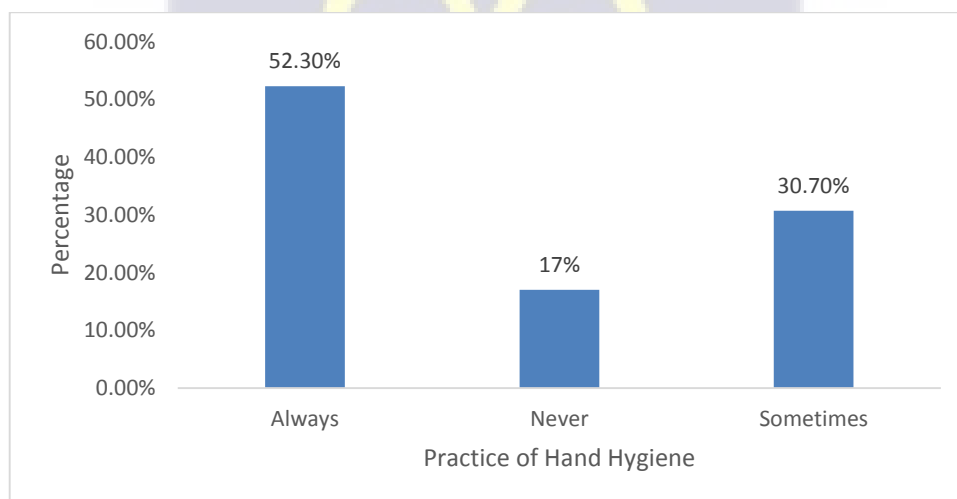
#### 4.4 Attitude of Food Vendors Towards Food Contamination

This research sought to investigate hygiene practices among street vendors at Ayensuano district. Knowledge of the consequences of unsafe food hygiene practice can enhance adherence to food safety guidelines. Knowledge on food safety concepts was established particularly on topics that dealt with health and personal hygiene, however, vendors were shown not to be knowledgeable in food legislation and waste management. A significant gap existed between knowledge and practice on these topics.

##### 4.4.1 Practice of Hand Hygiene towards Prevention of Food Contamination

The research to unravel the knowledge and understanding of street vendors at Ayensuano regarding hygienic practices of food sold on street, attention has been drawn on proper hand hygiene as an indicator of hygienic practice. Figure 4.2 represent respondents' indication of hand hygiene practices to indicate; always, never, or sometimes indicator. Clearly, Figure 4.2 reveals that 159 (52.3%) respondents acknowledged that they practice hand hygiene always. However, 52 (17%) indicated that they never practice hand hygiene while 93 (30.7%) respondents declared that the practice hand hygiene sometimes.

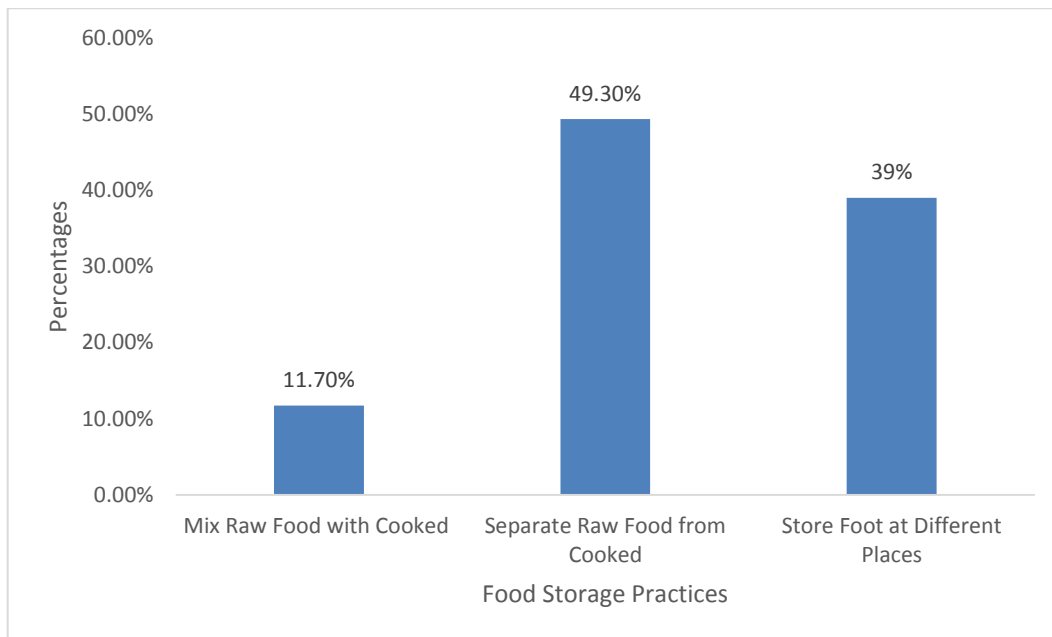
**Figure 4.2: Practice of Hand Hygiene**



#### 4.4.2 Food Storage Practices to Avoid Food Contamination

Concerning food storage practices, the study investigated the attitudes of vendors towards storage of raw and cooked food to reduce the risk of cross contamination. The vendors were to indicate whether raw and cooked food are best stored either together or separately. Apparently, 35 (11.7%) were observed mixing raw food with cooked food. Also, the number of street vendors that separated raw food from cooked food were 150 (49.3%). Additionally, street vendors that adopted the storage practice at different places were 119 (39%). Figure 4.3 presents the food storage practices of street vendors at Ayensuano.

**Figure 4.3: Food Storage Practices to Avoid Food Contamination**

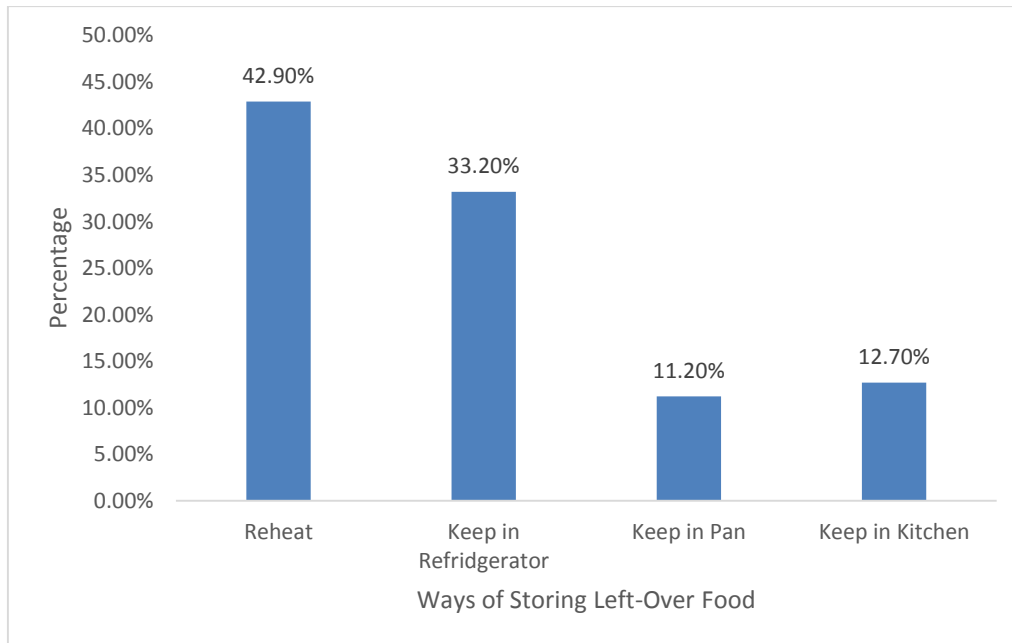


#### 4.4.3 Ways of Storing “Left-Over” Food

This research investigated the attitudes of street vendors on food contamination through the assessment of the ways in which they store left-over food. These street vendors are advised by food experts on the best ways to store food whether raw or cooked. Respondents were asked to indicate ways of keeping left over food. Figure 4.4 indicates the number of street vendors that adopted reheating as a means of storing left-over food were 130 (42.9%). On the other hand,

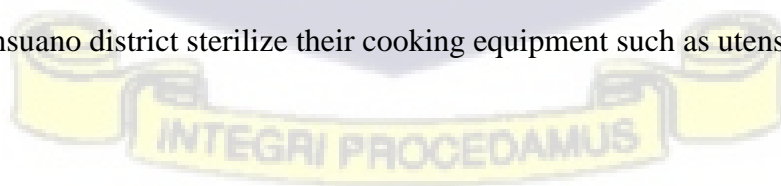
101 (33.2%) confirmed that food was stored in the refrigerator to avoid contamination. Also, 34 (11.2%) employed the act of using pan to store food while 39 (12.7%) of them kept food in the kitchen as means of storage mechanism.

**Figure 4.4: Ways of Storing Left-Over Food**

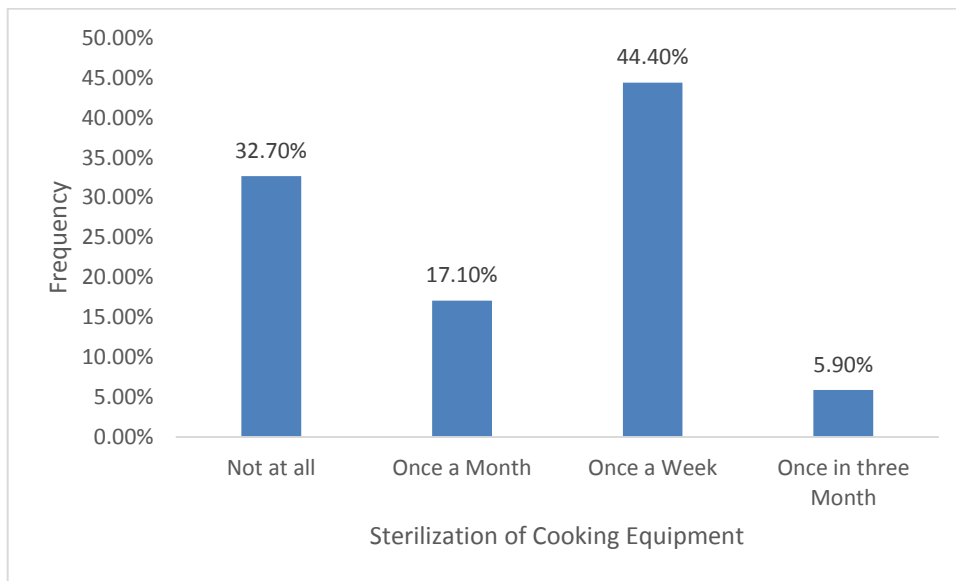


#### 4.4.4 Sterilization of Cooking Equipment

The study gauged the frequency at which street vendors at Ayensuano district sterilize their cooking equipment such as utensils. Thus,sterilization practice by the respondents was used to determine their attitude towards ensuring hygienic environment. The number of street vendors who sterilize their equipment once a month were 135 (44.4%). However, a total of 99 (32.7%) did not sterilize their cooking utensils.. Also, 18 (5.9%) engage in the act of sterilizing their cooking equipment only once in three months. Figure 4.5 presents the frequency at which street vendors at Ayensuano district sterilize their cooking equipment such as utensils.

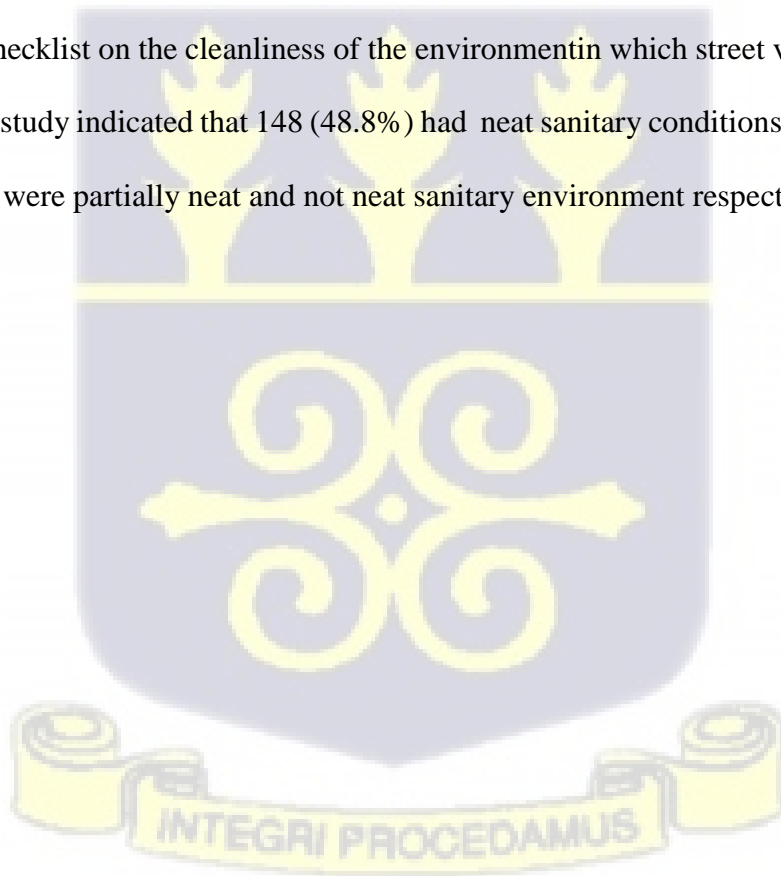


**Figure 4.5: Sterilization of Cooking Equipment**

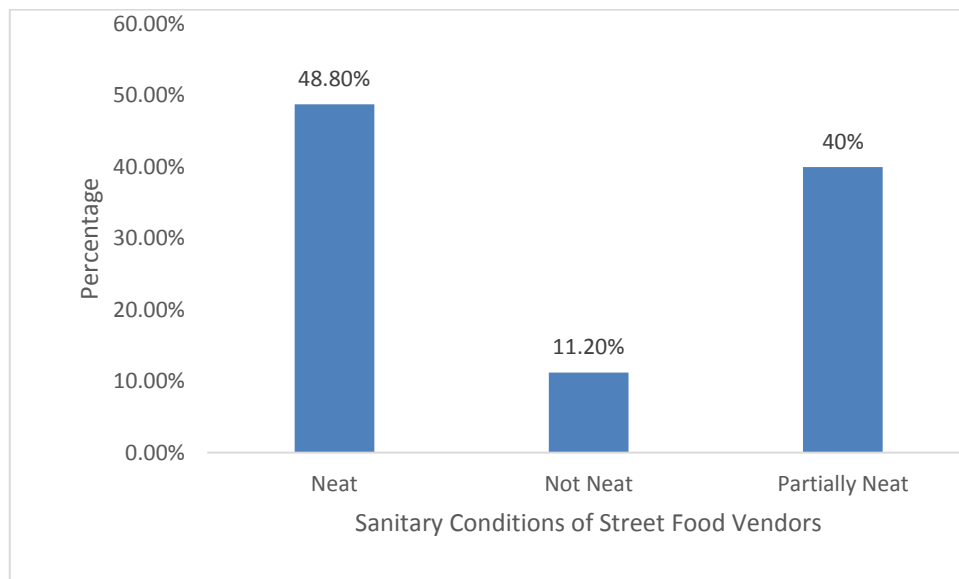


#### **4.4.5 Sanitary Conditions of Street Food Vendors**

The sanitary condition of street food vendors at Ayensuano district was measured using observational checklist on the cleanliness of the environment in which street vendors sell food. Result from the study indicated that 148 (48.8%) had neat sanitary conditions while 122 (40%) and 34 (11.2%) were partially neat and not neat sanitary environment respectively.



