

UNIVERSITY OF CAPE COAST

FOOD VENDING HYGIENE PRACTICES IN THE BOLGATANGA
MUNICIPALITY OF THE UPPER EAST REGION

BY

OPHELIA PHILOMENA AOVARE

This thesis submitted to the Institute for Development Studies of the Faculty of Social Sciences, College of Humanities and Legal Studies, University of Cape Coast in partial fulfillment of the requirements for the award of Master of Philosophy Degree in Development Studies

FEBRUARY 2017

DECLARATION

Candidate's Declaration

I hereby declare that this thesis 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.

Candidate's Signature.....Date.....

Name:.....

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature..... Date:.....

Name:.....

Co-Supervisor's Signature..... Date:.....

Name:.....

ABSTRACT

The study set out to examine food vending hygiene practices among food vendors in the Bolgatanga municipality. The specific objectives were to examine the factors that influence the choice of location for food vending, examine the sanitary conditions of the physical environment of food vending, analyse the safety of food handling practices of food vendors, examine the institutional set-up governing safe practices of food vendors, and analyse the microbial content of food served by food vendors. The study used a mixed research approach, and also adopted a cross-sectional design. A total of 150 food vendors were purposively sampled from 10 communities in addition to trend of the environmental health related institutions and the health inspectors. Food samples from the vendors were sampled and subjected to microbial load analysis. The major findings of the study were that the most significant factor influencing the choice of location of food vendors is proximity to customers; the physical state of the food vending places was satisfactorily healthy; the safety of food vendors' food handling practices was compromised; the institutional set-up was not effectively promoting conformance to the food vending controls; and most of the foods were contaminated above acceptable levels for consumption. The study recommended food vendors to practice proper personal hygiene and to avoid making direct skin contact with food. The Municipal Assembly and the Food and Drugs Authority were advised to advocate for no political neutrality in their duties and to advocate for provision of logistics to facilitate inspection.

KEY WORDS

Food Hygiene

Food Handling

Food Contamination

Sanitation of Food Vending Sites

Institutional Control

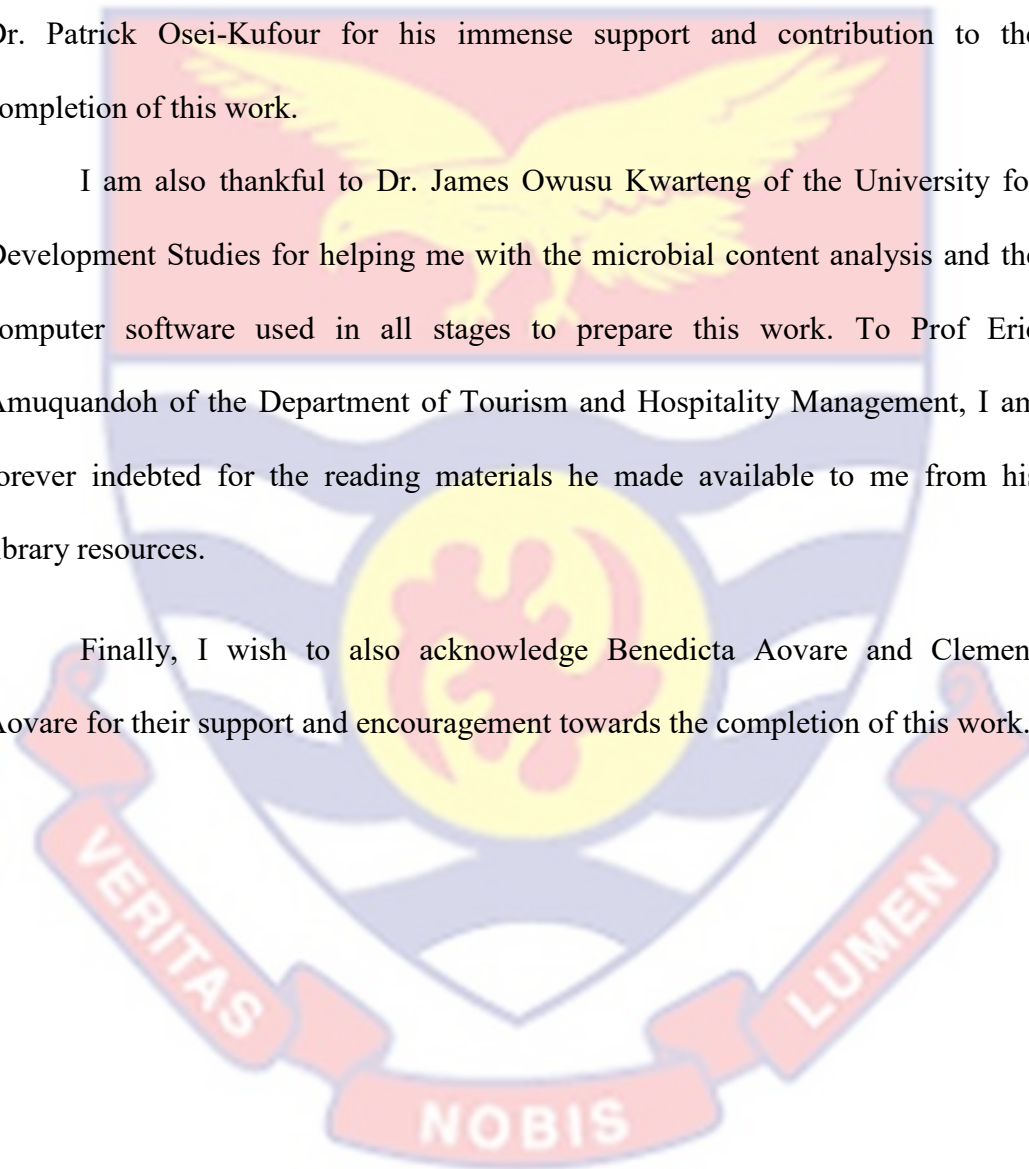


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DEDICATION

To the Aovare family of Navrongo, the Samani family of Tongo.

Especially to my children



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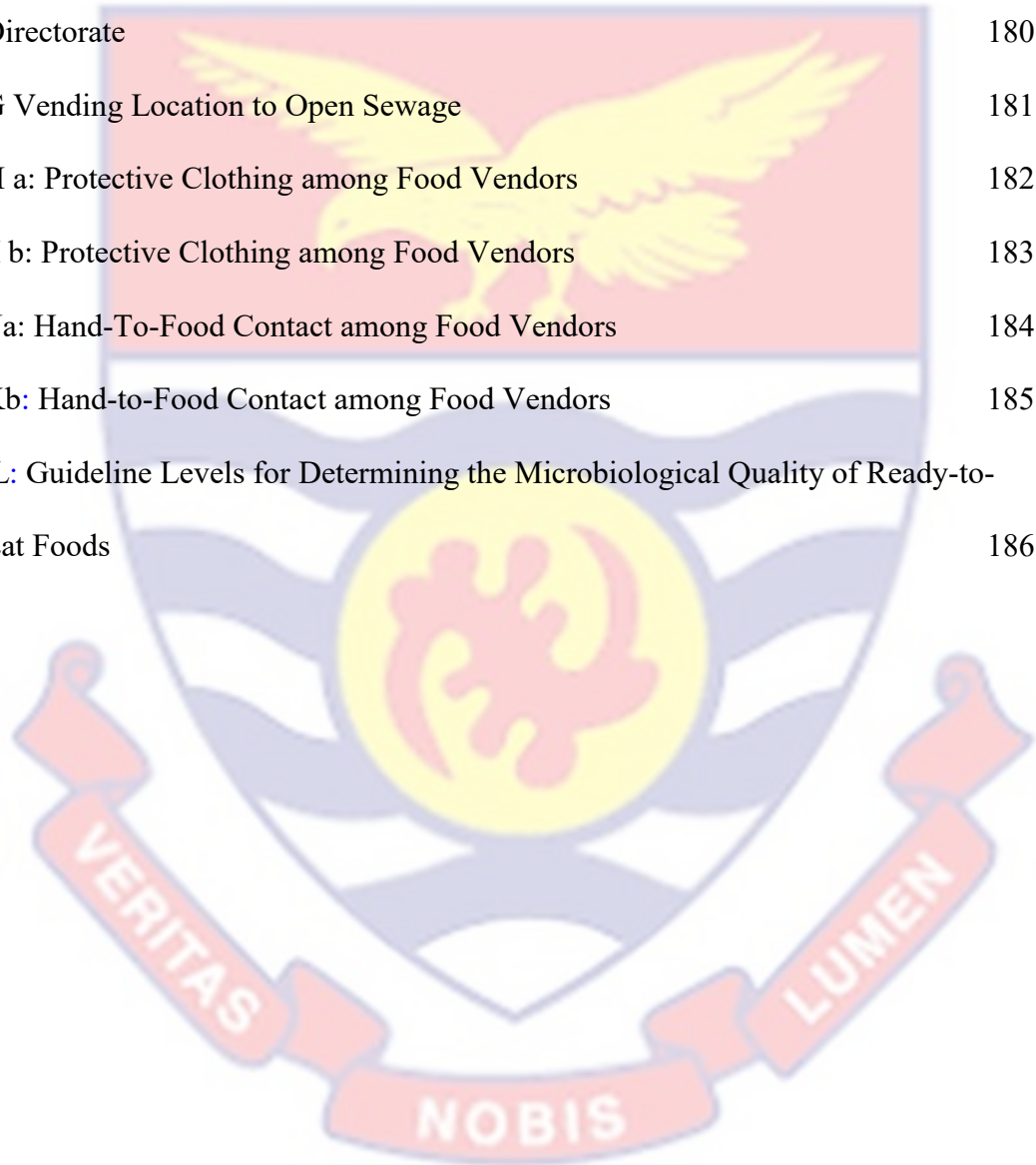
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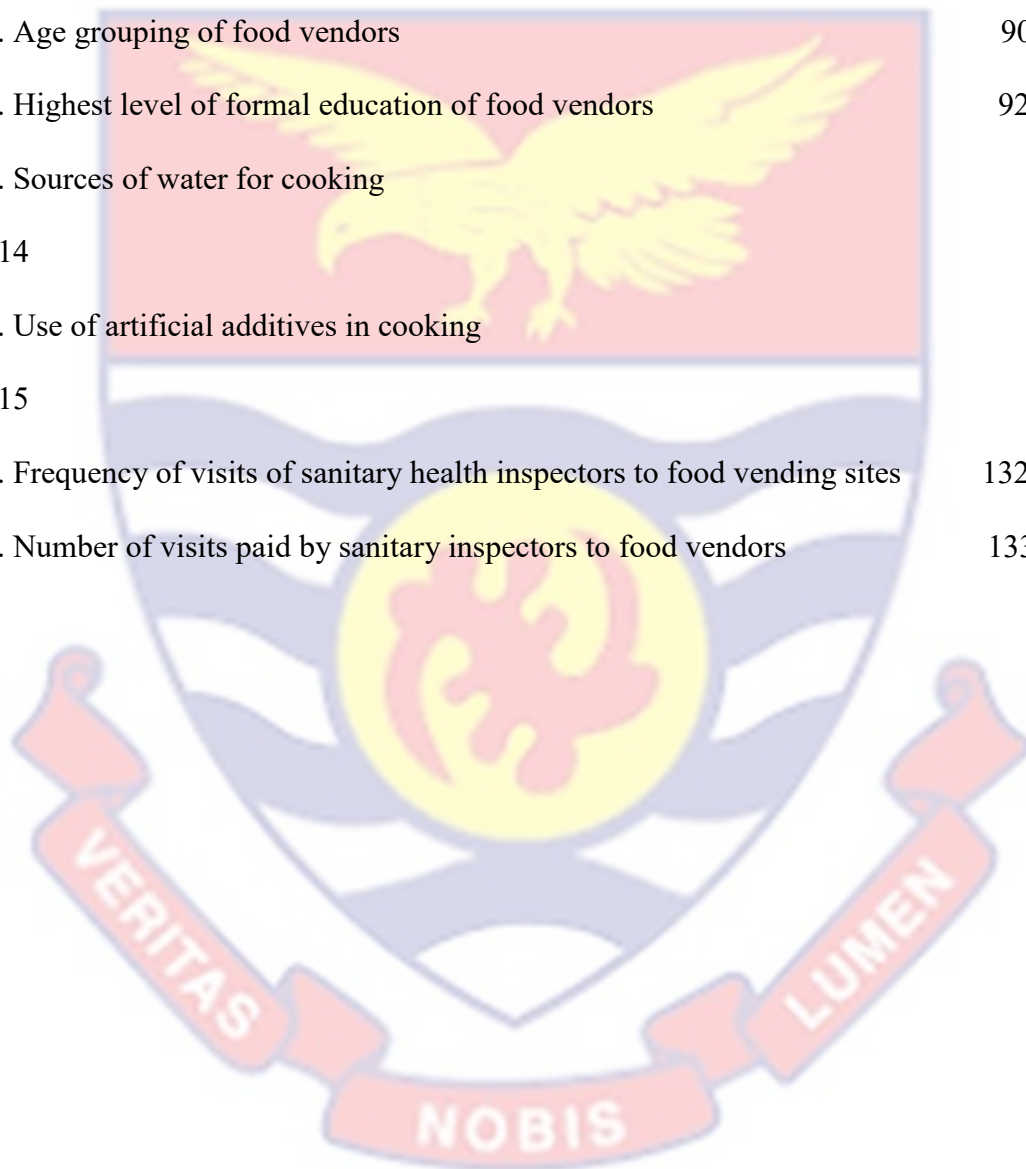
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LIST OF ACRONYMS



ANOVA	Analysis of Variance
BGS	Brilliant Green agar with Sulfadiazine
BPA	Bisphenol A
CDCP	Disease Control and Prevention
FAO	Food and Agricultural Organization
FDA	Food and Drug Authority
GSS	Ghana Statistical Service
ICMSF	International Commission on Microbiological
JHS	Junior High School
MSG	Monosodium Glutamate
MUG	Methyl-umbelliferyl- β -D-glucuronide
NSW	New South Wales in Australia
NY	New York
OPD	Out Patients Department
PBS	Phosphate-buffered Saline
PETE	Phthalates Polyethylene
PNDC	Provisional National Defense Council
RVS	Rappaport-Vassiliadis Soya peptone broth
SHS	Senior High School
	Specifications for Foods

SPSS	Statistical Product and Service Solutions
TSA	Trypticase soy agar
TSB	Tryptic Soy Broth
TZ	Tuozaafe
UNDP	United Nations Development Programme
USA	United States of America
USAID	United States Agency for International Development
UV	Ultra Violet
VRBGA	Violet Red Bile Glucose Agar
WHO	World Health Organization



CHAPTER ONE

INTRODUCTION

Background to the Study

In poverty analysis, food security and nutrition remain of global concern. Specifically, the handling and quality of food along the supply chain is a global concern because contaminants can affect the health of consumers along the chain. According to the FAO (2014), the global undernourished population is down more than 100 million over the last decade, and 209 million lower than in 1990–92. The prevalence of undernourishment has fallen from 18.7 to 11.3 percent globally and from 23.4 to 13.5 percent for developing countries. While the Millennium Development Goal of halving the proportion of undernourished people in developing countries by 2015 is within reach, another on-going concern is the quality and safety of food.

Food supply has become complex and involves a range of different stages and safety concerns involving on-farm production, slaughtering or harvesting, processing, storage, transport and distribution before the food reaches the final consumers (FAO, 2014; WHO, 2015). With regards to final consumption of food, meals are either made in homes by either household members or professional caterers (including hired helps) or they are purchased from sources outside the homestead from food vendors (Dwumfour-Asare & Agyapong, 2014).

Food vending is the practice of selling ready-to-eat food and/or drink to the public, which may take the form of cuisine in restaurants, foods prepared by inns, hotels and commercial accommodation, as well as street food (Higman,

2012). According to Kaufman (2006), food vending had its origin in Greece, where poor urban residents of ancient Rome bought street food because their tenement homes did not have ovens or hearths (Higman, 2012). Over the years, lifestyle patterns, modernisation of occupations, professionalization of the cooking art, and general preferences for cooking have popularised food vending around the world. Food vending is now typical of urban living because urban occupations increasingly absorb women into a pattern of work which interferes with their household duties, such as cooking (Satterwaite, McGranahan & Tacoli, 2010). It is quicker and time-saving to get meals from food vendors than to prepare them at home, and there are often more assorted options available than at the household level. Moreover, economies of scale enjoyed by food vendors ensure cheaper food from vendors, and thus food vendors also offer lower costs of meals (Obi-Nwosu, Oguegbe, Joe-Akunne & Okoye, 2013).

Studies in China showed that street food safety risks are primarily due to the use of unhealthy raw materials linked to ineffective inspections, poor infrastructure at the street food vending sites and lack of sanitation knowledge among street food vendors (Liu, Zhang & Zhang, 2014; Soliman, 2012). In Manhattan, Burt, Volel, and Finkel (2003) found that over half of the vendors studied served foods with bare hands, which was a violation of the New York City Code of Health. Other studies in Nigeria (Chukuezi, 2011), Kenya (Olang'o, Olima & Leah, 2012) and India (Chirag, Lakshmi, & Avanish, 2013) have shown unhealthy and unsafe practices among food vendors.

Generally, food vendors are noted to contaminate food through poor personal hygiene, cross-contaminating raw and processed food, as well as inadequate cooking and improper storage of food.

In Ghana, street food vending is dominated by the informal sector. A few restaurant operators and cuisines in hotels are, however, registered as formalised businesses (Afele, 2006). Street food vending, in particular, is an important source of income for particularly women (Dwumfour-Asare & Agyapong, 2014). However, several reports of infections and death resulting from food contamination from food vendors have raised concerns about the safety of foods and the appropriateness of the practices through which food vendors provide ready-to-eat meals for the public.

In Sheho in the Bawku West District of the Upper East Region, GhanaWeb (2010) reported that four people died from eating contaminated street food. Monney, Adjei and Owusu (2013) found that, in Konongo, most food vendors had debris of food on their hands, do not cover their hair while serving food, do not wear aprons, and do not protect their food from flies. However, those trained on food hygiene and safety was more likely to practice safe food handling practices.

The Food and Drugs Authority (FDA) of Ghana embarked on the licensing of street food vendors in addition to the already existing operational licence for enclosed eating places. This was to help intensify the monitoring of safety practices of food vendors. However, in Tamale, Dwumfour-Asare and Agyapong (2014) observed that securing a food-vending permit did not

influence a vendor to observe at least some basic and acceptable food hygiene and safety practices. This raises concerns regarding the effectiveness of FDB's monitoring roles of food vendors.

The Upper East Region is reported to be in threat of cholera outbreaks due to open defecation and improper garbage disposal. In September, 2014, 45 cases of cholera were recorded in the Bolgatanga Regional Hospital with one death (Bolgatanga Municipal Health report, 2014). Offei-Akoto (2015) reported that in Bolgatanga, gutters are filling up with garbage, taxi ranks and other public places were littered, while food vendors sell close to these unkempt places. This raises the concern of the safety of publicly sold food and the practices they engage in to ensure that sold food are not infected by the unsanitary environment.

Statement of the Problem

By October 2014, Cholera outbreak in Ghana during that year had hit a record 17,000 cases with 150 deaths (myjoyonline, 2014). The outbreak was attributed to poor sanitary conditions across the country. Given the generally poor sanitary practices among the Ghanaian populace, food vendors require to be extra meticulous with regards to the safety and health of food sold to the public. The issue of the safety of publicly sold food is of major concern because food vendors represent a point source of possible contamination and infection of the masses. This concerns the handling of farm produce from source to the market, and also importantly, the handling, cooking and serving methods adopted by food vendors.

Appendix F shows the top ten causes of OPD attendance in Bolgatanga regional hospital. These are mainly hygiene related diseases (malaria, ARTI, skin

diseases, diarrhea diseases, anemia, typhoid, intestinal worms, eye infections, hypertension, and rheumatism). This raises concerns on the safety of publicly sold food and the practices engaged in by food vendors to ensure that sold food are not infected by the unsanitary environment

The hygienic practices of food vendors can be linked to planned behaviour regarding their cooking and food handling practices. Moreover, it has also been contended that weak institutional control encourages poor food vending practices, including the selection of poor location, usage of low grade food inputs, and other poor food handling practices. However, others also argue that the socio-economic status of vendors and localities that vendors operate influence the choices of vending locations and preferences of consumers (Boateng, 2014; Mensah, 2002). These constrains impinge on healthy choices that consumers and vendors can make. From Hirschi's (1969) proposition, it can be argued that compliance with healthy standards of food handling is conditioned by utility maximisation motives of food handlers and consumers, whereas Reckless' (1973) submission would imply that compliance to food safety standards would be influenced by the external conditions such as policies and regulatory bodies. These arguments stem from theoretical uncertainty about the underlying factors and the remedies for poor hygiene practices by food vendors, as well as the choices that consumers make regarding their choices of vendors. This study aims to contribute to the debate by drawing on empirical data within the context of the Bolgatanga Municipality.

According to Offei-Akoto (2015), sanitation in Bolgatanga, the regional capital of the Upper East Region, is questionable with a dire need for consideration by authorities and the residents of the Region. Offei-Akoto (2015) also found deteriorating sanitary conditions in public places where food vendors operate. This raises questions as to what the municipal assembly is doing regarding the reports on deteriorating environs of food vending locations. In those environs, how do food vendors keep foods safe for consumption? Are foods sold in those environs safe for consumption, per the food safety standards and accepted levels of microbial content in food? Are the food-handling methods similar for restaurants and street foods? These questions are unanswered in the context of Bolgatanga Municipality. It is based on this background that this study delves into the food vending hygiene practices and the Municipal Assembly's capacity towards improving and ensuring healthy foods sold on streets and in restaurants.

Objectives of the Study

The general objective of the study is to analyse the hygiene practices of food vendors in the Bolgatanga municipality of the Upper East Region. The specific objectives are to:

1. Examine the factors that influence the choice of location for food vending;
2. Examine sanitary conditions of the environment within which food vendors operate;
3. Analyse the safety of handling, meal and serving practices of food vendors;

4. Analyse the microbial content of food served by food vendors;
5. Examine the institutional set-up governing safe practices of food vendors;

Research Questions

The following research questions guided the study.

1. What factors influence the choice of location for food vending?
2. How healthy is the sanitary conditions of the environment within which food vendors operate?
3. How safely do food vendors prepare and serve food?
4. What is the percentage of microbial content in food served by food vendors?
5. What institutional framework governs safe practices of food vendors?

Significance of the Study

The study provides a deeper insight into the conditions sanitary conditions of ready-to-eat foods, which are sold on the streets and in enclosed places, such as restaurants and hotels. The results of the study, when published could re-direct choices of publicly sold food to safer options. Public health officials could also be made aware of the effectiveness of the operational licensing for food vendors and the effectiveness of their monitoring roles in food vending in the Bolgatanga municipality through the findings of this study. The level of risk which food vending poses to public health could be deduced from this study and measures to correct unsafe food vending practices can be targeted at specific problematic areas, as highlighted by the findings of this study. The study also contributes to

the academic literature on food vending and Hygiene may also instigate further interest and research into general sanitary practices or policy issues concerning food vending in Ghana.

The study also adds more knowledge to the existing works done on food vending in Ghana. Some of the prominent studies on food vendors in Ghana including Mensah et al. (2002), Boateng (2014), and Monney et al. (2014) used mainly descriptive analysis. This study takes a step further to include inferential analysis, such as chi-square, t-tests, and F-tests to analyse statistical significance of results, thus making them more reliable for policy recommendations. Earlier studies such as Mensah et al. (2002), Boateng (2014), and Monney et al. (2014) did not include an institutional perspective of food vending businesses, and this study covered that research gap.

Scope of the Study

The study was conducted in the Bolgatanga municipality. Street food vendors, restaurant operators, and operators of food stalls were included in the study. The major concepts of the study were limited to food vending hygiene and institutional control.

Organization of the Study

The thesis is divided into five chapters. Chapter One provides a general introduction and set the basis for the study. Chapter Two discusses relevant literature and empirical evidence related to food vending practices. Chapter Three describes the methodology used in gathering data for the research. The study

population, the sample and sampling procedure, research instruments, data collection procedure and data analysis procedure are described in this chapter. Chapter Four presents and discusses the findings. Finally, Chapter Five summarises the findings, draws conclusions and makes recommendations for the attention of policy makers and administrators. It also suggests areas for further research.



CHAPTER TWO

REVIEW OF RELATED LITERATURE

Introduction

This chapter reviews theoretical and conceptual issues related to food vending practices as well as the safety and sanitary condition of food vending from global, regional to national perspectives. Additionally, empirical studies on the various concepts in the study are discussed.

Theory of Planned Behaviour

The Theory of Reasoned Action propounded by Ajzen and Fishbein (1975, 1980) paved the path for the Theory of Planned Behaviour by Ajzen (1991). The theory states that attitude toward behaviour, subjective norms, and perceived behavioural control, together shape an individual's behavioural intentions and behaviours behavioural beliefs linking the behaviour to various outcomes and other attributes. An individual's attitude refers to the person's positive or negative evaluation of self-performance of the particular behaviour, which is determined by the total set of accessible. Ajzen (1991) also conceptualised subjective norms as an individual's perception about the particular behaviour, which is influenced by the judgment of significant others, such as parents, spouse, friends, and teachers. The third fundamental concept of the theory of planned behaviour, which is perceived behavioural control, is explained by Ajzen and Fishben (2005), as an individual's perceived ease or difficulty of performing the particular behaviour.

In terms of food vending hygiene practices, the theory suggests that the vendor's personal attitude towards hygiene would determine the sanitary practices adopted by the vendor. In addition, the vendor's perception, such as the necessity for safe sanitary practices, the health implications of certain cooking methods, and the dietary implications of the choices of cooking ingredients, which has been formed from the influence of others, would also influence the sanitary quality of vending. Moreover, the ease with which the vendor can practice safe hygiene measures is also a determinant of intended or actual food vending practices.

The intended action enunciates disposition of the attitude and the subjective norm wherein the subjective norm is basically the perception formed by the individual about undertaking or not undertaking that behaviour due to the social pressure. One prominent observation by the theory of planned behaviour is that behaviour may also depend on other factors such as availability of appropriate opportunities and resources which collectively correspond to the people's actual control over the behaviour (Liska, 1984; McConnon, 2012). In this sense, the hygiene practices concerning food vending, could also be conditioned by the availability of effective monitoring institutions, official standards of operating food vending outlets and facilities, as well as effective information dissemination and communication channels for educating food vendors on hygiene practices.

Importantly, the theory of planned behaviour is one step ahead of the theory of reasoned action in the sense that it takes care of the original model's limitation to deal with incomplete volitional control (Ajzen, 1991). Ajzen (1991)

theorised that individuals perform certain acts under the assumption that people behave rationally, considering the ramification of their actions (Ramayah, Lee & Lim, 2012). However, some behaviours are non-volitional and may seem to be outside the scope of a planned behaviour, which stipulates that the more favourable the attitude toward behaviour and subjective norm, and the greater the perceived behavioural control, the stronger the person's intention to perform a particular behaviour. The theory of planned behaviour, however, accounts for non-volitional behaviour in the sense that not all behaviours or actions can be controlled by the performer of the action.

Within the context of non-volitional behaviours, the theory suggests that the sanitary conditions of the foods sold would also be conditioned by the inadvertent actions by the food vendor. For example, the food vendor might use over fertilized fruits for food, which might lead to food poisoning. It might be argued that the sourcing of the fruit and ingredients are planned and rationalised by the vendor, although the farmer is more likely to be responsible for the contaminated state of the fruits. Not all behaviours and actions can therefore be planned. The theory of planned behaviour leaves two important questions to be asked about food vending hygiene. The questions are, does the intention to maintain safe sanitary conditions actually lead to safe sanitary practices? Will attitudes, subjective norms and perceived behavioural control account for the sanitary practices among food vendors?

Compared to affective processing models, the theory of planned behaviour overlooks emotional variables such as threat, fear, mood and negative or positive

feeling and assessed them in a limited fashion. For example, Conner et al. (2003) maintains that some health behaviours may be largely influenced by emotion. Strong emotions are relevant to this model because they can influence beliefs and other constructs, such as perception, in this model. The theory is also criticised for its failure to fully mediate the influence of past behaviour, particularly given a meta-analysis conducted by Conner and Armitage (1998) revealed that past behaviour accounted for an additional 13 percent of variance in behaviour. These limitations are taken into account by the current study. The emotional influence, such as feeling guilt, happiness, or approval of certain vending habits will be accounted for in the analysis. Moreover, the influence of past vending practices on current practices will also be considered.