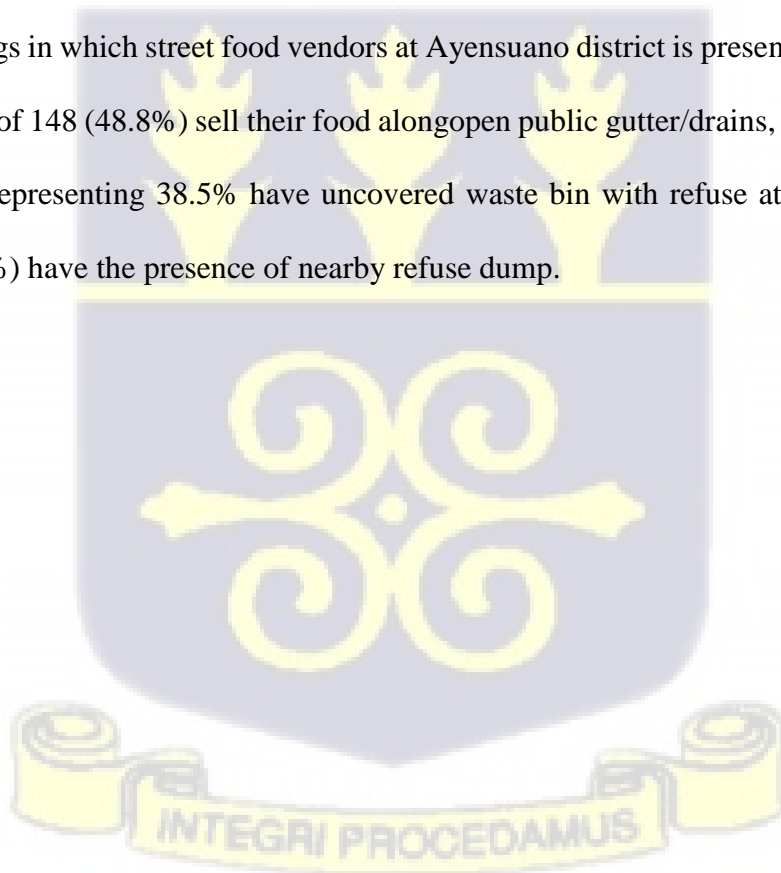
**Figure 4.6: Sanitary Environment of The Street Food Vendors**



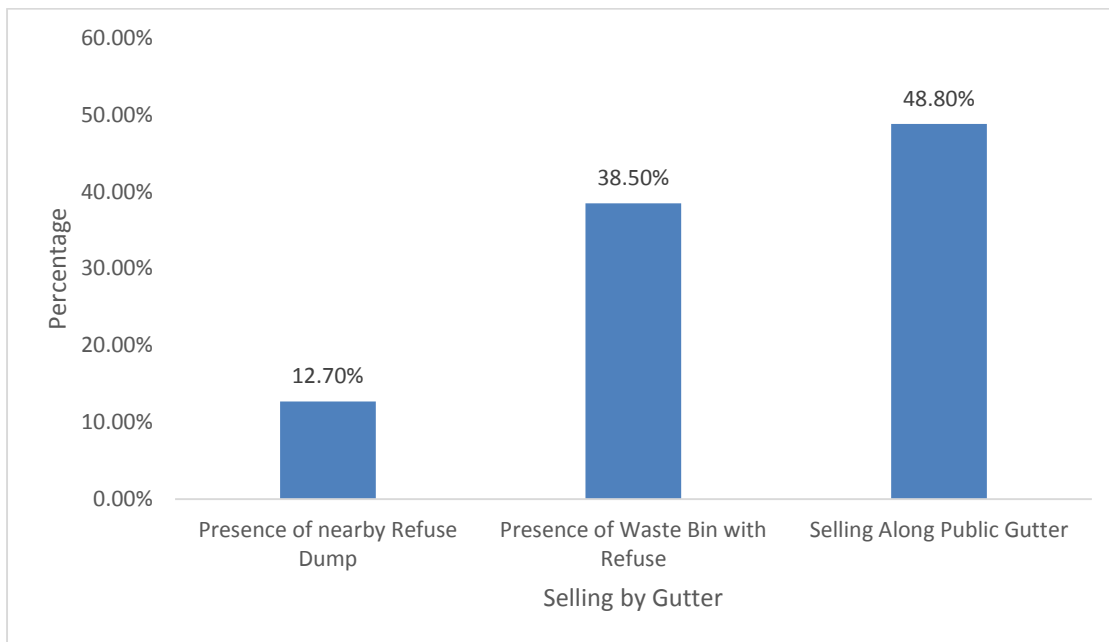
#### **4.4.5.1 Selling of Food by the Drain/ Gutter**

The surroundings in which street food vendors at Ayensuano district is presented in Figure 4.7.

A total number of 148 (48.8%) sell their food along open public gutter/drains, One hundred and nineteen 119 representing 38.5% have uncovered waste bin with refuse at where they sell, while 37 (12.7%) have the presence of nearby refuse dump.



**Figure 4.7: Selling of Food by Gutter (Location of food on Sale)**



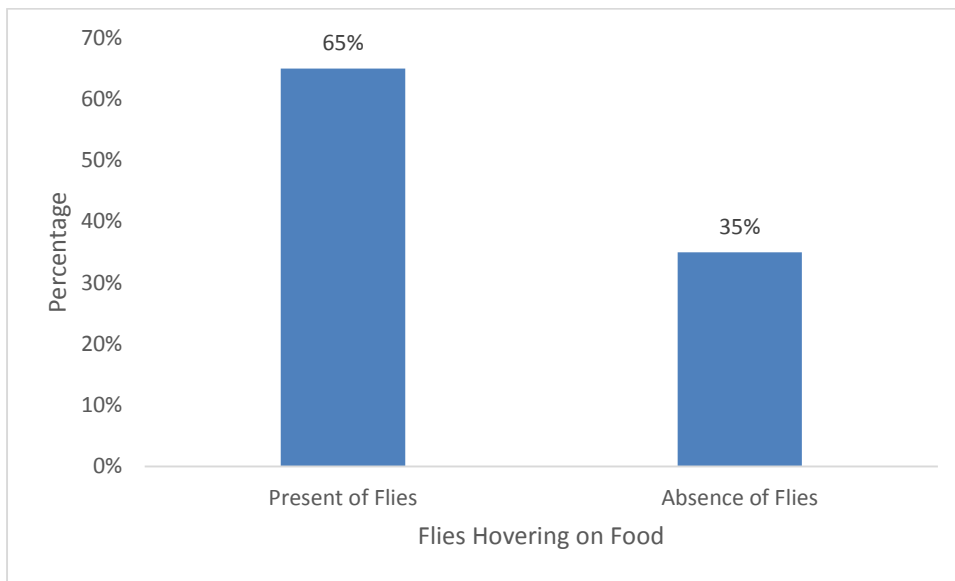
#### 4.4.5.2 Infestation of Flies on Food

The sanitary conditions of street vendors at Ayensuano district that were under investigation included flies hovering on food. Result from the study revealed that 198 (65%) of the street food vendors had flies hovering around the site where they sell food while 106 (35%) did not have flies hovering around food that were been sold.



Fried Fish exposed to flies infestation

**Figure 4.8: Flies Hovering on Food**

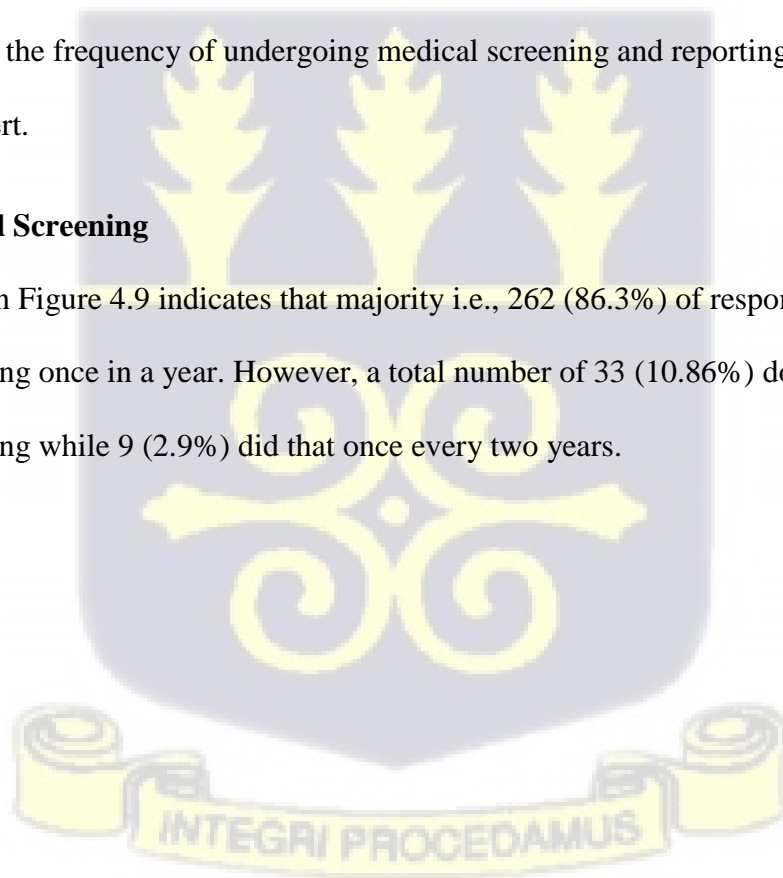


#### **4.4.6 Health Status of Street Food Vendors**

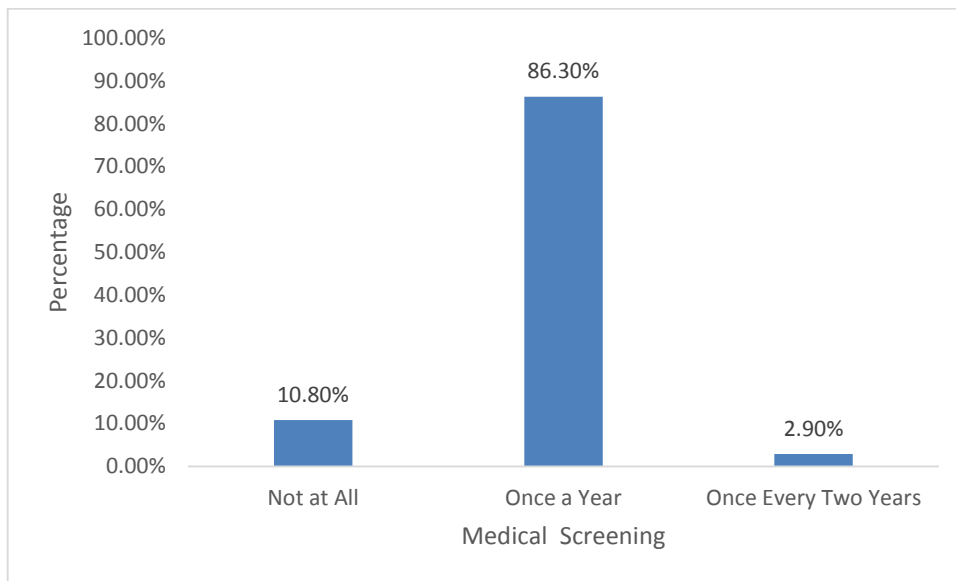
In relation to the health status of street food vendors at Ayensuano district, respondents were asked the about the frequency of undergoing medical screening and reporting of their illness to medical expert.

##### **4.4.6.1 Medical Screening**

The bar chart in Figure 4.9 indicates that majority i.e., 262 (86.3%) of respondents had medical screening once in a year. However, a total number of 33 (10.86%) do not attend medical screening while 9 (2.9%) did that once every two years.



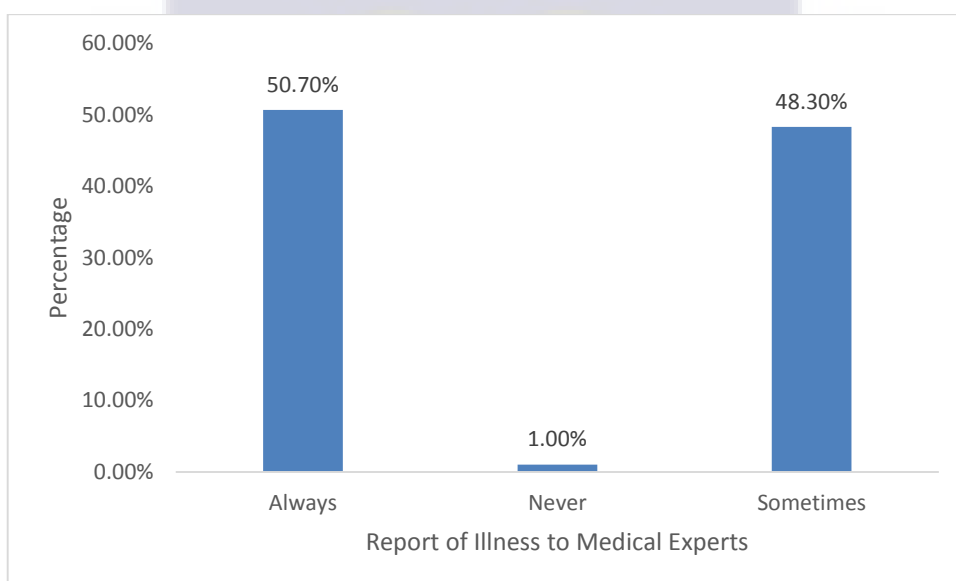
**Figure 4.9: Medical Screening of Street Food Vendors**



**4.4.6.2 Reporting of Illness to Medical Expert**

Figure 4.10 illustrates the data collected on the frequency of street food vendors reporting illness to medical experts. Statistically, majority of the respondents 154 (50.7%) always report their illness to medical expert. However, 3 (1%) surprisingly never reported their illness while 147 (48.3%) sometimes report their illness

**Figure 4.10: Reporting of Illness to Medical Expert by Street Food Vendors**



#### 4.4.7 Hand Washing with Soap

Figure 4.11 presents the frequency of hand washing with soap among the street food vendors at Ayensuano district. A significant portion of the respondent 159 (52.3%) indicated that they always wash their hands with soap while 93 (30.7%) and 52 (17%) admitted to them sometimes and frequently wash their hand with soap respectively.

**Figure 4.11: Hand Washing With Soap Among the Street Food Vendors**



#### 4.5 Level of Street Food Vendors Knowledge on Food Borne Diseases

##### 4.5.1 Knowledge of Street Vendors on Food Borne Diseases

The knowledge of street vendors on food borne diseases was tested. Four types of diseases i.e., Diarrhoea, Gonorrhoea, HIV and Malaria were presented to test the knowledge of the street vendors as food borne diseases. As expected, 256 (84.4%) identified that Diarrhoea is a food borne disease as presented in Table 4.5. Surprisingly, 21 (6.8%) identified HIV as a food borne disease. Out of the 304 respondents, 5 (1.5%) and 22 (7.3%) of them shockingly identified Gonorrhoea and Malaria respectively as food borne diseases. Table 4.3 displays the distribution of street vendors knowledge on food borne diseases.