Social Control Theory

Food hygiene practices by food vendors can also be established in the framework of institutional control. This is because food vendors often have to conform to municipal directives of handling and sales of food, where non-compliance amounts to a criminal offence punishable by law (Chirag et al., 2013). In line with this, some studies have argued that enforcing compliance with accepted standards of food hygiene practices is founded in the social control theory which was established by Hirschi (1969). Hirschi (1969) advanced the proposition that people tend to engage in wayward or criminal behaviour unless strong moral, social, and/or retributive deterrents are in effect. In other words, people will engage in malpractices if they know they would not have to pay the cost of deviance. The Control Theory is of the view that people refrain from

deviant behaviour because of diverse factors that control their impulses to break social norms. Control theory therefore explains why some people do not act on deviant impulses and why others do. In the social context, some controls are internal, such as a person's conscience and motivation, whereas others are external, such as parents, friends, and legal codes. Control theory links non-deviant behaviour to social bonds, and Hirschi (1969) advanced the proposition that weak bonds between the individual and society allow people to deviate. In other words, weak links between the populace and the regulatory institutions would encourage deviant behaviour. This is established in studies where weak regulations have encouraged food handling malpractices among food vendors (Boateng, 2014; Monney et al., 2014; Mensah et al., 2002).

Hirschi (1969) classified three forms of control, namely decentralised control, centralised control, and mixed control. Decentralised control is maintained through factors such as price, competition, or market share. For example, based on the rational choice theory, consumers would prefer to buy from healthy locations and visibly appealing environments. Therefore, effective competition would ensure that vendors with poor environmental hygiene improve on hygienic conditions in order to attract customers. Centralised control such as bureaucratic control is typically maintained through administrative or hierarchical techniques such as creating standards or policies. This reflects the form of control that is established through municipal authorities responsible for upholding food safety standards. Non-compliance to these policies would amount to a criminal offence. Mixed control or clan control is typically maintained by keeping a set of

values and beliefs or norms and traditions. For example, through the traditional cooking methods and formal training, food vendors learn some food-handling practices which appeal to their ethics and conscience when handling food. These norms, whether hygienic or unsafe, become the regular practice that food handlers adhere to.

Reckless (1973) supported the control theory with his containment theory, which states that behaviour is not caused by outside stimuli, but by what a person wants most at any given time. Hirschi (1969) had already theorised that human beings are selfish and therefore act in ways that maximise their personal benefit. This suggests that if the unwholesome foodstuffs would maximise the profits of food vendors, then they are likely to use unhealthy food ingredients if they are poorly monitored. Therefore, weak centralised control is seen as the major enabler of poor food-handling practices by food vendors.

The social control theory has been critiqued based on its fundamental assumptions. First, it assumes that people are generally driven by ethical codes, It also assumes that people have knowledge of all choices in the market, and always have access to their preferences, but does not take into account monopolies and the socio-economic status of consumers that may restrict demand for preferences.

Defining the Scope of Food Vending

Food vending broadly describes the practice of offering ready-to-eat food for sale (Burt et al., 2003; FAO, 2014). Two broad categories of food vending may be deduced from food vending, namely formal and informal. Generally, informal food vendors comprise street food, established in make-shift structures

as well as push carts and food trucks. On the other hand, formal food vendors are usually restaurants either with seating spaces and full service, or casual service with or without seating (Liu et al., 2014).

Informal food vending often reflects traditional local cultures and tastes, and there is much diversity in the raw materials used for their preparation. Food vendors would usually buy their fresh food locally, thus linking their enterprises directly with small-scale farms and market gardens. On the other hand, formal food vendors often make their mark with tastes that are not local to the populace and their higher quality of service (Olang'o et al., 2012).

There are also several other ways in which informal food vending can be distinguished from the formal sector. These differences characterise or affect the potential for the micronutrient fortification of food vending. Generally, the activities comprising the informal sector are marked by a number of characteristics, including ease of entry, reliance on indigenous resources, family/household ownership of the enterprise, small-scale operatives, high labour intensity, use of traditional technology and skills acquired outside the formal education system, and operating in unregulated and competitive markets (Hart 1973, Bendeck, Tefft, Seki & Nicolo, 2013). Given these characteristics, informal food joints spring up easily, tend to be small-scale, family owned, and unregulated. There is therefore a higher likelihood that informal street food joints would not operate according to the acceptable and legal hygienic standards. These are discussed in detail under the subsequent sections.

Street Food

According to the FAO (1986), the term ‘street foods’ describes a wide range of ready-to-eat foods and beverages sold and sometimes prepared in public places, notably streets. Artemis et al. (2000) also confirmed that street food is ready-to-eat food or drink sold by a hawker, or vendor, in a street or other public place, such as at a market or fair. It is often sold from a portable food booth, food cart, or food truck and mostly meant for immediate consumption.

Street foods are also defined by their costs. Generally, in cost comparison with restaurant meals, street foods are cheaper and offer an attractive alternative to home-cooked food. For example, Tinker (1997) established that in Thailand, for a meal on the street consisting of rice, vegetables, and a little meat on a single plate, the price should be anywhere from 30–50 THB (\$1 – \$1.66), whereas a big entire meals of street food with a selection of dishes and maybe an entire fish will cost 60 – 200 THB (\$2 – \$6.62) per person. On the other hand, indoor Thai food restaurants with air conditioning can cost 100 – 200 THB (\$3.31 – \$6.62) per person, whereas a full Japanese sushi buffets and other gourmet restaurants cost 300 – 400 THB (\$9.94 – \$16.56).

Street food businesses are also characterised by their ownership by individuals or families with close economic linkages with the local economy. Because of differences in culture, social stratification and history, the ways in which family street vendor enterprises are traditionally created and run vary in different areas of the world (Chow, 1994). For example, few women are street

vendors in Bangladesh, but women predominate in the trade in Nigeria and Thailand (Tinker, 1997).

Location of food vendors is also quite exquisite from restaurants and cuisines to food stalls and food carts. Their marketing success and promotion also depends extensively on location and word-of-mouth of patronisers. Obi-Nwosu (2013) observed that vendors' stalls are usually located outdoors or under a roof which is easily accessible from the street. It is common to find them under low-cost seating facilities which are sometimes rudimentary. Moreover, the central characteristic feature of street foods is their retail location, being 'on the street'. Tinker (1997) also maintained that street foods are sold on the street from pushcarts or baskets or balance poles, or from stalls or shops having fewer than four permanent walls. This differentiates street food from restaurants and fine dining places. In terms of production, street foods may be centrally processed foods made by the formal sector food industry, or they may be processed within the street food trade either by the vendor her/himself or another small-scale processor.

Street food vending is found all around the world, but what is sold varies greatly between regions and cultures (Wanjek, 2005) Kindersley (2011) described street food of Vietnam as being 'fresh and lighter than many of the cuisines in the area and drawing heavily on herbs, chile peppers and lime, while street food of Thailand is fiery and pungent with shrimp paste and fish sauce. New York City's signature street food is the hot dog. However, New York street food also includes everything from spicy Middle Eastern falafel or Jamaican jerk

chicken to Belgian waffles (Wanjek, 2005). In Hawaii, the local street food tradition of plate lunch (rice, macaroni salad, and a portion of meat) was inspired by the bento of the Japanese who had been brought to Hawaii as plantation workers (Etkin, 2009). In Denmark, sausage wagons allow passers-by to purchase sausages and hot dogs. In Ghana street foods mainly take the form of foods sold on tables and in make-shift stalls, mobile food vendors, and casual restaurants (Boateng, 2014). A variety of foods are sold by the vendors, covering various local and continental dishes (Monney et al., 2014).

Restaurants

Besides street food sold from in make-shift structures, food vending also encapsulates restaurants, which are often formal and regulated. There are different types of restaurants, with different attributes which are presented below.

Full-Service Restaurants

Full-service restaurants are typically either fine dining establishments or casual eateries which are equipped with seated tables for guests while servers take their full order and serve food and drink (Woellert, 2012). In addition to the kitchen staff they almost always employ hosts, servers and bartenders. Two standard types of full-service operations include fine dining and casual dining restaurants.

Fine dining restaurants offer the best in terms of service and quality. They usually gain perceived value with unique and beautiful décor, renowned chefs and special dishes. Prices for entrées are often higher than the other types of food

vending outlets and establishments, with a top-notch service style, undertaken by well-trained and experienced servers and sommeliers. This is an up-scale restaurant which requires constantly elevated level of service and quality in every aspect including dinner service, food presentation and cleanliness (Appelbaum, 2011). One would expect fine dining restaurants to conform to high cleanliness and food quality standards. The health hazards would be expected to be much lower in fine dining than other lower-ranking categories of restaurants.

Another type of full service eatery is casual dining restaurants. They are typically more affordable and often geared toward families. Casual dining restaurants offer full table service but the décor, food and service are usually less remarkable than a fine dining establishment. Guests are seated by a host or hostess and servers help explain menu items and take orders. Service style for casual dining restaurants is usually not as formal as a fine dining service as servers may act more casually around diners, but guests still expect a level of professionalism and service throughout the meal. Like fine dining restaurants, casual eateries can specialise in a certain regional cuisine or a fusion of several dishes (DiPietro et al., 2004).

“Fast-casual” is relatively modern terminology for a restaurant that falls between full-service and quick-service. Also called quick-casual or limited-service, these types of restaurants are typically distinguished by service type and food quality. Fast-casual restaurants are often perceived to offer better quality food and a more upscale dining area than quick-service restaurants, but with less expensive menu items than full-service restaurants (DiPietro et al., 2004). Guests

will often walk up to a service counter where they will choose items from a menu board and place their orders with a cashier. The guests may also choose their food first, perhaps walking along an assembly line for their sandwich or burrito, and then pay when they receive the food. Similar to quick-service, speed and convenience are important aspects of a fast-casual restaurant. Although, fast-casual restaurants arguably demonstrate better quality food and service than fast-casual restaurants (Huiskamp, 2001).

Quick-service is the term for restaurants that capitalize on speed of service and convenience. Fast-food restaurants often fall under the umbrella of quick-service restaurants, but not all quick-service places serve fast-food (DiPietro et al., 2004). Quick-service restaurants are characterized by simple décor, inexpensive food items and speedy service. Fast food restaurants are the least expensive of all the different genres of restaurants. They often provide various meal choices which can add on extra for sides and drinks. These food items are also available à la carte. Service style at quick-service restaurants typically includes a service counter with one or more cashiers working to take orders. Customers order off of a menu board hanging on the wall or from the ceiling. It is not unusual to see a drive-thru at a quick-service restaurant (Appelbaum, 2011).

Choice of Location for Food Vending

The location of any business is important for its survival, growth, and success. The choice of business location is established in location theory which is concerned with the geographic location of economic activity, and why businesses choose to locate where they are (Weber, 1929). It is based on the assumption that

agents, including business owners, suppliers, governments, and customers, act in their own self-interest. Thus, the theory proposes that firms choose locations that maximize their profits and individuals choose locations that maximise their utility (Glatte, 2005). Location is particularly important to food vendors, because marketing success of the street food vendors depends exclusively on location and word-of-mouth promotion (Winarno & Allain, 1991).

Generally, certain factors may push a business away from a location, whereas other factors may draw the business to a certain location. To a great extent, the probable influence of any of the factors would depend on the type of business and the business objectives. According to Winarno and Allain (1991), factors that draw a business away from a certain location are “push” factors. These include increasing costs, more competition, reduction in demand, as well as poor communication and transportation systems. Conversely, those that “pull” a business toward a location are lower labour costs, a growing consumer base, government incentives, and improved transportation and communication systems.

The decision to locate a store is also dependent upon some economic considerations (Ingene 1984; Karande & Lombard, 2005), including household income, income distribution, mobility (autos-per-household), willingness to spend their money on the firm’s services and products, the source of income, and the cost of rent. The spending power of the people residing in the area at which business considers to locate and but whether the residents are willing to spend their money at the store is more important for retailers (Redinbaugh 1987).

Most businesses often have equipment for operations, and they may need space for other operational activities like storage, car parks, and waiting areas. An important consideration for locating a business therefore involves considering whether there is enough physical space for the business operation. In the case of street food vendors, space is generally not an issue as most of them operate out of small stalls and keep a space where they either cook or allow a few customers to eat in-situ. Restaurants, however, need considerable sitting spaces for guests and in some cases they may need space for storage, kitchen, lavatory, and car parks. Restaurants often prepare meals on the premises and thus must have space for kitchens and storage of food and equipment.

Location Characteristics

The important aspects of a location for business venture are the ease in accessibility, image attributes, and costs. Lusch (2008) emphasises the ease of access as the most important component of location characteristics. He made specific reference to a specific scenario where many consumers move about by car, for example a drive-through fast food joint. Particular attention should be paid on the roads, streets, and parking facilities to give customers easier access to the vending premises.

Costs

The location selection decision should consider the effect of various costs including building, renting, buying, renovating of the physical facilities. Street food vendors often operate in makeshift stalls and may only pay operating permits. The costs are relatively however lower than that of a restaurant. In

Africa, and Ghana, in particular, street food vendors are largely informal small scale operators and do not rent spaces as in the case of restaurants. Their location preferences are largely influenced by the cluster of their target market. For example, some food vendors locate in schools to gain access to school children whereas others are located in various institutions or in the cluster of some working business district to gain access to specific clients.

Customer Convenience

Another important factor in the choice of space of operation is the convenience of customers to get to the premises of the location (Lusch, 2008). In the restaurant and food vending business where customers must be present to purchase or enjoy the services and product, the convenience of the customer cannot be over emphasised. Urban workers may wish to have a quick lunch break and head back to work. Therefore the ability for customers to access the food vendor with minimal effort, quickly and get to back to their urban jobs is relevant. In other cases, customers may want convenience in terms of the separation from the city atmosphere. This is can be the case for fine dining where the customer sits for longer period to enjoy a three or four course meal. In summary the location must be easily accessible and provide the customer with a feeling of safety upon their arrival and exit.

Psychographics

In the food service sector, the sanitary conditions, the set-up of the place including captions, paint, nature of seats, as well as social-status of the location

has to be aligned with the mind-set of the customer (Soliman, 2012). Thus, it may be prudent to locate the food vending business in the locality of the target market. The more aligned the location is to the mind-set of the customer, the more likely the customer would purchase the meal. Unsanitary locations may drive people who are environmentally-sensitised away. However, those who are indifferent about their personal health and unknowledgeable of the risks involved in eating from unsanitary places may still purchase the meal set in filthy environs.

Competition

Competition is also a key factor to consider when locating any business. Some firms survive within a cluster because of mutual advantages gained from competitors and the drawing power of a cluster, while other do better in isolation. Reinartz and Kumar (1999) emphasise the need to study the competitive environment because competitive factors account for the majority of the variation in price elasticity across vendors (Durvasula et al. 1992; Hoch et al., 1995). If the services of the firm are highly elastic, setting up among competitors may not be a clever approach unless the firm can outcompete other similar enterprises. For example, if the firm can outcompete in terms of price, taste and quality, then there is the propensity to pull and poach other customers.

Global Health Issues on Food Vending

According to Snodgrass (2004) government officials oversaw street food vendor activities, as early as the 14th century. With the increasing pace of globalisation, tourism, and concern for public safety, the wholesomeness of vended foods has become one of the major concerns of public health (FAO, 2007;

Lues et al., 2006; Mukhola, 2006). There has been a major concentration of contamination of street food, but FAO (2007) found that the health risk of street food is comparable to that of restaurants. FAO (2007) reported that there is a mistaken assumption that food contamination is inevitable in street foods. It is argued that vendors know that consumers watch the way food is prepared and notice whether the work area and vendor's hands and clothes are clean and tidy. However, Chukuezi (2010) also argues that consumers are often attracted by convenience and low prices and may overlook aspects of hygiene or sanitation. In some cases, the consumers lack substantial understanding of proper food-handling practices and the potential for food-borne diseases. This limits their ability to make safe judgements about purchasing from any particular vendor.

An FAO/WHO (1990) report indicated that food vendors widely use additives such as the unauthorised colouring agents rhodamine B and methanal yellow. According to Winarno and Allain (1991) the use of these additives by food vendors is most popular in developing countries. Similarly, prohibited synthetic sweeteners were frequently used to adulterate drinks sold on the street and in restaurants. Contamination of street foods is another problem, and the FAO/WHO has established thresholds that indicate unsafe presence of contaminants in foods. Aflatoxins and pesticide residues authorized levels have also been a major global health risk, as indicated by FAO/WHO (1995). However, pesticide residue has not been a problem for only street foods, but home-cooked meals are also likely to contain the same concentrations of pesticide residues (FAO/WHO, 2009).

The health risk of food is not only determined by the concentration of various additives and contaminants in a food product, but also by the cumulative daily intake of a certain contaminant or additive throughout a consumer's diet. In the African sub-region, however, food-poisoning is one of the major manifestations of food contamination (FAO/WHO, 2009). The subsequent sections discuss some of the pertinent health risks and standards in reference to food quality and safety.

Food Handling

The term food-handling, in its broadest sense, include the contact that the raw materials used for food may encounter through its cooking processes. Thus, food handlers are broadly all those, from the farm to the consumer, who come into contact with part or all of an edible end-product at any stage from its source. The FAO/WHO (2009) emphasises the importance of the food handler in the quality of food vending. They defined the food handler as the 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. Not all food handlers, however, actually come into contact with food, and not all 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.

Those who present 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 (FAO/WHO, 2008). 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. Street vendors, common in both developing and industrialised 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.

Universally, it is accepted that that unhygienic food and other forms of contamination in daily consumables have led to the death of millions of people throughout the world, especially in Africa where a deeper gap in education, poverty, public health policies, and financing health system exists (Ferron et al., 2000). This partly explains why diseases such as cholera, diarrhoea, typhoid and hepatitis exist and are of great concern to public health professionals especially in Africa where access to quality education on hygiene is a challenge to many food vendors (Chukuezi, 2010; Monney et al., 2013).

Several studies have been conducted to inspect the facilities and practices of food vendors in the African region which revealed that unclean, insufficiently or inadequately cleaned cooking equipment have been identified as a source of bacterial contamination in processed food (Boateng, 2014; Nigusse & Kumie, 2012; Rane, 2011). Containers, pumps or tanks used for holding or transporting unprocessed raw materials, have occasionally been used for processed products without any cleaning and disinfection (Rane, 2011). Moreover, the food is often

not treated in such a way as to destroy the organisms before they reach the consumer (Paa Nii, 2005; WHO, 1989). Usually, the nature of the food or its conditions of storage allows harmful organisms to multiply and produce an produce toxins in quantities sufficient to cause illness (WHO, 2012).

Notably, the transfer of microorganisms by personnel, particularly from hands, is of vital importance. Samakupa (2003) mentioned that during handling and preparation, bacteria are transferred from contaminated hands of food workers to food and subsequently to other surface. In support of this claim several studies have linked low infectious doses of organisms, such as *Shigella* and pathogenic *Escherichia coli*, to hands as a source of contamination (Snyder, 1998; Lambrechts, Human, Doughari & Lues, 2014). However, Rheinlander (2012) found that vendors and consumers demonstrated basic knowledge of food safety, but on basic hygiene practices such as hand washing, cleaning of utensils, washing of raw vegetables, and quality of ingredients were not their major concerns. Instead, customers selected their foods by four main criteria related to aesthetic appearance of food and food stand, appearance of the food vendor, personal trust in the vendor, as well as price and accessibility of the food (WHO, 1998, 2012; Nigusse & Kumie, 2012). Hence, consumers relied on risk avoidance strategies by assessing neatness, appearance, and trustworthiness of food vendor.

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. Nigusse and Kumie (2012) reviewed

extensive literature on global outbreaks of food borne disease and found that, in nearly all instances, they are caused by failure to observe satisfactory standards in the preparation, processing, cooking, storing or retailing of food.

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; WHO, 2012; Lambrechts et al., 2014). 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 pasteurisation, irradiation, cooking, freezing and pickling at the industrial, retail and domestic levels (WHO, 2010). 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.

Environmental Hygiene and Transmission of Pathogens

Environmental hygiene constitutes an important element of food hygiene and food quality. The WHO (2012) cautioned that 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. The underlying fact is that harmful microorganisms which are found in soil, water, and animals, can be transmitted through hands, wiping cloths and utensils, cutting

boards into meals, which can cause food borne diseases. In respect of this, the FAO (1997) and WHO (2010) outlined measures of ensuring hygienic environment for safe food preparation, including:

- 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;
- Discarding waste to avoid accumulation of waste in food handling, food storage and other working areas and the adjoining environment;
- Adequate drainage and waste disposal system and facilities;
- Adequate supply of portable water and the construction of drainage systems that safeguard and avoid contamination of potable water; and
- Washing and sanitising all surfaces and equipment used for food preparation

Several studies confirm that the hands are the most important transmitters of organisms from faeces, 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; WHO, 2012). Rane (2011) also found that 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. This indicated cross contamination

between dishwater, food preparation surfaces, and the food itself. Rane (2011) also 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.

Personal Hygiene

Food quality and its microbial content have been found with relationships with the personal hygiene of the food handlers. Studies have shown that humans also carry microorganisms naturally and personal hygiene reduces the risk of transmission of these microorganisms into meals. According to the WHO (2010), the following are important hygienic aspects related to personal hygiene:

- Food vendors practicing hand washing before handling food and often during food preparation.
- Food vendors washing hands after going to the toilet
- Food vendors drying hands after hand washing procedure
- Food vendors wearing clean protective clothing
- Food vendors wearing head covering
- Food vendors avoiding wearing of personal effects such as jewellery, watches, pins or other items in food handling areas
- Food vendors ensuring that cuts and wounds are covered by suitable waterproof dressings.
- Food vendors avoiding personal behaviour such as smoking, spitting, chewing or eating, sneezing or coughing over unprotected food

- Food vendors not handling food if you know or suspect to be suffering from or to be a carrier of a disease or illness likely to be transmitted through food

Food and Quality

The quality of raw materials in food preparation directly influences the microbial quality of meals. According to FAO/WHO (2010), raw materials, including water and ice may be contaminated with dangerous microorganisms and chemicals. When mouldy raw materials are used, toxic chemicals may be transferred from the moulds into foods. The FAO/WHO (2010) established guidelines for food quality in respect of the raw materials used in their preparation:

- Food vendors should select fresh and wholesome foods to prepare food for sale
- Food vendors must choose food processed to reduce the risk associated with cooking raw foods for foods
- Food vendors should make ice from safe water
- Food vendors should use safe water or treat it to make safe

Microbial Quality of Food

Microbial quality of food refers to diseases and infections that may be present in food caused by some microorganisms present in the ready-to-eat food (FAO/WHO, 2010). While contamination of food is highly possible, there are

certain levels of contamination that are either immediately harmful to the consumer or which become harmful or deadly to over a considerable period of regular consumption.

Traditionally, three principal means have been used by governmental agencies and food processors to control microorganisms in food as listed by the International Commission on Microbiological Specifications for Foods (ICMSF, 1996). These are (a) education and training, (b) inspection of facilities and operations and (c) microbiological testing. These have direct relations with food handling, food preparation, and the hygienic state of the service area where food is prepared and sold. Several studies show different results in microbial contents in food prepared.

The ICMSF (1996) indicated that 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 sporeformers, enterococci, and members of *Enterobacteriaceae*, a variety of yeast and mould and pathogens like coagulase positive staphylococci. In order to reduce the presence of these microbial contents in ready-to-eat meals, the FAO/ WHO (2010) had established some safety practices aimed at reducing the microbial contamination of vended foods, and they include:

- Separating raw meat, poultry and seafood from other foods

- Using separate equipment and utensils such as knives and cutting board for handling raw foods
- Storing food in containers to avoid contact between raw and prepared foods
- Washing fruits and vegetables, especially if eaten raw
- Removing outer leaves of leafy vegetables
- Cooking food thoroughly; make sure that the temperature has reached 70°C
- Reheating cooked food thoroughly
- Avoid leaving cooked food at room temperatures for more than two hours
- Refrigerating promptly all cooked and perishable food (preferably below 5°C)

Buchanan and Whiting (1998) found that in Santa Fe de Bogota, Colombia over 30 percent of a group of food handlers examined were carriers of pathogenic microorganism including *Salmonella typhi*, *Staphylococcus aureus*, *Salmonella enteritidis*, and *Shigella*. Rane (2011) also conducted microbiological analysis of utensils surface and knives and found *Salmonella* and *Shigella* on the utensil surfaces. Moreover, 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 Ghana, Mensah, Yeboah-Manu, Owusu-Darko and Ablordey (2002) studied 511 menu items vended on the streets of Accra and detected Mesophilic

bacteria in 356 foods, *Bacillus cereus* in 28 menu items, *Staphylococcus aureus* in 136 items and Enterobacteriaceae in 136 items. 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. Moreover, *Shigella sonnei* and entero aggregative *Escherichia coli* were isolated from macaroni, rice, and tomato stew, and *Salmonella arizonae* from light soup.

A study conducted by Feglo and Sakyi (2008) in Kumasi of 60 food samples revealed that most of these foods contained higher than acceptable contamination level of $<5.0 \log_{10}$ CFU/ml. The isolates obtained in order of magnitude were Coagulate negative staphylococci, *Bacillus* spp, *Klebsiella pneumoniae*, *Aeromonas pneumophila*, *Enterobacter cloacae*, *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*.

In Cape Coast, it was found that the following had bacterial contamination levels in colony forming units per gram (cfu/g): meat pie (1.3×10^5), khebab (5×10^4), rice with stew (4.1×10^5), fried fish (8×10^4), pepper sauce (1.4×10^5), banku (3×10^5), beans with gari (2×10^4), fufu (1.6×10^5) waakye (6.6×10^5) and dakua (2.3×10^5). The presence of *Escherichia coli* of faecal origin was detected in all investigated food samples, and most of the foods had contamination levels higher than the accepted margin of less than $5 \log_{10}$ cfu/g. Moreover, fungi, including *Aspergillus flavus*, *Aspergillus niger*, *Aspergillus candidus*, *Cladosporium herbarum*, *Necrospora crassa*, *Penicillium citrinum*, *Fusarium*, and *Mucor* species, were found in all investigated food items.

Food Hygiene Knowledge and Practices

Several studies in many countries reveal differences and similarities in food hygiene practices among food vendors. In general, the WHO (2010) 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. Specific country cases emphasise this claim by the WHO and also reveal other malpractices in food handling by food vendors.

In the Philippines, Azanza, Gatchalian, and Ortega (2000) found that most vendors were knowledgeable in food safety but not in food legislation and waste management. The vendors did not put their knowledge of food safety practices into use, but compromised food safety for financial reasons. In Manhattan, Burt, Volel and Finkel (2003) found out that over half of all vendors contacted served food with bare hands. Moreover, some vendors had visibly dirty hands or gloves and no vendors once washed his or her hands or changed gloves in the 20 minutes observation period.

In Nairobi (Kenya) Muinde (2005) conducted a study on hygiene and sanitary practices of food vendors and found that most of the vendors had only primary education but there was no significant relationship between food vending practices and educational attainment. Similar findings were found by Benny-Oliviera (2007) in Trinidad where most of the food vendors had only primary education, but this study found relationship between food vending practices and sanitation of vending environment. Another study by Muinde and Kuria (2005)

found that water for washing utensils and hygiene was compromised. Food served had no proper protection of the street food from the dust and smoke from vehicles. Furthermore, vendors observed minimal personal hygiene. Most of the vendors did not use aprons, they handled food with their hair uncovered, and all the vendors handled money while serving food. Moreover, utensils were washed using dirty water in buckets which were rinsed only once and the water used repeatedly before it was replaced. More so, proper methods of storing leftover food were not used, hence this could have promoted the sale of stale food.

Barro, Ouattara, Nikiema, and Traore (2002) found that in Ouagadougou, Burkina Faso, the vendors were located 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. Food handling practices by the vendors were poor 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.

Musa and Akande (2003) found that in Nigeria, premedical practice among food vendors was high as 76 percent of the sample. They also noticed that most of vendors prepared food in advance and reheated food before sale. The major unhygienic practices observed among the food vendors were poor care of utensils, the use of previously used water for washing and cleaning, lack of covering apron among food vendors, and the lack of hand washing basin for immediate cleaning. Some of the food contaminating risk factors they discovered included unkempt finger nails, skin lesions and poor protection from flies.

Chukuezi (2010) also found that in Owerri, Nigeria, about one-fifth of the vendors prepared food in unhygienic conditions, and most did not use aprons and handled food with bare hands. The majority of the vendors also wore no hair coverings while 90 percent handled money with their bare hands while serving food. Other practices that were not hygienic, but were done by the vendors included wearing jewellery while serving foods, blowing air into polythene bag before use, storing food for serving openly in the stalls, and serving left over's the next day with poor storage facilities. Most vendors also washed their utensils with dirty water which is recycled and used.

In Ghana, Mensah, Yeboah-Manu, Owusu-Darko and Ablordey (2002) found that out the 177 street vendors, most were educated and these vendors exhibited good hygiene behaviour. Most of the surroundings of the vending sites were clean. The cooking of food was well in advance of consumption. However, most of the foods were exposed to flies and most were prepared on the ground.

Okai and Dordi (2002) discovered two types of vendors in Accra, namely those who brought already prepared food from home and those who cooked on site. They showed that 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.

Monney, Agyei, and Owusu (2013) found out that food vendors in educational institutions in Konongo generally adhered to good food hygiene practices, namely, regular medical examination, protection of food from flies and dust, proper serving of food, good hand hygiene, and the use of personal protective clothing. The training of food vendors on food hygiene, instead of the level of education had a significant association with crucial food hygiene practices such as medical examination, hand hygiene and protection of food from flies and dust.

Sarkodie, Bimpong, and Tetteh (2014) revealed that street food vending trade is predominantly a job for women in Sunyani and 85 percent of food vendors had no any form of training on personal, food and kitchen hygiene. Furthermore, the study revealed that most food vendors observed minimal hygienic practices. Most of the vendors did not bath before work, had unkempt finger nails, and spat openly while serving food. The majority of the vendors did not reheat cold food before sale, most did not have the right temperature of the food, and most of them used dirty utensils to cook and store food. In most cases, the vendors stored their leftovers in a cool and dry place, whereas refrigeration was used by about one-fifth of the vendors sampled.

Boateng (2014) discovered that, in Dunkwa-on-Offin, more than 90 percent of food vendors had no formal education, the majority taught themselves food preparation and most also started food vending without going through the appropriate procedures. The major health risks identified by the study included unhygienic sources of water for food preparation, unsafe source of meat, improper

treatment/storage of left-over food, unkempt kitchens or sites for food preparation, and poor hand washing practices. The study finding indicated the presence of microbial agents of more are those that potentially could cause serious gastrointestinal infection. These isolated microorganism included *Salmonella typhi*, *Escherichia coli*, *Staphylococcus aureus* and *fecal coliforms*.

Push and Pull Factors

In Ghana, vended foods tend to have an enormous impact on the urban food supply, economically, socially and nutritionally (Chukuezi, 2010; FAO, 1992; Monney et al., 2013). According to Boateng (2014), people of all ages in Ghana, and from different social and educational backgrounds depend, one way or the other on food vendors because they are comparatively cheap, varied, usually traditional, convenient, available when required and often tasty.

As opposed to restaurants, street food businesses often start with minimum capital and little expertise (Artemis et al., 2000). This allows for the participation of a lot of women who generally tend to be unskilled in the developing countries (Artemis et al., 2000; Otoo et al., 2006). With very little overheads and the use of cheap and probably low quality raw materials, street food vendors can provide basic foods at a lower cost than restaurants. Food vending is an increasing popular informal urban business that allows people to eat affordable, local and varied foods, while representing an important source of income for many vulnerable families (Boateng, 2014; Monney et al., 2013). The heavy dependence on street foods by Ghanaians requires that good quality raw materials are used and that the foods are properly prepared, handled, and sold under hygienic conditions for the

assurance of good health. Bendeck et al. (2013), however, noted that this is considered to be a major cause of health hazards such as food borne diseases, resulting from poor vending environments and unhealthy food handling practices. Moreover, inadequate consumer education does not allow food consumers to make demands that would compel the producers to come up with safe foods.

Institutional Control of Food Vending

Realising the significant contribution to the nutritional needs of a large proportion of the population, the preparation, wrapping and sale of food both on streets and in restaurants are controlled through bye-laws, licensing and regular inspection by Government Departments and Agencies to ensure food safety to all consumers. The Food and Drugs Law (PNDC Law 305 B), Food and Drugs Law Amendment Act 523, and various bye-laws on food hygiene at the district assembly level are directed at ensuring safe and wholesome food for public consumption. As per these laws, the sale of food under unsanitary conditions is an offence. Sections 1 and 5 of the Food and Drugs Law (PNDC Law 305 B) clearly prohibit the sale of unwholesome food. Section 7 prohibits sale of food under unsanitary conditions. For example, section 7(2) states that food shall be stored and conveyed in such a manner as to preserve its composition, quality and purity and to minimise the dissipation of its nutritive properties from climatic and other deteriorating conditions. The Act also emphasises on penalties that offenders of Section 1 to 8 of the Act may be liable to.

The bye-laws governing food vending at the district level have some common elements. These bye-laws are expected to maintain high quality food

handling practices and also deter unsafe food handling practices by the vendors. The laws require all persons dealing in all kinds of food in whatever form to obtain Development and Building permits from the District Assembly for their site and or structure for their operation. This aspect of the law takes care of structure specification or dimension, suitability and adequacy of the site and structure for the purpose. Therefore, it is made clear that no person shall operate any business within the jurisdiction of the district assembly without a licence issued by Assembly. The persons who process, sell, expose or offer for sale of any food would require a Business Operation Permit before the establishment can be set up. Prior to the acquisition of the Business Operation Permit, a license of safe practice should be issued on the recommendation of the Medical Officer of health after an inspection by Health Inspectors. The license states the number, the person to whom it is issued, the premises or location, the duration and the date issued. It is required that the licence must be displayed at the place of sale, and all licences are subject to renewal every year.

All the laws entreat all food handlers and manufacturers to protect it against any form of contamination. To this effect foods are to be stored in containers approved by the Councils Medical Officer, and no person shall expose for any sale, any food unless the items are placed on a table or on a support raised at least one or one and a half metres from the ground. The laws also recommend that food sold should be away from sources of contaminants, including solid and liquid wastes, pets and pests.

Medical Examination of Food Vendors

Another method of monitoring or controlling the activities of food vendors had been by medical examination of the vendors. Medical examination of food handlers, as per FAO and WHO (2008) requirements, is necessary if clinically or epidemiologically indicated. This is to ensure that people with communicable diseases are excluded from food handling. However, the FAO (2009) argued that medical examination of food vendors prior to licensing does little towards ensuring food safety and should not be mandatory. Nevertheless, as a form of precaution, Section 286 of the Criminal Code, (Amendment) Act, 2003 (Act 646) of Ghana charges all food vendors to be examined to ensure they do not infect consumers with communicable diseases.

In Ghana, medical screening of food vendors has been reported mainly in cases where an outbreak of a food borne disease like cholera occurs. In 2012, the Korle-Bu Medical School and the Public Health Department screened about 2,700 food vendors in Accra for early detection of typhoid, intestinal worms and other diseases to ensure that the vendors prepare food and sell food under hygienic conditions. Similarly, in 2014, food vendors in the Accra Metropolitan area were given mandatory health screening and in 2014, the USAID in collaboration with the Accra Metropolitan Assembly and the Sekondi-Takoradi Metropolitan Assembly screened and educated food vendors in Accra and Takoradi on basic concepts in personal hygiene, food safety, housekeeping, and customer services.

Health Certificate

It is required that food and beverages handlers must have valid health certificates issued by a recognized health institution, and these certificates must be within easy reach on the premises for ease of inspection by the Health Officers. Monney et al. (2013) also added that all food vendors are required to register with the Metropolitan Assembly and obtain authorisation, with respect to development and building permit, business operating permit, and health certificate, prior to starting their activity. People suffering from an infectious or contagious disease are legally prohibited from handling or taking part in the preparation of food or allowed to handle fresh meat or fish or be present in the place of sale or storage.

Protective/Special Clothing

Butchers and their assistants, when engaged in carrying, handling or selling meat, are mandated to wear clean clothing of a style approved by the sanitary officer of the council who shall act on the advice of Medical Officer of Health concern (WHO, 2012). This is also legally required of vendors of ready-to-eat foods in respect of their style of clothing, including overall aprons, hand gloves, appropriate shoes, and hair covers. They are required to wear these clothing to reduce contact of fresh foods with bare hands and the possibility of microbial transfer to the food.

Enforcement of the laws regulating food treatment and or handling in general and street-food vending in particular is primarily the task of the Public Health Department of the District Assemblies (Monney et al., 2013). It is their duty to prosecute offenders who contravene the laws. According to source, one

possible way of monitoring the much dispersed food vendors is to organise them into groups or through their own associations based on the type of food and the nature of their operations. This would make it easier to trace them for purpose of education, inspection, and ensuring that they abide by requirements applicable to them. In terms of the effectiveness of the laws, Monney et al. (2013) found that with the exception of laws which were made and or revised in 1995, the fines or penalties under the existing laws are low and therefore do not serve as deterrent enough to members of the public who may be inclined to contravene them.

According to Johnson and Yawson (2000), these laws aim to develop capacities of street food vendors in terms of food safety and quality, but less has been done with reference to the nutritional importance of the food sold on the streets and the entrepreneurial aspects of this activity. In practice, however, Monney et al. (2013) observed that most street food vendors do not comply with the complex set of authorisations needed for food vending. Several studies, have revealed that a significant number of vendors operate without vending permit (Boateng, 2014; Mensah et al., 2002; Okai & Dordi, 2002). The commonest authorisation vendors, especially restaurant operators acquire is the health certificate, which is just one of the many authorisations needed for vending (Mensah et al., 2002; Bendeche et al., 2013). Bendeche et al. (2013) indicated that long and costly procedure, mainly in terms of days spent out of work, the difficulty to access proper information, given the low literacy level of many vendors, and the low enforcement by local authorities due to limited resources, constrain registration processes of food vendors. Despite the health hazards and

its informality, street food vending is an important source of income for many Ghanaians and helps in fighting food insecurity and poverty in urban areas. Source emphasises the importance of supporting this sector to be more formal. The propensity increases for reducing the risks, ensuring consistent and regular earnings, both for the vendors and the Government. However, such an approach needs strong participation of the Government, as well as the Civil Society and the Development Partners.

Empirical Studies

Mensah et al. (2002) conducted a cross-sectional study to 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 purposively sampled street vendors on their vital statistics, personal hygiene, food hygiene and knowledge of food-borne illness.

The researchers found that most vendors were educated and exhibited good hygiene behaviour. The surroundings of the vending sites were clean, but four sites (3.4%) were classified as very dirty. 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%). The microbial quality of most of the foods was within the acceptable limits but samples of salads, macaroni, fufu, omo tuo and red pepper had unacceptable levels of contamination. *Shigella sonnei* and enteroaggregative *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. Vendors should therefore receive education in food hygiene. The study recommended special attention to be given to the causes of diarrhoea, the transmission of diarrhoeal pathogens, the handling of equipment and cooked food, hand-washing practices and environmental hygiene.

The Food and Agriculture Organisation (2012) conducted a study on the potentials and challenges of street food vending in West African capital cities, namely Bamako, Abidjan, Freetown, and Accra. Purposive sampling was used to sample 400 food vendors and two thousand consumers in the four capital cities. The food vendors included in the study comprised those at fixed locations installed around hospitals and other public and private buildings. Three areas within each city were selected, based on socioeconomic criteria. They comprised a prevalent high income area, a prevalent middle income area, and a prevalent low income area. The customers and food vendors were interviewed using an interview schedule and the data were analysed using descriptive tools.

The study found that women formed between 89 and 98 percent of the total sample interviewed and most of them were aged between 33 and 49 years. The survey revealed that a high number of informal street food vendors had a secondary level of education (57% in Freetown, 47% in Accra, 30% in Bamako but only 16% in Abidjan). In Bamako and Accra, most of the vendors had been in the sector for more than 10 years (46% in Bamako and 33% in Accra), while the average number of years in street food vending is 7.5.

In Accra, 18 percent had no permission to operate as food vendors. However, the permits shown by the vendors were not proper permits which authorise and allow legal vending of food. Several barriers to development include limited access to capital, inadequate local infrastructure and basic food storage facilities, transportation, municipality taxes and the absence of training provision for food operators in the areas of hygiene, nutrition and food safety as well as basic business skills. Street vendors also faced the constant threat of displacement through forced eviction which meant that the majority lacked a permanent market location, which negatively impacted efforts to secure a customer base.

The study recommended creating, adopting and enforcing legislation on the street food sector focusing on monitoring of vendor practices, working conditions and food handling in close partnership with consumer associations. It also recommended simplifying the licensing process and clarification of the roles and responsibilities at the different institutional level.

Boateng (2014) assessed food hygiene practices by street food vendors and microbial quality of selected foods sold in Dunkwa-On-Offin in the Upper Denkyira East municipality. Among the specific objectives of the study were to assess the backgrounds of street food vendors, identify the means of food contamination from sales to consumption, as well as to observe the environmental conditions of areas meant for food preparation and sales, and to determine the microbial quality of the selected foods.

Descriptive and cross-sectional study designs were adopted for the study. The town was divided into five zones and a randomly sample of 423 food vendors were randomly selected from each zone. Structured questionnaires as well as an observational checklist were used to collect data from 423 food vendors. Two-hundred and sixteen food samples, including kenkey and hot pepper, waakye, fried rice and fufu were collected and transported to laboratory in sterile plastic bags within a period of one month to assess its microbial quality. The SPSS software was used to analyse all the data collected.

The study found that more than 90 percent of the vendors were females and the youngest was 15 years old. Using the age cohorts, with class intervals of 10, the age distribution was fairly even across all the age categories, with the exception of those above 48 years who were only 11 percent of the study population. The most represented vendors were those with no formal education, who were about 23 percent of the study population.

It was also found that over 60 percent of the food handlers had been trained in food safety practices, but almost 70 percent received this type of training about once every year. Most of the vendors noted that their knowledge on food safety was self-taught and 42 percent of them had no permit to sell food. Ninety percent of the vendors sold by roadsides, 59.7 percent kept their vending sites kempt, 70 percent kept garbage away from selling sites, 62.4 percent regularly wiped the eating tables, and most of them had clean potable water available for washing of hands. However, most of the vendors had no covered dustbins, neither did they cover their hair, and most of them used their bare hands

to touch food when serving. The microbial agents, including salmonella typhi, Escherichia coli, Staphylococcus aureus and fecal coliforms, which were present in the food, could cause serious gastrointestinal infection.

The recommendations of the study included that health education which focuses on personal and environmental hygiene must be organised by the Municipal Assembly in collaboration with the Health Directorate of District Assembly for food vendors at least four times a year. It was also recommended that medical examination should be done at least four times a year and the law ensuring it must be enforced.

Monney et al. (2014) assessed the hygienic practices of street food vendors in Sunyani Township. The study was both descriptive and cross-sectional. It involved purposive sampling of 140 food vendors in the Sunyani Township. Interview schedules were used to collect data from the sampled respondents and observation checklist was used to collect observable data from the cooking and vending sites. The quantitative data from the interview schedules were analysed using SPSS and presented in tables and frequency/percentage charts. The discussions were supported with examples from the observation checklist.

It was shown that 86 percent of the respondents in this study were females. In terms of age, only about nine percent of the respondents were teenagers, whereas the majority were within the age bracket of 31-35 years. The most represented respondents had primary education. With regards to the food handling practices among the vendors, 96 percent of the respondents did not cover their

hair during food preparation. Similarly, 96 percent of the respondents did not keep their fingernails clean and short and 74 percent of the respondents did not wash their hands before handling food. About 25 percent cover their mouth and nose whenever they sneeze, 11 percent do not touched their ears during food preparation, two percent spits during food preparation while none of the vendors involved in the study smoke during food preparation. It was also found that 26 percent of the respondents put their foods in fly proof cages, 49 percent use clean utensils in cooking food, while nine percent serve food at the correct temperature and 16 percent reheat their food often. Moreover, 27.9 percent store their left over foods in a cool, dry place, four percent in polythene bags, 14.2 percent in plastic containers while 20 percent uses refrigerator in storing their left over foods.

The study recommended that Sunyani Metropolitan Assembly and Food and Drug Board should occasionally organised seminars on basic training in personal, kitchen and food hygiene. It was also recommended that Public health officers should ensure that food vendors undergo medical screening on periodical bases and certificates should be issued to them.

Lessons Learnt From the Empirical Studies

This section draws on the lessons that were learnt from the empirical studies. These include the data need, sources and methods of data collection and analysis. Studies employed both quantitative and qualitative designs in analysing their respective objectives on food vending practices in their various study areas. Throughout the empirical review each study put together quantitative and

qualitative methods in sampling, data collection, and data analysis. Mensah et al. (2002), the FAO (2012), Boateng (2014), and Monney et al. (2014) used cross-sectional designs, and in some cases, as shown by Boateng (2014) and Monney et al. (2014) used a both descriptive and cross-sectional designs which fit either quantitative and qualitative studies.

The sampling procedures used by most of the studies, including Mensah et al. (2002), the FAO (2012), and Monney et al. (2014) was purposive largely based on the fact that the vendors are dispersed, too many, and with a large segment of non-stationary vendors, which makes it difficult to construct a sampling frame. Boateng (2014), on the other hand, divided his population into five zones and focused on the stationary vendors which allowed him to randomly sample the vendors. The data collection method employed by all the studies was observation, supported with an observation checklist. While the FAO (2012) used an interview schedule to collect data, Mensah (2002), Boateng (2014), and Monney et al. (2014) used structured questionnaires to collect food from vendors. The analytical methods used on the hygiene and food vending practices were mainly descriptive. However, studies like Mensah et al. (2002) and Boateng (2014) that analysed the microbial contents of sampled foods used laboratory experiments. However, none of these compared the incidence of microbial contents to the accepted standards of food contamination.

The studies suggest that effective institutional frameworks can help resolve some of the hygiene and vending malpractices in food vending. They suggest that the behaviour of the vendors can be influenced through institutional

set-ups, which supports both institutional theory and the theory of planned behaviour which underlie the current study. The empirical review provides evidence supporting that the vendors engage in several malpractices because of weak institutional control in the country. For example, most of the vendors sold in unkempt environments and did not have dustbins to encourage proper waste disposal (Boateng, 2014).

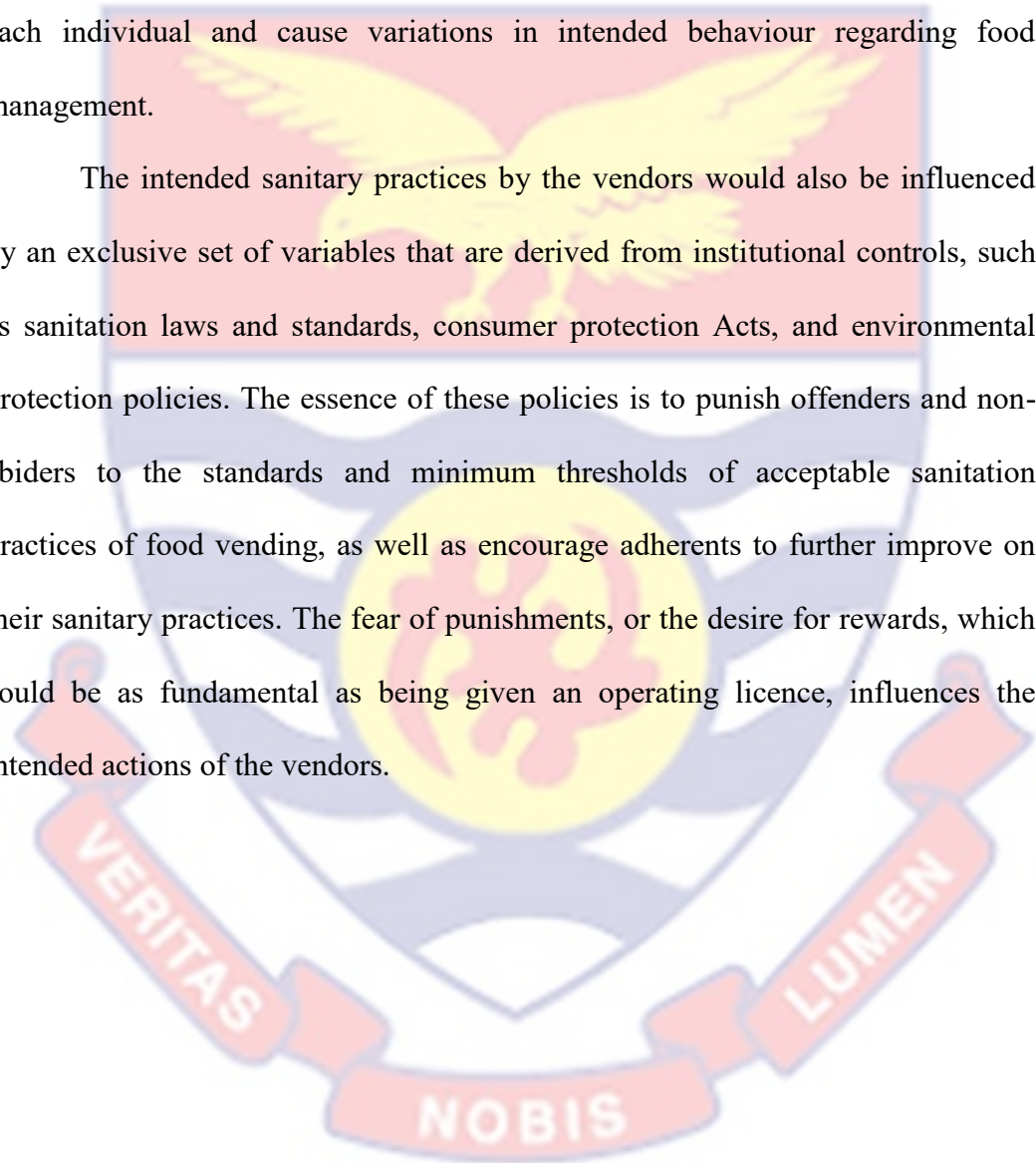
Education for vendors was found to be relevant to proper food hygiene practices (Mensah et al. 2002), but most of the vendors had inadequate or infrequent training on food safety practices (Boateng, 2014). Monney et al. (2014) observed that most of the vendors neither covered their hair nor kept their fingernails short and clean. Also, some coughed and sneezed directly into the food being served, and only one-fifth of the vendors stored their foods in refrigerators. Some of the major challenges in food vending, as identified by FAO (2012) in the cross-country study included limited access to capital, inadequate local infrastructure and basic food storage facilities, transportation, municipality taxes and the absence of training provision for food operators in the areas of hygiene, nutrition and food safety as well as basic business skills.

Conceptual Framework

The conceptual framework for the study takes into account the theoretical and conceptual underpinnings of the study. The direction of the arrows depicts the flow in the diagram and the connection between the various segments of the framework. This framework explains the fundamental factors that underlie the sanitary practices of food vendors within the study area. It is suggested that food

vendors have pre-dispositions about sanitation practises, which are derived from their attitudes, subjective norm, perceived behavioural control. These personal psychological attributes would have been derived from society, cultural beliefs and practices, past experiences, and personal education. They would differ for each individual and cause variations in intended behaviour regarding food management.

The intended sanitary practices by the vendors would also be influenced by an exclusive set of variables that are derived from institutional controls, such as sanitation laws and standards, consumer protection Acts, and environmental protection policies. The essence of these policies is to punish offenders and non-abiders to the standards and minimum thresholds of acceptable sanitation practices of food vending, as well as encourage adherents to further improve on their sanitary practices. The fear of punishments, or the desire for rewards, which could be as fundamental as being given an operating licence, influences the intended actions of the vendors.



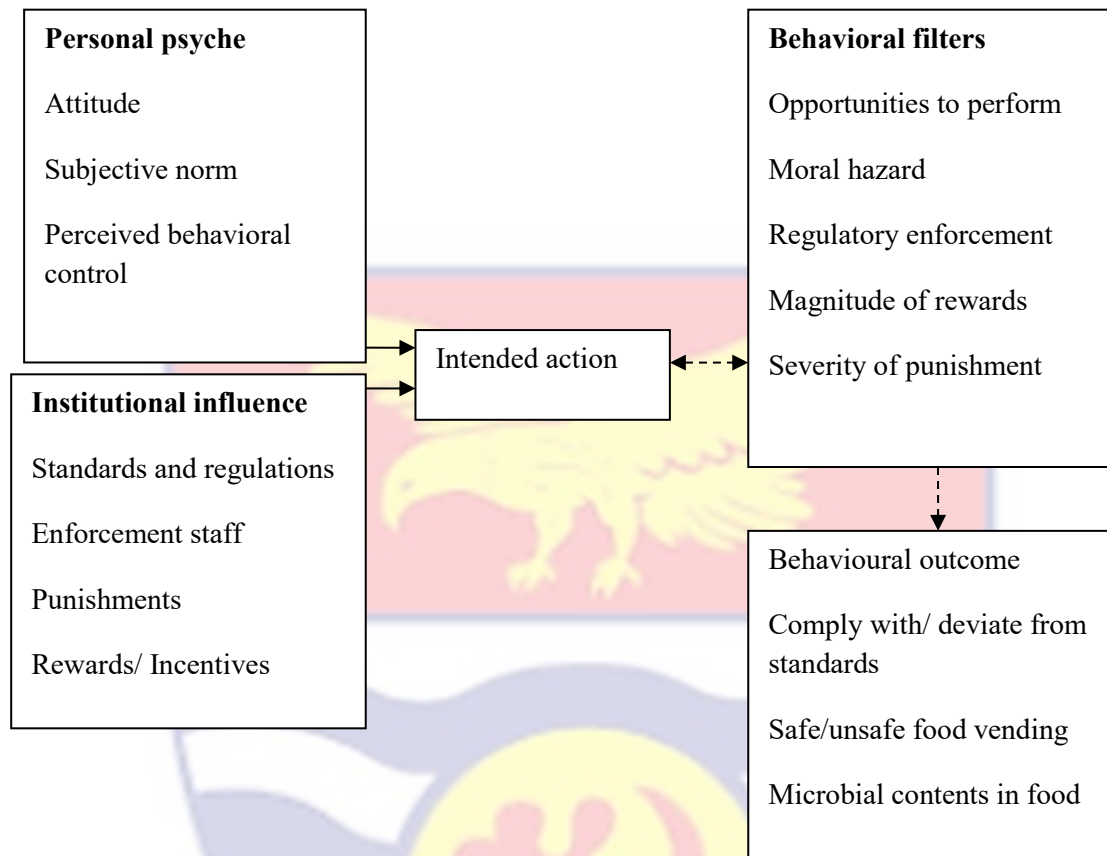


Figure 1: Factors influencing sanitary practices of food vendors

Source: Hirschi (1969), Boateng (2014), Monney et al. (2014)

Beyond what is intended, the actual behavioural outcomes, which are the real sanitation practices of the vendors, are conditioned by some behavioural filters including the opportunity to actually act as intended. For example, the availability of suitable places to set up vending outlets at desired posts, could engender a variation between what was intended and the actual practice. The dilemma, in such a situation would be to set-up shop or not. Similarly, a severe punishment, which is in itself subjective, as well as the austerity of law enforcers, could deter unacceptable practices in food vending. Moral hazard, including bribery and falsifying auditing reports could also influence actual practices when

vendors acknowledge that such avenues are available to escape punishments. The framework holds the position that intended practices are not always equal to actual practices, due to the influence of behavioural filters, as shown by the broken arrows.



CHAPTER THREE

METHODOLOGY

Introduction

This chapter deals with the methodological approach used for the study. It discusses the study area, research design, study population, sample size, and sampling procedures. The methods and instruments for data collection, and data analysis techniques and the pilot-testing of the research instrument are also discussed.

Study Area

The study area is the Bolgatanta Municipality. The Bolgatanga Municipality is the home of the Upper East regional capital. The Municipality forms part of the Thirteen (13) Districts and Municipals in the Region. Bolgatanga is the largest urban centre in the region. The Municipality shares boundaries with Bongo District to the North, to the East with Nabdam District, to the South with Talensi District and to the West with Kassena / Nankana East District. The Administrative capital is Bolgatanga. Bolgatanga Municipality is located in the centre of the Upper East Region.