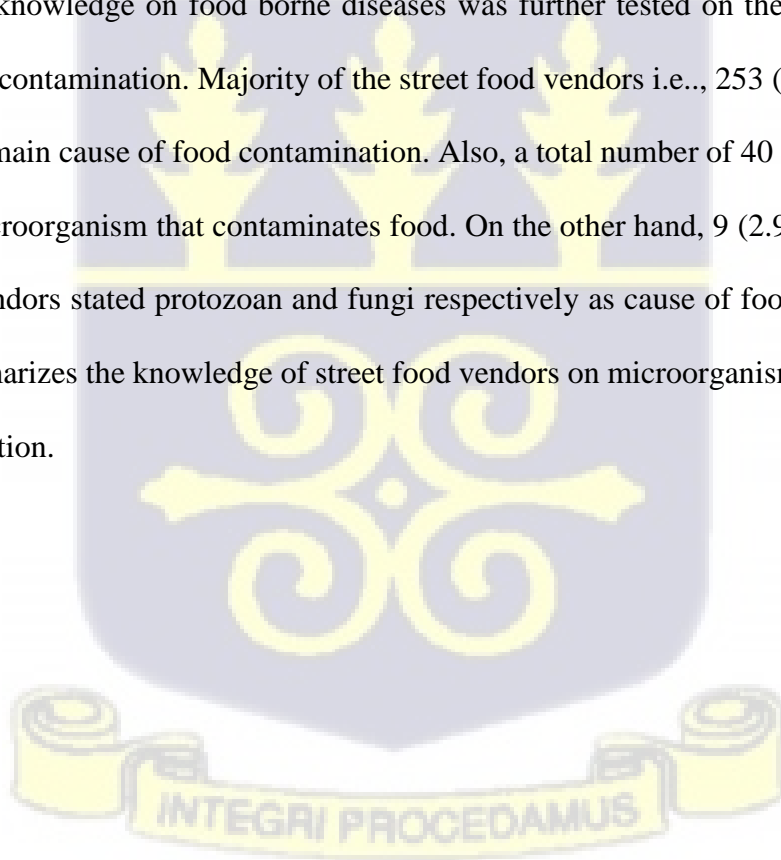
**Table 4.2 Knowledge of Street Vendors on Food Borne Diseases**

<b>Food Borne Diseases</b>	<b>Frequency</b>	<b>Percentage</b>
Diarrhea	256	84.40%
HIV	21	6.80%
Gonorrhoea	5	1.50%
Malaria	22	7.30%
<b>Total</b>	<b>304</b>	<b>100%</b>

#### **4.5.2 Knowledge of Street Food Vendors on Microorganisms that Cause Food**

##### **Contamination**

Street vendors knowledge on food borne diseases was further tested on the microorganisms that cause food contamination. Majority of the street food vendors i.e., 253 (83.4%) indicated bacteria as the main cause of food contamination. Also, a total number of 40 (13.2%) revealed viruses as a microorganism that contaminates food. On the other hand, 9 (2.9%) and 2 (0.5%) of the street vendors stated protozoan and fungi respectively as cause of food contamination. Table 4.4 summarizes the knowledge of street food vendors on microorganisms that can cause food contamination.



**Table 4.3: Street Food Vendors Knowledge on Microorganisms that Cause Food****Contamination**

<b>Microorganism</b>	<b>Frequency</b>	<b>Percentage</b>
Bacteria	253	83.40%
Viruses	40	13.20%
Protozoan	9	2.90%
Fungi	2	0.50%
<b>Total</b>	<b>304</b>	<b>100%</b>

**4.5.3 How Cooked Food is Handled**

The knowledge of street food vendors at Ayensuano was tested on the ways of handling cooked food. From Table 4.5, 124 (41%) street food vendors handle cooked food with spoons, 102 (33.7%) use ladle to handle cooked food, 73 (23.90%) used their bare hands to handle cooked food while 3 (1%) and 2 (0.5%) used bare hands with ladle spoon respectively.

**Table 4.4: How Cooked Food is Handled**

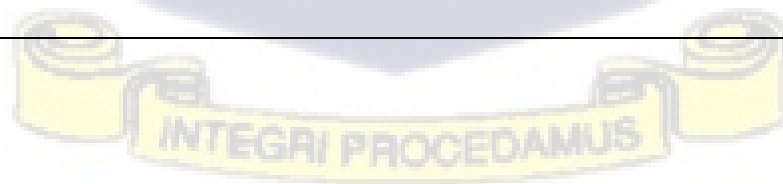
<b>Handling of Cooked Food</b>	<b>Frequency</b>	<b>Percent</b>
With bare hands	73	23.90%
With bare hands, With Ladle	2	0.50%
With Ladle	102	33.70%
With Ladder, With Spoon	3	1%
With Spoon	124	41%
<b>Total</b>	<b>304</b>	<b>100</b>

#### 4.5.4 Ways by which Food can be Prevented from Contamination

Ways in which street food vendors at Ayensuano District prevent of food contamination was also an important variable for this study. Outcome of the study indicates the notable ways of preventing food contamination included Practice of Personal Hygiene, protecting food from flies, Protecting food from dust.

**Table 4.5: Street Food Vendor’s Views by which Food can be Prevented from Contamination**

Ways by which Food can be Prevented from Contamination	Frequency	Percent
Don't know	5	1.50%
Practice of Personal Hygiene	16	5.40%
Practice of Personal Hygiene, Protecting food from flies	36	11.70%
Practice of Personal Hygiene, protecting food from flies, Protecting food from dust	111	36.60%
Practice of Personal Hygiene, protecting food from flies, Protecting food from dust,	3	1%
Protecting food from dust	21	6.80%
Protecting food from flies	59	19.50%
Protecting food from flies, Protecting food from dust	53	17.65%
<b>Total</b>	<b>304</b>	<b>100%</b>



#### 4.5.5 Temperature of Water Used for Sterilization

Still on the level of street food vendors knowledge on food borne diseases, the study revealed whether street vendors have some level of knowledge on temperature of water used to sterilize cooking equipment. Out of the 304 street food vendors, 157 (51.7%) of them have no idea about the water temperature for sterilization. Street food vendors also indicated that the temperature of water for sterilization is 0 degrees, 50 degrees and 82 degrees.

**Table 4.6: Temperature of Water Used for Sterilization**

<b>Water Temperature for Sterilization</b>	<b>Frequency</b>	<b>Percent</b>
0 degrees	13	4.40%
50 degrees	101	33.20%
82 degrees	33	10.70%
Don't know	157	51.70%
<b>Total</b>	<b>304</b>	<b>100%</b>

#### 4.6 Socio-Demographic Characteristics and Personal Hygiene Practices

This section illustrates the extent to which street vendors practice personal hygiene at Ayensuanodistrict. Chi-square test was used to measure the relationship between socio-demographic relationship of street food vendors at Ayensuano District and the extent of personal hygiene practice. Table 4.8 displays the association between the socio-demographic characteristics and personal hygiene practices of street food vendors using the cross-tabulation tool in Statistical Package for Social Sciences (SPSS) Version 25.

**Table 4.7: Relationship Between Socio-Demographic Characteristics and Personal Hygiene Practices**

Variables	Chi-Square	P-Value
Age	1.4	0.23*
Sex	10.85	0.18*
Marital Status	20.12	0.000
Educational Qualification	14.51	0.001

#### 4.6.1 Relationship between Age and Personal Hygiene Practices

The table 4.8 presents the relationship between the demographic characteristics of respondents and their knowledge in street food safety. There is no relationship between age and knowledge of food safety as indicated on the table as ( $X^2 = 1.4, p > 0.05$ ). The p-value which is 0.23 establishes that the relationship between the variables is not significant.

#### 4.6.2 Relationship between Gender and Personal Hygiene Practices

Considering the relationship between gender and personal hygiene practices, Table 4.4 shows that ( $X^2 = 10.85, p > 0.05$ ) that there is no relationship between the two variables and the relationship is very insignificant. This inferential statistic implies that, the sex of a street vendor does not imply personal hygiene practices. Obviously, the outcome from table 4.8 presents an insignificant relationship between the sex and personal hygiene practices.



#### **4.6.3 Relationship between Marital Status and Personal Hygiene Practices**

This research explored the various destinations of the street food vendors to identify the sort of relationship they had with personal hygiene practices. The findings from Table 4.8 indicated an association between the two variables ( $X^2 = 20.12, p < 0.05$ ). This implies that the relationship that exists between marital status and personal hygiene is significant. Consequently, the relationship these variables is significant at 5% alpha level ( $P < 0.000$ ).

#### **4.6.4 Relationship between Educational Qualification and Personal Hygiene Practices**

The study examined whether a street food vendor who has acquired education, formal or informal, influences personal hygiene practices to ensure the selling of safe food. The Chi-square test of independence conducted to determine the relationship between educational qualification and personal hygiene practices revealed a statistically significant relationship between the variables of ( $X^2 = 14.51, p < 0.05$ ).

#### **4.7 Knowledge on Food Hygiene and Clean Environment**

This section investigates whether the knowledge of street food vendors influences the cleanliness of the environment in which they operate using the variables attending food hygiene training. Inferential statistics i.e., chi-square statistics is used to determine the significant impact of food hygiene knowledge on the environment of street food vendors. Table 4.8 displays the outcome of the relationship between knowledge on food hygiene and clean environment. The Chi-square test of independence revealed a statistically insignificant relationship between the attending food hygiene training and clean environment ( $X^2 = 7.63, p > 0.05$ ).



**Table 4.8: Knowledge on Food Hygiene and Clean Environment**

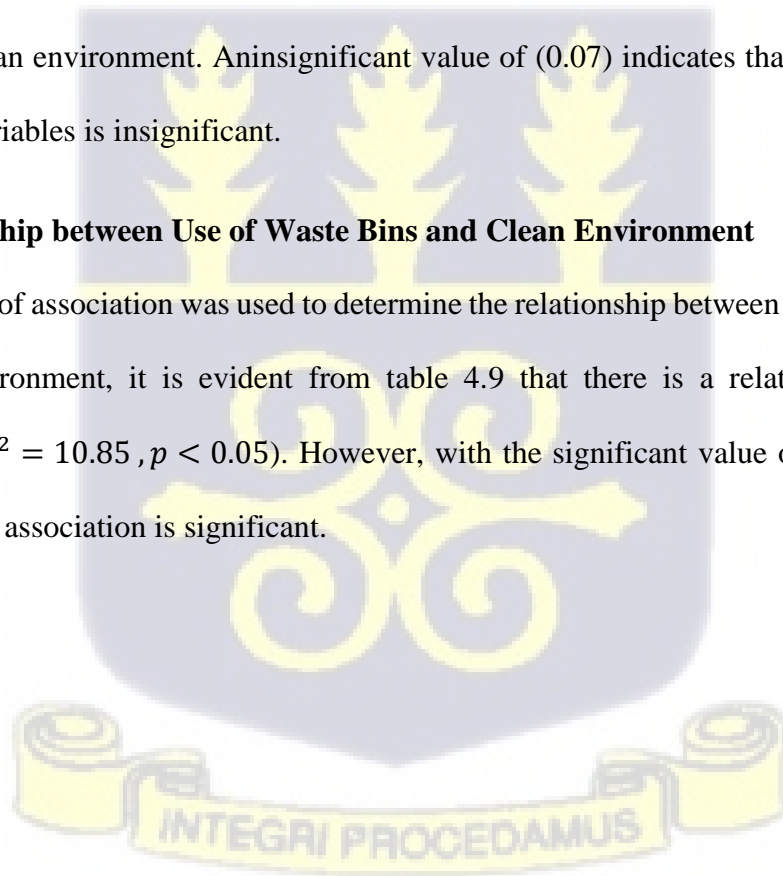
Variables	Chi-Square	P-Value
Attending Food Hygiene Training	7.63	0.07*
Use of Waste Bins	10.85	0.002
Choice of Selling Site	30.04	0.003

#### 4.7.1 Relationship between Attending Food Hygiene Training and Clean Environment

Investigation on whether a street vendor attending a food hygiene training ensures a clean environment around the place of selling. The Chi-square test of independence revealed a statistically insignificant relationship between the attending food hygiene training and clean environment ( $X^2 = 7.63, p > 0.05$ ). Implying, a street vendor attending food does not guarantee a clean environment. An insignificant value of (0.07) indicates that the relationship between the variables is insignificant.

#### 4.7.2 Relationship between Use of Waste Bins and Clean Environment

Chi-square test of association was used to determine the relationship between use of waste bins and clean environment, it is evident from table 4.9 that there is a relationship between the variables ( $X^2 = 10.85, p < 0.05$ ). However, with the significant value of ( $P = 0.002$ ), it implies that the association is significant.

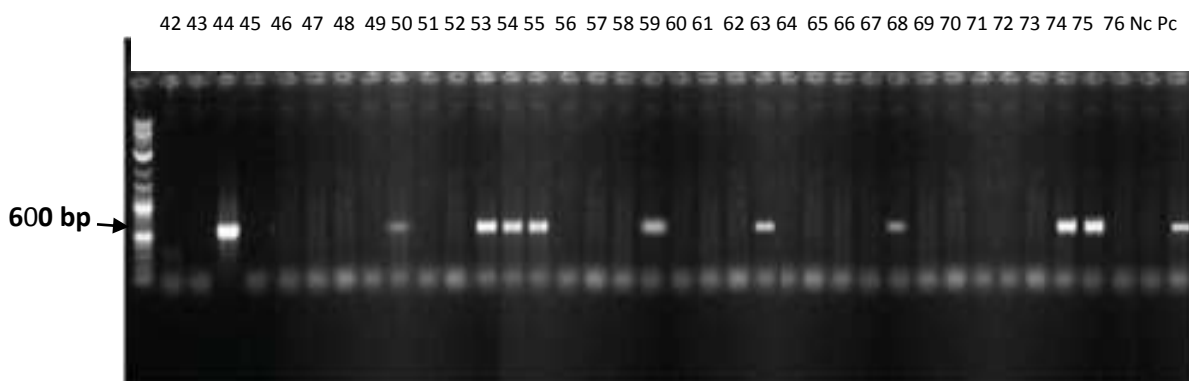


### 4.7.3 Relationship between Choice of Selling Site and Clean Environment

To establish the link between knowledge on food hygiene and clean environment, this research examined choice of selling site influence on the nature of the surroundings of street vendors. Using an ordinal scale of measurement, the statistical tool appropriate for this analysis was chi-square test. The findings revealed an existence of association between choice of selling site and clean environment ( $X^2 = 30.04, p < 0.05$ ). The chi-square test result indicates that there is a significant relationship between the variables under study.