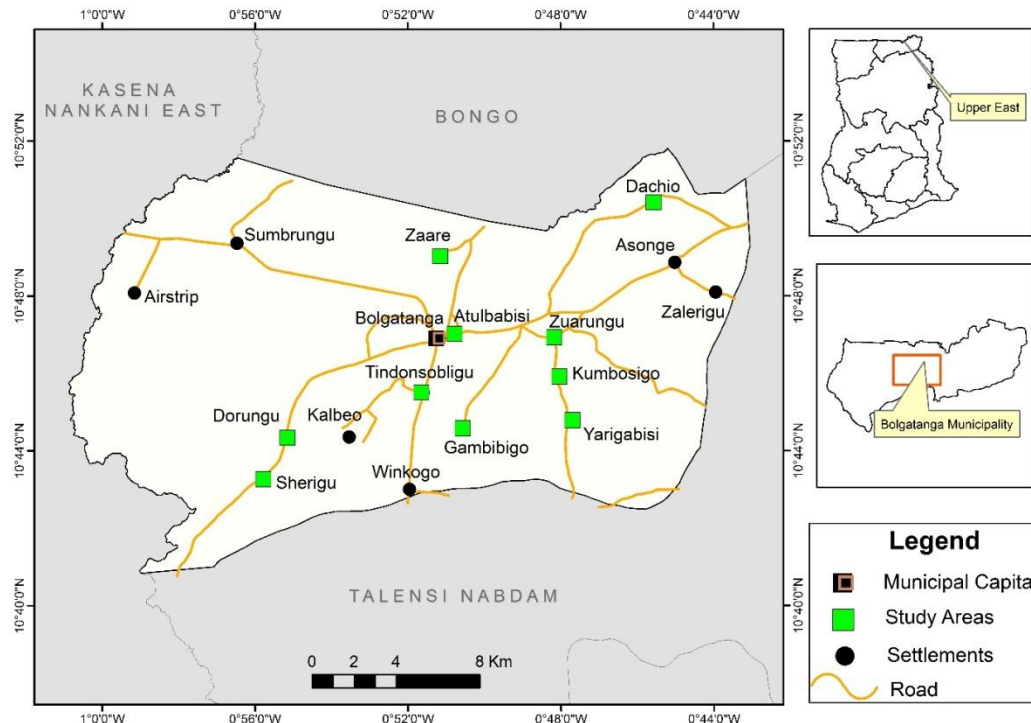


Figure 2: Map of Bolgatanga Municipality

Source: Department of Geography and Regional Planning, University of Cape Coast (2016)

Physical Characteristics

The Bolgatanga Municipality has a total land area of 729 sq km. The natural vegetation is that of the savannah woodland, characterized by short scattered drought-resistant trees and grass that gets burnt by bushfire or scorched by the sun during the long dry season. Human interference with ecology is significant, resulting in near semi-arid conditions. The most common economic fruit trees are the Shea, dawadawa, baobab and acacia.

The climate is characterised by one rainy season from May/June to September/October. The mean annual rainfall during this period is between 800 mm and 1,100 mm. The rainfall is erratic spatially and in duration. There is a long

spell of dry season from November to mid-February, characterized by cold, dry and dusty harmattan winds. Temperatures during this period can be as low as 14 degrees Celsius at night, but can go to more than 35 degrees Celsius during the day. Humidity is, however, very low making the daytime high temperature a little uncomfortable. The municipality is entirely within the “Meningitis Belt” of Africa. It is also within the onchocerciasis zone, but with the control of the disease, large areas of previously abandoned farmlands have been declared suitable for settlement and farming (UNDP Ghana, 2010),

Population size and distribution

According to the Ghana Statistical Service (2010), the Bolgatanga Municipality has a total population of 131,550, accounting for 12.6 percent of the population of the Upper East Region (1,046,545). The Municipality has a male population of 62,783 constitutes 47.7 percent while females are 68,767 or 52 percent of the total population. Although urbanization is fast catching up with the Bolgatanga Municipality, the rural population still account for half (50.2%) of the population. While the Municipality has 12.6 percent of the regional population, it accounts for three out of every 10 (29.8%) urban dwellers in Upper East.

The urban dwellers are significantly higher than their rural counterparts for the population 20 to 49 years, which constitute the peak of the productive age. Similar patterns are observed among the male and female and urban and rural populations. Understanding the age and sex structure of the population of the district is important for planning and equitable allocation of resources. The age and sex structure of the population of the district follow the region and the

national pattern. The age structure is that of a broad base and reduces gradually in the subsequent age groups and narrows in the older ages. Whiles more males than females are observed in the age group 0-14 years, females outnumber males in the economically productive age group of 15-64 years as well as in the older ages.

Education

The total population in school is 52,273 comprising 26,665 (51.0%) males and 25,608 (46.8%) females (GSS, 2010). Males exceed females for both population currently in school and those who attended school in the past. Among the population currently in school, nearly half (47.0%) are in primary school with slightly more males than females, about a one-fifth (19.4%) are in JHS and 9.5 percent are in SHS, whiles only four out of every 100 (4.1%) are in a tertiary institution. There are slightly more females than males in vocational or technical or commercial and post-secondary schools in the municipality. Generally, the number attending school considerably decreases with progression to higher educational levels.

Ghana Statistical Service (2010) also found that among the population who attended school in the past, three out of five (59.8%) only had basic education with more females (63.0%) than males (57.0%). Whiles about the same proportion of males and females reported to have attained secondary or vocational or technical or post-secondary education, more males (14.1%) than females (8.5%) attained tertiary level.

Economic activities

The proportion of the population that is economically active (74.0%) is nearly three times higher than proportion of the population not economically active (26.0%). While 72.2 percent of the economically active population 15 years and older are employed, 2.4 percent are unemployed. Among the unemployed population, 44.4 percent have ever worked but are currently seeking work, while 55.6 percent are seeking work for the first time. The proportion of females who worked before and are seeking work is 46.6 percent whilst those seeking work for the first time is 53.4. On the other hand, 41.9 percent of the male unemployed population had worked before but now seeking work whereas 58.1 percent are first time job seekers. The data further reveal that those who are involved in full time education, that is, students (52.6%) constitute the majority of economically not active population. The proportion of the economically not active population who did home duties are 19.2 percent. However, the proportion of females who did home duties is higher than their male counterparts. This could be due to the social norm where females usually keep the home.

Social amenities and infrastructure

At the municipality level, the GSS (2010) observed that the proportion of households using various improved water sources is as follows: more than forty-six percent (46.1%) of the population in the Municipality use borehole/pump/tube well as their main source of drinking water. About 43.8 percent use pipe-borne water, 4.7 percent use protected well and 0.3 percent use protected spring, The proportion of households using unimproved water sources is as follows: 2.5

percent of the households in the Municipality use unprotected well, 1.5 percent use river/stream and 0.4 percent use dug out/ pond/lake/dam/canal/others. On the basis of the classification discussed earlier over four out of five households (94.9%) in the municipality have access to improved drinking water sources, which is higher than the regional proportion (88.2%). Access to improved drinking water sources is almost evenly spread between urban and rural communities.

More than three out of every five households in the municipality either dispose of their solid waste at an open public dump site (37.9%) or in a public refuse container (25.2%). While 16.9 percent of the households burn their solid waste, 8.2 percent indiscriminately dump their generated solid waste. More than four percent (4.4%) of households bury their solid waste and about 6.9 percent of the households pay for their solid waste to be collected. More rural households than their urban counterparts burn or bury their solid waste. The use of open public dump sites is a more of a rural practice as slightly more than half of the rural households use this method. Probably due to the unavailability of refuse containers in the rural areas, only one in every 100 households has access to this facility

The two major ways of liquid waste disposal in the Municipality, in both urban and rural areas, are to throw onto the street/outside and unto the compound. These two methods account for at least 74.0 percent of liquid waste disposal used in the municipality. In the rural areas about 74.3 percent of the households throw

their liquid waste onto the street/outside, while 13.1 percent throw their liquid onto compound.

Study Design

The study adopted a mix of qualitative and quantitative research approaches. A mixed method was adopted by Mensah et al. (2002), the FAO (2012), Boateng (2014), and Monney et al. (2014) in their assessment of food vending practices. The quantitative approach involves numerical representation and manipulation of observations for the purpose of describing and explaining the phenomenon that those observations reflect (Babbie, 2005). This allowed the collection of quantitative data and also enabled the use of quantitative methods in the analysis of data. Qualitative research entails non-numerical examination and interpretation of observations for the purpose of discovering underlying meanings and patterns of relationships (Babbie, 2007).

According to Creswell (2003), such an approach provides complementarities between the research approaches whereby the strengths of one approach complement the weakness of the other. Thus, the statistical approach of quantitative research will be supported with the narrative approach of qualitative research in this study. This allowed for generalizability and inferences to be made in the same study. In this respects, the study will be cross-sectional, which refers to the type of study which involves a one-time interaction with a group or groups of people. Cross-sectional designs were used by Mensah et al. (2002), the FAO (2012), Boateng (2014), and Monney et al. (2014). The implication for using a cross-sectional design is that the results of the study were applicable to the

population and the conditions of the study at the particular period when the survey was conducted.

Sample Size and Sampling Procedure

Given the diversity of food served and the spread of food vendors, constructing sampling frame for food vendors in Bolgatanga municipality was difficult given the financial and time allowance for the study. The study therefore purposively sampled stationary street food vendors and restaurants, operating at different hours of the day, notably breakfast, lunch and dinner hours. This is mainly because some types of foods are sold at specific hours conforming to breakfast, lunch, and supper. This required purposive sampling method. Purposive sampling was used to sample several food vendors and their customers in studies conducted by Mensah et al. (2002), the FAO (2012), Boateng (2014), and Monney et al. (2014) because a definite number of food vendors could not be established to support a valid sampling frame.

There are several food vendors to be sampled from, as well as several towns to be included in the study. To start with, ten communities within the Municipality were purposively selected. They included Tindonsobulugu, Yarigabisi, Zuarungu Dachio, Gambibigo-Azuabisi, Kumbosigo, Sherigu Dorungu-Agobgabis, Zaree, and Atulbabisi. In each of the communities, 15 food vendors were purposively sampled. In total, 150 food vendors were sampled. The types of meals that the food vendors also sell were sampled for laboratory testing. The head of the Bolgatanga Municipal Authority, the head of the Sanitation Unit of the municipal authority, the head of the Food and Drugs Authority, and the

head of the Ghana Standards Board were purposively sampled for the study, as key informants on the institutional framework governing food vending in the Bolgatanga municipality.

Instruments for Data Collection

Structured interview schedules were used to collect data from the food vendors. This was used because of the largely informal nature of food vending and the fact that usually informal operators have lower level of educational qualification. Thus, it can be assumed that most of the respondents may not be literate enough to respond to a questionnaire on their own without an interviewer to interpret in their local language. The interview schedules were structured into five sections based on the demographic characteristics of the respondents and the four specific objectives of the study. Interview guides were used to conduct in depth interviews with the head of the Bolgatanga Municipal Authority, the head of the Sanitation Unit of the municipal authority, the head of the Food and Drugs Board, the head of the Ghana Standards Board, and five sanitary inspectors.

An observation checklist was designed and used extensively in examining the sanitary conditions of the food vending sites as well as food handling practices. Photographs were taken of these sites and practices to reinforce the data collected through the observations.

Pre-Testing of Instrument

The pre-testing of the instruments for data collection was conducted a week before the actual field work. Thirty sampled food vendors from Navrongo

were recruited for pre-testing. The purpose of the pre-testing was to identify items that were not relevant to the objectives of the study and either modify or delete them. It was found that some of the questions were repetitive and redundant, and thus they were deleted. More items were added to the initial list of observable data to capture the required data for the analysis. The instruments were also vetted by my supervisors.

Ethical Considerations

The study was conducted in conformity to ethical codes in social science research. According to Sarantakos (2005), the ethical considerations include ensuring voluntary participation, anonymity and confidentiality of the respondents. An introductory letter was first sent to the Municipal Assembly and the FDA to ask for permission to include the selected respondents from their institutions in the study. The purpose of the research was explained to all respondents and respondents were interviewed based on their informed consent and voluntary participation. Respondents were also assured of their anonymity and the confidentiality of their responses. The study also adhered to other codes of ethics regarding data collection and information retrieval, as well as attributing secondary data to the valid sources.

Field Work

Prior to the fieldwork, five research assistants (graduates) from the University for Development Studies on National service were briefed on the instruments for data collection. This was to make them conversant with the

objectives of the study and minimise possible errors associated with collection of data. Data was collected from 2nd May, 2016 to 20th June, 2016.

The Municipal Assembly and the FDA were presented with letters of introduction that described the researcher and the purpose of the research. After gaining the consent of the institutions, interview meetings were scheduled with the sampled respondents. Interviewees who could not be reached on the scheduled meetings called on phone and the meetings were rescheduled. The interview schedules were administered to the sampled food vendors after a brief introduction of the purpose of the study. In most cases, the interviews were conducted in the local language, which is mostly Gruune but those who were more conversant with the English or Twi language were also interviewed in those languages. The researcher and the research assistants also collected data on the physical environment of the food vendors' sites using an observation checklist.

Food Sampling

A purposive sampling technique was used to obtain 66 varieties of street vended food samples in the Bolgatanga municipality. Specific food samples collected included rice balls and groundnut soup; Tuozaafe (TZ) and vegetable soup; jollof rice; kenkey and tomatoe sauce; and porridge (koko) were collected within a period of one month from different food vendors and sent to the laboratory for microbial assessment. The food samples were bought into sterile polythene bags and transported immediately to the Microbiology laboratory of the Department of Applied Biology, University for Development Studies. These food

samples were subjected to microbial analysis for estimation of faecal coliforms, *Escherichia coli*, *Salmonella typhi* and *Staphylococcus aureus*.

Laboratory / microbiological analysis

Homogenisation and serial dilution

Ten grams of each food sample was homogenized in 90 ml sterile diluent [peptone water (Sigma, Germany; pH 7.0)] using a stomacher (Stomacher-Bagmixer, Buch and Holm) for 30 s at normal speed. Ten-fold serial dilutions (10^1 to 10^{-9}) were made with same diluent and 0.1 or 1 ml aliquot of each appropriate dilution was spread onto petri dishes containing the appropriate agar medium.

Enumeration of total coliforms and *E. coli*

Total coliforms were enumerated by pour plate on Violet Red Bile Glucose Agar (VRBGA; Oxoid CM 0107), pH 7.4. Inoculate plates were incubated at 37 °C for 24 hours. Colonies were confirmed by their ability to produce gas from brilliant green bile broth, pH 7.4. *E. coli* colonies were distinguished among the coliform colonies on VRBA by adding 100 µg of 4-methyl-umbelliferyl-β-D-glucuronide (MUG) per ml in the VRBA overlay. After incubation at 37 °C for 24 h, colonies were observed for bluish fluorescence around colonies under long wave UV light.

Isolation and enumeration of *Staphylococcus aureus*

Staphylococcus aureus were isolated by spread plating on trypticase soy agar (TSA) and incubated at 37 °C for 24 h. suspected colonies were transferred

onto manitol salt agar plates and incubated at 37 °C for 24 h. the colonies were identified by macro- and microscopically, and by catalase and coagulase tests.

Isolation and enumeration of Salmonella spp

Salmonella spp. was pre-enriched from food samples as follows. TrypticSoy Broth (TSB) phosphate (30 g TSB, 2.31 g KH₂PO₄, 12.54 g K₂HPO₄ per litre, final pH 7.2) or TSB was added to samples in a 1 : 10 ratio and incubated at 25 °C for 2 h, 42 °C for 6 h and then held at 4 °C overnight until processed the next day. A 1-ml aliquot of each enrichment sample was removed and mixed with 20 µl of IMS beads (Dynal, Lake Success, NY, USA). Enrichment/IMS bead mixtures were incubated at room temperature, with shaking, for 15 min and then the IMS beads were removed and washed with phosphate-buffered saline (PBS) Tween 20 (Sigma, St Louis, MO, USA). The IMS beads were then placed into 3 ml of Rappaport-Vassiliadis Soya peptone broth (RVS, Oxoid, Basingstoke, UK) and incubated at 42 °C for 18–20 h. This secondary enrichment was swabbed onto DifcoHektoen Enteric medium (Beckton Dickinson) with novobiocin at a concentration of 5 mg l⁻¹ (HEn) and Difco Brilliant Green agar with Sulfidiazine at 80 mg l⁻¹ (BGS, Beckton Dickinson), then streaked for isolation and incubated at 37 °C for 18–20 h. Black colonies or pink colonies on BGS were considered putative *Salmonella* isolates.

Methods of Data Analysis

The study used the Statistical Package for Social Sciences (SPSS, version 21) and Microsoft Excel for the cleaning and analysis of the data. First, the

quantitative data from the interview schedules were cleaned, coded and entered into the SPSS software. The data was also transferred into Excel to aid in other data analysis needs. The statistical tools used in analysing the data included descriptive such as frequencies, percentages, means, and standard errors. These were used to give an impression of the data, especially with regards to the background characteristics of respondents and their occupational characteristics. Inferential analytical tools, such as chi-square, ANOVA (F-statistic), independent sample t-test, and post-hoc Tukey's test were also used to analyse the statistical significance of associations and differences in the data collected. All the tests were conducted at a default alpha of 0.05. The interview guides were analysed qualitatively using paraphrases of responses and direct quotes from the interview guides. The observable data were also depicted using pictures to support arguments and data observed on the field.

Field Challenges

The major challenge of the study had to do with the spread of the towns which were selected for the study. This had financial and time implications which impacted on the budget and the time allocated to the entire project. In order not to risk unwanted time overruns, the researcher had to employ research assistants to help cover all the 150 food vendors in all the ten communities sampled for the study. There was also a challenge with booking interviews with the key informants due to the nature of the work. They were highly mobile and getting them at their offices was difficult. After several re-scheduling of interview meeting they were finally interviewed by the researcher, but this also added to the

time overrun of the project. However, the Head of the Ghana Standards Board was not available, as well as the Head of the Bolgatanga Municipal Assembly and so these could not be interviewed.



CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents the results and discussion of the study in relation to the sanitary and health conditions of food vendors in the Bolgatanga Municipality. Results of statistical significance and practical importance are explained as they pertain to the specific objectives. A total of 150 food vendors were sampled for interviewing. In addition, three key informants were sampled and interviewed on the institutional practices regarding food vending. Implications of practical and educational significance are derived from the findings and reported in this section. The first section of the chapter examines the demographic and occupational characteristics of respondents while the subsequent sections address the specific objectives of the study.

Demographic and Business Characteristics of Vendors

The study found that out of the total sample of 150 food vendors, nine (6%) were males and 141 (94%) were females. This constituted a proportion of 1:15, which indicated that for every male, there were 15 more females who were food vendors in the study area. In similar studies, Boateng (2014) found that 90 percent of food vendors in Dunkwa-On-Offin in the Upper Denkyira East municipality were females. Also, Monney et al. (2014) showed that the majority (86%) of food vendors in the Sunyani Township were females. These studies confirmed that most food vendors in different localities in Ghana are females.

Therefore, the current study further buttressed the knowledge that food vending in Ghana is mostly carried out by females.

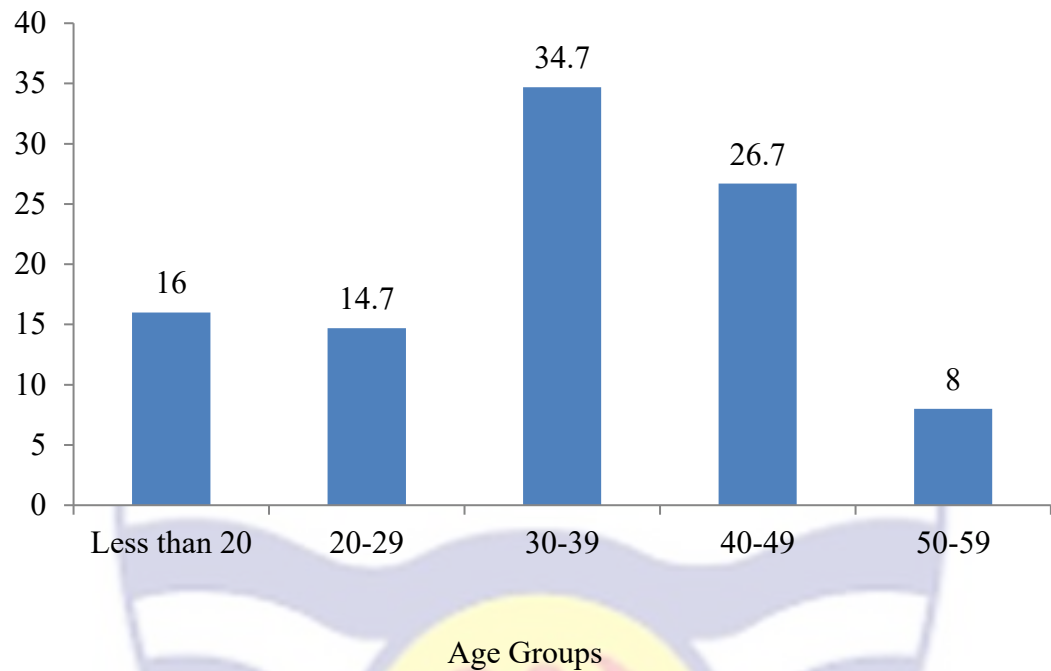


Figure 3: Age grouping of food vendors

Source: Field study, 2016

With respect to the age of the food vendors, it was found that 16 percent of the food vendors were less than 20 years old, indicating that they were teenagers. The age group that formed the highest proportion of the respondents were those in their 30s (30-39 years). They comprised 34.7 percent of the total sample. This was followed by the vendors in their 40s, who were 26.7 percent of the total sample of 150 vendors. The least were those in their 50s who were eight percent of the sample. In similar studies, Boateng (2014) used a class interval of 10 and found that teenagers as young as 15 years were working as food vendors in Dunkwa-On-Offin and those older than 48 years formed the least represented age cohorts in his sample. Monney et al. (2014) also found that the least represented in their sample

of food vendors in Sunyani were teenagers, whereas the majority were those within the age brackets of 31-35 years. The results of the current study therefore bear similarities to earlier studies, in terms of the age of food vendors.

The educational attainment of the respondents was also explored, given that some studies found that educational level of vendors is a significant determinant of the hygienic practices in food vending (Chukuezi, 2010; Dunder, 2012; Mensah et al. 2002; Monney et al., 2013). The current study revealed that 52 percent of the sampled food vendors had attained only basic education. This categorisation included respondents who had lower than Junior High School certificates or equivalent. The highest proportion of the respondents had secondary education, which covered those who had completed and acquired Junior High School and Senior High School certificates. Respondents with tertiary education only formed two percent of the total sample. Earlier studies that examined the educational attainment of food vendors presented mixed results. The Food and Agriculture Organisation (2012) found that a relevant number of informal street food vendors had a secondary level of education (57% in Freetown, 47% in Accra). Boateng (2014) found that the highest proportion of food vendors in Dunkwa-On-Offin were those with no formal education, whereas Monney et al. (2014) found that most of their respondents in Sunyani had basic education. This study therefore adds to the side of the results, which indicated that food vendors usually have only basic education as their highest level of educational attainment.

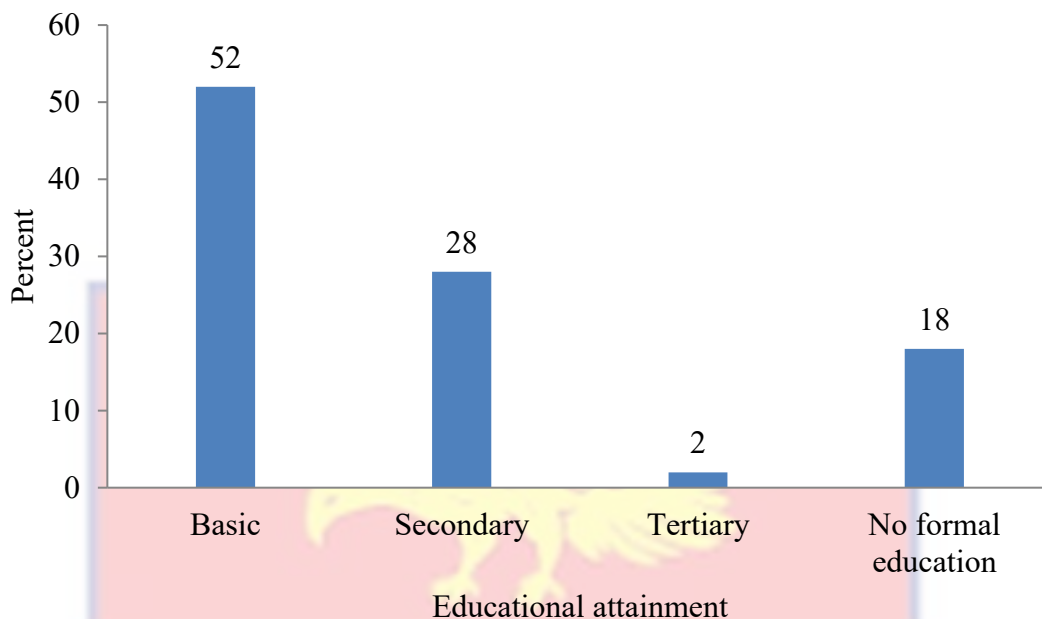


Figure 4: Highest level of formal education of food vendors

Source: Field study, 2016

Occupational Characteristics of Vendors

The study explored the occupational characteristics of the vendors, including the type of vending outlet they managed or operated, the types of foods they sold, source of cooking skills applied in the vending businesses, the sources of capital for their businesses, the factors that influenced the selection of their location, authentic approval of their locations, as well as visual characteristics of the vending locations. The sampled food vendors were from ten locations as shown in Table 1. Three types of outlets were targeted including vending stalls, food sold on tables, and casual restaurants. Respectively they formed 38 percent, 36 percent, and 26 percent of the sample. The results indicated that subsequent comparisons made among the food outlets on various issues would be unequal sample size comparisons.

Table 1-Distribution of food vendors according to towns

Town	Type of vending outlet			Total
	Vending stalls	On tables	Casual restaurant	
Gambibgo	6(40%)	5(33.3%)	4(26.7%)	15
Tindonsobligo	7(46.7%)	0	8(53.3%)	15
Zuarungu	3(33.3%)	12(66.7%)	0	15
Yarigabisi	2(13.3%)	13(86.7%)	0	15
Zaare	10(66.7%)	0	5(33.3%)	15
Sherigu	4(26.7%)	8(53.3%)	3(20%)	15
Dorongo	5(33.3%)	5(33.3%)	5(33.3%)	15
Atulbabisi	5(33.3%)	6(40%)	4(26.7%)	15
Kumbosigo	5(33.3%)	6(40%)	4(26.7%)	15
Dachio	8(53.3%)	1(6.7%)	6(40%)	15
Total	57(38%)	54(36%)	39(26%)	150

Source: Field survey, Aovare (2016)

Bendeck et al. (2013) identified similar food outlet in their studies of formal and informal food vending outlets in Accra. Dwumfour-Asare and Agyapong (2014) also identified that vending stalls, food sold tables, and different types of restaurants were major contributors on the food vending business in Ghana. The results of the current study therefore reiterate the common types of food vending outlet in Ghana and the fact that they are common to most vending places in the Bolgatanga Municipality.

The study explored the length of operation of the food vendors. The study indicates that most (62%) of the operators had been in business between 1 to 5 years (Table 2). In contrast, Food and Agriculture Organisation (2012), on the other hand, found that most food vendors in Accra had been in operation for more than 10 years.

Table 2-*Length of running a food vending Business*

Year cohorts	Type of vending outlet			Total
	Food vending stall	Street food sold on table	Casual restaurant	
Less than a year	3(5.3%)	6(11.1%)	4(10.3%)	13(8.7%)
1-5	41(71.9%)	24(44.4%)	28(71.8%)	93(62.0%)
6-10	5(8.8%)	8(14.8%)	1(2.6%)	14(9.3%)
11-15	7(12.3%)	10(18.5%)	1(2.6%)	18(12.0%)
16-20	1(1.8%)	6(11.1%)	5(12.8%)	12(8.0%)
Total	57(100.0%)	54(100.0%)	39(100.0%)	150(100.0%)

Source: Field survey, Aovare (2016)

Dwumfour-Asare and Agyapong (2014) found that in Aboabo in Tamale, 40 percent of 50 food vendors had one to three years of experience and 34 percent had four to six years of experience. The results bear similarity with Dwumfour-Asare and Agyapong’s (2014) findings in Tamale rather than with the FAO’s (2012) findings in Accra.