### Laboratory result on the presence and absence of food pathogens in the 76 food samples using the molecular techniques

#### 1. *Escherichia coli* primer (100 bp DNA Ladder)



M 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41

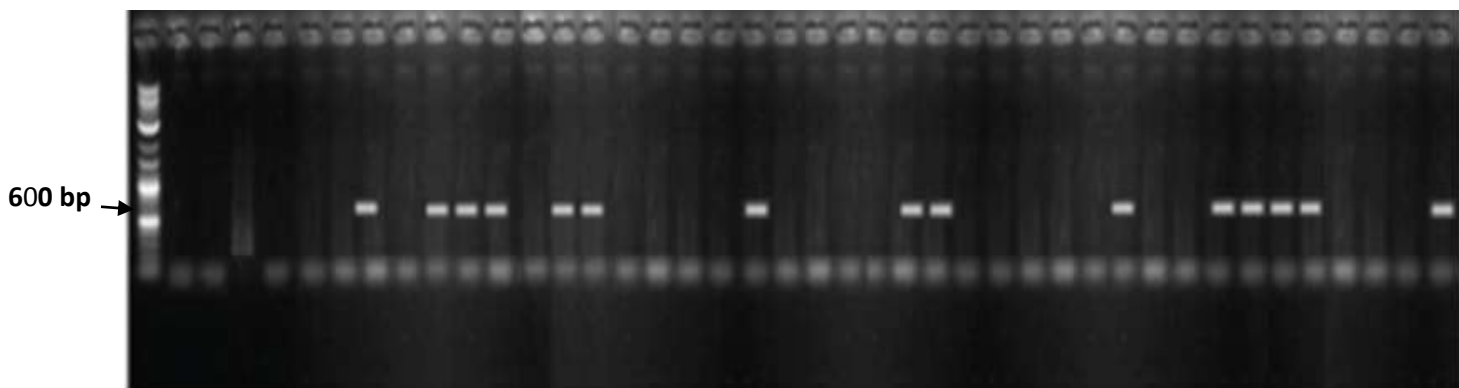


Plate 1: PCR amplification of *Escherichia coli* pathogen in prepared food samples collected from three Zonal Councils at Ayensuano District, E.R. Samples: (1-76), Nc: Negative control (Sterile- free water). Pc: Positive control M: DNA Ladder (1kb).

From the result, out of the 76 food samples collected, 25 of them were contaminated with *Escherichia coli*, showing positive amplification, of which waakye and kenkey with pepper were most contaminated.

## 2. *Salmonella typhi* (1 kb DNA Ladder)

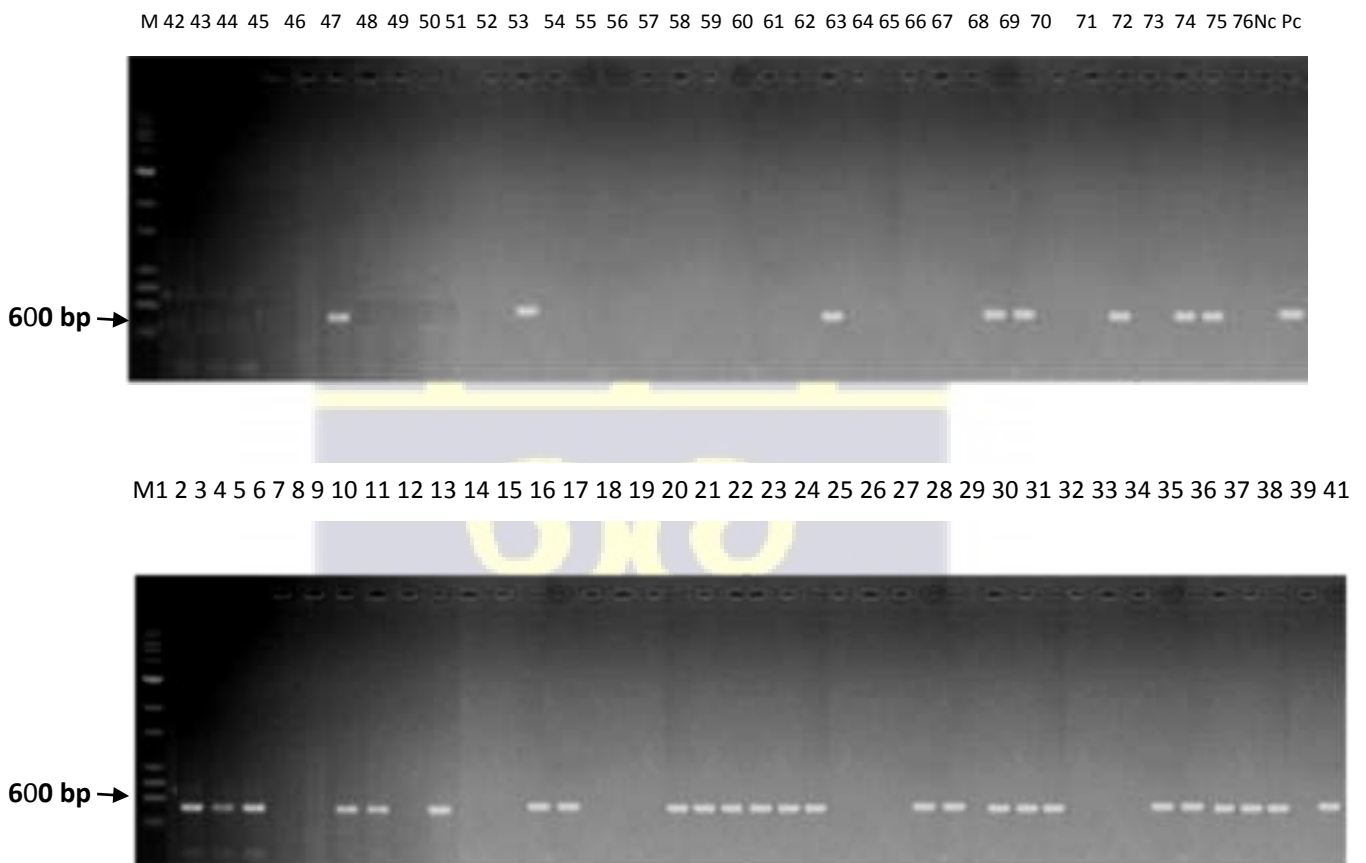


Plate 2: PCR amplification of *Salmonella typhi* pathogen in prepared food samples collected from three Zonal Councils at Ayensuano District, E.R. Samples: (1-76), Nc: Negative control (sterile-free water). Pc: Positive control M: DNA Ladder.

From the result, out of 76 food samples collected, 32 of them were contaminated with *Salmonella typhi*, showing positive amplification, of which waakye and kenkey with pepper were most contaminated.

**Table 4.9 Presence and absence of the food pathogens in the various food samples**

**Table 4. 10: Detection (Present/Absent) of food-borne pathogens in food samples**

SAMPLE CODE	<i>E.coli</i>		<i>Staphylococcus aureus</i>		<i>Salmonella typhi</i>		<i>Campylobacter jejuni</i>	
	Present	Absent	Present	Absent	Present	Absent	Present	Absent
1.		-		-	+			-
2.		-	+		+			-
3.		-		-	+			-
4.		-		-		-		-
5.		-	+			-		-
6.		-		-	+			-
7.	+		+		+			-
8.		-		-		-		-
9.	+		+		+			-
10.	+		+			-	+	

Detection (Present/Absent) of food-borne pathogens in food samples. CONT' 2

11.	+		+			-		-
12.		-		-	+			-
13.	+		+		+			-
14.	+		+			-	+	
15.		-	+			-		-
16.		-	+			-	+	
17.		-		-	+		+	
18.		-		-	+		+	
19.	+			-	+			-
20.		-	+		+			-
21.		-	+		+			-
22.		-		-	+			-
23.		-		-		-	+	
24.	+		+			-	+	
25.	+			-		-		-
26.		-		-	+			-
27.		-	+		+			-
28.		-	+			-		-

Detection (Present/Absent) of food-borne pathogens in food samples. CONT' 3

29.		-	+		+			-
30.		-		-	+			-
31.	+			-	+			-
32.		-	+			-		-
33.		-	+			-		-
34.	+		+			-		-
35.	+			-	+			-
36.	+			-	+		+	
37.	+			-	+		+	
38.		-		-	+			-
39.		-		-	+			-
40.		-	+			-		-
41.	+		+			-		-
42.		-	+			-		-
43.		-	+			-	+	
44.		-	+			-	+	
45.		-	+		+		+	
46.		-		-		-	+	
47.	+			-		-		-
48.		-	+			-		-

49.		-		-		-		-
50.	+			-		-		-
51.	+			-	+			-
52.	+		+			-		-
53.		-	+			-	+	
54.		-		-		-	+	
55.		-		-		-		-
56.	+			-		-		-
57.		-		-		-		-
58.		-		-		-		-
59.		-		-		-		-
60.	+			-		-	+	
61.		-		-	+			-
62.		-		-		-		-
63.		-	+			-	+	
64.		-		-		-		-
65.	+			-		-	+	
66.		-	+			-		-
67.		-	+		+			-
68.		-	+		+			-
69.		-		-		-		-
70.		-		-		-		-
71.	+			-	+			-
72.	+			-		-		-
73.		-		-	+			-
74.		-	+		+			-

Detection (Present/Absent) of food-borne pathogens in food samples. CONT' 5

75.	+		+		+			-
76.		-		-		-		-

Table 4.10 shows the food samples with green colour depicts that the samples are clean, safe and not contaminated with any of the above indicated microorganisms after molecular analysis while the samples with color red indicates the present of two or three microorganisms in the food samples which is unsafe, contaminated and dangerous for human consumption. From the table again, it can be noted that *Staphylococcus aureus* and *Salmonella typhi* were major pathogens which dominated the food samples.



## CHAPTER FIVE

### DISCUSSION OF FINDINGS

#### 5.1 Demographic Characteristics of Respondent

In Sub-Saharan Africa, the problem of food safety and hygiene stems not only from inadequate knowledge but also as a result of the interplay of many antecedent factors that are social, cultural, economic and behavioral coupled with very high illiteracy. Even in situations of modern facilities such as portable water, many routine traditional or normative practices affect the quality of food sold by food vendors. According to FAO (2016), food handlers should have the necessary knowledge and skills to enable them to handle food hygienically.

In this study the dominant age group of the vendors was between 26-33 years (31.40%) of them were within the ages of 42 years and above (11.82%). 274 (90%) of the respondents were females while 30 (10%) were males. Most of the respondents were married with a single, separated, divorced or widowed.

Educational level is an important determinant of knowledge or practice of a good personal hygiene. Most of the respondent's educational qualification were JHS (39%) and no formal education (15.60%) SHS and tertiary level formed (24.4 % and 7.3%) respectively. Respondents with no formal education can negatively affect their hygiene practices. Since educational level is an important determinant of knowledge or practice ranging, food vendors who have no formal education may engage in unhygienic practices from selection, preparation through to sales.

The finding of this study where 47 (15.60%) have not had any formal education is in consonance with a study conducted in Ghana by Mensah et al. (2002), entitled, Street food in Accra, Ghana how safe are they? The study investigated the microbial quality of food sold on

street of Accra and factors predisposing food to contamination. They found out that out of 177 street vendors, 79 (66.7%) were educated and these people exhibited good hygiene behavior. Similarly, a study conducted by Isara and Isah in Benin in 2019 to assess knowledge and practice of food hygiene and safety among food handlers in fast food restaurant showed that majority (98%) of their respondents had formal education. There was good knowledge and practice of food hygiene and safety among the respondents. Knowledge was significantly influenced by previous training in food hygiene and safety ( $p=0.002$ ).

A total of 135 (44.68%) of the respondents in this study had selling experienced less than 2 years, 65 (21.28%) had selling experienced over 6 years. This implies that respondents with higher selling experienced would practice good personal and environmental hygiene as far as food is concern compared with vendors with low selling experienced.

## **5.2 Practice of Hand Hygiene Towards Prevention of Food Contamination**

Hand washing with soap and clean water is one of the most important ways of preventing diseases. Hand washing with soap has proven to be an effective way of removing microbial organisms from the hands. This study showed that, majority 159 (52.3%) out of 304 respondents indicate that they always wash their hands before preparing food, 52 (17%) showed that they never washed their hands before preparing food with about 31% of the respondents stating that they sometimes washed their hands before preparing food.

Preparing food without washing hands with soap and clean water and washing hands sometimes is an indication that microorganisms can be easily transmitted into food. This study conforms with the rules and regulation laid down on hand hygiene by WHO (2010), as outlined below:

1. Food vendors practicing hand washing before handling food and often during food preparation.

2. Food vendors washing hands after going to the toilet.

This study is different from the study done by Burt, Volel and Finkel (2003), which assessed the food handling practice of 10 processing mobile food vendors operating in Manhattan, New York City. They found out that over half of all vendors (67%) contacted served food without washing their hands with soap. Serving food for public consumption without hand washing with soap could lead to the spread of communicable diseases such as typhoid.

### **5.3 Cooked Food Storage Practices**

Cooked food and raw food must be stored separately to prevent cross-contamination. Department of Health (2016). This study showed 49.3% of the food vendors separated cooked food from raw food which conformed to the guidelines of FAO (1999) on the need to separate cooked foods from raw foods in order to prevent cross-contamination. However, 35 (1.7%) vendors mixed cooked foods with raw foods, in line with the study done by Campbell (2010), which found (89%) of the respondents knowing how cooked foods are stored separately from raw foods and how foods are displayed to prevent contamination. No matter how safety foods are prepared, if it not stored well and under the right temperature, it can be predisposed to contamination.

In Ghana, most patrons of the food vending industry would want food to be displayed before making selection of their choice. In view of this, food vendors prefer to display food items for easy access to speed customers' decisions making process on what to choose and also attract them to buy.

#### **5.3.1 Ways of Storing Left-Over Foods**

Findings from this study showed that 42.9% out of 304 respondents of food vendors reheated left-over foods for their next sales. Reheating foods at the right temperature is not the problem but how these foods are stored before getting it reheated. From this study, 101 (33.2%) of the

food vendors said they keep left-over foods in a refrigerator whereas, 39 (12.7%) keep left-over food in kitchen and 34 (11.2%) keep it in a pan. This study is in contrast to a study by Muinde and Kuria (2005), where food vendors stored left-over foods in open spaces (21%), plastic containers (21%) while (16%) kept them in polythene bags or in cupboards. Thus, proper methods of storing left-over foods were not used, hence promoting selling of stale food. In other words when food is not stored at the proper place and temperature, it may go bad or get contaminated.

In an international conference on nutrition, it was resolved that if food cannot be served immediately, it should be kept hot or cooled down rapidly and reheated completely to a temperature of at least 70°C before eating. This is to make sure that microbes will not thrive on the food because these microbes flourish well between 10°C and 60°C. It is proposed that the street food vendors prepare enough food for the day, so that they can sell all the food since most of them do not have good storage facilities.

#### **5.4 Sterilization of Cooking Equipment**

Sterilization is one of the best practices in destroying microorganisms, tools and utensils used in the kitchen should be sterilized in autoclave or in a very hot water. This study found 135 (44.4%) of the vendors sterilized their equipment once in a month, 99 (32.7%) did not sterilized their equipment at all (not at all) 18 (5.9%) sterilized their equipment once in every three months. This report is similar to one by Rane, (2011) on microbiological analysis of utensils surface and knives have the presence of *Salmonella* and *Shigella*. It is also reported that during the preparation of food, the raw material is cut and chopped using the same knife without in between cleaning and such knives are often invaded by flies. In situation where equipment is not sterilized, it may lead to cross-contamination during cooking since the same utensils and knives are used.

## **5.5 Sanitary Conditions of Street Vending Premises**

FAO (2008) notes that foods should be prepared in a place set aside exclusively for that purpose, the place of preparation should be kept clean at all times and should be far from any source of contamination like rubbish, waste water, dust and animals. Vending stalls should therefore be designed and constructed so that they are easily cleaned and maintained as such the Ministry of Local Government should design appropriate food vending stalls. Also, adequate drainage and waste disposal systems and facilities should be provided in the street food industry and designed properly so that the risk of contamination of food and potable water is low. Where food is prepared and sold should not be contaminated. This study shows that, 34 (11.2%) sells food within a clean environment, 122 (40%) and 148 (48.8%) sells their food in unclean environment, in other words the environment in which they sell foods is not neat, they were the presence of flies, rubbish and open gutter exposing the food to contamination. A study done by FAO (2020) support this study that ready to eat foods sold in unsanitary locations are susceptible to contamination by flies and domestic animals and diarrheal diseases are always present at site. It is therefore prudent for food vendors to protect ready to eat food from contamination especially for public consumption.

### **5.5.1 Selling Food by the Gutter**

Observing environmental hygiene is vital for any food establishment. Any food vendor, who observes both personal and environmental hygiene will prevent contamination of food. Training should therefore be conducted for the street food vendors on various aspects of environmental hygiene. According to the Local Government Act 462 (1993) any person who sells, prepares, packages, conveys, stores or display for sale any food or drink under insanitary condition without adequate protection from dust, waste, and bad handling etc. commits an offence. It was observed from this study that, majority 148 (48.8%) sell their foods along open gutter, 119 (38.5%) sell their foods in the presence of waste bins with refuse, 37 (12.7%) sell

their foods in the presence of nearby refuse dump. This study is similar to Okai and Dordi (2002) in a non- experimental design determine the knowledge, attitude and practice on food hygiene by food vendors of University of Ghana campus. The study showed that food vendors practiced poor food hygiene as evidenced by the poor state of the cooking and selling environment as well as improper handling and washing of drinking cups. This study is also in conformity with a study done by Okojie (2014) on sanitary conditions of food vending sites and food handling practices of street food vendors in Benin City, Nigeria shows that 50% of street food vendors have poor environmental hygiene practices while 50% was classified as good environmental hygiene practices. A total of eight parameters were assessed in his study, these includes (1) appearance (2) presence of waste bin (3) presence of nearby refuse dump site (4) presence of hand basin (5) presence of hand towel(6) presence of soap (7) presence of flies and (8) presence of rats/cockroaches. The presence of these insanitary environment are the main factors that can easily contaminate cooked foods.

### **5.5.2 Flies Hovering on Food**

Pathogens can be passed mechanically by flies because *Salmonella typhimurium* and *Shigella* can multiply in the gut of the housefly and can be excreted for weeks or longer. There is consequently a risk of contamination associated with the presence of food to flies. Flies like habiting in gutters, places of convenience and dirty environments. This study showed that majority 196 (65%) out of the 304 street food vendors who were observed had flies hovering on their foods due to lack of fly-proof net. Also, foods are at places where dustbins are not covered. This situation created congenial atmosphere for flies to exist, moreover, the presence of these flies serves as microbes as carriers of diseases causing microorganisms. However, 106 (35%) of the vendors protect their food from fly infestation. FAO (2008) notes that foods should be prepared in a place set aside exclusively for that purpose, while the place of preparation should be kept clean at all times and should be far from any source of contamination

(rubbish, waste water, dust and animals). Vending stalls should be designed and constructed so that they are easily cleaned and maintained. This study conforms with the regulation by FDA/FSMD/CP-FSE/2013/03 regulations regarding sanitary keeping of vending premises includes the presence of insects, rodents and other pests shall be controlled to minimize their presence on the premises by

- ❖ Routinely inspecting incoming food and supplies.
- ❖ Routinely inspecting the premises of evidence of pests.
- ❖ Eliminating harborage conditions.

## **5.6 Health Status of Food Vendors**

### **5.6.1 Medical Screening**

All persons engaged in handling of food or drink shall undergo periodic medical examination and must be declared medically fit, by a certified medical officer and must obtain a certificate to that effect. The health certificate must be renewable yearly ( AYDA, 2012). Even though someone can be medically fit today and can be unfit tomorrow, it is expected of food vendors to undergo medical screening for early detection of diseases and to avoid possible spread of food and water-borne infection. This study showed that 262 (86.3%) have undergone medical screening once in a year as against 33 (10.86) who have not done it before. This finding is similar to a study conducted by Aman-Prah (2011) on street foods: handling, hygiene and client in Cape Coast. That study showed that 15 (55.5%) out of 50 food vendors investigated had undergone medical examination (8 only once and 7 annually).

Musah and Akande (2003) showed similar results in a study carried out on food hygiene practices among food vendors in Illorin Secondary School in Nigeria. The study showed that out of 185 respondents, 141 (76%) went through medical examination as a requirement and 30

(16%) underwent periodic medical examination. Similarly, Okojie, Wagbatsoma, and Ighoroge in (2005) found that only 31 (30.41%) out of 102 respondents had pre-employment medical examination. The findings of this study is in consonance with other aforementioned studies where the number of food vendors who have had medical examination were woefully less than the sample size. This implies that in a situation where food vendors are infected with any transmittable disease, consumers may not be safe for consuming food from such food vendors. Secondly, early detection which is a good principle in treatment of disease may be skipped and consumer safety may be compromised.

### **5.6.2 Reporting illness to Medical Expert**

This study showed that majority of the respondents 154 (50.7%) report illness to medical expert as against 3 (1%) surprisingly never reported illness to medical expert. One of the ways to prevent transmission of communicable diseases is to report illness to medical expert or hospital for early detection and treatment. Infections can be hidden in the human system without showing any signs and symptoms. Food vendors who never reported illness to medical expert are capable of spreading disease to consumers who patronized their food. This study is consonance with a study conducted by Abera et al., (2010) at Bahir Dar town among food handlers indicated that most of them were infected with enteric bacteria and parasites. Good personal hygiene and food handling practices are the basis for preventing the transmission of pathogens from food handlers to the consumers.

### **5.7 Hand Washing with Soap**

Hand washing with soap and clean water is one of the most important ways of preventing communicable diseases. Hand washing with soap has proven to be an effective way of removing microbial organisms from hands. This study showed a significant proportion of the respondents, 159 (52.3%) wash their hands with soap all the time, thus before preparing food and after preparing food. This study is conducted during the era of the COVID-19, where hand

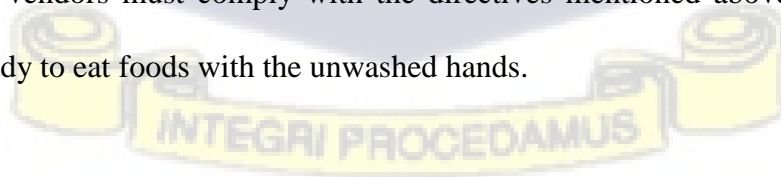
washing with soap was the order of the day. This is a good habit practiced and appreciable, 52 (17%) of the respondents admitted that they sometimes wash their hands.

Code of hygiene practice for food service establishment in the hospitality industry by FDA/FSMD /CP-2013/03 stipulates that,

Food service employees shall keep their hands and exposed portions of their arms clean by thoroughly washing their hands and the exposed portions of their arms (or surrogate prosthetic devices for hands or arms) with soap and warm water, including lathering bands for at least 20 seconds. This includes immediately,

- before putting gloves on
- after using tobacco products
- before or after eating
- before starting work
- upon reentering the kitchen and
- after using the washroom or being potentially contaminated by other means, shall not clean their hands in a sink used for food preparation, ware washing or in a service or a curbed cleaning facility used for the disposal water and similar liquid waste.

Therefore food vendors must comply with the directives mentioned above in order not to contaminate ready to eat foods with the unwashed hands.



## **5.8 Level of Street Food Vendors Knowledge on Food Borne Disease**

### **5.8.1 Knowledge of Street Food Vendors on Food Borne Diseases**

Knowledge and attitude are indicators used to measure food vendors understanding of diseases that are associated with food which includes the selection, preparation and serving of foods to consumers. When respondents were asked to identify the type of disease that mostly associated with consumption of contaminated foods in an environment, majority 256 (84.4%) indicated diarrhoea as the major disease associated with food contamination, 21 (6.8%) indicated HIV as a major disease associated with contaminated foods, 22 (7.3) surprisingly indicated gonorrhoea and malaria as a major disease associated with contaminated foods. This study supports a study conducted by Tjoa et al. (1997) have confirmed the role played by unwholesome meat in the causation of disease.

They recommended that food vendors should receive education on food hygiene and moreover special attention be given to the causes of diarrhea, transmission of diarrhea pathogens, the handling equipment's and cooked food, hand washing practices and environmental hygiene.

This study however different from the study done by Azanza, Gatchalian, and Ortega (2000). Topics such as health and personal hygiene of vendors, food manufacturing procedures, food contamination and waste management as well as food legislations were assessed. The study found that among the 54 street food vendors surveyed, knowledge on food safety concepts was established particularly on topics that dealt with health and personal hygiene, food contamination and good manufacturing procedures; however, vendors were shown not to be knowledgeable in food legislation and waste management.

### **5.8.2 Knowledge of Street Food Vendors on Microorganisms**

Microorganisms are always present everywhere mostly where nutrients are present. There are various microorganisms that causes food contamination. This study showed majority 253 (83.4%) have identified bacteria as one of the major microorganism group that cause food contamination, 40 (13.4%) identified viruses, 9 (2.9%) and 2 (0.5%) identified protozoan and fungi respectively as pathogens that causes food contamination. This implies that majority of the vendors have knowledge about bacteria been the major cause of food contamination. This study was in conformity with a study done in Ghana by Mensah, Yeboah- Manu, Owusu-Darko and Ablordey (2002), carried out a study entitled, Street food in Accra, Ghana how safe are they? The study investigated the microbial quality of food sold on street of Accra and factors predisposing food to contamination. They found out the 177 street vendors 79 (66.7%) were educated and these vendors exhibited high knowledge and good hygiene behavior. The surroundings of the vending sites were clean but some sites (3.4%) were classified as very dirty.

### **5.8.3 How Cooked Food is Handled**

Cooked foods are ready to eat foods and for that matter must be handled properly in order to prevent contamination by hands. This study showed majority of the vendors 124 (41%) handled cooked foods with a spoon, 102 (33.7%) handled cooked foods with a ladle, 73 (23.9%) handled cooked foods with bare hands. This study was in contrast with the study conducted by Abera et al., (2010) at Bahir Dar town among food handlers indicated that most of them were infected with enteric bacteria and parasites due to poor handled of cooked foods. Good personal hygiene and food handling practices are the basis for preventing the transmission of pathogens from food handlers to the consumers.

This study different to a study by Burt, Volel and Finkel (2003), conducted study to assess the food handling practice of 10 processing mobile food vendors operating in Manhattan, New York City and found out that over half of all vendors (67%) contacted served food with bare hands.

### **5.9 Ways by which Food can be Prevented from Contamination**

A USA- based study suggested that improper food handling practices contributes to about 99% of food borne illness in food services establishment and home. (Howes M, McEwen S, Griffiths M, Harris L. 1996). Therefore, to reduce foodborne illness, it is crucial to practice good personal hygiene.

Knowledge by which food can be prevented from contamination was identified among the street food vendors in this study. Majority of the vendors 111 (36.60%) indicated that practice of personal hygiene, protecting food from flies, protecting food from dust are the best ways of preventing food from contamination, 21 (6.80%) indicated that protecting food from dust will prevent food contamination, 59 (19.80%) indicated that protecting food from flies alone is the best way of preventing food from contamination, only a few respondents 5 (1.50%) who actually indicated that they don't know ways by which food can be prevented from contamination. From the findings, it implies that a good number of the respondents have the knowledge by which food can be prevented from contaminations. Therefore contamination of cooked foods by these vendors would be reduced.

### **5.10 Temperature of Water Used in Sterilization**

The serving utensils used at the vending site are often contaminated with *Micrococcus spp.* and *Staphylococcus aureus spp.* which may have originated from the vendors hands when they touched the food preparation areas, dishcloths, or the water during dish washing or hand washing which indicates cross contamination between dishwater, food preparation

surfaces, and the food itself. It is reported that dirty dish washing water and other sources adhere to the utensil surface and can constitute a risk during the food vending process (Rane, 2011).

The correct temperature at which water should be boiled for sterilizing equipment very crucial in destroying microbes that hid on equipment and utensils. Majority 157 of respondents (51.7%) in this study indicated they have no idea of the correct temperature used for sterilizing tools. 33 (10.70%) and 101 (33.20%) have indicated 82<sup>0</sup>C and 50<sup>0</sup>C respectively. This finding indicates that majority of the respondents have no idea of the temperature at which tools should be sterilized which is a recipe for contamination of food because pathogens need to be destroyed under high temperature 80-100 <sup>0</sup>C. Boiling at 100<sup>0</sup>C for 30 minutes is done in a water bath. Knives and other tools used in the food industry may be sterilized by this method, all bacteria and certain spores are killed. .

### **5.11 Relationship between Age and Personal Hygiene Practices**

A person age and personal hygiene practices have nothing to do in common. This study showed no significant relationship between the two variables. This implies that the age of a food vendor does not necessarily implies that the vendor will maintain good personal hygiene practices. The chi-square test showed that the p-value which is 0.23 establishes that the relationship between the variables is not significant. The findings showed that age has nothing to do with good personal hygiene practices.

### **5.12 Relationship between Sex and Personal Hygiene Practices**

The findings of this study showed that there is no relationship between the sex of a vendor and personal hygiene practices. This implies that, being a male or female does not guarantee good personal hygiene practices, only that the female vendors in this study are more than the males. The chi-square test showed that ( $X^2 = 10.85 , p > 0.05$ ). Therefore a male can practice good

personal and a female can also practice good personal hygiene, and again a male can have a poor personal practices practices and a female can also have poor personal hygiene practices.

### **5.13 Relationship between Marital Status and Personal Hygiene Practices**

The findings of this study showed a significant association between the two variables. This implies that those street food vendors who are married had good personal hygiene practices than those who are not married. It can also be deduced from the study that since married food vendors especially women have the responsibilities of preparing food for the husbands at home, there is a tendency of applying the hygiene skills at their vending premises. The chi-square test showed the association between the variables ( $X^2 = 20.12, p < 0.05$ ). This implies that the relationship that exists between marital status and personal hygiene is significant. Consequently, the relationship between these variables is significant at 5% alpha level ( $P < 0.000$ ). Therefore, these women are likely to exhibit the habits of good personal hygiene practices into the food they prepared for public consumption.

### **5.14 Relationship between Educational Qualification and Personal Hygiene Practices**

The findings of this study showed a statistically significant relationship between the two variables. This findings implies that street food vendors with higher educational qualification practices good personal than those with lower or no formal education. This study was in line with the study done by Mensah et al., (2002) on the safety of street foods in Accra to purposely investigate the microbial quality of foods sold on streets of Accra and factors predisposing to their contamination. Structured questionnaires were used to collect data from 117 street vendors on their vital statistics, personal hygiene, food hygiene and knowledge of foodborne illness.

Findings from the study indicate that most vendors were educated and exhibited good hygiene behavior. Education is a key factor that contributes to a person's ability to understand

things and applied them appropriately. The chi-square test showed statistically significant relationship between the variables of ( $X^2 = 14.51, p < 0.05$ ).