The characteristics of the vending outlets also included a description of the site for food preparation. This was analysed by Boateng (2014) given its centrality to the wholesomeness of food being served. In this study, it was found that 36

percent of the food vendors cooked their food in the open space near their vending sites. In the disaggregated results, it was noted that this was the practice of 53.7 percent of table-top food vendors and 35.1 percent of vending stalls operators, but the majority (84.6%) of casual restaurants cooked in enclosed kitchens at the vending sites (Table 3).

Boateng’s (2014) study indicated that most food vendors do not keep a clean kitchen. This study did not focus on the cleanliness but the potential health threats from cooking in open spaces as against an enclosed kitchen. There have been concerns raised that outdoor cooking makes food susceptible to higher risks of contamination. Therefore, the study indicated that the probability of food contamination while cooking in a casual restaurant may be lower than the other types of vending outlets because most restaurants do not practice outdoor cooking.

Table 3: Place of cooking food

	Food vending stall	Street food sold on table	Casual restaurant	Total
Outside open space	20(35.1%)	29(53.7%)	5(12.8%)	54(36.0%)
Enclosed kitchen	5(8.8%)	5(9.3%)	33(84.6%)	43(28.7%)
Home open	15(26.3%)	11(20.4%)	0(0.0%)	26(17.3%)
At home enclosed kitchen	17(29.8%)	9(16.7%)	1(2.6%)	27(18.0%)
Total	57(100.0%)	54(100.0%)	39(100.0%)	150(100.0%)

Source: Field survey, Aovare (2016)

The vending places were also describes in terms of how vendors learnt their trade. This was important in the sense that professional caterers are more likely to have knowledge of safe food practices as compared with unprofessional cooks. It was found that 49.3 percent of the vendors in the total sample were self-taught and 26.7 percent learnt from their relatives (Table 4). This meant that only 24 percent of the vendors were professionals. In the disaggregated results, it was also noticed that while 84.6 percent of the vendors in casual restaurants were professionals, the majority of those in vending stalls and those who sold on table-tops were not. Similar findings were made by Boateng (2014) who found that 90 percent of food vendors he studied taught themselves food safety measures.

Table 4- *Methods of learning food vending trade*

Source of knowledge	Food vending stall	Street food sold on table	Casual restaurant	Total
Relatives	27(47.4%)	13(24.1%)	0(0.0%)	40(26.7%)
Self-taught	27(47.4%)	41(75.9%)	6(15.4%)	74(49.3%)
Catering school	3(5.3%)	0(0.0%)	0(0.0%)	36(24.0%)
Total	57(100.0%)	54(100.0%)	39(100.0%)	150(100.0%)

Source: Field survey, Aovare (2016)

Factors affecting the choice of location of food vendors

The primary factors that influenced the respondents’ decision to locate their businesses at their current sites were also explored by the study. The study found that a little over half (50.7%) of the respondents chose their vending locations due to proximity of those locations to customers (Table 5). Others

(17.3%) chose their locations for customer convenience. In the disaggregated responses, it was found that proximity to customers was the commonest factor to all locational decisions among street foods in vending stalls (63.2%) and those sold on tables (33.3%), as well as casual restaurants (56.4%). It was found that health-related decisions were not mentioned by any of the respondents as the prime factor influencing their decision to locate their food vending businesses.

Table 5- Reasons for choosing vending sites

Reason	Food vending stall	Street food sold on table	Casual restaurant	Total
Proximity to home	2(3.5%)	12(22.2%)	0(0.0%)	14(9.3%)
cluster of food sellers	5(8.8%)	8(14.8%)	1(2.6%)	14(9.3%)
proximity to customers	36(63.2%)	18(33.3%)	22(56.4%)	76(50.0%)
customer convenience	5(8.8%)	16(29.6%)	5(12.8%)	26(17.3%)
Serve specific groups	3(5.3%)		11(28.2%)	14(9.3%)
Lower competition	6(10.5%)			6(4.0%)
Total	57(100.0%)	54(100.0%)	39(100.0%)	150(100.0%)

Source: Field survey, Aovare (2016)

In a similar study, Obi-Nwosu (2013) observed that vendors' stalls are usually located outdoors or under a roof which is easily accessible from the street. The results also confirm theoretical convictions of Weber (1929) which stipulates that firms choose locations that maximise their profits and individuals choose locations that maximise their utility (Glatte, 2005). The fact that most of the vendors indicated proximity to customers as the major factor influencing the choice of their locations points to the utility factor. This supports the ideas of the

rational choice theory to maximise utility, in this case, by location. Other studies in Ghana found different results regarding the factors influencing the choice of location for food vending. They found that the socio-economic status of vendors and localities that vendors operate influence the choices of vending locations and preferences of consumers are most important factors of choice of food vending locations (Boateng, 2014; Mensah, 2002). Lusch (2008) also noted that the location characteristics influence the choice to site a business. In this study, proximity to customers and easier access by customers featured as the most prominent factors for food vendors' choice of location. Thus, locational characteristics were more important to the food vendors in selecting their locations than any other factors.

In another aspect of the question, the respondents were asked to identify the factors that made their location suitable for their food vending business. The highest proportion (42%) of the responses indicated that their locations were suitable because they were easily accessible by the customers (Table 6). Following this, 26 percent of the respondents also indicated that their location offered convenience for the customers, whereas 23.3 percent were more concerned about that their locations were found in the catchment area of customers. For 8.7 percent of the vendors, low competition in their locations was the most important factor for siting their businesses at their current locations.

The responses given by the vendors conformed to the reasons for locating a business in both theory and practice. Reinartz and Kumar (1999) indicated that competition is an important factor in locating businesses because it accounts for

the majority of the variation in price elasticity across vendors. Lusch (2008) also emphasised customer convenience and ease of access as an important factor for locating businesses, which are also confirmed by the respondents of the current study.

Table 6- Factors that make vending locations suitable

Factors	Food vending stall	Street food sold on table	Casual restaurant	Total
Easy access	27(47.4%)	27(50.0%)	9(23.1%)	63(42.0%)
Low competition	6(10.5%)	4(7.4%)	3(7.7%)	13(8.7%)
Convenience	16(28.1%)	0(0.0%)	23(59.0%)	39(26.0%)
Catchment area	8(14.0%)	23(42.6%)	4(10.3%)	35(23.3%)
Total	57(100.0%)	54(100.0%)	39(100.0%)	150(100.0%)

Source: Field survey, Aovare (2016)

Sanitary Conditions of Food Vending Sites

The study delved into the sanitary characteristics of the food vending sites. This was done through observation of the vending sites. The purpose was to identify whether health and sanitation reasons either implicitly or explicitly manifested in the choice of vending sites of the respondents. The first variable that was assessed among the food vending types was the presence of open sewage near the premises for the food vending. It was observed that there were no open sewages near 84 percent of the vending sites (Table 7). This was the case for most of the vending stalls (73.7%), table-top sellers (90.7%), and casual restaurants (89.7%). The statistical comparison of the vendors' responses revealed a

significant association between the type of vending outlet and their proximity to open sewages. The distribution of responses was associated with a chi-square of 7.296 (df = 2; phi = 0.221; p-value = 0.026).

Table 7-Proximity of vending location to open sewage

Characteristic of vending location	Food vending stall	Street food sold on table	Casual restaurant	Total
Near open sewage	15(26.3%)	5(9.3%)	4(10.3%)	24(16.0%)
Not near open sewage	42(73.7%)	49(90.7%)	35(89.7%)	126(84.0%)
Total	57(100.0%)	54(100.0%)	39(100.0%)	150(100.0%)

Pearson Chi-Square = 7.296^a; df = 2; p-value = 0.026; Likelihood Ratio = 7.088; p-value = 0.029

Source: Field survey, Aovare (2016)

The results therefore presented evidence that there is a higher propensity for street food sold in vending stalls to be located near open sewages than food sold on table and casual restaurants. The fact that most of the food vendors were not found located near open sewages depicted that some level of health and sanitary considerations informed their location decisions. In earlier studies, such as Boateng (2014), Dwumfour-Asare and Agyapong (2014), and Monney et al. (2014) that assessed the location characteristics of food vendors in Ghana, proximity to sewage was not a central part of the analyses. Thus, this study adds new knowledge that within the study area, most food vendors, within the categories of casual restaurants, food vending stalls, and food vending tables, were not located near open sewages.

The locations of the vendors were also observed for presence of proximity to open gutters and drainages. The observation revealed that 82 percent of the vendors were not sited near any open gutters (Table 8). This was the case for most of the vending stalls (91.2%), table foods (72.2%), and casual restaurants (82.1%). Moreover, the study found a statistically significant association between the location of vendors and their typologies (chi-square = 6.786; phi = 0.213; p-value = 0.034; df = 2). The phi-value further showed that the association being tested was only moderately strong. Thus, it was deduced that foods sold on tables were more likely to be located near open gutters than the other types of vending outlets. With a likelihood ratio of 7.015 (df = 2; p-value = 0.30), it was also found that the likelihood that it is seven times less likely for a food vending outlet in the study area to be sited close to an open gutter or drainage than it is for those same food vending outlet to be sited near or close to an open gutter.

Table 8- Proximity of vending location to open gutters

Vending location	Food vending stall	Street food sold on table	Casual restaurant	Total
Near open gutter	15(26.3%)	5(9.3%)	4(10.3%)	24(16.0%)
Not near open gutter	42(73.7%)	49(90.7%)	35(89.7%)	126(84.0%)
Total	57(100.0%)	54(100.0%)	39(100.0%)	150(100.0%)

Pearson Chi-Square = 6.786^a; df = 2; p-value = .034; Likelihood Ratio = 7.015; p-value = .030 a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.02.

Source: Field survey, Aovare (2016)

While this study asserts that most food vendors practising away from open sewages and gutters, it runs contrary to Ofeei-Akoto's (2015) general claim that

food vendors in Bolgatanga sell close to these unclean places. Earlier studies reviewed in this study did not employ such a disaggregated approach to analyse sanitary conditions of food vending locations. However, the general indication by other studies, have been that food vending sites in Ghana are unkempt (Nurudeen, Lawal & Ajayi, 2014).

The study found that most of the food-vending outlets were not located around dump sites. This was the case with 87.7 percent of the vending stalls, 66.7 percent of the foods sold on tables, and 94.9 percent of casual restaurants (Table 9). According to the findings, there is a moderately strong association between the location of the vending outlets near dump site and their typologies. This was deduced from a phi-value of 0.38 (chi-square = 14.243; df = 2) and a p-value of 0.01. The deduction from the statistics was based on Rea and Parker's (1996) classification of phi-values. With the likelihood ratio of 14.434 (df =2; p-value = 0.001), the study also deduced that it is 14 times less likely for the vending outlets being located around dump sites than for the same vending outlets to be located near dump sites. Boateng (2014) found that most food vendors in Dunkwa-on-Offin kept away from waste disposal sites. The current study confirmed that most food vendors are located away from dump sites.

Table 9-Proximity of vending location to open gutters

Vending location characteristic	Food vending stall	Street food sold on table	Casual restaurant	Total
Near dumpsite	7(12.3%)	18(33.3%)	2(5.1%)	27(18.0%)
Not near dumpsite	50(87.7%)	36(66.7%)	37(94.9%)	123(82.0%)
Total	57(100.0%)	54(100.0%)	39(100.0%)	150(100.0%)

Pearson Chi-Square = 14.243^a; df = 2; p-value = .001; (Likelihood Ratio = 14.434; p-value = 0.001) a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.02

Source: Field survey, Aovare (2016)

The study scored the various food outlets based on their locational characteristics. Five locational factors were employed. These were proximity to open sewage, proximity to open gutters, proximity to bushes and overgrown weeds, proximity to refuse dumps, and littering at selling place. Each of these variables were labelled with two possible scores; 1 = Yes; and 2 = No, where Yes represented proximity to the specific objects (sewage, gutter, bush/vegetation, refuse dump, or litter), and No (2) was scored in the case where the vendor was not close to the object in question. Thus, the highest score and most desirable score was 12 and the lowest was 6. The six variables had equal weights, indicating that the fundamental assumption for the scores was that locating near any of these objects for the purpose of food vending poses equal health risks to the consumers.

Table 10 presents analysis of the scores of the food vendors according to their resident communities. The results showed that the total mean score for all

the vendors was 11.17 (std. Deviation = 0.886; std. Error = 0.072), which was 0.82 points below the highest possible score of 12. This gave the impression of an overall healthy choice of location of the food vendors.

Table 10-Scores of number of locations for vending towns

Town	f	Mean	Std. Dev	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Gambibgo	15	11.00	1.000	.258	10.446	11.553	9.00	12.00
Tintonsobligo	15	11.60	.632	.163	11.249	11.950	10.00	12.00
Zuarungu	15	9.80	.561	.145	9.489	10.111	8.00	10.00
Yarigabisi	15	11.47	.516	.133	11.181	11.752	11.00	12.00
Zaare	15	11.33	.724	.187	10.932	11.734	10.00	12.00
Sherigu	15	11.73	.456	.119	11.479	11.987	11.00	12.00
Dorongo	15	11.67	.488	.126	11.396	11.937	11.00	12.00
Atulbabisi	15	10.73	1.033	.267	10.161	11.305	9.00	12.00
Kumbosigo	15	11.07	.799	.206	10.624	11.509	10.00	12.00
Dachio	15	11.27	.704	.183	10.877	11.656	10.00	12.00
Total	150	11.17	.886	.072	11.023	11.310	8.00	12.00

Sum of Squares: (Between Groups = 44.700; Within Groups = 72.133; Total = 116.833); F = 9.460; df = 149; p-value = 0.000

Source: Field Survey, Aovare (2016)

From the disaggregated results, it was noted that vendors in Sherigu had the highest mean score of 11.73 (std. Deviation = 0.458; std. Error = 0.126), whereas those in Zuarungu (mean score = 9.8; std. Deviation = 0.561; Std. Error = 0.145) were the only group to score below a 10 point average score. Therefore, at the extreme end of performance of choosing healthy locations, food vendors in Sherigu made the healthiest choices and those in Zuarungu made the rather more unhealthy choice of locations. Overall, the differences in the location scores based

on the resident communities of the food vendors was found to be statistically significant at an alpha of 0.05, given an F-statistic of 9.640, a p-value of 0.000, at 149 degrees of freedom.

In Table 11, the study explores the differences in the scores between vendors with vending permits and those without vending permits. The independent sample t-test was used for this analysis. The Levene's Test for Equality of Variances produced an F-statistic of 15.072 and a Sig. Value of 0.000 (<0.05), which indicated that there are variances between the population. This meant that the obtained differences in the scores are unlikely to have occurred based on random sampling of a population with equal variances. This was confirmed by the skewness statistic of -0.746 (std. Error = 0.198) recorded for the distribution of scores. This indicated that the scores were not normally distributed.

The results showed that the vendors with permit scored an average of 11.81 whereas those without permits scored an average of 10.87 on the healthy choice of location score. According to the statistics, the mean difference of 0.93 was statistically significant at an alpha of 0.05, given a t-stat of 8.101 and a p-value of 0.000. Thus, the study showed that vendors who had food vending permits were located in healthier places than those who had no permits. This would mean that, using location as the only variable factor, it is safer to buy food from vendors with permits. Dwumfour-Asare and Agyapong (2014) found that, in Tamale, securing a food-vending permit did not influence a vendor to observe basic and acceptable food hygiene and safety practices. In this study, the contrary is proven in terms of selecting a healthy site for vending.

Table 11- Location scores according to permit status of food vendors

Permit status	f	Mean	Std. Deviation	Std. Error Mean
With permit	47	11.8085	.53724	.07836
Without permit	103	10.8738	.85954	.08469
Total	150	11.17	.886	.072

mean diff. = 0.93472; std. Error diff. = 0.11539; t-stat = 8.101; df = 133.859;

p-value <0.01

Source: Field Survey, Aovare (2016)

The location scores were also disaggregated by the type of vending facility. In Table 12, casual restaurants scored highest on choosing a healthy location to sell food and street vending stalls scored lowest in the same assessment. Overall, the differences among the types of vending facilities were statistically significant at an alpha of 0.05 ($F = 4.986$; $p\text{-value} = 0.008$; $df = 149$). In the post-hoc test (see Appendix 5), it was found that the mean score difference between vending stalls and foods sold on tables was not statistically significant, but the mean score difference between casual restaurants and vending stalls, on one hand, and also between casual restaurants and foods sold on tables, on the other hand, were statistically significant. This meant that while operators of vending stalls and foods sold on tables make similar choices in locating their vending outlets, casual restaurants made significantly healthier choices in locating their vending outlets.

Table 12- Location scores according to type of vending outlet

	f	Mean	Std. Dev	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Vending stall	57	11.07	.753	.099	10.8705	11.2699	9.00	12.00
Food sold on table	54	11.00	1.009	.137	10.7245	11.2755	8.00	12.00
Casual restaurant	39	11.54	.790	.126	11.2825	11.7944	10.00	12.00
Total	150	11.1667	.88550	.07230	11.0238	11.3095	8.00	12.00

Sum of Squares: (Between Groups = 7.422; Within Groups = 109.412; Total = 116.833);

F = 4.986; df = 149; p-value = 0.008

Source: Field Survey, Aovare (2016)

The sites were also observed for the presence of dustbins for proper collection of solid waste. It was found that 74.0 percent of the food vending outlets had dustbins but they were left open without proper lids (Table 13). This was the case for 91.2 percent of the food vending stalls and 98.1 percent of the table top foods. According to the study, there was a very high likelihood that the food vendors would have dustbins without lids as opposed to having dustbins with properly fitting lids. The likelihood ratio of 94.586 (chi-square = 14.243; p-value <0.01) indicated that it was 94 times likely for the vendors in the various categories having a covered dustbin as opposed to them not having any.

Wuluyeng (2013) found that 58 percent of the food vendors in Nsawam had dustbins and 58.6 percent of those with dustbins had dustbins with covered lids. In the study, a significant majority of the food vendors with dustbins had no lids covering them. In Dunkwa-on-Offin, Boateng (2014) found that most of the vendors did not have a covered dustbin. The results of this study leaned towards

Boateng’s (2014) findings and contribute to the argument on whether food vendors in Ghana keep covered dustbins or not.

Table 13- Use of covered dustbins at vending sites

Observation	Food vending stall	Street food sold on table	Casual restaurant	Total
Covered dustbins	5(8.8%)	1(1.9%)	33(84.6%)	39(26.0%)
Nodustbins/not covered	52(91.2%)	53(98.1%)	6(15.4%)	111(74.0%)
Total	57(100.0%)	54(100.0%)	39(100.0%)	150(100.0%)

Pearson Chi-Square = 94.803^a; df = 2; p-value <0.01; (a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.14.

Source: Field survey, Aovare (2016)

The study further investigated (through observation) whether houseflies made contact with food being served at the vending outlets. The importance of this is borne in the fact that houseflies are potential transmitters of germs and harmful micro-content into foods (Boaten, 2014). The overall data showed that 54.7 percent of the food vending outlets prevented flies from making contact with the food while being served. However, the disaggregated data revealed that this was the case for only a majority (84.6%) of casual restaurants (Table 14). In the case of most street food vending stalls (54.4%) and foods sold on tables (57.4%), flies made direct contact with the food while being served. The propensity that flies would make contact with the food being served was significantly associated with the type of vendor at an alpha of 0.05 (chi-square = 19.176; likelihood ratio = 20.898; p-value <0.01).

Several studies including Barro et al. (2002) in Ouagadougou, Rane (2011) in India, as well as Monney et al. (2013) and Mensah et al. (2002) in Ghana have found evidence supporting poor prevention of flies from foods. The findings of this study therefore confirm that in many parts of Africa; most street food vendors do not properly protect their foods from flies.

Table 14- Housefly-to-food contact prevention among food vendors

Practice	Food vending stall	Street food sold on table	Casual restaurant	Total
Houseflies contact food	31(54.4%)	31(57.4%)	6(15.4%)	68(45.3%)
Houseflies do not contact food	52(91.2%)	23(42.6%)	33(84.6%)	82(54.6%)
Total	57(100.0%)	54(100.0%)	39(100.0%)	150(100.0%)

Pearson Chi-Square = 94.803^a; df = 2; p-value <0.01; (a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 17.68

Source: Field survey, Aovare (2016)

The study further investigated the water used to wash plates that are used to serve customers as it applies to the food vendors who provide eating places for their customers. The initial analysis revealed that 10 percent of the respondents did not provide eating places for their customers and thus they did not require providing plates and other food-serving ware to their customers. On the other hand, 90 percent of the food vending outlets, corresponding to 135 vendors, had places for customers to sit and eat using plates provided by the vendors. Subsequent observations revealed that 80.7 percent of the 135 food outlets did not use clean water to wash utensils and plates used by their customers (Table 15). This was due to prolonged use and reuse of the same washing water.

The analyses further revealed that the likelihood for the food vendors to use dirty water in washing their dishes was 12 times more possible than using clean water to wash dishes used by customers (chi-square = 13.519; likelihood ratio = 12.768; df = 2; p-value = 0.002). Some earlier studies have made similar revelations. For example, in Ouagadougou, Barro et al. (2002) found that water used to wash food materials was of poor quality. Similarly, in Nigeria (Chukuezi, 2010) and Nairobi (Muinde & Kuria, 2005), studies have found that the water which food vendors use for washing utensils and hygiene was compromised. Moreover, utensils were washed using dirty water in buckets which were rinsed only once and the water used repeatedly before it was replaced. This study, therefore, affirmed that it a common practice the for food vendor to recycle dirty water in washing dishes.

Table 15- Characteristics of washing water on site

Observation	Food vending stall	Street food sold on table	Casual restaurant	Total
Clean washing water	7(14.3%)	4(8.5%)	15(38.5%)	26(19.3%)
Dirty washing water	42(85.7%)	43(91.5%)	24(61.5%)	109(80.7%)
Total	49(100.0%)	47(100.0%)	39(100.0%)	135(100.0%)

Pearson Chi-Square = 13.519^a; df = 2; p-value <0.01; (a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.51

Source: Field survey, Aovare (2016)

Safety of Handling, Preparing and Serving of Meals by Food Vendors

Food can be contaminated during handling by vendors (Boateng, 2014; Monney et al., 2014; Mensah et al., 2002). It is therefore imperative to analyse the food-handling practices of food vendors to encourage good practices being

undertaken by food vendors and also to discourage poor food-handling practices among them. Contamination of food can occur prior to meal preparation (Olang'o et al., 2012), therefore the study analysed some of the safety practices that food vendors engage in prior to the preparation of meals for sale.

The results in Table 16 showed that the most important attributes of food ingredients which 68 percent of all the food vendors look out for is the quality of the products. This was supported by all the vendors in the casual restaurant and most of the table-top vendors, whereas a little over one-half of the vendors in stalls indicated that they would chose costs over quality. Furthermore, most (56.9%) of the respondents noted that their primary inspection of food ingredients was the discolouring of the ingredient. This was the case for 80 percent of street food vending stall operators and 55.3 percent of operators of casual restaurants.

Earlier research reviewed in this study did not explore deeper into what operators of food outlets look out for while purchasing food ingredients. This study adds knowledge and establishes that most food vendors would consider quality of food ingredients over their costs and most would use discolouring of the ingredient as the surrogate for quality.

Table 16- Quality checks by food vendors

Response	Food vending stall	Street food sold on table	Casual restaurant	Total
Cost	29(50.9%)	19(35.2%)		48(32.0%)
Quality	28(49.1%)	35(64.8%)	39(100.0%)	102(68.0%)
Sub total	57(100.0%)	54(100.0%)	39(100.0%)	150(100.0%)
Worms	6(10.9%)	13(29.5%)		19(13.9%)
Rotten parts	5(9.1%)	16(36.4%)	13(34.2%)	34(24.8%)
Tender parts		2(4.5%)	4(10.5%)	6(4.4%)
Discolouring	44(88.0%)	13(29.5%)	21(55.3%)	78(56.9%)

Source: Field survey, Aovare (2016)

Apart from vegetables, meat also plays an important role in food vending and its quality is of essence to the consumers. About 45 percent of the food vendors, indicated that they procure their meat from the meat shop (26.7%). Others reported that they buy directly from the abattoir (9.3%), from cold stores, the open market (17.3%), or slaughtered the animals and prepared the meat themselves for cooking (2%).

Table 17- Source of meat for food preparation

Source	Food vending stall	Street food sold on table	Casual restaurant	Total
Meat shop	29(50.9%)	22(40.7%)	16(41.0%)	67(44.7%)
Abattoir	14(24.6%)	17(31.5%)	9(23.1%)	40(26.7%)
Cold store	1(1.8%)		13(33.3%)	14(9.3%)
Open market	10(17.5%)	15(27.8%)	1(2.6%)	26(17.3%)
Self-prepared/slaughtered	3(5.3%)	-	-	3(2.0%)
Total	57(100.0%)	54(100.0%)	39(100.0%)	150(100.0%)

Source: Field survey, Aovare (2016)

The sources of water used for cooking was also analysed. It was noted that most of the respondent had access to regular supply of pipe-borne water for cooking. This was the case in most of the communities, except in Kumbosigo, Yarigabisi, and Dorongo, where more than half of the respondents reported that they did not have regular supply of pipe-borne water (Figure 3). Among the measures put forward by FAO (1997) and WHO's (2010) for ensuring hygienic environment for safe food preparation included adequate supply of portable water supply. In this study most of the food vendors indicated they had regular supply of potable water for cooking. Boateng (2014) also found most of the food vendors he studied in Dunkwa-on-Offin to have clean potable water available for cooking and hand washing. This study thus attested that water for cooking by food vendors in Ghana is usually from a clean source, mostly pipe-borne.

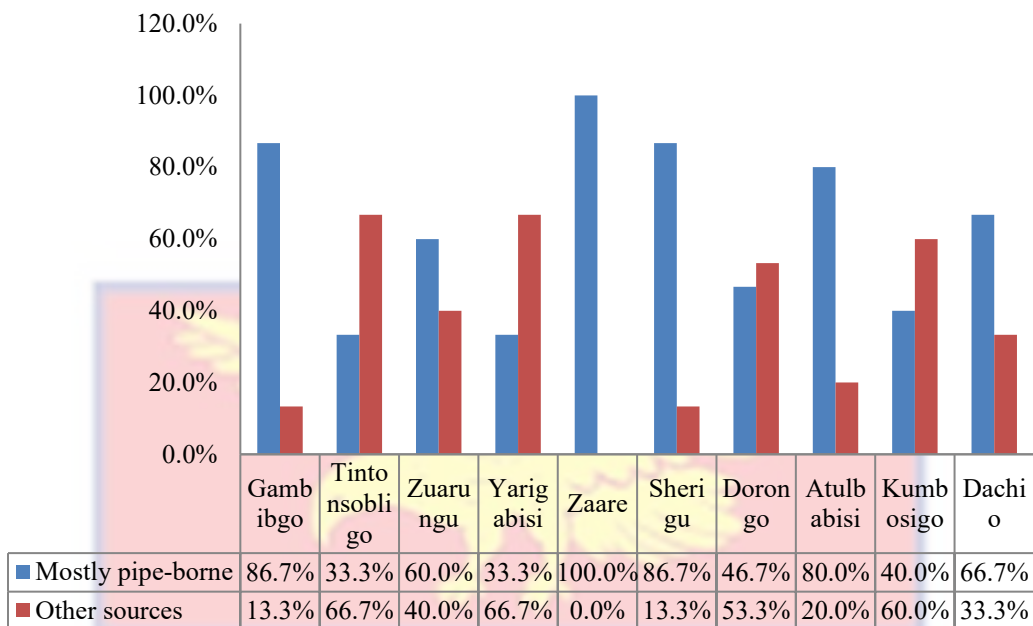


Figure 5: Sources of water for cooking

Source: Field survey, 2016

Observation of Sanitary Conditions

The researcher also closely observed the food vending sites as a complement to the views expressed by the vendors. The Plates in Appendix G show the sanitary conditions and hygiene behaviour of some of the vendors. Some vendors are shown to sell near open gutters and refuse dumps, although this was not the norm. Other vendors were seen to expose the food to contamination through excessive hand – to – food contact. The use of protective clothing (aprons and head gears) was however widespread, which is positive in reducing food contamination.