### **5.15 Relationship between Attaining Food Hygiene Training and Personal Hygiene Practices**

The findings from the study showed that there is no association between attaining food hygiene training and personal hygiene practices. This implies that vendors who attended training on food hygiene practices does not guarantee them that they would exhibit good personal hygiene practices. The findings also implies that attaining training alone does not matter, but the ability to put what is learnt into practices that will make the impact. The chi-square test showed ( $X^2 = 7.63, p > 0.05$ ). Implying, a street vendor attending food does not guarantee a clean environment. An insignificant value of (0.07) indicates that the relationship between the variables is insignificant. Notwithstanding this, there is a need for street food vendors to acquire training on hygiene practices and how to keep their environment clean through training such as workshops and seminars.

### **5.16 Relationship between Use of Waste Bins and Clean Environment**

The findings showed that there is a significant association ( $p < 0.05$ ) that exist between the two variables i.e (waste bins and clean environment). This means that where there are uncovered waste bins in the presence of food premises it rendered the selling environment unclean. Because waste bins served as a breeding ground for flies that can transmit disease causing microorganisms.

This study compare favorably with a study done by FAO (1995) shows that liquid and solid waste were disposed at food establishment. They were of the view that foods should be prepared in places far away from the sources of contamination such as rubbish, wastewater and

animals. The findings was supported by FDA/FSMD/CP-FSE/2013/03 regulations regarding sanitary keeping of vending premises includes:

1. Receptacles and waste handling units for refuse recyclables, and returnable shall be kept covered.
2. A storage area and enclosure for refuse, recyclable, or returnable shall be maintained clean and free of items unnecessary to the operation or maintenance of the establishment.
3. Receptacles and waste handling units for refuse, recyclable, and returnable used with materials containing food residue and used outside the food establishment shall be designed and constructed to have tight-lids, doors and covers.

However, the chi-square test showed ( $X^2 = 10.85, p < 0.05$ ). and with the significant value of ( $P = 0.002$ ), it implies that the association is significant. The sanitary condition of a vending premises is very important, so if the sites where they sell food is full of refuse there is a possibility of contamination to occur.

### **5.17 Relationship between Choice of Selling Site and Clean Environment**

The food vending premises determines the clean environment, this study showed a significant relationship between the variables. This implies that if the selling sites is dirty it would have negative effects on the food been sold to consumers.

This study showed that street foods sold along an open drain, food sold at a place where waste bins are open to flies and selling at nearby refuse dump sites are all indications that the vending sites is not clean.

It is prudent that the choice of selling sites must be cleaned and free from disease causing microorganisms. Poor sanitation continues to be a major environmental challenge and a

contributing factor to food contamination in Africa as food vendors operate under varying degrees of environmental challenges. In most cases, the authorities mandated to oversee their activities are not able to do so due to various reasons ranging from lack of manpower to equipment to work with. Unhygienic environment is breeding place for houseflies and other disease causing microbes hence the need for food vendors to operate within a clean environment. ( $X^2 = 30.04, p < 0.05$ ). The chi-square test result indicates that there is a significant relationship between the variables under study.

### 5.18 Microbial Content of Some Selected Foods

A study conducted by Feglo and Sakyi (2008) among street food vendors in four bus terminals in Kumasi recorded that bacterial counts on selected food like fufu, red pepper, ice-kenkey, macaroni, and salad. The isolates obtained among other bacteria were gram negative *Staphylococcus aureus*, and faecal coliforms were isolated in high levels, *Staphylococcus aureus* (3.7%) and *Escherichia coli* (2.2%).

The results of this showed similar trend with microorganisms isolated in this study. The similarity between these two studies are as a result of the fact that, food vendors operated within similar setting, their knowledge levels were similar, prevailing defective environmental and personal hygiene conditions according to the studies. This is the reason why this study isolated afore mentioned microorganisms in foods sold on the streets of A yensuano.

Again, this study is similar to Mensah et al., (2002), a study in Accra in the sense that factors such as poor environmental and personal hygiene, non- enforcement of food hygiene bye-laws, selling along gutters and poor personal hygiene practices were identified in both studies. Some of the factors create congenial atmosphere for microbes to exist or multiply. It was not surprisingly to have isolated *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi* and

*Campylobacter jejuni* in selected food such as “Kenkey” with hot pepper, “waakye”, porridge and “fried rice” samples.

Similarly, in Santo Fe de Borgo, Columbia a study conducted on a group of food vendors by Buchanan et al in 1998 and their study showed that 30% of food vendors were carriers of pathogenic microorganisms including *Salmonella typhi*, *Staphylococcus aureus*, *Salmonella enteritidis* and *Shigella*. This reflected in the high levels of *Escherichia coli*, *Staphylococcus aureus* in the foods they sold. Presence of *Escherichia coli* of faecal origin was detected in all investigated food samples. Khebab, fried fish and beans with gari had acceptable bacterial contamination levels of  $<5 \log_{10} \text{cfu/g}$ . Yeasts were found in all food items analysed. These findings were similar to the findings of this study where *Escherichia coli*, *Staphylococcus aureus*, *Salmonella typhi*, and *Campylobacter jejuni* were isolated in “Kenkey” with hot pepper, “waakye”, porridge and fried rice. The street foods were, therefore, found to contain pathogenic microorganism to can be harmful to human health. Unfortunately, food vendors in Ayensuano do not undergo all test as it happened in Bogota. However, these findings may be as a result of environmental conditions under which foods were prepared, stored and dished to customers. Stakeholder education, legislation, verifiable micro-organisms standards, inspections and environmental sanitation improvement are necessary to ensure quality standards. Begue et al 1997 sample one hundred and four food vendors to ascertain risk factors with regards to the transmission of *H. pylori* in Lima, Peru. They concluded that their findings supported the role of prepared foods under unhygienic conditions as a probable mechanisms of transmission of *H. pylori* in developing countries. This finding is similar to the findings of this study as poor environmental condition continues to be a constant factor contributing to food contamination.

### 5.18.1 Microbial Content found In Kenkey with Hot Pepper

Appetite for “kenkey” with hot pepper among Ghanaians has increased predominantly due to its cheap cost, with GHC 2.00 one can afford kenkey with hot pepper. The laboratory finding showed 23 “kenkey” samples out of 76 food samples isolated. *E. coli* and *Salmonella typhi* were the major microorganisms isolated. Lower levels of *Staphylococcus aureus* and *Campylobacter jejuni* were isolated in the “kenkey”. This implies that personal hygiene practices among street food vendors in handling “kenkey” is poor. Observations showed that majority of the kenkey sellers used their bare hands in handling the kenkey. This observation is supported by a study done by Samakupa, (2003) on street food vendors which revealed that bacteria are transferred from contaminated hands of food workers to the food and subsequently to other surfaces. Low infectious doses of organisms such as *Shigella* and pathogenic *Escherichia coli* have been linked to hands as a source of contamination (Snyder, 1998). Poor hygiene, particularly deficient or absence of hand washing has been identified as the causative mode of transmission. “Way – side” canteens and other food vendors undoubtedly are one of, if not the main source of contaminated food. Nevertheless, most of the kenkey food samples were collected from Abesua Zonal Council of the Ayensuano District Assembly.

### 5.18.2 Microbial Content found In “Waakye”

Majority, 33 out of 76 of the samples were “waakye”. “Waakye” is a very delicious meal that most Ghanaians patronize., The cost of buying waakye in Ghana is cheap. With GHC 2.00 one can afford waakye for breakfast.

This study isolated *E. coli* and *Staphylococcus aureus* for the waakye samples collected from three Zonal Councils of the Ayensuano district. However, majority of these samples were collected from Abesua Zonal Council. This study also revealed that waakye is the most contaminated samples among the four food samples collected. In Ghana it is not uncommon to

notice that most health centers are filled with patient of various ages suffering from different food related diseases. Contaminated or unhygienic food can lead to various complications and diseases.

This finding is in relation with a study by Mensah et al. (2001) on street foods which revealed that 691 food poisoning outbreaks and 49 deaths from 1983 to 1992 in Shangdong Province (China) were recorded due to the presence *E.coli*. FAO has implemented and supported several projects which aimed at improving various aspects of the street food sector in countries like Bolivia, Colombia, Ecuador, India, Zaire, etc. Malaysia, Philippines and India are the three countries which have regulations for protecting street vendors.

#### **5.18.3 Microbial Content found In Porridge**

Microorganisms are widely found in soil, water, animal and people and these microorganisms are carried on hands, wiping cloths and utensils, cutting boards and the slightest contact of these microorganisms to food can cause food borne diseases (WHO, 2012). Porridge is one of the cheapest food in the Ghanaian society and with GHC 0.50 one can buy some for breakfast. This study showed 15 porridge samples out of 76 samples isolated, the study revealed the presence of *Salmonella typhi* and *Staphylococcus aureus* pathogens.

The presence of these two pathogens are indications that the porridge samples are unsafe and contaminated. This implies that the handle of porridge not is in a proper manner.

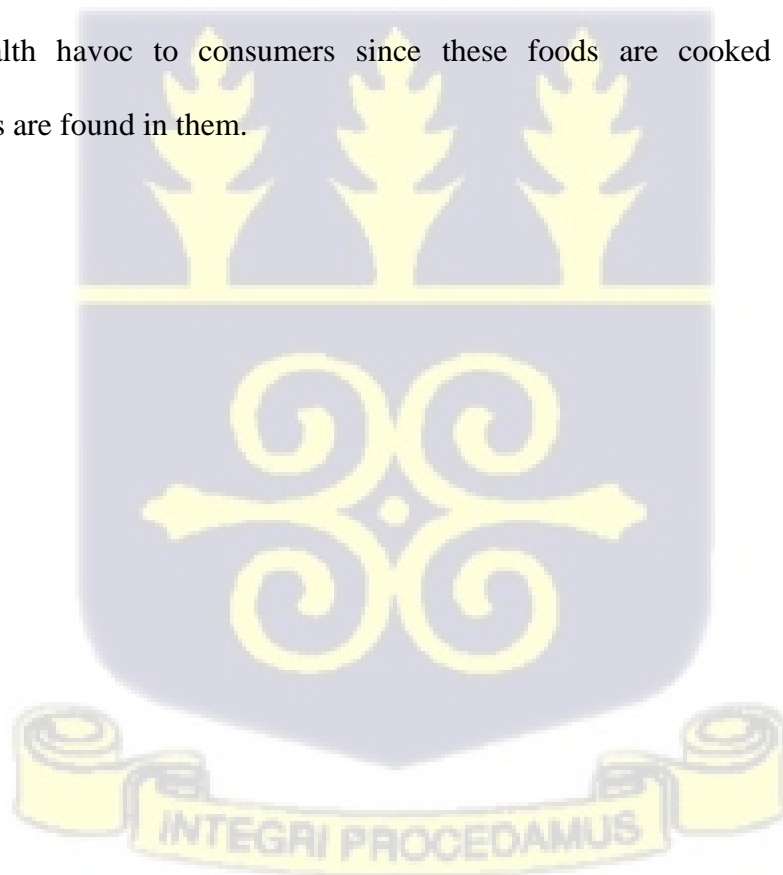
#### **5.18.4 Microbial Content found In Fried Rice**

*Campylobacter spp*, *Vibrio cholera*, *Vibriovulnificus*, *Escherichia coli* 0157:H7 and *Listeria monocytogenes* have emerged in recent years and their significance needs to be examined in relation to their possible implications for the health surveillance of food handlers. The task of the consultation FAO and WHO was therefore to review systematically those food borne diseases that may be transmitted by food handling personnel via food to the consumer, and to

determine the kinds of food contamination that can be prevented and the kind of health surveillance of such personnel necessary for the purpose. In view of the great importance of the education of food-handling personnel in preventing contamination of food, the consultation was also requested to consider ways and means of achieving this.

This study showed that 5 fried rice samples out of 76 food samples isolated, *E. coli*, *Salmonella typhi*, *Staphylococcus aureus* and *Campylobacter jejuni* pathogens from the fried rice samples collected. The demand for fried rice in the Ghanaian society is less as compared to other foods due to its cost. However, the fried rice collected in this study proved to be containing all the four food pathogens, this is a result of poor handling of the food, the source of vegetables salads used and the water used in the preparation.

On the general objective of the study, the laboratory result actually revealed the microorganism that cause health havoc to consumers since these foods are cooked ones and these microorganisms are found in them.



## CHAPTER SIX

### CONCLUSION AND RECOMMENDATIONS

#### 6.1 Conclusion

A descriptive study was conducted to investigate hygiene practices among street food vendors and microbial content of some selected foods sold at Ayensuano district. The study was structured in four core variables which included level of knowledge of food borne diseases among food vendors, personal hygiene practices of food vendors, sanitary conditions of food vending premises and the microbial content of some selected foods sold by the street vendors.

##### 6.1.1 Knowledge Level Among Street Food Vendors on Food Borne Diseases

- The study found that the level of knowledge of street food vendors on food borne diseases was appreciable.
- Majority of the vendors have knowledge on the various ways of preventing food contamination.

##### 6.1.2 Personal Hygiene Practices Among Street Food Vendors

- This study was conducted during the era of COVID-19 where hand hygiene was being promoted to most Ghanaians on regular basis.
- This study showed a significant proportion of the respondents 159 (52.3%) wash their hands with soap all the time.
- This study showed that 262 (86.3%) have undergone medical screening once in a year. However, the remaining 17% who did not wash their hands raise an important concern that require attention.

##### 6.1.3 Sanitary Conditions of Street Food Vendors Premises

- Poor environment or food vending site is a major determinant of food safety in the food vending industry.

- Majority 148 (48.8%) sell their foods along open gutter, 119 (38.5%) sell their foods in the presence of waste bins without a fitting cover.
- Majority 196 (65%) out of the 304 street food vendors who were observed had flies infested on their foods.

#### 6.1.4 Microbial Content Found in Food

- The isolated microorganism included *Salmonella typhi*, *Escherichia coli*, *Staphylococcus aureus*, and *Campylobacter jejuni* were presence in the food samples.
- The majority of the food samples that were infected mostly with the isolated micrrorganisms were “kenkey” with hot pepper and “waakye”

#### 6.2 Recommendations

Based on the findings of the study, a recommendation is made to the Ayensuano District Assembly with the view to initiate suitable intervention. The planned intervention shall be aimed at improving the personal hygiene of food vendors and improving upon the sanitation conditions under which foods are prepared and sold within the district.

A copy of the major findings of this study shall be given to the Health Department (District Health Directorate) of the AYDA. Discussions should be held with the relevant staff of the AYDA in order to facilitate the implementation of findings of this study.

Based on the findings of this particular study, the following recommendations are made to the authority of the AYDA in order to improve overall efficiency and effectiveness of the food vending industry.

#### District Assembly

1. The District Assembly must increase awareness about the benefits of observing proper food hygiene practices by food vendors.

2. The District Assembly should focus on health education on personal and environmental hygiene in collaboration with the Health Directorate of AYDA for food vendors at every quarter. This recommendation, when implemented will help improve the practice of personal and environmental hygiene.
3. Licensed street food vendors must be provided with facilities by the District Assembly for conducting their trade since some of the street vendors do not sell under decent environmental conditions.
4. The District Assembly should provide incentives (award system) for food vendors who are doing a good job in terms of personal and environmental hygiene.

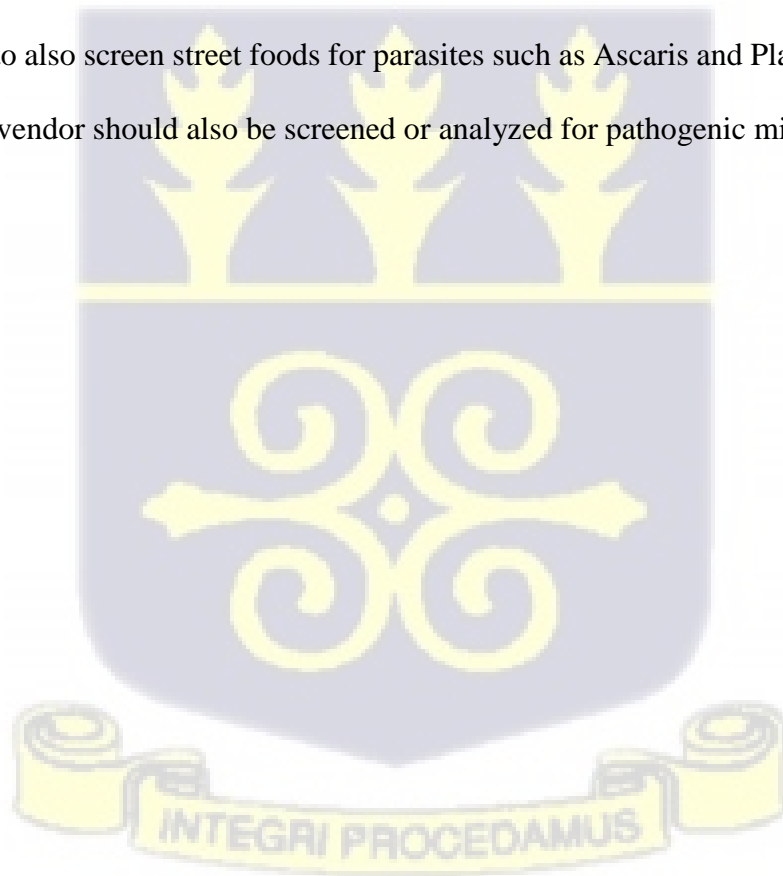
#### **The Environmental Health Unit -AYDA**

5. The Environmental Health Unit should promote improved methods of preparing and selling food through the available media houses in order to reach most of the food vendors to improve upon the food vendor' knowledge on food preparation.
6. The Environmental Health Unit should organize medical screening for food vendors in the district at least two (2) times in a year and the law ensuring it must be enforced. This recommendation,when implemented will improve upon the number of food vendors who have been screened to work in the food vending industry and will reveal vendors carrying infectious diseases as well.
7. The Environmental Health Unit must enforce the Public Health Law of ACT 851 (ACT 2012) as well as the by- laws of the District Assembly on recalcitrant food vendors who flout the regulation regarding cleanliness of vending premises.

8. Monitoring activities should be put in place by the EHSU quarterly for check screening of food vendors who sell at night and refused to comply with food vending regulations and obtaining license before operating as a vendor.

### **The Government of Ghana**

9. The Government of Ghana should invest more in the street food industry as it provides employment, cheap food, and wide variety of foods for the urban dwellers.
10. The Government should provided more logistics to the various agencieswho regulate the activities of the street food industry.
11. This study screened the food for bacteria contamination. It will be beneficial for future studies to also screen street foods for parasites such as Ascaris and Planaria. The hands of food vendor should also be screened or analyzed for pathogenic microorganisms.



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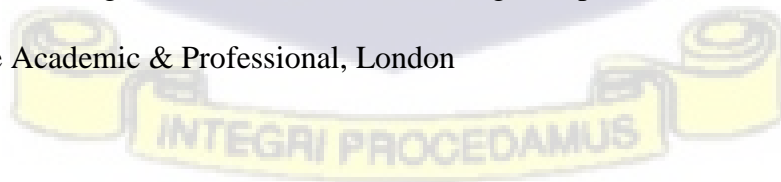
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**APPENDIX (1) ONE**  
**QUESTIONNAIRE FOR FOOD VENDORS**

**INSTITUTE FOR ENVIRONMENT AND SANITATION STUDIES, UNIVERSITY OF**  
**GHANA, LEGON.**

Dear respondent,

The researcher is a student of University of Ghana, Legon, Institute for Environment and Sanitation Studies.

This questionnaire is intended to investigate hygiene practices among street food vendors at Ayensuano District. The results are purely meant for academic purpose and will be treated with utmost confidentiality. You are hereby requested to feel free to give the most appropriate answer.

From section A to E please tick (✓) appropriately in the space provided and fill in where necessary.

Thank you for your time and cooperation

**SECTION A: Personal Information**

1. Age

(a) 18-25  (b) 26-33  (c) 34-41  (d) 42 and above

2. Sex

(a) Male  (b) Female

3. Marital Status

(a) Single (b) Married  (c) Divorced/Separated  (d) Widowed

4. Education Qualification

- (a) No formal education
- (b) Primary
- (c) JHS
- (d) SHS
- (e) Tertiary

5. For how long have you being selling?

- (a) Less than 2 years
- (b) 3-4 years
- (c) 5-6 years
- (d) Over 6 years

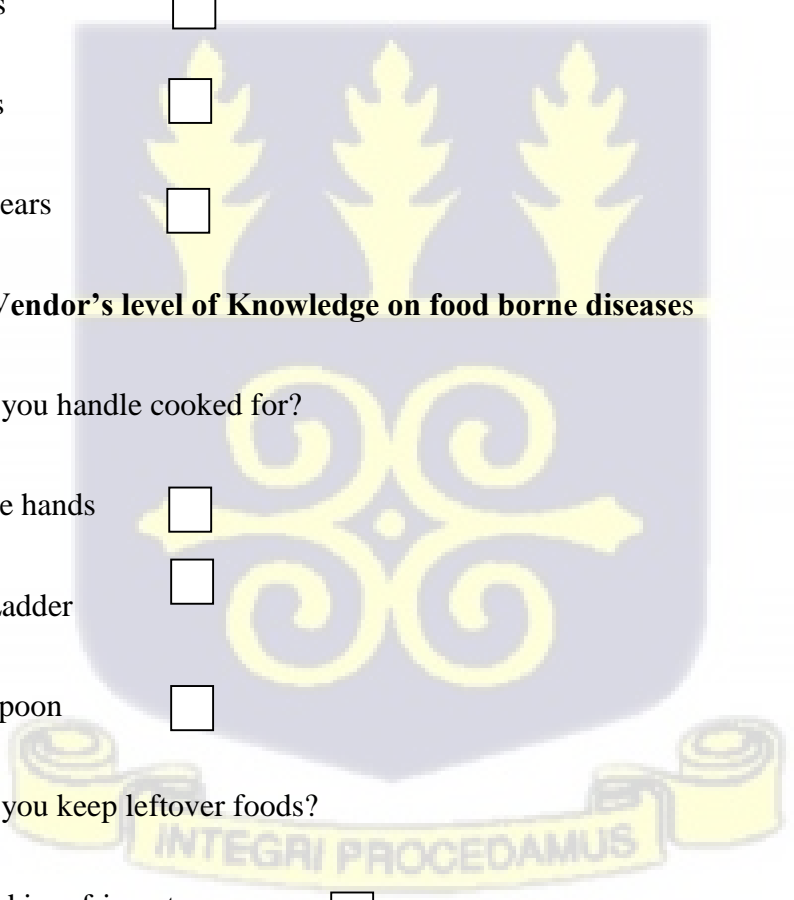
**SECTION B: Vendor's level of Knowledge on food borne diseases**

6. How do you handle cooked for?

- (a) With bare hands
- (b) With a Ladder
- (c) With a Spoon

7. How do you keep leftover foods?

- (a) Kept food in refrigerator
- (b) Kept food in a Pan



(c) Kept food in a Kitchen

(d) Reheat

8. How often do you sterilize your cooking utensils?

(a) Once a Week

(b) Once a Month

(c) Once in three months

(d) Not at all

9. In handling raw food and cooked food how do you handle them?

(a) Mixed raw food with cooked food

(b) Separate raw food from cooked food

(c) Store raw food in different place

10. How often do you disinfect cutting boards after each use?

(a) Always

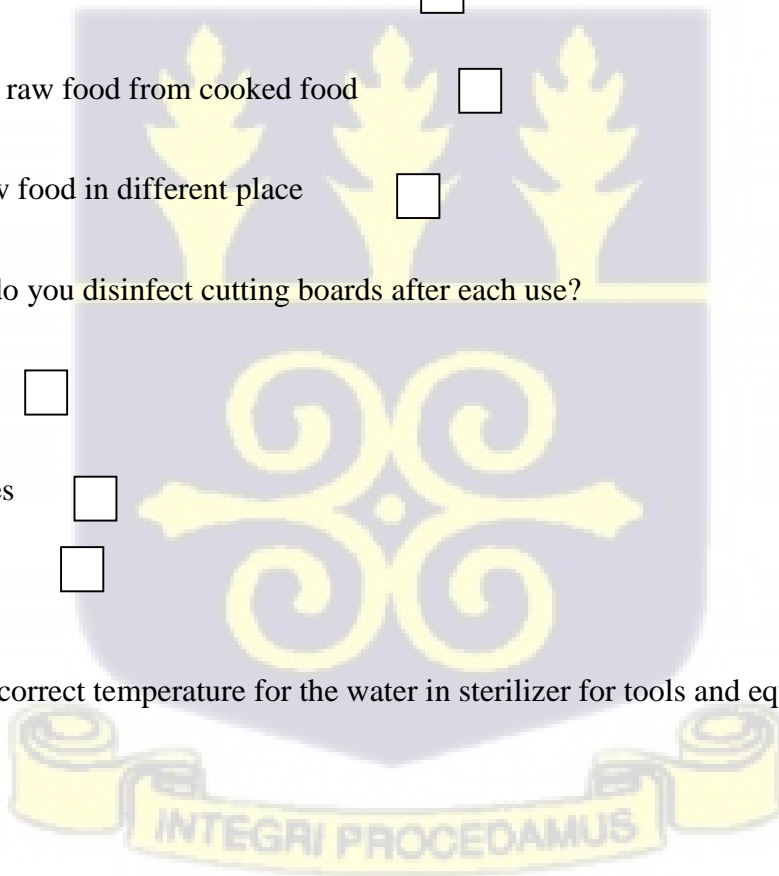
(b) Sometimes

(c) Never

11. What is the correct temperature for the water in sterilizer for tools and equipment used at the kitchen?

(a) 82°C

(b) 0°C



(c) 50°C

(d) Don't know

12. Which of these following ways can prevent food contamination?

(You can choose more than one possible answer)

(a) Practice of personal hygiene

(b) Protecting food from flies

(c) Protecting food from dust

(d) Don't know

(e) Other.....