Use of Food Additives

The FAO/WHO (2009) reported that some health risks of food stems from the concentration of various additives and the cumulative daily intake of a certain contaminant or additive throughout a consumer’s diet. This study investigated the artificial additives that food vendors use in cooking. The results showed that 78.7 percent of the food vendors used artificial additives in their foods, whereas 21.3 percent of them refrain from it. The study further asked the types of additives that the respondents commonly used. Figure 6 depicts that 66.7 percent of the food vendors used Maggi and other bouillon cubes in cooking meals, whereas 8.7 percent used varieties of local powdered seasoning and 2.7 percent used a variety of imported seasoning powder.

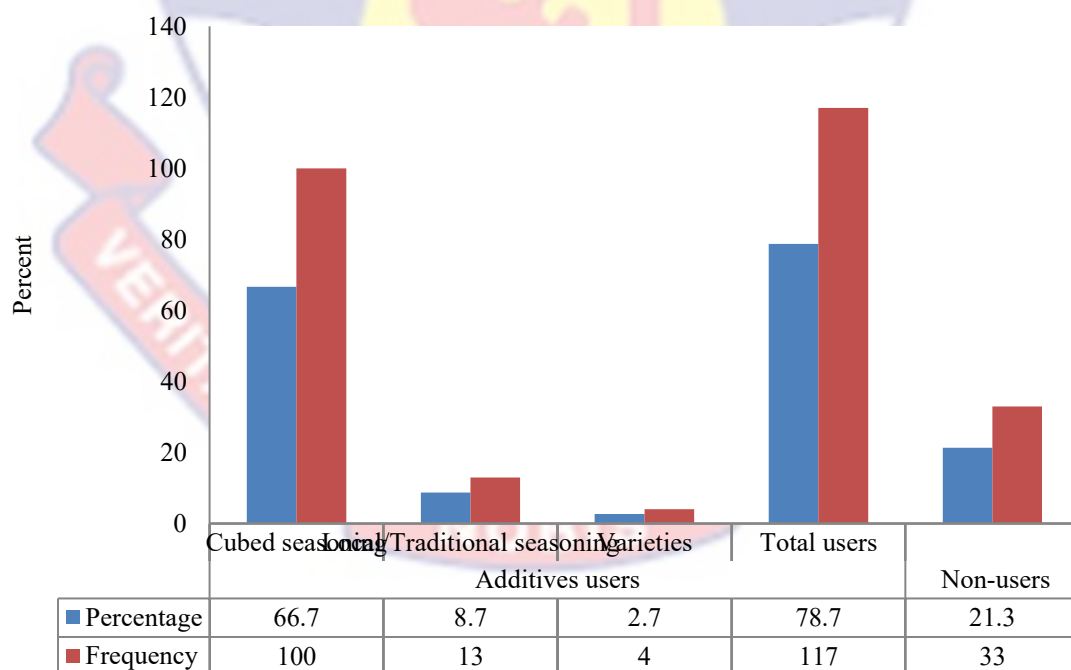


Figure 6: Use of artificial additives in cooking

Source: Field survey, 2016

While curry and natural seasoning have been found with health benefits, Maggi and other bouillon cubes are primarily made of salt, monosodium glutamate (MSG), and hydrogenated oil(trans fat), which have all been found with negative health effects, of which the commonest include high blood pressure and stroke. Research also shows that trans-fat consumption has a definite link to increased chances of developing coronary artery disease (de Souza et al., 2015). This research thus revealed that most food vendors use additives which have potential negative consequences on the health of consumers.

Storage of Cooked Food

The study investigated into how food vendors stored cooked food before serving them. Table 18 shows that 15.3 percent of the vendors stored cooked food in open bowls and this practice was only typical of 26.3 percent of vending stalls and 14.8 percent of food sold on tables. About 21 percent of the food vendors stored cooked food in plain plastic bags. In the disaggregated data, 46.3 percent of restaurants practiced storing foods in plastic bags. It was noticed that foods like banku and rice balls were wrapped in thin transparent plastics to keep them warm before serving. Most (74.7%) of the respondents also stored the polythene wrapped foods in ice chest to further keep them warm for serving at a later time. This was a common practice among 82.1 percent of casual restaurants, 78.9 percent of the vending stalls, and 64.8 percent of the foods sold on tables. The study also shows that about 30.7 percent of the vending outlets stored their cooked foods in saucepans. This practice was common among over half of casual restaurants. On the other hand, it was observed that most vending stalls (75.4%)

and table-top food operators (79.6%) did not use saucepans to store cooked food before sales.

In a radio interview on Joy FM’s Health and Fitness programme (September 26, 2012), Dr. Andre Kwasi-Kumah, a general practitioner at the Eden Family Hospital, indicated when heated, plastic materials, such as polythene, bottles, and ice chests, used to store food can release damaging chemicals into the food, which can cause diners serious medical complications over time. This was confirmed by Mr Dominic Gyamfi, in the September 24, 2014 edition of Daily Graphic that harmful chemicals such as bisphenol A (BPA), phthalates, polyethylene (PETE) and antimony in plastics leach into food, water and other consumables and these activities put consumers at risk.

Table 18-Storage of cooked food

Methods	Food vending stall	Street food sold on table	Casual restaurant	Total
Stored in open bowl	15(26.3%)	8(14.8%)		23(15.3%)
Stored in bowl with lid	42(73.7%)	46(85.2%)	39(100.0%)	127(84.7%)
Stored in plastic bags	7(12.3%)	8(14.8%)	17(43.6%)	32(21.3%)
Storage in plastic bags not practiced	50(87.7%)	46(85.2%)	22(56.4%)	118(78.7%)
Stored in ice chests	45(78.9%)	35(64.8%)	32(82.1%)	112(74.7%)
Stored in saucepan	14(24.6%)	11(20.4%)	21(53.8%)	46(30.7%)

Source: Field survey, Aovare (2016)

The Institute for Agriculture and Trade Policy (2008) pointed out that the 92 percent of 163 government-funded studies in the United States of America found significant developmental and reproductive effects from low-level exposure to BPA in humans. However, Mr Kofi Essel, a Principal Regulatory Officer of the Food and Drugs Authority (FDA), argued that there is no scientific evidence of plastic causing harm through the leach of BPA into foods. This may explain why food vendors use plastics in storing both hot and cold foods before serving.

Use of Protective Clothing

This study showed that 54 percent of the food vendors covered their hair while serving food. This was practiced by 56.1 percent of vending stall operators, 51.9 percent of table-top food sellers, and 53.8 percent of servers in casual restaurants. Further observations revealed that in most cases the sellers wear headgears instead of caps designed for caterers. Therefore, these vendors are not able to tuck all their hair under the headgears which still make them susceptible to falling into the food. The statistics (chi-square = 0.206; df = 2; p-value = 0.902) indicated that there was no statistically significant association in the hair covering practices among the three focal types of food vending outlets. Further observation revealed that a little over one - half (50.7%) of the food vendors did not use aprons while cooking or serving food.

The current study confirmed did not agree with many of the earlier studies in different countries and in different parts of Ghana. For example, Muinde and Kuria (2005) in Kenya and Chukuezi (2010) in Nigeria found that most of the

vendors in their respective countries neither used aprons nor handled food with their hair covered.

In Ghana, Monney et al. (2014) found that as much as 96 percent of the respondents did not cover their hair during food preparation. Boateng (2014) also made similar discoveries, which pointed out that majority of the vendors do not wear hair coverings. In this study more than one – half of the food vendors wore some kind of hair covering although there were usually not caterers’ caps. However, the study confirmed that aprons were not popular among food vendors as observed by Musa and Akande (2003), Chukuezi (2010), and Monney et al. (2014).

Table 19- Use of protective clothing among food vendors

Protective gears	Food vending stall	Street food sold on table	Casual restaurant	Total
Covered hair	32(56.1%)	28(51.9%)	21(53.8%)	81(54.0%)
Uncovered hair	25(43.9%)	26(48.1%)	18(46.2%)	69(46.0%)
Wearing aprons	7(12.3%)	33(61.1%)	34(87.2%)	74(49.3%)
Not wearing aprons	50(87.7%)	21(38.9%)	5(12.8%)	76(50.7%)

chi-square = 0.206; df = 2; p-value = 0.902

Source: Field survey, Aovare (2016)

Food Handling

One of the major issues of concern in food handling is hand-to-food contact in serving food. The study showed that 55 percent of the food vendors made direct contact with the food with their bare hands (Table 19). It was noticed

that 86 percent of the servers in vending stalls and 57.4 percent of table-top food operator contact their foods with their bare hands. On the contrary, only 5.1 percent of food servers in casual restaurants make direct contact with food with their bare hands. From observation, it was noted that some servers covered their hands with polythene bags when picking up food. Others had thongs to pickup meat and other types of solid foods that can be picked up by thongs.

The statistical analysis revealed that there was a significant association between the types of food-vending outlets and the probability that the servers would touch food with their bare hands, at an alpha of 0.05 (chi-square = 61.314; $df = 2$; $p\text{-value} < 0.01$). Several studies around the world have indicated that street food vendors commonly practice touching food with their bare hands. For example, in Manhattan, Burt, Volel, and Finkel (2003) found that over one - half of the studied vendors contacted served foods with bare hands. Similarly, Chukuezi (2010) also found that, about one-fifth of the vendors in Owerri, Nigeria, touched food with their bare hands. Boateng (2014) made similar findings in Dunkwa-on-Offin, indicating that most food vendors used their bare hands to touch food when serving.

Table 20-Hand-to-food contact among food vendors

Modes of handling foods	Food vending stall	Street food sold on table	Casual restaurant	Total
Contact with bare hands	49(14.3%)	31(57.4%)	2(5.1%)	82(54.7%)
No contact with bare hands	8(14.0%)	23(42.6%)	37(94.9%)	68(45.3%)
Total	57(100.0%)	54(100.0%)	39(100.0%)	150(100.0%)

Pearson Chi-Square = 61.314^a; df = 2; p-value <0.01; (a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 17.68

Source: Field survey, Aovare (2016)

At the operational level, it was found that 51.3 percent of the food vendors had food debris on their bare hands while serving food, which further confirmed that they touch the food with their bare hands. It was also found that this was a common practice among 86 percent of food stall operators and one - half of table-top food sellers. Only 2.6 percent of servers in casual restaurants had food debris on their hands. The statistical analysis revealed that, at an alpha of 0.05, there was a significant association between the types of food-vending outlets and the probability that the servers would have food debris on their bare hands (chi-square = 64.533; df = 2; p-value <0.01). The Phi of 0.656 (p-value <0.01; likelihood ratio = 77.438) also depicted a very strong relationship between the variables. Thus, it was highly probable for food stall vendors and table-top food sellers to have food debris on their hands, in comparison to servers in casual restaurants. In a similar study in Konongo, Monney et al. (2013) found that most food vendors had debris of food on their hands.

Table 21- Food debris on the hands of food vendors

Observation	Food	Street food	Casual	Total
	vending stall	sold on table	restaurant	
Food debris on hands	49(14.3%)	31(57.4%)	2(5.1%)	82(54.7%)
No food debris on hands	8(14.0%)	23(42.6%)	37(94.9%)	68(45.3%)
Total	57(100.0%)	54(100.0%)	39(100.0%)	150(100.0%)

Pearson Chi-Square = 64.533^a; df = 2; p-value <0.01; (a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 18.98

Source: Field survey, Aovare (2016)

The study further analysed the manner in which the vendors attend to other harmful objects while serving food by analysing the contact made with jewellery including bracelets, finger rings, watches, and other forms of jewellery. It was found that 18 percent of the vendors wore jewellery that made contact with food while serving. The study further indicated that avoiding contact of jewellery with food was a practice common to 97.4 percent of servers in casual restaurants, 80.7 percent of table-top, and 72.2 percent of those in vending stalls.

Table 22- Food-to-Jewellery Contact

Observation	Food	Street food	Casual	Total
	vending stall	sold on table	restaurant	
Contact with jewellery	11(19.3%)	15(27.8%)	1(2.6%)	27(18.0%)
No contact with jewellery	46(80.7%)	39(72.2%)	38(97.4%)	123(82.0%)
Total	57(100.0%)	54(100.0%)	39(100.0%)	150(100.0%)

Pearson Chi-Square = 9.859^a; df = 2; p-value = .007; (a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 18.98

Source: Field survey, Aovare (2016)

The statistics revealed that the association between the vending outlets and their practices with respect to food contacts with jewellery was statistically significant at an alpha of 0.05 (chi-square = 9.859; df = 2; p-value= 0.007). This meant that a higher proportion of casual restaurants were more likely to ensure that their servers do not wear jewellery. Chukuezi (2010) found out that most food vendors in Nigeria wear jewellery that make direct contact with food.

Microbial Content of Food Served by Food Vendors

The microbial content of food is important in assessing the health risks involved in consuming certain types of foods sold. This study analysed the microbial content of some of the foods sold in the streets and restaurants. Table 22 presents the microbial contaminants and the load of contaminants in the sampled foods. In all the 66 samples of food collected, *Escherichia coli* (*E. coli*) was isolated in 31 samples (46.9%). The results in terms of specific foods were comprised of four out of seven samples of rice balls, four out of seven samples of groundnut soup, one out of 10 samples of T.Z, five of ten samples of vegetable soup, three of eight samples of Jollof rice, one of six samples of kenkey, and all six samples of tomato sauce. None of the samples of porridge had traces of *E. coli*. According to the food safety standards of the Ghana Standards Authority (2013), *E. coli*, *Salmonella typhi* and Faecal coliform must be absent in food, while *Staphylococcus aureus* must be less than 1×10^3 cfu/g. In this study, all the samples that were isolated for *E. coli* had microbial loading of 1 and above, with the lowest recorded in the sample of kenkey (1.6 ± 0.6). The highest

contamination by *E. coli* was in the samples of tomato sauce, followed by samples of rice balls and then by groundnut soup.

Only six of the 66 food samples had any presence of *Salmonella typhi* (*S. typhi*). This included one of the seven samples of rice balls, one of the eight samples of jollof rice, and four of the six samples of tomato sauce. The microbial loads determined by the colony forming units per gram (log cfu/g) in the isolated samples were greater than the acceptable standard defined by Ghana Standards Authority (2013). *Salmonella typhi* is the agent that causes typhoid fever. According to the Centers for Disease Control and Prevention (2015), the only source of this agent is infected humans, through poor personal hygiene, improper waste management, and poor water management. .

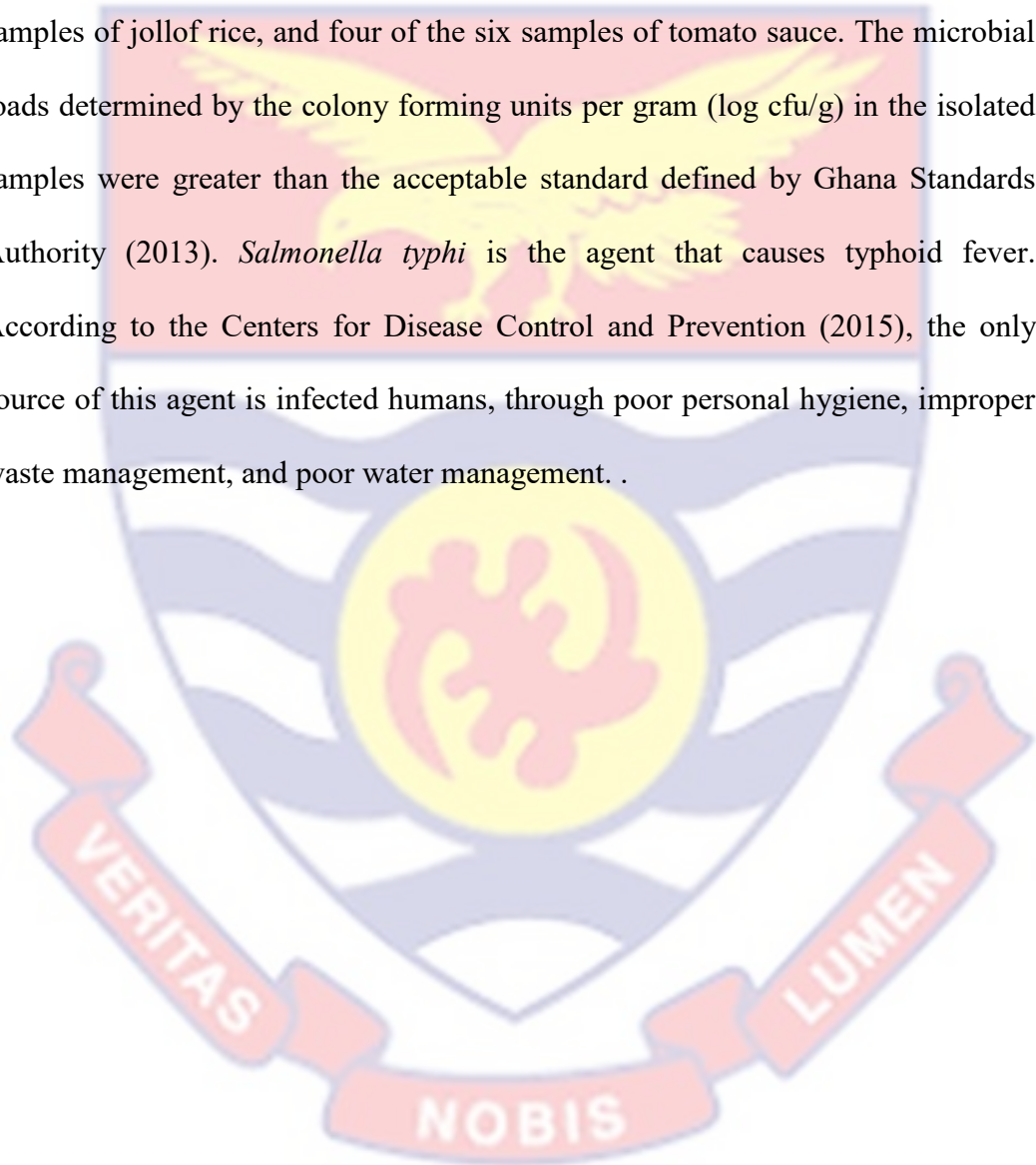


Table 23-Microbial contaminants and load in ready-to-eat street foods in Bolgatanga

Food type	Number of contaminated (positive) food samples				Average microbial load (log cfu/g)		
	Fecal coliform	<i>E. coli</i>	<i>Staph. aureus</i>	<i>Salmonella</i> spp.	<i>E. coli</i>	<i>Staph. Aureus</i>	<i>Salmonella typhi</i>
Rice Balls (<i>n</i> =7)	6(85.7)	4(57.1)	7(100)	1(14.3)	5.5 ± 1.1	6.3 ± 2.2	2.1 ± 0.5
Groundnut Soup (<i>n</i> =7)	5(71.4)	4(57.1)	2(28.6)	0(0.00)	4.4± 0.8	3.5 ± 1.0	ND
T.Z.(<i>n</i> =10)	2(20.0)	1(10.0)	3(30.0)	0(0.00)	2.6± 0.5	1.8 ± 0.7	ND
Vegetable Soup (<i>n</i> =10)	7(70.0)	5(50.0)	4(40.0)	0(0.00)	3.5 ± 2.1	2.1 ± 0.4	ND
Jollof Rice (<i>n</i> =8)	5(62.5)	3(37.5)	5(62.5)	1(12.5)	4.8 ± 1.5	3.7 ± 1.2	1.6 ± 0.7
Kenkey (<i>n</i> =6)	0(0.00)	1(16.7)	1(16.7)	0(0.00)	1.6 ± 0.6	1.0 ± 0.5	ND
Tomato/Pepper Sauce (<i>n</i> =6)	6(100)	6(100)	5(83.3)	4(66.7)	6.7 ± 1.4	4.5 ± 2.5	3.2 ± 1.5
Porridge {Hausa koko}(<i>n</i> =12)	0(0.00)	0(0.00)	1(8.30)	0(0.00)	ND	1.3 ± 0.2	ND
Total (<i>n</i> =66)	31 (46.9)	24 (36.4)	28 (42.4)	6 (9.1)			

Source: Field Survey, Aovare (2016)

E. coli is an organism that is part of the normal microflora of the intestinal tract of humans and warm-blooded animals. As such, their presence in ready-to-eat foods (fully cooked or those containing raw fruits or vegetables) can be an indication of poor hygiene and sanitation or inadequate heat treatment. As per the standards set by both the UK food safety authority and the World Health Organization (WHO), *E. coli* counts $\geq 2 \log \text{ cfu/g}$ in ready to eat foods is unsatisfactory (See Appendix 10). Therefore the results indicate that except for kenkey, all ready-to-eat foods sampled were not satisfactory.

Staphylococcus aureus can be routinely isolated from humans and associated environments. As such, their presence is an indication of human contact. Some *S. aureus* strains produce a toxin which can cause food poisoning. Again, as per the standards, the number of *Staphylococcus aureus* found in ready-to-eat tuozaafe (TZ), vegetable soup, kenkey and fermented porridge (Hausa koko) were within acceptable limits. On the other hand, *S. aureus* found in groundnut soup and jollof were unsatisfactory while in rice balls and tomato/pepper sauce, they reached potentially hazardous levels.

Salmonella species are also enteric bacteria and can be found in the intestinal tract of animals, including birds. As such, Salmonella can frequently be isolated from raw foods of animal origin. Environmental contamination can also result in Salmonella being present in a wide variety of foods, although generally at lower numbers. Their presence in ready-to-eat foods may be a result of undercooking, poor handling practices and cross contamination.

Salmonella can occasionally be isolated from fresh fruit and vegetables, and these may be a source of contamination when included in ready-to-eat food. According to the UK food safety authority and the World Health Organization (WHO) standards, salmonella should not be detected in 25g of the food sample to be considered wholesome for consumption. Thus if Salmonella is detected in any 25g of a ready-to-eat food, it represents a potential hazard for consumers. In this investigation, Salmonella was not detected in groundnut soup, T.Z, vegetable soup, kenkey and Hausa koko. However, it was detected in rice balls; jollof rice and tomato/pepper sauce which present potential hazard to consumers of these food products.

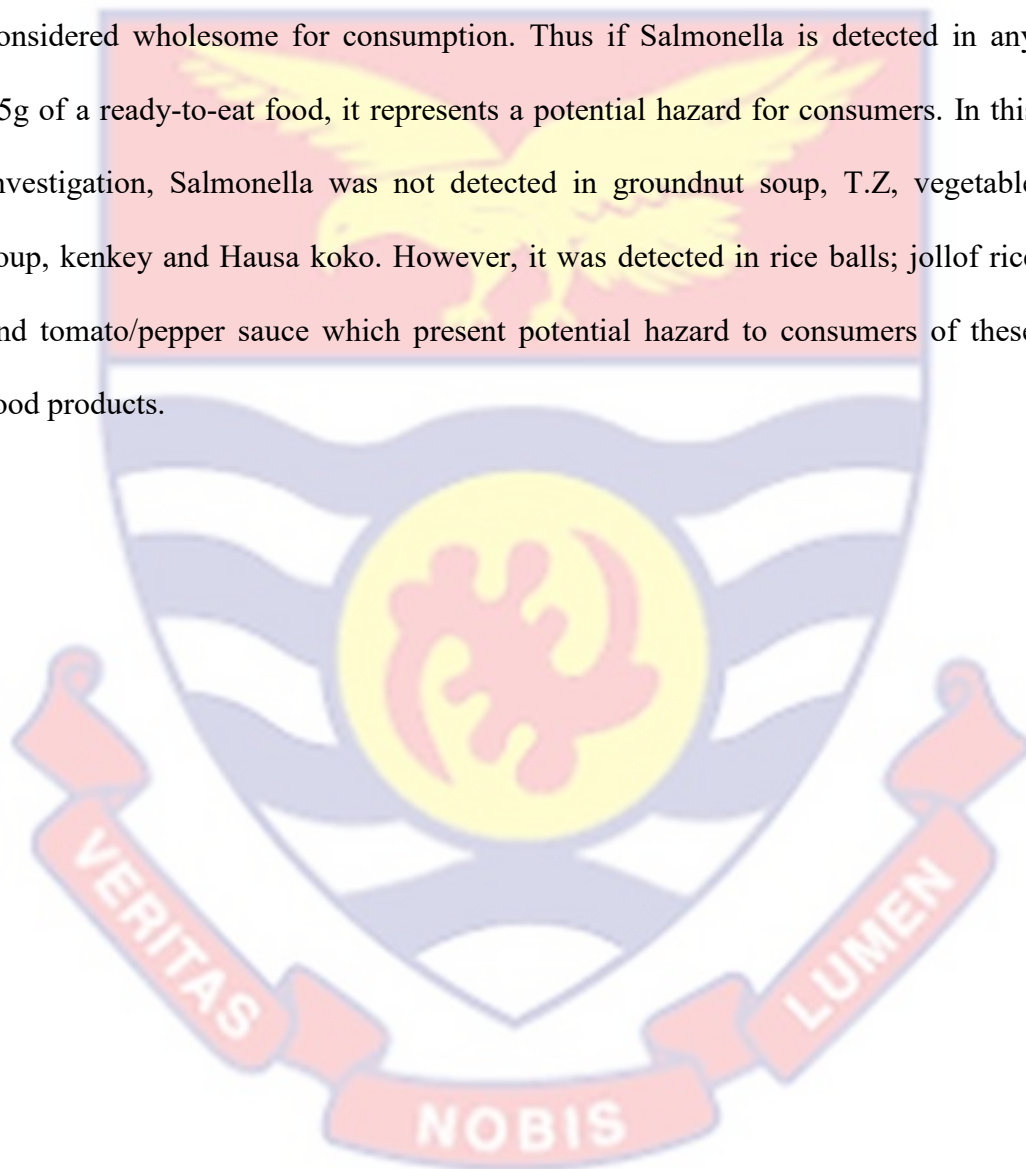


Table 24- Possible diseases that could arise from the isolated microorganisms

Organisms isolated	Diseases caused	Disease symptoms
<i>E. coli</i>	Intestinal infection	Diarrhoea, abdominal pain, and fever. More severe cases can lead to bloody diarrhoea, dehydration, or even kidney failure
<i>Staphylococcus aureus</i>	Skin and soft tissue infections such as abscesses (boils), furuncles, and cellulitis. serious infections such as bloodstream infections, pneumonia, or bone and joint infections	<p>Abscess: Area surrounding the abscess is usually red, painful and swollen.</p> <p>Cellulitis: redness, swelling, and pain at the site of infection.</p> <p>Pneumonia (infection of the lungs) or bacteraemia (bloodstream infection): difficulty breathing, malaise, fever, or chills.</p>
<i>Salmonella typhi</i>	Typhoid or enteric fever	This disease is characterized by the sudden onset of a sustained and systemic fever, severe headache, nausea, and loss of appetite. Other symptoms include constipation or diarrhoea, enlargement of the spleen, possible development of meningitis, and/or general malaise. Untreated typhoid fever cases result in mortality rates ranging from 12-30% while treated cases allow for 99% survival.

Source: Field survey, Aovare (2016)

The fact that many of the operators used polluted water in washing dishes, and also the fact that the key informants raised concerns that poor hygiene was common among the vendors can explain the presence of high levels of *S. typhi* in

some of the food samples. In similar studies, Mensah et al. (2002) and Boateng (2014) found high levels of *Staphylococcus typhi* in sampled ready-to-eat foods.

The acceptable contamination level of *Staphylococcus aureus* (*S. aureus*) in foods is 1×10^3 per the directives of the Ghana Standards Authority (2013). In this study, a total of 28 of the 66 samples of food, representing 42.4 percent, were isolated with presence of *S. aureus*. All the samples of rice balls had *S. aureus* present including samples from all the other selected food, as shown in Table 22. Only the sample of Kenkey was found with levels of *S. aureus* that met the maximum threshold. Thus, all the other foods sampled were contaminated above the threshold to make them safe for consumption.

Other studies including Rane (2011) in India, as well as Mensah et al. (2002) and Boateng (2014) in Ghana found high levels of *Staphylococcus aureus* in ready-to-eat food samples. This indicated that commercial ready-to-eat foods are commonly contaminated with *S. aureus* which is indicative of potential food poisoning of the foods. According to the Centers for Disease Control and Prevention (2010), *Staphylococcus aureus* (*Staph*) is a bacterium found on the skin and in the noses of up to 25 percent of healthy people and animals. Thus, it can be transmitted from either meat or the skins of food servers, when they make direct skin contact with food. The high presence of *S. aureus* in the food samples can be explained by the fact that a significant majority of the servers in this study made direct contact with the cooked food. It should be noted that *Staphylococcus aureus* cannot be destroyed by heat (CDCP, 2010) and this makes the food more susceptible to *Staphylococcus aureus* contamination through direct skin contact.

As shown in Table 23, improper handling and contamination of the street vended foods sold in the Bolgatanga municipality could serve as potential source of disease outbreak. These potential diseases could be due to the presence of a number of pathogenic microorganisms identified in food samples collected during this study. The identification of *E. coli* from a number of diseases including diarrhoea, abdominal pain, and fever, with more severe cases leading to bloody diarrhoea, dehydration, or even kidney failure (Griffin and Tauxe, 1991). Similarly, the isolation of *Salmonella typhi* from foods such as rice balls, jolloff rice and pepper sauce could also lead to typhoid or enteric fever among consumers (Wain et al., 2015).

Institutional set-up Governing Safe Practices of Food Vendors

An effective institutional set-up is important for controlling the food safety standards as indicated by the adapted control theory. In this study the institutional controls and their implementation were analysed from the perspectives of the vendors and key officials of relevant institutions. In Table 21, 68.7 percent of the respondents operated without vending permits. In most cases, casual restaurants (84.6%) had vending permits but a few vending stalls (5.3%) and people who sold on tables (20.4%) had permits to sell food.

Earlier studies in Ghana have revealed that most food vendors operate without the required permits. For example, Monney et al. (2013) observed that most street food vendors operate without due satisfaction of the set of authorisations needed for food vending. Other studies, including Mensah et al. (2002), Okai and Dordi (2002), as well as Boateng (2014) have revealed that most

vendors, especially restaurant operators only acquire the health certificate, which is just one of the many authorisations needed for vending (Mensah et al., 2002; Bendeck et al., 2013).

Table 25- Permit status of food vendors

Observation	Food vending stall	Street food sold on table	Casual restaurant	Total
Operating with genuine permits	3(5.3%)	11(20.4%)	33(84.6%)	47(31.3%)
Operating with no or full permits	54(94.7%)	43(79.6%)	6(15.4%)	103(68.7%)
Total	57(100.0%)	54(100.0%)	39(100.0%)	150(100.0%)

Pearson Chi-Square = 72.483^a; df = 2; p-value <0.01; (a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.22

Source: Field survey, Aovare (2016)

According to the Environmental Health and Sanitation Director, the food vendors are required to meet inspection standards, medical exams, and follow-up inspection before they are offered permits. The Director of Food and Drugs Authority in the municipality also added that before issuing out permits to food vendors, they have to meet hygiene requirements, medical examinations and inspections, storage inspections, and inspection of cooking ware and paraphernalia like aprons and gloves.

While the Municipal Environmental Health and Sanitation Director noted that about 70 percent of the food vendors with permits meet all the requirements, the Director of the Food and Drugs Authority contradicted that all the food vendors who are handed permits meet all the requirements in the checklist as well as all other examinations and inspections. The Director of the Food and Drugs

Authority also indicated that the food vendors do not fall short of any of the requirements, but the Municipal Environmental Health Director noted that the vendors usually lack in personal hygiene. In the same manner the sanitary inspectors indicated that only hawkers, which included sellers with make shift outlets, and those selling on tables had no permits, but most restaurants had permits.

The respondents were asked on the frequency of visits from inspectors and officials from FDA and the Municipal Assembly. In total 74.7 percent of the respondents indicated that they get repeat visits from inspectors and other health officials (Figure 5). In all the communities, most of the food vendors affirmed that they get visits from health inspectors.

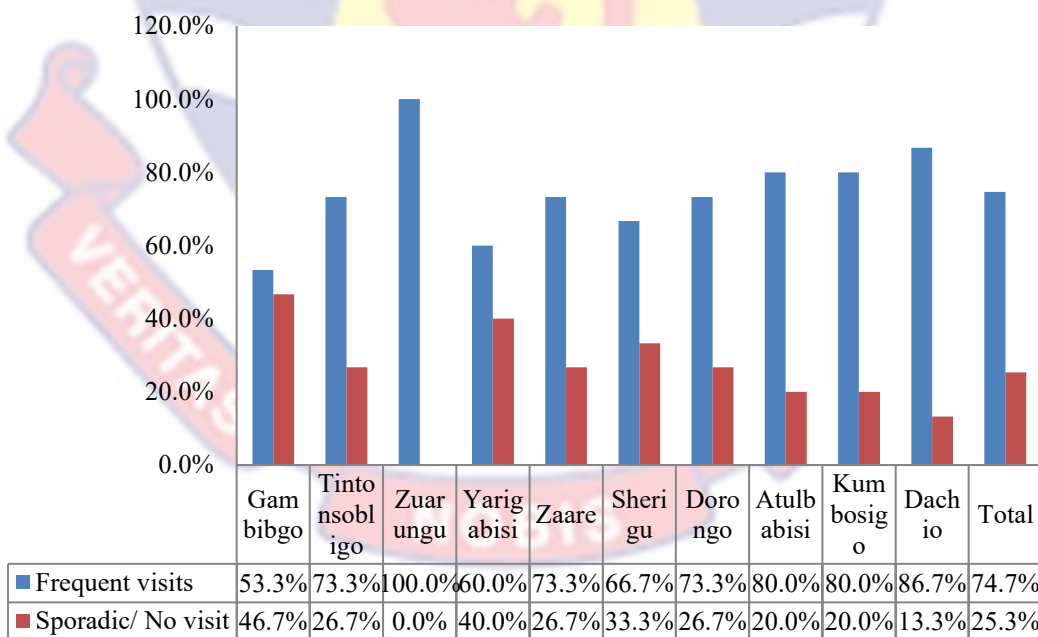


Figure 7: Frequency of visits of sanitary health inspectors to food vending sites

Source: Field survey, 2016

Figure 6 presents the frequency of visits that the respondents got from health inspectors. A greater part of the visits according to the respondents were at regular intervals whereas 33 percent of the visits were irregular. Some noted that the health inspectors paid them about one to two visits every month, others received visits twice a week, some three months apart and the rest were six months apart.

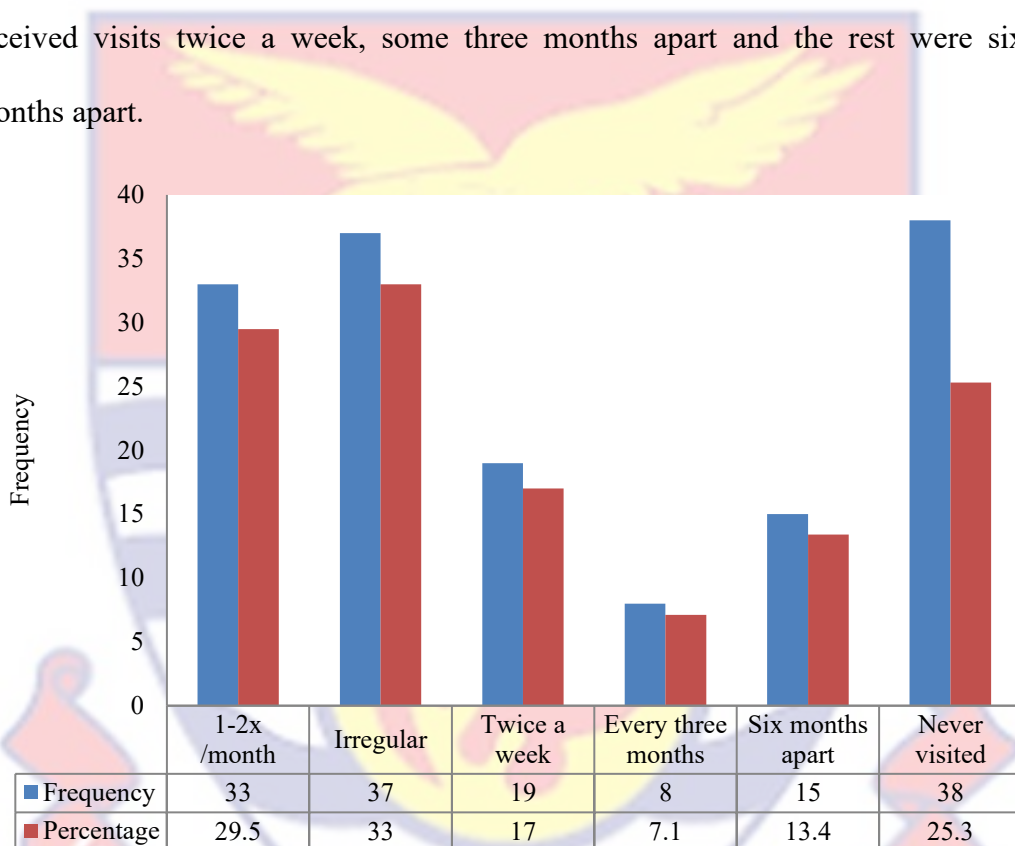


Figure 8: Number of visits paid by sanitary inspectors to food vendors

Source: Field survey, 2016

The response on the frequency of health inspection visits to food vendors differed among sanitary inspectors, the Director of FDA and the Municipal Environmental Health Officer. The sanitary inspectors indicated that they visited the food vendors twice in a month; the Director of FDA responded that the visits were a month apart, and the Municipal Environmental Health Officer responded that the visits were two months apart. This conformed to the various responses

given by the food vendors on the visits paid by sanitary inspectors. Although, the responses were varied, they still showed that health inspectors actually pay visits to food vendors to carry out their inspection duties. The sanitary inspectors also indicated that they inspected between 40 and 50 food outlets in a period of one month. The Municipal Environmental Health Officer confirmed that the visits ranged between 45 and 50 outlets per month, and the Director of FDA also added that about 30 to 35 outlets were visited every month.

When asked of the commonest violations that operational food vendors are guilty of, the Director of FDA indicated that the commonest violation was the lack of proper medical approvals but was quick to add that this was due to delays from the authorities in charge of approving medical record and requirements. On the same issue, the Municipal Environmental Health Officer's response was that food vendors are fond of using wet napkins repeatedly, and using the same napkins for washing and wiping plates, as well as cleaning hands. The responses from the sanitary inspectors were more diverse. They pointed out that food vendors often use dirty utensils for cooking; have poor personal hygiene; often expose their foods to flies and dirt when selling; do not have protective clothing like aprons and they also touch the food with their bare hands.

The respondents were asked about the reaction of the inspectorate to food vending violations. The Municipal Environmental Health Director noted that the officials are directed to give immediate education on the types of violation which they observe. For food vendors who continuously succumb to the same violations, warnings are issued, and in the extreme cases, they are prosecuted. In the same

way, the Director of the FDA indicated that they issue fines to offenders, as well as advice and education on food hygiene. Verbal warnings are also issued to offenders, and in extreme cases, they are prosecuted. However, when asked if any of the food vendors had been sanctioned for violating food safety practices, none of the respondents indicated that they had ever been sanctioned for violating food safety standards. This raised concerns about the effectiveness of the municipal authorities in their inspection duties, given that the researcher observed several malpractices among the food vendors as reported earlier.

In this respect, the key informants were asked of their opinions on the effectiveness of the inspectorate in controlling malpractices among food vendors. The Municipal Environmental Health Director responded that the inspectorate was not effectively promoting hygienic food vending practices among the food vendors within the Region. The Director of the FDA also added that political interference in their jobs makes it difficult to achieve the desired level of effectiveness in monitoring and controlling food vending practices. Thus, the Director noted that their work was not as effective as could ideally have been. The sanitary inspectors were also asked about the effectiveness of their sanitary inspection duties in encouraging safe food practices among food vendors. They indicated that street food vendors are very widely dispersed and it is difficult to pay them repeat visits as required. They indicated that food vendors add up to their numbers daily but closing their businesses would lead to a lot of political tension which makes them resort to only educating them whenever they can. The responses of a sanitary inspector were captured as follows:

We can't get to places we want to because of the lack of transportation and other logistics to cover a wider area. There is not even a single motor bike or official vehicle for the municipal environmental health directorate.

The Municipal Environmental Health Director also confirmed that political interference is a major deterrent to the work of the Directorate. The Director confirmed that the lack of transport creates mobility problems for the health inspectors and that limits the effectiveness of their inspections. The responses of the Director of FDA were captured as follows:

The collaboration between FDA and the Municipal Assembly has not been effective due to differences in what we look out for in food vending. There is also inadequate staffing which leads to lower coverage of inspectors and work overload.

From the responses, it could be deduced that the major challenges encountered by the inspectorate were; understaffing, inadequate logistics and transportation, political interference, and ineffective institutional collaboration.

The key informants were asked on their suggestions to improve the monitoring duties of the inspectorate. The Director of FDA was of the opinion that increasing the staff strength of the directorate and a harmonious collaboration among the Municipal Assembly and the FDA would help improve the health regulatory duties of the inspectorate. The Municipal Environmental Health Director also indicated that political interference in their jobs should be eliminated and transport logistics for health inspectors should be provided by the

government. The health inspectors also offered their opinions, which centred on the provision of transport like motorbikes for health inspectors, and also continuous media education on health issues regarding food vending. The response of a health inspector was as follows:

If our work is to be effective and satisfactory, then a lot of improvements need to be made in the way we are supported to do our work. Right now we lack motorbikes to move around this municipal area. There are hundreds if not thousands of food vendors here but how many can we contact just by walking around. We need motorbikes for each inspector. People are also buying food in very risky places; maybe because they are not aware of the risks involved, so continuous mass-media education is key to also making our work effective. If the risky food vendors are not getting patronage because people know the risks involved in buying from them, our work would be very easy.

Food Safety and Health

Although this study was not set out to examine the direct relationship between food vending practices and human health, this can be inferred by the extent of microbial load in the food samples and secondary data from the Bolgatanga Municipal health services. The microbial loads as shown in the analysis are worrying, and could potentially lead to all kinds of illnesses as indicated in the discussion.

The secondary data shown in Appendix 6 on trends on OPD attendance clearly reveal the health effects of poor sanitation and hygiene conditions in the area of which poor food vending practices are a part. From the data, skin diseases, diarrhoeal diseases, typhoid fever, intestinal worms and eye infections consistently feature among the top ten disease cases reported in the out-patient departments in the municipality. These diseases are hygiene related and occur due to poor environmental health conditions. The absence of hand washing facilities at all the vending sites is a good example and vendors transfer pathogens onto food which in turn negatively affects consumers.

The Upper East region features prominently among the poverty zones of the country. The poverty head count in the region was 45.9% in 2010 compared to the 6.6% of the population in Greater Accra, 13.6% in Ashanti and 28.6% in Brong Ahafo. This only reduced marginally to 44.4% in 2015 as found in the GLSS6 survey compared to Greater Accra's 5.6%, Ashanti region (14.8%) and Brong Ahafo (27.9%). It is known from the literature that poverty reduces the possibility of people cooking at home or patronizing more hygienic or upscale restaurants. The urban poor patronise street foods mainly and are more prone to disease infections as this study has unearthed. Frequent bouts of illnesses increase expenditure on health care on people who are not well off. About 4000 children in Ghana die each year from diarrhoea and even more die from pneumonia. It is also estimated that 23% of children in Ghana are said to suffer from stunting (chronic malnutrition linked to poverty and poor sanitation). Poverty, ill-health and low

productivity are therefore intertwined in ways that keep the urban poor in Bolgatanga in a poverty trap.



CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents summary of objectives and the findings for the study. Conclusions from the results and discussions are drawn and presented. Recommendations to improve the socio-economic conditions of garage operators, as well as suggestions for further studies are also made.

Summary of the Findings

The study set out to examine food vending hygiene practices among food vendors in the Bolgatanga municipality. The specific objectives were to examine the factors that influence the choice of location for food vending, examine the hygienic conditions of the physical environment of food vending, analyse the safety of food handling practices of food vendors, examine the institutional set-up governing safe practices of food vendors, and analyse the microbial content of food served by food vendors. The study was conceived in the theory that food handling practices were the result of planned behaviour, but not of spontaneous decisions.

The study employed a mix of quantitative and qualitative research approaches, and also adopted a cross-sectional design. A total of 150 food vendors were purposively sampled from 10 communities, taking care to sample from a variety of foods which were sold at food stalls, food sold on tables, and casual restaurants. The Director of the Environmental Health Unit of the Bolgatanga Municipal Assembly, the head of the Food and Drugs Authority, and five sanitary inspectors were also sampled as key informants on the institutional

set-up on food vending in the Municipality. Food samples from the vendors were also sampled and subjected to microbial load analysis.

Both quantitative and qualitative data were analysed by the study. Descriptive statistics, charts, cross-tabulations with chi-squares, independent sample t-test, and One-Way ANOVA were mostly used to analyse the quantitative data, while the qualitative aspects were mostly analysed through transcription and interpretations of interviews of key informants.

The study data were analysed based on the research objectives and the key findings are as follows: The first objective examined the factors that influence the choice of location for food vending and the major findings were:

- Proximity to customers was the commonest factor to all locational decisions among street foods in vending stalls (63.2%) and those sold on tables (33.3%), as well as casual restaurants (56.4%).
- The highest proportion (42%) of the responses indicated that their locations were suitable because they were easily accessible by the customers.

The key findings regarding the sanitary conditions of food vending sites were:

- There were no open sewages near 84 percent of the vending sites of most of the vending stalls (73.7%), table-top sellers (90.7%), and casual restaurants (89.7%).
- There were no open gutters near the vending sites of most vending stalls (91.2%), table foods (72.2%), and casual restaurants (82.1%).

- Eighty-two percent of the food-vending outlets were not located around dump sites. This was the case with 87.7 percent of the vending stalls, 66.7 percent of the foods sold on tables, and 94.9 percent of casual restaurants.
- The vendors scored only 0.82 points below the highest expected score of 12 points for hygienic choice of locations. Vendors in Sherigu had the highest mean score of 11.73, whereas those in Zuarungu scored lowest. Vendors with permits scored significantly higher than those without permits. Casual restaurants scored significantly higher on the choice of hygienic locations than food stalls and table-top foods.
- Seventy-four percent of the food vending outlets had dustbins but they were left open without proper lids. This was common among 91.2 percent of the food vending stalls and 98.1 percent of the table top foods.
- While the case for only a majority (84.6%) of casual restaurants had fly-to-food-contact prevention mechanisms, most street food vending stalls (54.4%) and foods sold on tables (57.4%) allowed flies to make contact with foods sold.
- Observation revealed that 80.7 percent of the 135 food outlets did not use clean water to wash utensils and eating ware used by their customers.

The study also examined the safety of meal food handling, meal preparation, and meal serving practices of food vendors, and the most significant findings were:

- Most (56.9%) of the respondents noted that their primary inspection of food ingredients was the discolouring of the ingredient

- Most of the respondents had access to regular supply of pipe-borne water for cooking. This was the case in most of the communities, except in Kumbosigo, Yarigabisi, and Dorongo, where more than half of the respondents noted that they did not have regular supply of pipe-borne water.
- A total of 78.7 percent of the respondents indicated that they used artificial additives in their foods, whereas 21.3 percent of the respondents did not. Most of the vendors (66.7%) used Maggi and other bouillon cubes in cooking meals.
- Majority of the sellers covered their hair while vending food, but most did not wear aprons. Most also made contact with food with their bare hands, and also, the majority could be seen with food debris on their bare hands.

The institutional set-up governing safe practices of food vendors were also analysed, and the major findings were:

- Most casual restaurants (84.6%) had vending permits but a few vending stalls (5.3%) and people who sold on tables (20.4%) had permits to sell food.
- Over 74 percent of the respondents indicated that they get repeat visits from inspectors and other health officials, which were as frequent as twice a week.
- The inspectorate was directed to give immediate education of the types of violation which they observe. For food vendors who continuously

succumb to the same violations, warnings are issued, and in the extreme cases, they are prosecuted.

- The key informants indicated that the effectiveness of their work was compromised for various reasons including political interference, lack of proper transportations, and poor collaboration among between the FDA and the Municipal Assembly.

The final objective of the study analysed the microbial content of food vendors, and the major findings included the following:

- Over 46 percent of the food samples were contaminated with *Escherichia coli* (*E. coli*). All the samples that were isolated for *E. coli* had microbial loading of 1 and above, which was higher than the minimum standard measure for safe levels of *E. coli* in ready-to-eat foods.
- Only six of the total 66 food samples had any presence of *Salmonella typhi* (*S. typhi*). In all six samples, the microbial loads determined by the colony forming units per gram (log CFU/g) in the isolated samples were greater than the acceptable standard.
- A total of 28 of the 66 samples of food, representing 42.4 percent, were isolated with presence of *S. aureus*. With the exception of the kenkey sample, all the other foods sampled were contaminated above the threshold to make them safe for consumption.

Conclusions

On the first objective, the study concluded that the most significant factor influencing the choice of location of food vendors is proximity to customers. Food vendors chose to locate in the catchment area of customers. From the observation exercise, it was also noted that in most cases the food vendors chose a healthy location to set-up, which was indicated by the generally high scores on the choice of healthy locations, according to the variables which the study adopted. Other factors influenced the choice of location of food vendors, and they included easy access, low competition, and convenience.

On the second objective, the study concluded that the physical state of the food vending places was found to be satisfactorily healthy, based on observation and scores compiled for each vendor. In most cases, the food vendors were not sited near open sewage, open gutters, dump sites, and toilet facilities. There was also little litter around the food vending sites.

The safety of food vendors' food handling practices was compromised. This conclusion was based on the fact that most food vendors used dirty water in washing dishes, and they either had no dustbins or left them uncovered. Most of the vendors cooked their foods with bouillon cubes, which were found with deleterious health effects and they also stored their food in plastics which could potentially harm the consumers. Most of the respondents did not wear aprons and they also allowed make direct contacts with their foods, but the majority of the vendors covered their hair and did not allow their jewellery to touch of their foods.

The institutional set-up was not effectively promoting conformance to the food vending controls instituted by the Municipal Assembly and the FDA. This conclusion was reached at based on the insights obtained from the key informants. They indicated that the effectiveness of their duties was compromised by poor collaboration between the Municipal Assembly and the FDA, political interference, and lack of transport.

The study also concluded that most of the foods were contaminated above acceptable levels for consumption. There were high levels of *Escherichia coli*, *Salmonella typhi*, and *S. aureus* that were above safe levels for consumption. The study also found that these pathogens had infected multiple food samples and this made the consumers prone to various types of infections and food poisoning.

Recommendations

Based on the summary and conclusion of the study, the following recommendations were made:

Food vendors are advised to:

- Practice proper personal hygiene. Personal hygiene was said to be one of the core areas that food vendors failed to measure up to. Thus, by practicing proper personal hygiene food vendors can reduce the risk of transmitting pathogens into food from their skin.
- Avoid making direct skin contact with food. The high incidence of infection-causing agents in the food samples pointed to reason that there was frequent skin contact with food through serving or touching food with

bare hands. Thus, avoiding such contact can help reduce the risk of transmitting food poisoning agents into foods consumed by customers.

- Use healthy methods of washing dishes and cleaning utensils. The recycling of washing water and the multiple use and reuse of napkins was high among the food vendors. This increased the chances of food contamination, and thus, by using of clean water for washing, pathogen transfer into foods can be reduces.

The FDA and Municipal Assembly officials are advised to:

- Align their environmental and sanitation objectives in order to enforce the collaboration between the FDA and the Municipal Authorities in monitoring the activities of food vendors.
- Advocate for no political agenda in their duties in order to objectively carry out their sanitation functions and to monitor the activities of food vendors in the municipality.
- Advocate for the provision of logistics and vehicular means make their visits to food vendors easier and to also obtain wider coverage in their duties.
- Embark on frequent media and personal education of the food vendors, safe food handling, and also consumer on identifying safe foods to purchase on the streets.

Suggestions for Further Studies

The study recommends further studies into the practical ways of implanting safety standards for food vendors. While the study found out that political influence was a major obstacle to monitoring and implementing the penalties for poor food influence, it did not delve into the specifics of the issue. This can be conducted by other studies to throw more light of the situations and how to help reduce or use the political influence to enforce proper monitoring of food vendors. The factors hindering effective collaboration of the FDA and the Municipal Assembly in their monitoring duties, with respect to food vendors, can also be studied to identify and implement a resolution. It is also recommended that future studies must examine the effects of street foods consumption on the health of the consumers. In particular, an examination of loss of productivity due directly to illnesses acquired from street foods' consumption would be useful in understanding the spread and depth of the problem of poor sanitation among food vendors and its effects on the economy of the municipality. Furthermore, a more critical analysis of microbial load of the food samples in relation to location of the food vendors and type of food vending would have been useful in determining the specific environmental conditions that directly affect food contamination.

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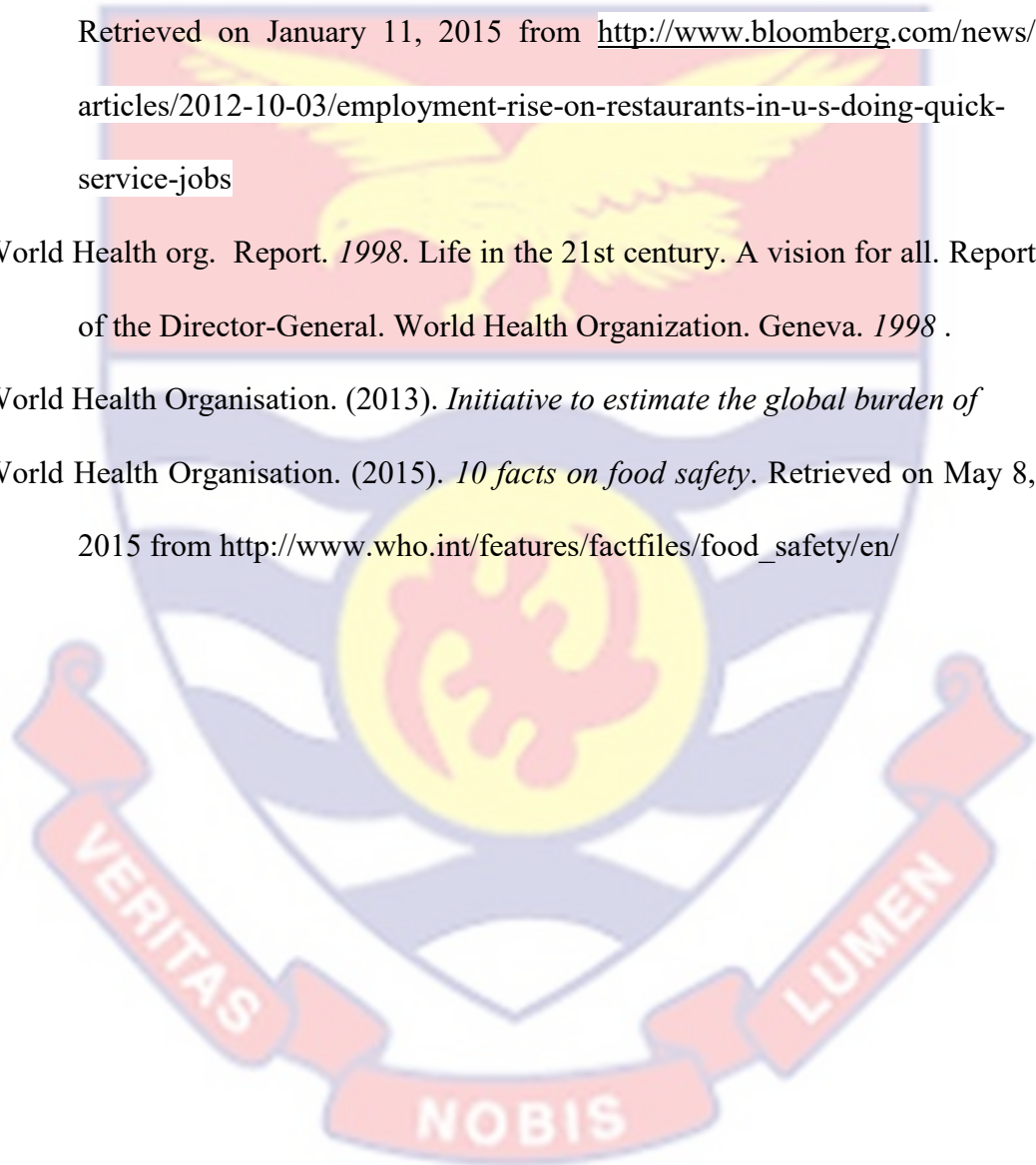
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APPENDIX: A

INTERVIEW SCHEDULE FOR FOOD VENDORS

This instrument seeks data on the hygienic practices of the food vendors in the Bolgatanga Municipality for an academic study. Please answer as candidly as you can.