13. When was the last time you went for training on food hygiene practice?

(a) Last month

(b) Last months

(c) Three month ago

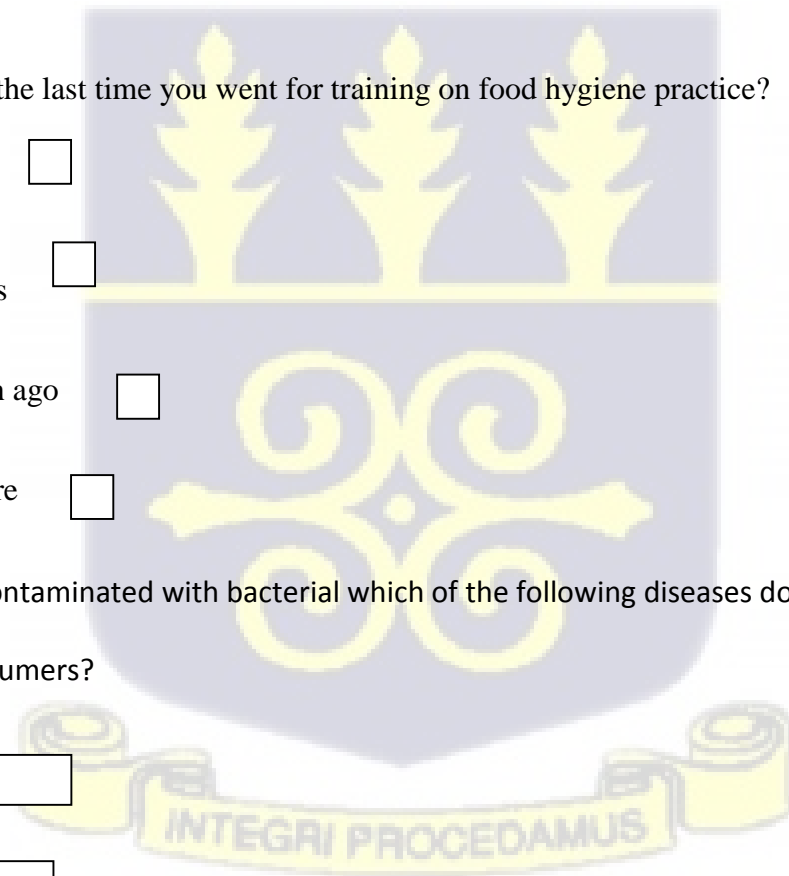
(d) Never before

14. If food is contaminated with bacterial which of the following diseases do you think can affect the consumers?

(a) Diarrhea

(b) Malaria

(c) HIV



(d) Gonorrhoea

15. Which of the following microorganism do you think can affect food consumption mostly?

(a) Bacteria

(b) Viruses

(c) Fungi

(d) Protozoan

16. In what ways do you think food hygiene training will help you?.....

**SECTION C: Personal hygiene practices by food vendors**

17. Do you wash your hands before touching unwrapped raw food?

(a) Always

(b) Sometimes

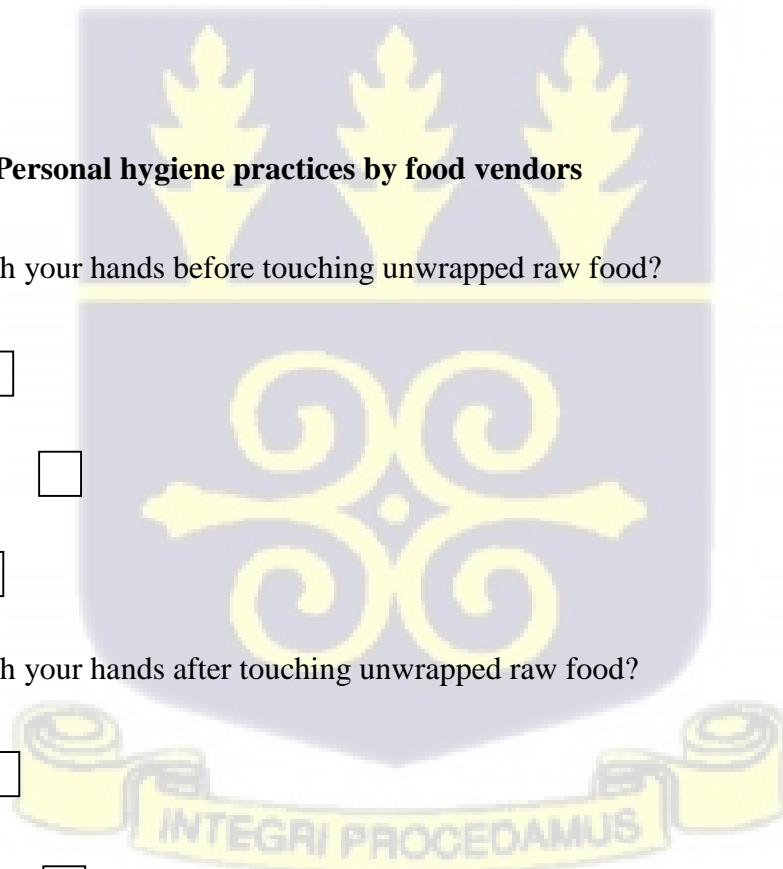
(c) Never

18. Do you wash your hands after touching unwrapped raw food?

(a) Always

(b) Sometimes

(c) Never



19. Do you wash your hands before touching cooked foods?

(a) Always

(b) Sometimes

(c) Never

20. Do you wash your hands after touching cooked foods?

(a) Always

(b) Sometimes

(c) Never

21. Do you use a handkerchief or tissues when suffering from a cold?

(a) Always

(b) Sometimes

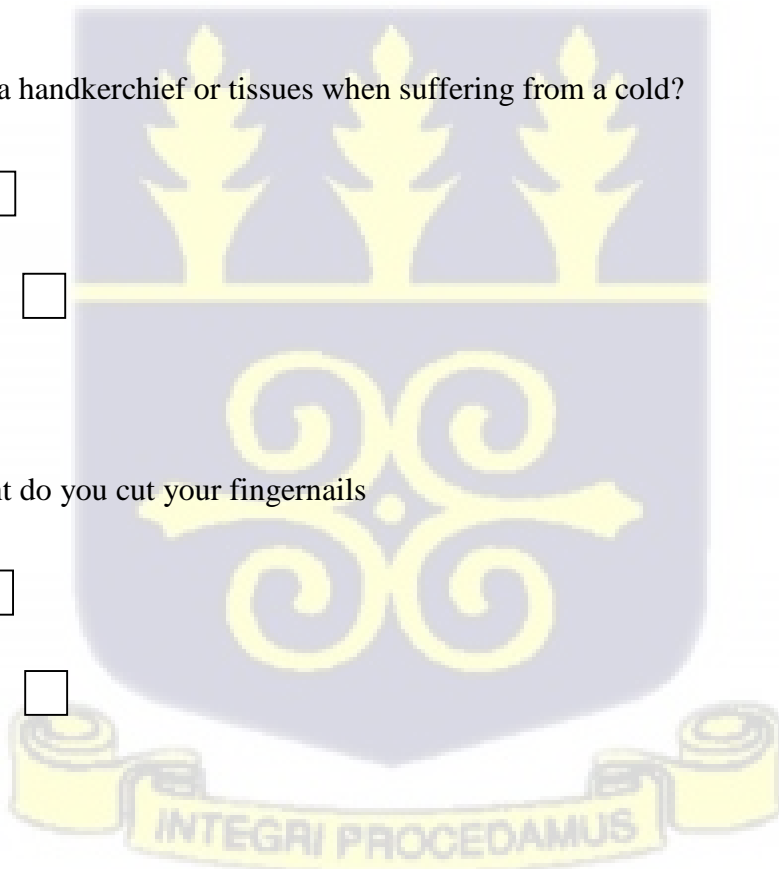
(c) Never

22. How frequent do you cut your fingernails

(a) Always

(b) Sometimes

(c) Never



23. When washing your hand how do you do it and what do you use to wash your hands?

(a) Wash hands without soap

(b) Wash hands in a bowl with soap

(c) Wash hands under tap without soap

(d) Wash hands under tap with soap

24. Having washed your hands, how do you dry your hands?

(a) Dry hands with handkerchief

(b) Dry hands-on clothing

(c) Dry hands under warmer

(d) Don't dry hands

25. How often do you wash your hands after selling?

(a) Always

(b) Sometimes

(c) Never

26. Availability of soap at selling place?

(a) Always available

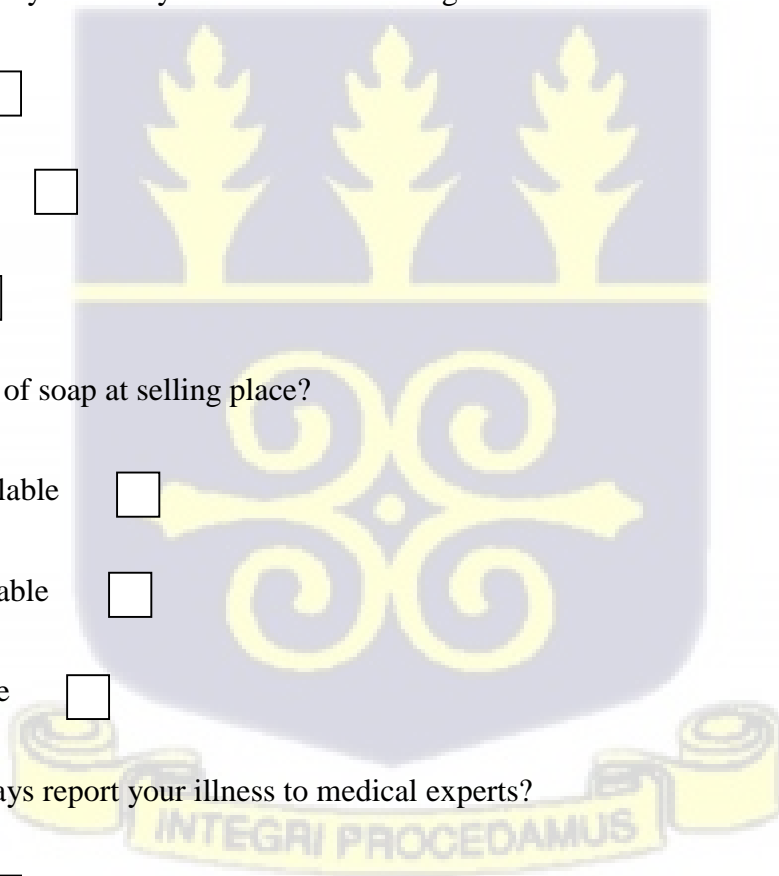
(b) Rarely available

(c) Not available

27. Do you always report your illness to medical experts?

(a) Always

(b) Sometimes



(c) Never

28. How often do you undergo medical screening of food vendors?

(a) Once a year

(b) Once every two years

(c) Not at all

**SECTION D: Sanitary condition of vending premises**

29. How often do you clean your table?

(a) Always

(b) Sometimes

(c) Never

30. What is the physical appearance of the site?

(a) Neat

(b) Partially neat

(c) Not neat

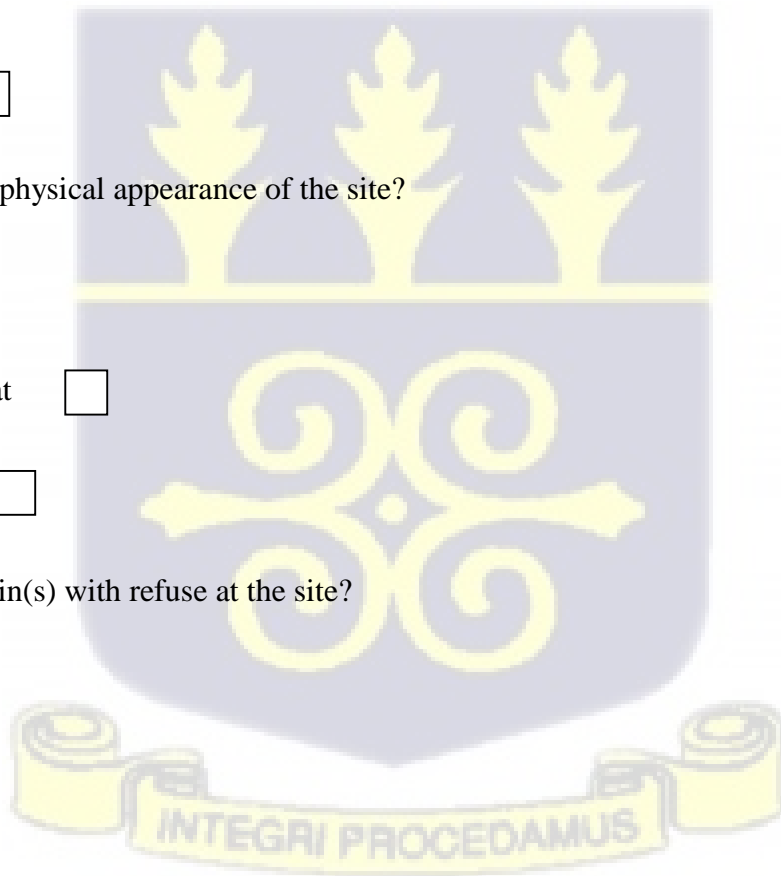
31. Are waste bin(s) with refuse at the site?

(a) Yes

(b) No

32. If yes, what is the state of the waste bin

(a) Waste bin with a felting cover



(b) Waste bin without a felting cover

(c) Waste bin partially covered

(d) Waste bin exposed with flies

33. What is the nature of selling tables?

(a) Tables with no-fly proof net

(b) Tables with fly proof net

(c) Tables with dust

34. How often do you disinfect your kitchen

Ans.....



**SECTION E: Observation checklist**

35. Do the vendors cover their heads?

(a) Hair covered

(b) Hair not covered

36. Do the Vendor wear aprons?

(a) Yes

(b) No

37. Do the vendor have hand washing basin at the selling premises?

(a) Present

(b) Absent

38. Are flies hovering on food?

(a) Present of flies

(b) Absent of flies

39. Do vendor talk while selling?

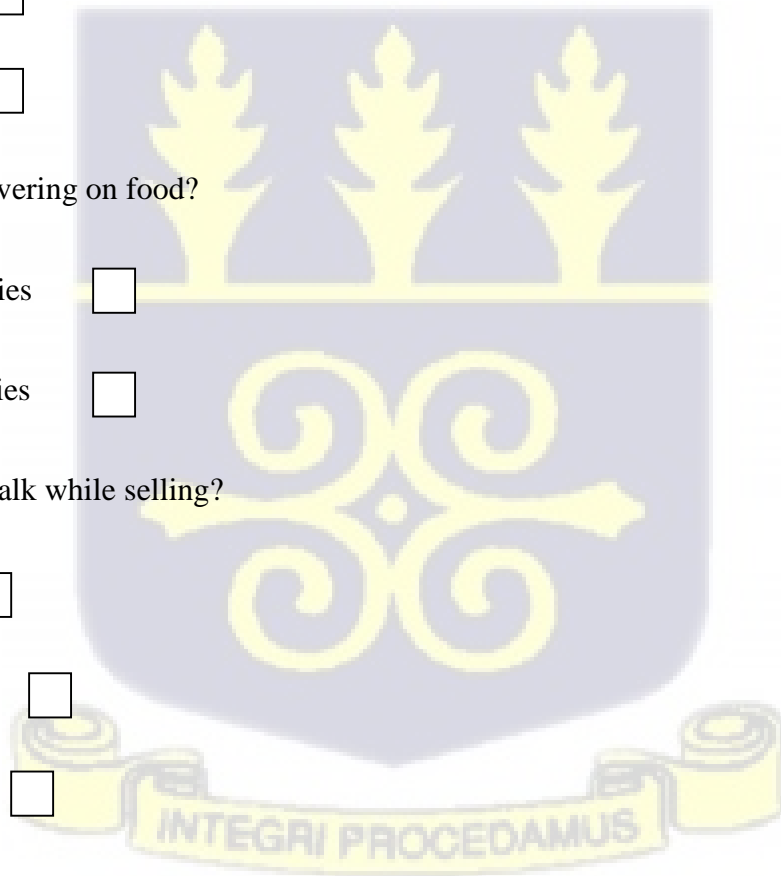
(a) Always

(b) Sometimes

(c) Not at all

40. What is the nature of fingernails of vendors?

(a) Very long with dirt



(b) Long with dirt

(c) Short

41. Do vendors put on artificial nails?

(a) Yes

(b) No

42. Where do the vendor selling food?

(a) Presence of nearby refuse dump site

(b) Selling along a public gutter

(c) Presence of waste bin with refuse

43. Do the vendor has cuts on the hand?

(a) Evidence of cut on hand

(b) Absence of cut on hand

44. What is the number of selling plate?

(a) Adequate

(b) Not adequate

THANK YOU





**UNIVERSITY OF GHANA**  
**INSTITUTE FOR ENVIRONMENT AND SANITATION STUDIES**

Ref. No.: IESS. AC 13/03/ 10803542

01 March 2021

The District Chief Executive  
Ayensuano District Assembly  
Eastern Region

Dear Sir / Madam,

**LETTER OF INTRODUCTION**  
**MR. BRIGHT YAO GBEDZE**

This is to introduce to you Mr. Bright Yao Gbedze (Student ID: 10803542), a second year MPhil Environmental Sanitation student at the Institute for Environment and Sanitation Studies (IESS), University of Ghana, Legon, Accra.

Mr. Gbedze research project topic is 'Investigating hygiene practices among street food vendors and microbial content at Ayensuano District'.

To achieve some aspect of his objective, Mr. Gbedze will need data for his research. He is requesting for data on hygiene practices, and any other information relating to his topic. The data collected will be used for research purposes only.

I am appealing to your organization to assist the student to obtain the data needed for the research. Your assistance will be highly appreciated as it contributes to a successful research.

Thank you.

Yours faithfully,

Prof. K. Appeaning Addo  
Director

COLLEGE OF BASIC AND APPLIED SCIENCES

P. O. Box LG 209, Legon, Accra, Ghana

• Telephone: +233 (0) 302 962 720 / 302 977 972 / 302 966 976

• Email: [infoieess@ug.edu.gh](mailto:infoieess@ug.edu.gh)

• Website: [www.ug.edu.gh](http://www.ug.edu.gh)



**UNIVERSITY OF GHANA**  
**ETHICS COMMITTEE FOR BASIC AND APPLIED SCIENCES (ECBAS)**

*P. O. Box LG 1195, Legon, Accra, Ghana*

Ref. No: ECBAS 066/20-21

Mr. Bright Yao Gbedze  
Institute for Environment and Sanitation Studies  
University of Ghana  
Legon, Accra

28<sup>th</sup> October, 2021.

Dear Mr. Gbedze,

**ECBAS 066/20-21: INVESTIGATING HYGIENE PRACTICES AMONG STREET FOOD VENDORS AND MICROBIAL CONTENT AT AYENSUANO DISTRICT**

This is to inform you that the above referenced study has been presented to the Ethics Committee for Basic and Applied Sciences for a full board review and the following actions taken subject to the conditions and explanation provided below:

<b>Expiry Date:</b>	21/08/2022
<b>On Agenda for:</b>	Initial Submission
<b>Date of Submission:</b>	22/07/2021
<b>ECBAS Action:</b>	Approved
<b>Reporting:</b>	Annually

Please accept my congratulations.

Yours sincerely,

Professor Daniel Bruce Sarpong  
ECBAS Chairperson





PICTURE (A) Exposed fried fish being sold at night



PICTURE (B) The researcher collecting food sample



PICTURE (C) kenkey with fried fish exposed to flies that's not protected



PICTURE (D) The researcher collecting kenkey sample





PICTURE (E) the researcher extracting the DNA at the laboratory



PICTURE (F): The Researcher interacting with a food vendor selling in an open space.



PICTURE (G): A food vendor cooking and selling food in an open space.