CHARACTERISTICS OF THE BUSINESS

- a. Type of outlet
 - a. Street food vending stall
 - b. Street food sold on table
 - c. Casual restaurant
 - d. Others specify
- b. Type of foods sold?

SECTION A: Demographics

1. Sex
 - a. Male
 - b. Female
2. Age
3. Level of education
 - a. Basic
 - b. Secondary
 - c. Tertiary
4. Religion

5. What is your reason for vending food?
6. How long have you been in this line of business?
7. Do you have a vending permit?
8. How did you acquire the permit to sell food?
 - a. Through application to environmental officer
 - b. Contacting a health inspector
 - c. Started on your own
 - d. Continued from a friend or relative

9. Where did you get your start- up capital from?
 - a. Spouse
 - b. Parents
 - c. Relatives
 - d. Friends
 - e. Credit from banks
 - f. Others, please specify

SECTION B: CHOICE OF LOCATION

10. Which of the following would you say influenced the choice for locating your food vending services?
 - a. Proximity to home
 - b. Only place demarcated by local authorities
 - c. It is a cluster of food sellers
 - d. Proximity to customers

- e. Customer convenience eg. Available parking or eating spaces
- f. The only space available large enough to support the vending business
- g. Lower cost of rent
- h. Lower cost of renovation and repairs
- i. To serve a specific group of people (workers, race etc.)
- j. Lower competition
- k. Others, please specify

11. How suitable do you think your location is to your business?

12. Is your location approved by the Municipal Assembly?

SECTION C: FOOD HYGIENE PRACTICES

13. For how long have you been selling or preparing food for sale?

14. How did you acquire your knowledge on food preparation?

- a. From relatives
- b. Self-taught
- c. Catering school
- d. Others, specify

15. What do you consider before you select food stuffs?

- a. Cost
- b. Quantity
- c. Quality
- d. Cultural background

- e. None of the above
- f. Specify if others _____

16. What do you physically look out for on the food stuffs before purchasing them?

- a. Worms
- b. Rotten parts
- c. Tender parts
- d. Colour of the fruits and vegetables
- e. None of the above
- f. Others, specify

17. Where do you buy your meat and animal foods from?

- a. Meat shop
- b. Abattoir
- c. Cold store
- d. From open market
- e. Others, specify

18. Do you have any knowledge on indicators of safe meat?

- a. Yes
- b. No

19. If yes, what do you look out for?

- a. Redness or colour of the meat
- b. Smell of the meat
- c. Darkened and soft spots

- d. Texture of the meat
 - e. Others, specify
20. Where do you prepare your food before selling?
- a. At the selling place (open space)
 - b. At selling place (enclosed kitchen)
 - c. At home (open space)
 - d. At home (enclosed kitchen)
21. Who prepares the food?
- a. Seller
 - b. Formally trained cooks
 - c. Home-schooled cooks
 - d. Others, specify _____
22. Is there constant supply of water at the place of cooking?
- a. Yes
 - b. No
23. Where do you get water from when the tap is not flowing?
24. Do you use food additives and condiments during and after food preparation?
- a. Yes
 - b. No
25. How do you transport foodstuff to cooking site?
- a. By carrying
 - b. By car

- c. By carriage truck
26. Where do you store cooked foods?
- a. In an open plastic bowl
 - b. In an ice chest
 - c. In a saucepan
 - d. In a plain rubber suck
 - e. Specify if others _____
27. How do you keep food warm before serving?
- a. Reheating by microwave before serving
 - b. Keeping food in an enclosed ice chest
 - c. Keeping food in saucepans with lids
 - d. Keeping food in plastic cases
 - e. Others, please specify
28. How often do you wash your plates?
- a. At the end of the day
 - b. After each use
 - c. At the beginning of sales
29. How many hours do you sell in a day?
30. How many customers do you get averagely in a day?
31. How often do you change the water for washing plates within the period of sales?
32. How do you treat leftover foods?
- a. Consume by self and family

- b. Discard as waste
- c. Reheat for sale the next day
- d. Others, specify

33. Have you ever undergone medical examination by food and drugs board or any municipal authority?

- a. Yes
- b. No

34. If yes, when was the last time you underwent such medical examination?

35. How often do you go through these medical examinations?

36. Have you received any health education on food hygiene?

- a. Yes
- b. No

37. If yes, how often do you go through it?

SECTION D: Institutional set-up governing safe practices of food vendors;

38. Do sanitary inspectors visit you regularly to inspect your place?

39. Do food and drugs board inspectors pay you regular visits?

40. If yes, have you ever been told that you have violated sanitary and safe food practices?

41. If yes, what was the resolve of the inspection team?

- a. I was fined
- b. A warning was issued
- c. I was invited to train in a sanitation programme
- d. Nothing was done

- e. Others, specify
42. Are you a member of any Work-Group Association?
43. If yes, does the Association ensure that you practice safe and hygienic food handling practices?
44. If, yes how do they ensure this monitoring duties are effective?
- a. Assigning inspectors to visit vending sites
 - b. Obtaining reports on the vending sites
 - c. Organising training programmes for vendors
 - d. Others, specify
45. Are you required to renew your vending permit or operating license periodically?
46. If yes, do the authorities perform a sanitary inspection before issuing the continuance in your operations?
47. If yes, what do they inspect?
- a. The environs
 - b. The cooking ware
 - c. The professional certificate of vendors and helpers
 - d. The foodstuffs
 - e. The protective ware
 - f. Others, specify
48. How many minutes does it take for inspectors to go through one inspection session?

PART D: OBSERVATION CHECKLIST FOR ASSESSING THE SANITARY CONDITIONS OF THE ENVIRONMENT WITHIN WHICH FOOD VENDORS OPERATE

Description of location of the vendor (eg. Economic activities, socio-economic class of the location etc.)			
	Yes	No	Comment
Food sold near open sewage?			
Food sold near gutters			
Food sold close to bush			
Food sold close to refuse dump			
Public toilets			
Litter around the selling points?			
Availability of open dustbins			
Availability of covered dustbins			
Flies making direct contact with food served			
Use of clean water for washing plates			
Foods prepared are stored in:			
a. Flytrap sieve			
b. Glass sieve			
c. Open bowl			
d. Plain rubber suck			
e. Ice chest			

	Yes	No	Comment
Hair covered			
Vendors wear aprons			
Vendors touch the food with their bare hands			
Vendors touch the food and money with same bare hands			
Jewellery on hands make contact with the food			
Debris of food on hands			
Customers allowed to make contact with food			
Talking while serving food			
Chewing sticks/gums etc while serving food			
Spitting while serving food			
Fingernails are short			
Fingernails are polished			
Any further observation			

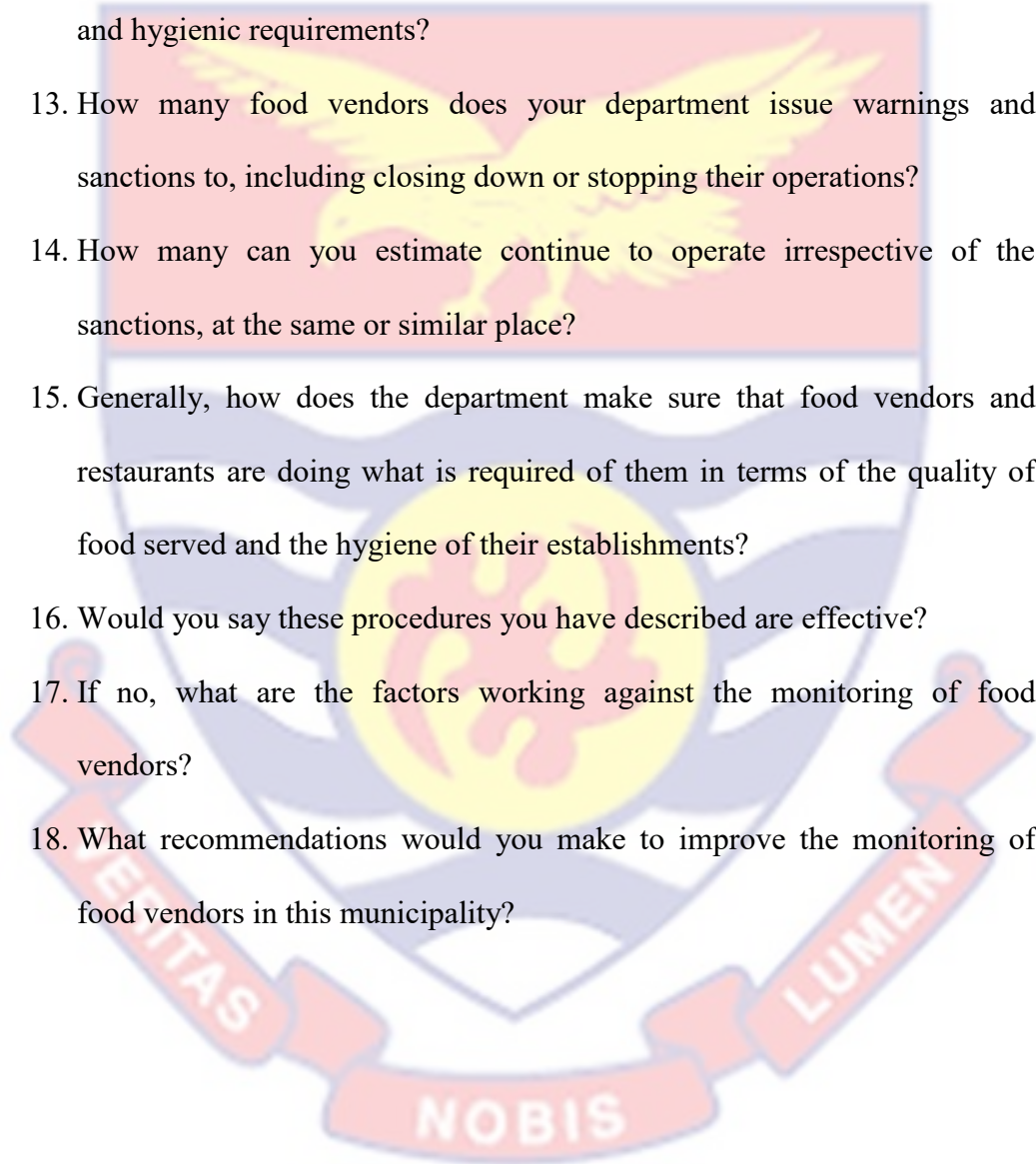
APPENDIX B

INTERVIEW GUIDE FOR THE HEAD OF THE SANITATION UNIT OF THE BOLGATANGA MUNICIPAL ASSEMBLY

This instrument seeks data on the institutional monitoring of food vendors in the Bolgatanga Municipality for an academic study. Please answer as candidly as you can.

1. Which department in the Municipal Assembly is responsible for issuing operating permits for food vendors and restaurants?
2. Does this department have to work in collaboration with other offices like the Food and Drugs Board?
3. If yes, has this collaboration been successful and why?
4. What requirements do food vendors and restaurants have to meet before being issued the licence to operate?
5. What percentages of vendors who are issued permits meet all the listed requirements?
6. Which of the requirement do vendors usually fall short of?
7. What percentage of food vendors in the municipality would you estimate have permits to operate?
8. What is the Municipal Assembly doing about food vendors and restaurants without operating permits?
9. Does the Assembly have special inspectors dedicated to food vendors and restaurants?

10. If no, how does the Assembly ensure that the food vendors are operating within the required safety and hygienic standards?
11. If the Assembly have inspectors, then what do they often look out for?
12. How are they supposed to handle food vendors who do not meet the safety and hygienic requirements?
13. How many food vendors does your department issue warnings and sanctions to, including closing down or stopping their operations?
14. How many can you estimate continue to operate irrespective of the sanctions, at the same or similar place?
15. Generally, how does the department make sure that food vendors and restaurants are doing what is required of them in terms of the quality of food served and the hygiene of their establishments?
16. Would you say these procedures you have described are effective?
17. If no, what are the factors working against the monitoring of food vendors?
18. What recommendations would you make to improve the monitoring of food vendors in this municipality?



APPENDIX C

INTERVIEW GUIDE FOR SANITARY INSPECTORS

1. Which of the following institutions do you work with? The Food and Drugs Board, Ghana Standards Board, or the Municipal Assembly?
2. What are your specific duties in terms of being a sanitary inspector?
3. How many times in a month do you specifically visit food vendors in the streets and restaurants?
4. How many food outlets do you visit in a period of one month?
5. How many times do sanitary inspectors make repeat visits to the same vendor?
6. What are some of the commonest food vending malpractices you usually identify?
7. What happens when food vendors are found to be practising unhealthy habits?
8. Which office/position in your office is your direct superior?
9. Do you submit a daily report on your inspections to your superiors?
10. What are some of the commonest violations from the standard practices that food vendors engage in?
11. What are the measures taken to correct such violations?
12. Are inspectors required to implement these corrections?
13. In your own opinion and from your expertise, do you think sanitary inspectors are effectively controlling food vending malpractices in the District?

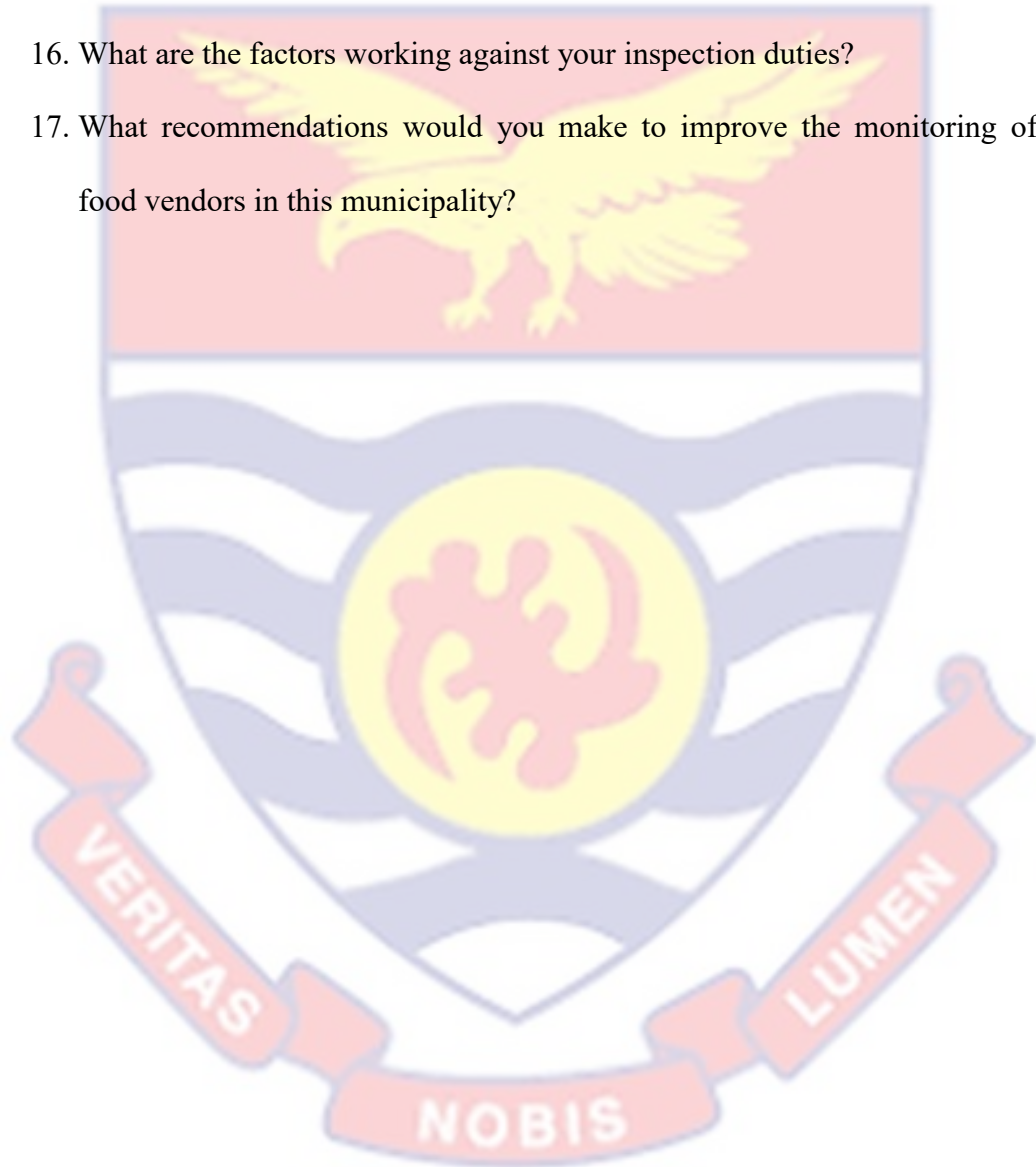
14. There is evidence of food vendors selling in unclean places, especially around lorry stations. What is your office doing about that situation?

15. How effective has the resolutions of your office been?

What percentages of vendors that you visit have operating licenses?

16. What are the factors working against your inspection duties?

17. What recommendations would you make to improve the monitoring of food vendors in this municipality?

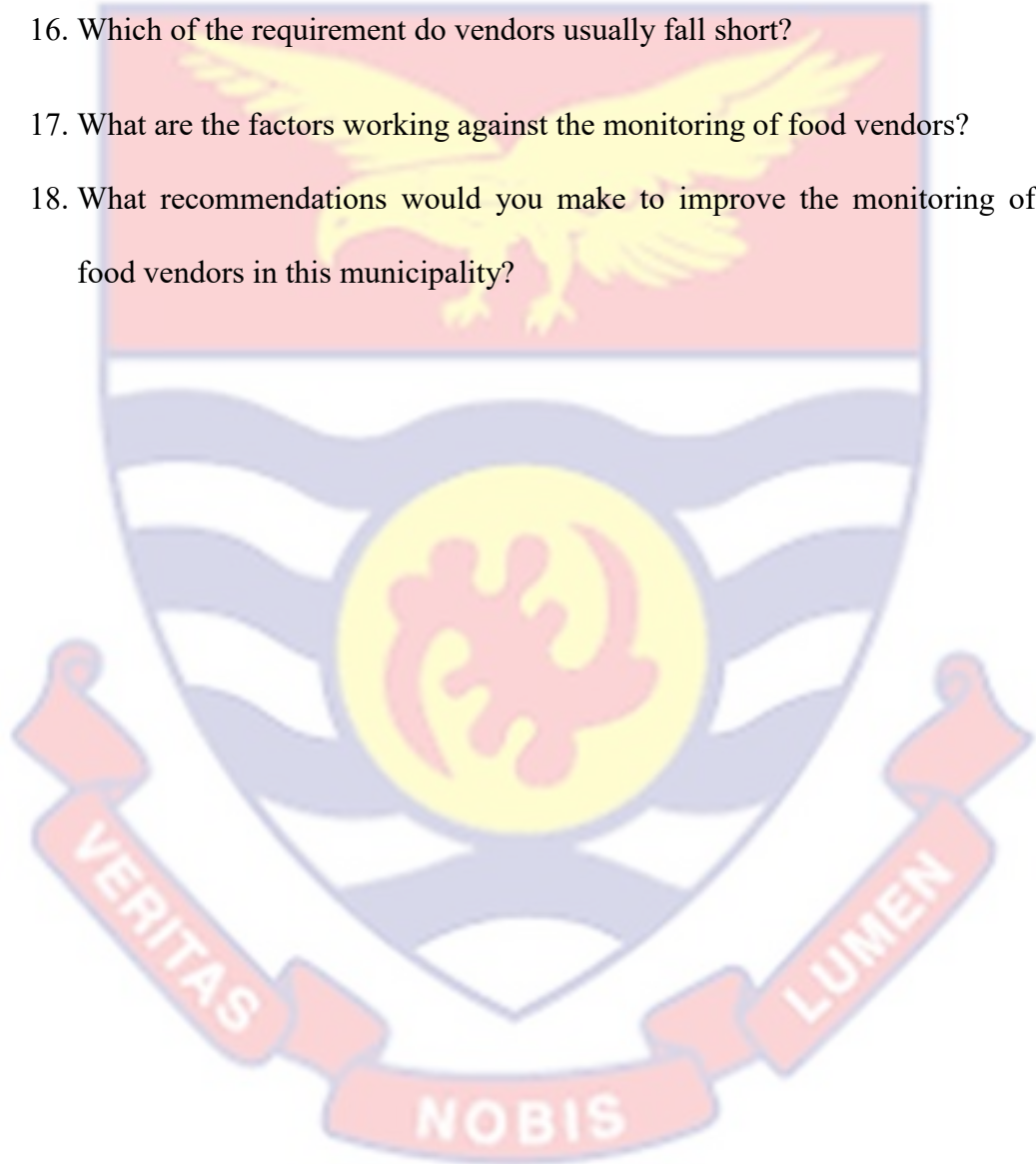


APPENDIX D

INTERVIEW GUIDE FOR THE DIRECTOR OF FOOD AND DRUGS AUTHORITY

1. Does the FDB send out sanitary inspectors to visit food vendors?
2. If yes, how many times in a month does this occur?
3. How many food outlets do they visit in a period of one month?
4. How many times do sanitary inspectors make repeat visits to the same vendor?
5. What are some of the deviations in food vending practices that inspectors look out for?
6. What happens when food vendors are found to be practising unhealthy habits?
7. What are some of the commonest violations from the standard practices that food vendors engage in?
8. What are the measures taken by the FDB to correct such violations?
9. In your own opinion and from your expertise, do you think the FDB is effectively controlling food vending practices in the District?
10. There is evidence of food vendors selling in unclean places, especially around lorry stations. What is the FDB doing about that situation?
11. How effective has the resolutions of the FDB been?
12. Does the FDB have to work in collaboration with other offices like the municipal assembly
13. If yes, has this collaboration been successful and why?

14. What requirements do food vendors and restaurants have to meet before being issued the licence to operate?
15. What percentages of vendors who are issued permits meet all the listed requirements?
16. Which of the requirement do vendors usually fall short?
17. What are the factors working against the monitoring of food vendors?
18. What recommendations would you make to improve the monitoring of food vendors in this municipality?



APPENDIX E

POST-HOC TEST FOR DIFFERENCES IN LOCATION SCORE AMONG TYPES OF FOOD VENDING



Post-hoc test for differences in location score among types of food vending outlets						
Tukey HSD						
(I) Type of vendor	(J) Type of vendor	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Street food vending stall	Street food sold on table	.07018	.16383	.904	-.3177	.4581
	Casual restaurant	-.46829*	.17928	.027	-.8928	-.0438
Street food sold on table	Street food vending stall	-.07018	.16383	.904	-.4581	.3177
	Casual restaurant	-.53846*	.18129	.010	-.9677	-.1092
Casual restaurant	Street food vending stall	.46829*	.17928	.027	.0438	.8928
	Street food sold on table	.53846*	.18129	.010	.1092	.9677

Dependent Variable: Location Score

*. The mean difference is significant at the 0.05 level.

APPENDIX F
TREND OF TOP TEN OPD ATTENDANCE AT THE BOLGATANGA MUNICIPAL HEALTH
DIRECTORATE

<i>CONDITIONS</i>	<i>YEAR</i>			
	<i>2012</i> <i>Cases (%)</i>	<i>2013</i> <i>Cases (%)</i>	<i>2014</i> <i>Cases (%)</i>	<i>2015</i> <i>Cases (%)</i>
<i>Malaria</i>	166, 929 (44.1%)	131, 163 (21.7%)	50, 133 (16.1%)	60, 062 (16.0%)
<i>Acute Respiratory</i>	35, 089 (9.3%)	37, 858 (6.3%)	40, 079 (12.9%)	53, 332 (14.2%)
<i>Infections</i>				
<i>Skin Diseases and</i>	26, 472 (7.0%)	29, 850 (4.9%)	21, 849 (7.0%)	22, 553 (6.0%)
<i>Ulcers</i>				
<i>Diarrhoeal Disease</i>	17, 799 (4.7%)	20, 681 (3.4%)	14, 919 (4.8%)	15, 865 (4.2%)
<i>Anemia</i>	6, 359 (1.7%)	10, 579 (1.7%)	9, 274 (3.0%)	10, 368 (2.8%)
<i>Typhoid Fever</i>	8, 554 (2.3%)	10, 138 (1.7%)	9, 506 (3.0%)	10, 252 (2.7%)
<i>Rheumatism and</i>	5, 396 (1.4%)	9, 473 (1.6%)	5, 664 (1.8%)	6, 913 (1.8%)
<i>other Joint Pains</i>				
<i>Hypertension</i>	Not available	7, 319 (1.2%)	11, 089 (3.6%)	11, 751 (3.1%)
<i>Intestinal Worms</i>	5, 371 (1.4%)	6, 249 (1.0%)	Not available	Not available
<i>Acute Eye Infection</i>	Not available	4, 952 (0.8%)	6, 556 (2.1%)	5, 118 (1.4%)

**APPENDIX G
VENDING LOCATION TO OPEN SEWAGE**



APPENDIX H a:

PROTECTIVE CLOTHING AMONG FOOD VENDORS

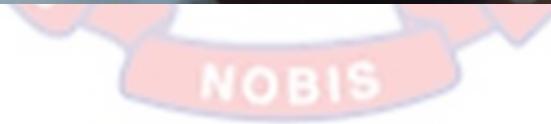


APPENDIX I b:

PROTECTIVE CLOTHING AMONG FOOD VENDORS



**APPENDIX Ja:
HAND-TO-FOOD CONTACT AMONG FOOD VENDORS**



APPENDIX Kb
HAND-TO-FOOD CONTACT AMONG FOOD VENDORS



**APPENDIX L
GUIDELINE LEVELS FOR DETERMINING THE MICROBIOLOGICAL QUALITY OF READY-TO-EAT
FOODS**

Test	Microbiological result (cfu/g unless otherwise stated)			
	Good	Acceptable	Unsatisfactory	Potentially hazardous
Standard Plate Count				
Category A	<10 ⁴	<10 ⁵	≥10 ⁵	N/A
Category B	<10 ⁶	<10 ⁷	≥10 ⁷	N/A
Category C	N/A	N/A	N/A	N/A
Indicators				
<i>Enterobacteriaceae</i>	<10 ²	10 ² to <10 ⁴	≥10 ⁴	N/A
<i>E. coli</i>	<3	3 to <10 ²	≥10 ²	N/A
Pathogens				
Coagulase +ve staphylococci	<10 ²	10 ² to <10 ³	10 ³ to <10 ⁴	≥10 ⁴
<i>C. perfringens</i>	<10 ²	10 ² to <10 ³	10 ³ to <10 ⁴	≥10 ⁴
<i>B. cereus</i>	<10 ²	10 ² to <10 ³	10 ³ to <10 ⁴	≥10 ⁴
<i>V. parahaemolyticus</i>	not detected in 25 g	If detected then as per below		
	<3	3 to <10 ²	10 ² to <10 ⁴	≥10 ⁴
<i>Campylobacter</i> spp	not detected in 25 g			detected in 25 g
<i>Salmonella</i> spp.	not detected in 25 g			detected in 25 g
<i>L. monocytogenes</i>				
Food Group 1	not detected in 25 g			detected in 25 g
Food Group 2	not detected in 25 g	detected but <10 ²		≥10 ²
Food Group 3	not detected in 25 g	detected but <10 ²		≥10 ²

Notes: Table has been developed based on the guidance documents developed by both the UK Food Protection and the WHO. **Category A** – applies to ready-to-eat foods in which all components are fully cooked for immediate sale or consumption. **Category B** – applies to ready-to-eat foods that are fully cooked with further handling or processing before consumption. **Category C** – food that contained uncooked fermented ingredients or fresh fruit and vegetables.